

SKY Lab III
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**Skylab News Center
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S/L IV - Change of Shift Briefing
Johnson Space Center
December 25, 1973
6:28 p.m. CST

Participants:

Milton Windler, Flight Director
Dr. Story Musgrave, Capsule Communicator
Mr. William Bates, EMU Officer
Terry White, PAO

SL-1V PC71A/1
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PAO Okay, let's get rolling with the change-of-shift briefing here. I understand UPI will be in in the next few minutes across the way there. This - this evening we have the offgoing Flight Director, Milt Windler, Spacecraft Communicator, Story Musgrave and EVA planner - EVA officer -

WINDLER EMU flight controller.

PAO EMU, okay.

WINDLER He's a hardware man.

PAO Yeah.

WINDLER He's going to answer this first question.

PAO About where the leak is and all that

good stuff, huh?

SPEAKER Right.

WINDLER Well, let me summarize the EVA for you.

And - it really - I thought it went pretty well. We did everything that we set out to do. Let's t - let's start with the scientific type. We just got started, anybody else out there? In a scientific way, we took all the T025 exposures, the S020 was scheduled for a list of 6 or 8 going in decreasing order of priority; we got the majority of the data that's the long exposures of the 60-minute and the 30-minute and some shorter ones. The 201, the crew reported that they could not see the comet in it, in fact, they said they couldn't see any stars either. However, they adjusted the - the - the instrument so that it was looking at the part of the sky that we felt that the comet was in. And we feel - I wouldn't say confident, but - but we feel full - certainly we feel like our - everything was done that could be done to get the data. They - they did exactly what - what we discussed pre-mission and before the EVA, in case they couldn't see the comet. So we feel that there is a high probability that - that the comet data's - is on the 201 film. And they did take the three exposures. They retrieved some miscellaneous gear. So the - the scientific part of it went very well. They changed all their - all the ATM film. The - the door turned out to be open, the 82A door, and they pinned that. They - there was some difficulty at the end of the EVA as you recall with the - with the S054. We had been led to believe that it was very unlikely that that shutter - and I guess most of y'all were here yesterday and heard Rusty's briefing and saw that little mechanism. But th - but the shutter inadvertently closed - in fact, it - it apparently closed when they took the film canister out. And we didn't think it would do that, so that was a little bit of a surprise to us. And it was also a surprise when it closed on the commander when he was - had - had the screwdriver in it, or was working on it. It n - it really

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never was clear to me and may - and maybe Story recalls what they said, but I was a little bit confused over whether the - the shutter closed after he withdrew the screwdriver or why he actually had the screwdriver in it. But in any event, it did close and - and - and in that process it did get bent somewhat. And the condition it's in right now is that the - the shutter is - and it's a real flemsy thing - kind of suprisingly so. But it - of course, it doesn't need to be very heavy to do it's job, especially in zero g. But it is now pushed away from the opening. And - and the commander was able to rotate the filter wheel around and has the open filter across the - the opening so that it is essentially passes the - the ATM light - I mean the Sun light. And we think that the - the data - of course, we lose some of the the aspects of the filter and the resolution that that gives us in different spectrum, but it des - we will get good data. And I guess we have to admit, of course, that the - the worse condition existed before the EVA. That is, we surmised that the filters could be stuck in between two, 5 and 6. Or we could have had a bad telemetry indication and it could be stuck in the filter 3 position which is the open position, open in the sense that - you know, the - the camera's open to the Sun. Well, it turns out it - sure enough it was stuck in intermediate position, so the data's probably not going to be very useful that we've taken since that has occurred. We had some control systems problems today. M - most of which we don't really understand yet. They're going to have to go back and with - and extract the information from the onboard recorders. And it takes a while, as you know, to get that down on the ground plus some while to retrieve it and analyze it. So I imagine it will be perhaps even this -

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WINDLER Strike the information from the on board recorders and it takes a while as you know to get that down on the ground plus some while to retrieve it and analyze it so I imagine it'll be perhaps even this time tomorrow before we have a real good story on exactly what happened there. Certainly we were - did not anticipate some of the things that occurred in the control system, and as I say we can't explain them yet. We - the telemetry indicates control system firing sometimes when the computer issues commands and there were occasions there when the computer you might say was disconnected from the jet so that the commands didn't actually get through and use up TACS. So we - for that reason until we get this reconstruction I can't tell you how much TACS we used today. It's not as much as - as at least I first thought when I looked at the tube and saw the numbers that were on the tube because to tell you the truth I'd forgotten that - that they didn't - all the numbers that were added up there didn't necessarily represent firings. So we'll let Bill here tell you a little bit about the hardware and answer a couple of these questions if he will then.

BATES Okay, let me start with what we found out just a few minutes ago by the - the little check we had them do right before they repressed the cabin that we just got some information back from them where Commander Carr reported that he did have a lot of ice on the front of his PCU, Press Control Unit. And this essentially has about told us where our problem is, we're going to have to do some more checking on it before we know for certain that that's the only problem or that is the problem. But what we think the problem is right now is we noticed this morning right after we got data on - on both crewmen that we were - we were seeing some characteristics of the hardware that showed us that normally EV - the crewman that we designate EV-1 wears one set of hardware and the crewman designated as EV-2 wears another set. And we noticed that just from the characteristics of the data that they were reversed. So we just surmised that all they had done was just switch positions with some of the hardware and it turned out from a readout by one of the crewmen later on that we did verify that. And apparently what happened is by switching this hardware we had been operating one of the PCUs with a specific umbilical or bell and when we switched it over apparently one of the O-ring seats in the connector that mates the two together either did not seat or it was cut or - or was torn and started to leak. And apparently as - as the crewmen moved around I guess the leak got worse because we did notice that our temperature problem became worse during the EVA. And so what was happening

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he was leaking water out of this connector on the front of his PCU. The water then was freezing, being opened to a vacuum. And this wasn't readily apparent to him because he had on a deflector which was just strickly a piece of Beta cloth material over the front to keep the gas and moisture that comes out of the unit from getting into the ATM hardware as contamination. So essentially that's what was driving the pressure or the temperature down was the fact that we had this water leaking and freezing and was essentially just drawing heat out of the hardware. I hope that hadn't been too confusing. I guess - let me address some of the questions we got here. There's one that's something about the particles seen by the crew indicate a leak in the spacesuit. Well the particles they were seeing was the ice that was coming out from underneath this deflector on the front. And when you say a leak in the spacesuit I think everyone is probably triggered to thinking about their - the pressure part of it and as far as we know right now there was no leak in the pressure vessel itself, all we had was this minor water leak. That's the reason we weren't really too concerned over having any kind of an immediate problem that - all we saw was some decrease in temperatures, which in itself is no problem either. Just indicates that you have something off nominal in the operation. - - about that.

SPEAKER

Well we - we could take that last.

SPEAKER

Maybe Story can tell us a little bit about

the crew's performance and the - the length of the EVA and work loads perhaps.

MUSGRAVE

I think they did a - a fantastic performance. They got into it following the checklist and then they saw little gaps where they could run some - some events simultaneously, which they did very well. And especially of course, I guess EV number 3, he's the guy who's inside. He doesn't get a lot of credit do - doing the EVA from most people because he's not outside doing it. But as was very clear on SL III, one particular one Al Bean was inside, he's kind of the conductor, he's kind of the one who's reading procedures and looking after the other people outside. And I think Ed did a superb job of integrating the whole thing today. Especially when they got off the - the serial type procedure and they got running some simultaneously, which they probably saved us an hour or 2 in doing that. Is there anything else on the questions here?

WINDLER

You might mention - maybe you already said that the length of the EVA is approximately 7 hours and we'll have to refine that number when we get the - the actual open and close hatch data. As you're aware we didn't run over a station when it -

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WINDLER - - when we get the - the actual open and closed hatch data as you're aware we didn't - we didn't - weren't over a station when that happened.

MUSGRAVE And records on Skylab are about 7 hours and 34 minutes, so that's a very long EVA. The metabolic loads however, were quite low most of the time. And some - some very non-colorful tasks it turns out as was true in the water tank during the training really took a lot more load than some of the more dramatic tasks such as film - film replacement or the SO54 filter wheel. The - really the hardest place to work is inside the airlock and they - they ran bigger loads stowing things inside the airlock. And the - the hardest tasks of any EVA is - is restowing any umbilical that you pull out of the stowage spheres. But in general throughout that - in the 7 hours their metabolic loads were low and as the surgeon requested and he usually does, we keep kicking up the - the water cooling. And what this does, the only way you can get cooling through air is to evaporate sweat from inside the suit, convective cooling is just - just not very important. But in doing so, of course you're losing body fluids. So by increasing the load of heat taken out by the liquid cool garment, carried away by the water, this preserves body fluids. So I think they stayed in beautiful shape for 7 hours.

WINDLER I believe the numbers on the work loads for the PLT, were in the order of about 650 BTUs and hour and around a thousand for the CDR. There is one question here I'd like to answer before we get into others. And that's for Mary Bulb. And she asked is it dangerous to perform an EVA with a leaking the space suit? And as Bill pointed out just a little while ago when you say leaking you normally think of a gas leak. And of course we wouldn't like to do an EVA with - with a gas leak. The water leak, of course, affected the cooling and as you're well aware we haven't done EVAs with - with gas cooling only. So, we do have a - that backup type capability available to us and it's not a great concern to have - have a small water leak. It's it's mostly a problem with - with contamination or - or particles coming out and things like that. But water itself is not - is not a real particularly bad contaminant, although we just the same not have it. Or ice is - I guess what it amounts to by the time it gets out there.

PAO Okay, now we've taken care of Mary Bulb's questions. Let's get some here. Howard?

QUERY Milt, could you go a little bit in - into the problems you had with the - controlling the vehicle today. What possibly could have gone wrong? And at one time Ed

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seemed a little bit confused about one instructions he was supposed to be following before going into the TACS firing?

WINDLER Okay, well one problem we had, you know this cer - such thing as having too much communications I guess you could say. And it's - it's kind of difficult to - to follow what the crew is doing when they're on VOX because - I say difficult in a sense because they're talking all the time of course when they're on VOX. And you - you find yourself forced in the MOCR discussing things with the operators on another loop at the same time and it's confusing to the CAP COMM. I know it's confusing to me trying to listen with one ear what the crew is saying and pick out the things they're saying to the ground, as opposed to the things they're saying to one another. And it was some element of confusion at least in my mind at some points, I - I confused things that they were saying to the out - the guys on the outside were saying to the inside man, Ed in this case, with questions they were directing to the ground. So that - there's a little bit of difficulty of following that - that sequence of event. But primarily our problem we had today comes about when - our - our capability is reduced and we only had two CMGs. And it's further made more difficult by the fact that the two deflectors or the deflectors that are on the suits, which are there to prevent contamination, impart a thrust to the suit or to the - to the man, if that's how you want to say it. And when the crew is moving all over the spacecraft and particularly at the Sun end or the immediate station, why, this relatively small amount of thrust but - but yet it compared to the capability we have now does impart attitude changes to the vehicle or attempt to. And then of course, the CMGs have to resist these and this makes our momentum diversion is certainly not in a predictable manner. As you well recognize the - the crew can do something in a little bit different order or they can delay it by 30 minutes, or advance it by a little bit. So - so that proposes a particularly difficult problem for the G&S. And the first time I think - -

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WINDLER - advance it by a little bit. So - so that poses a particularly difficult problem for the G&S. And the first time, I think that the - certainly the ground was somewhat at fault when they didn't tell Ed to expect a large maneuver by the vehicle when they did a reset. We have occasions to - to reset the CMGs, which essentially amounts to spending a small amount of TACS - what we expect to be a small amount of TACS to bring the momentum back to a nominal condition so that we - we can sort of start over. Kind of like getting your bank statement every month, you know, you can either go through and add it all up or you can just assure the bank's right and reinitialize your balance and press on it. But - we - we do that - did that - I - I don't remember. Story, do you - about 4 times I would say during this EVA something like that. And it primarily was designed to - to - to bring the CMGs back in. We have two problems with them. We have a total momentum problem, which is a sort of a capability that the CMGs have and then we also have another problem that they sometimes get on the (garble) and lose their - their effectiveness that way. So we have to watch those two things. And the - basically, the problems that we had were caused by, I'd say the - the effect of the PCV deflectors on the - on the system. And we're going to be taking a hard look at that for the next EVA. And based on what we really find out - was the TACS cost and - and any procedures, things that we can do to make that better. A - Another option, of course, is not to put the deflectors on for the next EVA. We did see one small anomaly or glitch, or whatever you want to call it in the - in the CMG number 2 that we've seen before. The one where the current goes up slightly and the - the speed goes down and the temperature on the bearings gets a little bit warm. One of the - the first ones of those that we've seen since we started managing the heaters and this was - the magnitude of it was less than we've had before, but indicated, I think, the fact that the CMG was being worked by - by all these resets because they do - the CMGs rotate around the gimbals quite a bit when they do a reset. That's probably a longer answer than you were looking for and I apologize for that. I got carried away there.

PAO Paul?

QUERY (Garble), you used 600 more - or more mibs, which you probably didn't, but if you did, would you consider even scrubbing the next EVA?

WINDLER No, I don't think so. 600 mibs - 3000 pound/seconds, I think, you know. The TACS is - signed - to allow us to augment the CMGs or substitute for them. I think the science is worth it.

QUERY Okay.

PAO Louie.

QUERY How far did the spacecraft roll on those maneuvers before they stopped it? Was it around 40 degrees?

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WINDLER The first time they indicated, it was around 40. We had some that, I guess, we expected to go a little bit higher than that. You can go to 60 before you get into - an undesirable situation so they were - they were trying to protect this 60 degree limit. And the first time - because they - it was going at a fairly high rate - they terminated and we did not - told them to expect it. They - they terminated the maneuver early or before it would have been over.

QUERY Did the crew see Kohoutek visibly at any time during the mission?

WINDLER I don't believe they did. They indicated that at a certain point when they were looking for it they could not see it. And I don't think they ever indicated that they did see it any other time. They indicated that it was very hard to see because it was too washed out by the Sun.

QUERY Would you tell us the likelihood then that they got the comet in the scope of the - of both of those cameras? What is the range of those cameras?

WINDLER Well, the field of - the field of view is large and I don't know the angle, do you?

SPEAKER - - happen to know -
SPEAKER No. - - how many degrees on S201 -
SPEAKER 20 and 7, I believe, on T025.
SPEAKER 20? Okay. Okay. 20 and 7, they're telling me and of course, there shouldn't have been any problem with T025. With T0 - with S020, I think that they got the data that they were looking for - 201, rather.

WINDLER Did you say 20 was 201?
SPEAKER 20 degrees. (Garble).
WINDLER Okay, with the 201 the crew put the viewfinder at - the best place to put it relative to the - to the solar panel that they were looking at and where the Sun would appear. It's kind of like looking at the sky early in the morning. You know the Sun's getting ready to come up, you can't see it yet, but you're pretty sure where it is and if somebody told you that something was just a little above the Sun, you probably would be able to get it in your viewfinder. It would be -

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WINDLER - - that we're looking at and where the Sun would appear. It's kind of like of looking at the sky early in the morning, you know the Sun's getting ready to come up, you can't see it yet but you're pretty sure where it is. And if somebody told you that something was just a little above the Sun, you'd probably be able to get it in the viewfinder. It would be that kind of a thing. You'd like to be able to see it better but if you couldn't you're chances of getting it are good and that's the way we feel about it.

QUERY What was the effect of the movement of that roll on the 60 minute exposures? Were they over already or - -

WINDLER Yes, yes, they were not going on. They only took data when the spacecraft was quiescent. All those exposures I should say, not just the 60 minute but the other ones too.

PAO

Tom?

QUERY What is the affect of - of having that filter on S054 then stuck between - the way it was found stuck between - or the filter wheels stuck between openings?

WINDLER The data is very much degraded. And I can't tell you - you know scientifically exactly how much, but yes it has been degraded to a fair extent. I guess we ought to let the - now that we know exactly the condition it was in. I'm sure the ATM people will be trying to evaluate that and give you perhaps a more quantitative answer.

QUERY And on the - on the TACS use, I know you said that it wouldn't have any effect probably on the - on the next EVA. But can you see down the road of having any effect if you were to use 3,000 pound-seconds - -

WINDLER Well - -

QUERY That - that still gives you plenty of insurance playing around there?

WINDLER Yes, we think we have ample margin. I didn't mean to say that it didn't have any effect on the next EVA. I think I was trying to say that we would still go ahead and do the EVA, but we'd certainly look at what we - our experienced today. And try to manage TACS better, particularly related to the PCU - PCU deflector. But - but certainly we'd want to see if we couldn't do that a little bit better. But we - as you're probably well aware oh, I don't know how many days, but it's been a long number of days since we've had any large amount of TACS usage, we just used a - a few hundred pound-seconds and less than that. And so we've really been getting ahead of cur - our usage rate or our red line, or whatever you want to call it.

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PAO

QUERY

Art?

To Bates on this water leak. Is what you suspect is true, will just putting it back with the right suit the PC - the right PCP with the right suit and connectors be - make it all right you think?

BATES

Well, probably not I'd - I think we're going to do some more testing probably in the next couple of days, what we'll probably end up doing is unless it turns out being more minimal than what we thought, we'd probably end up switching out the hardware. We have several spares on board as - we've had spares on board since SL-I launch and we've never used them except for switching up some of the umbilicals, so we have more than adequate spares on board.

QUERY

How - how many pictures were taken with TO25 and also with 201?

WINDLER

There were 40 taken with TO25 and there were 3 sequences taken with 201. And I - I guess I don't know how many frames that is. That includes some calibration and some stuff like that.

MUSGRAVE

Yeah, it's about 7 or 8 per sequences, I remember, so that's about 28 for TO - 201.

PAO

QUERY

Further questions? Louie?
This you may have already talked about and I missed it. But would you mind explaining what an H CAGE is? And what happens during these momentum rolls?

WINDLER

Well, every so often you have to - as you fly around the orbit, you gradually use some of your momentum capability. And essentially you - your CMGs - the attitude or the gimbal angles diverge and when they get to the stops then you lose control capability. And before that happens you need to reset. And the way you reset essentially you use your TACS, and you essentially drive the CMGs back to a nominal condition for that part of the orbit. As you're probably aware the - the nominal position of them varies as you go around with relation to the gravity vector and that sort of thing. So you - you're essentially bringing the C - the angles back to the right relationship.

QUERY

It's more sophisticated but it's essentially resetting the gyro and a gyro compass on an airplane?

WINDLER

Yes, except the only difference would be that it would cost you little bit to do that and that's the TACS penalty that you pay. If you had to spend some gas or something in the airplane to do that it would be kind of similar.

PAO

QUERY

Any further questions? Art?

Yeah, I don't know whether you've had a chance to talk to any of the scientists over there or not but we they particularly happy especially the Koh - -

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PAO Any further questions? Gordon?
QUERY I don't know whether you had a chance
to talk to any of the scientist over there or not but were
they particularly happy especially the Ko - Kohoutek
scientist?

WINDLER Well, I didn't talk to them. I gotta
believe they'll be happy though. (Laughter).

BATES Well, I know the T025 PI is happy.

WINDLER Okay. (laughter).

PAO Louie?

QUERY Based on what you saw today, you've mentioned
one change that you were thinking about and probably will
make for the Saturday EVA and that is concerning the
deflectors on the suits. Are there some others you've been
thinking about?

WINDLER I haven't been thinking about any to
tell you the truth. I'm thinking about how I'm going to
go home and eat some turkey. I'll think about that tomorrow
how that be?

PAO Okay, no further questions. Thank you
very much.

WINDLER I - really your question a little bit
better, I think probably the - the procedures are in a
pretty good state of readiness and there's not any - we're
not anticipating any major changes.

PAO Thank you.

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BAYLOR NEWS CENTER
HOUSTON, TEXAS

S/L IV - Change of Shift Briefing
Johnson Space Center
December 24, 1975
4:50 pm CST

Participants:

Phil Shaffer, Flight Director
Don Green, PAO

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Time: 16:56 CST
12/24/73

PAO

Okay, we're ready down and Dave got this evening's change-of-shift briefing with Phil Shaffer here on my left. I'll say nothing more except take over Phil.

SHAPPER

Okay, to have had been a very pleasant day. Certainly for the guys on in ground and I believe for me - for the crew. The Flight Plan was executed with great alacrity, if I said that right. You've just seen some of the TV that they sent down, the Christmas TV, which was done during a long LOS this morning about 9 o'clock. Today was a very busy day scientifically by that I mean, we did JOP 14, which is taking data during the annular eclipse that was described last evening. And backed right up against that was another JOP 18 Delta which is looking at the comet Kohoutek with the ATM. We had kind of an interesting little aside there and that is that with the solar eclipse going on, the Sun sensors were disabled to keep the spacecraft from following the eclipse to keep it looking at the center of the Sun. And when it was time to re-enable the Sun sensors, to update the reference system to go look at the comet, the eclipse was not over yet. And we had a - a notch out of the Sun by the Moon and the sensors just seek the centroid of the light, the center of the light source. So we went into the JOP 18 with a small pointing error. It - I'd could see it on the scope when he got up there but it was small. The comet was there, he could see the planet Mercury. And he took out the errors and went right in and picked up the comet. And it really worked very well today. The crew is in the process of preparing for the EVA tomorrow, and of course tomorrow is dedicated to EVA. The planned hatch opening is 10 o'clock local. And they'll be outside for about 5 hours. The evening is dedicated to stowing the gear associated with the EVA. And then one ATM pass on the Sun in the evening. Again, the questions and comments and information that flowed both ways today after we got through with the science part of the day and started getting to the EVA was - was very good in my opinion. The crew asked very pertinent questions. And I really feel like we're going to do a good job tomorrow. I guess I don't have - oh yeah I do too, the CMGs have had no distress, the heater management is working just fine. Spacecraft is again well behaved. We have no new information - new information on the telemetry problem that we had yesterday morning. That's all working normally again, and we're up to a (garble) holes in the sky. Questions.

QUERY

Maybe they gave an explanation during

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the day, because I wasn't on all day. Now about those two mib firings they reported last night? Was there any - what - what caused them?

SHAPPER Well, let's see, Howard. When I was on days last, 2 weeks ago or so? When I was talking to you guys and I kept telling you guys our - our predictions on the TACS cost is 3 to 4 mibs? We - we missed it a little bit. Today we anticipated using zero mibs and we used 4 again today. It's just a - this is an environment almost for 4 equals zero. Because it really is I think the accuracy of our predictions, and the other thing that I might point out is that yesterday, we had 5 momentum inhibits in a row. And twice we used the TACS to reset the momentum. And because it's hardware that we're dealing with, things don't turn out exactly like you anticipated. Again, I don't want to sound like a drunk parrot but the two CMG problems - -

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SHAFFER Things don't turn out exactly like you anticipated in the - again I don't - don't want to sound like a drunk parrot, but the 2-CMG problem is very sensitive. So that if things don't set up just right, i.e., where right is defined is as you modeled it in the simulation then the track of the momentum profile is not the same thereafter and in those places where you were close before you're now hitting boundary lines and you get a couple of TACS firings which are momentum desaturation firings and then press right on. It's absolutely no concern to us.

QUERY About how much fuel have you got left on that now?

SHAFFER 26,000 pound-seconds plus or minus 20 pound-seconds. And it's for all practical purposes 26,000 pound-seconds.

QUERY Did they check recently to find out if there were any more mildew on the liquid cool garments like they found before the last EVA or has that been checked?

SHAFFER Yeah, we checked those a couple of weeks ago and there was absolutely nothing on them. The crew got into the suits on one of their days off and no mildew in there. And they haven't opened them back up in EVA preps, that'll be going on this evening, but the odor was still there which indicates that there is something still there but they were unable to see anything like they saw before.

QUERY You saw the TV then, could you give us now your best description of that tree, where it was and what it was made of?

SHAFFER The - the area that the crew was in was in the upper end of the OWS I believe because I could see all the lockers around the - around the edge there. The tree looked like it was fastened down on a pedestal made of something that I did not recognize, to the grid work between the 2 areas of the - the living area of the OWS. I - I suspect it was taped - taped down. The branches of the tree I think were soup cans and butter cookie cans, and lemon drop cans, and et cetera. But those are impressions and opinions and I would not present them to you as facts.

QUERY If indeed this is correct does this present any concern to you as to have something in there that's made up of a bunch of tin cans, more or less just taped down?

SHAFFER No. Yeah, the question is interesting in a sense you know you worry about things - what - getting loose, bumping around, et cetera, but what's going to make them come loose? There are no accelerations on them, they're in free fall just like everything else up there. I think it's

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kind of a neat idea myself.

QUERY Is the next day still going to be the
day off?

SHAFFER The day after the EVA.

QUERY Yeah, oh-huh.

SHAFFER Yes, that's right. The - of course you
know we have TV scheduled again on the crew day off, and it's
crew option TV, they can do whatever they want to and we
do not have a EREP pass planned at present for that which
means we'll do at least 4 ATM passes on the Sun. Kohoutek
observations we probably will not do because the comet is
now so close to the Sun that you can't really see it. I
might add that the - the few days ago the spacecraft was
getting what was uncomfortably warm to the crew, it was
all right for them during the daytime but they felt like
they weren't resting very well because it was warm. And we
turned on the primary coolant loop which you'll remember is
the one that leaked essentially empty and we reserviced
early in the mission. The combination of turning on that
loop which doubles the cooling capability of the system plus
the last two or three days we haven't been maneuvering out
of solar inertial attitude and exposing the rest of the
workshop to the Sun, i.e., the sun shades protecting it has
made that a whole lot better. And Ed -

END OF TAPE

SL-IV PC70C/1
TIME: 16:56 CST
12/24/73

SHAFFER

- - latitude and exposing the rest of the workshop to the Sun, by using use sunshades to protect it has made that a whole lot better. And Ed commented on that today, that the spacecraft was a lot more comfortable. Now we're coming into a region of the mission where the - we have what we call a high Beta angle and that means that night passes are shorter and shorter, they don't go to zero we don't go to a hundred percent orbits. But, combining the increased sunlight with the Kohoutek maneuvers which we will be doing after perihelion passage has the potential for warming the spacecraft up again and it's something we'll have to be alert for. Keep it comfortable for them, as comfortable as we can. Again it's - it's not any big concern; I just pass it on to you. It was a nice day today.

PAO

Okay. Let me close up with one announcement: The members of the pencil radio and TV for the state wish to have me pass on to you and your team best wishes for a very Merry Christmas.

SHAFFER

PAO

We appreciate that, thank you very much.
Okay.

END OF TAPE

SYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 23, 1973
16:30 p.m. CST

Participants:

Phil Shaffer, Flight Director
Dr. Richard H. Munro, Co-investigator for S052
Don Green, PAO

SL-IV PC67A/1
TIME: 16:38 CST
12/23/73

PAO Okay, we're ready to start this one with Dr. Richard H. Munro, to my immediate right, co-investigator for the S052 experiment is here. He is with the high altitude observatory of the National Center for Atmospheric Research in Boulder, Colorado, he'll talk about eclipses. Next to him is Phil Shaffer the offgoing Flight Director. We'll start with you Phil and then take it back to you Dr. Munro.

SHAFFER Okay, today has gone well, we've accomplished the things that we set out to do. The M509 was done with no apparent problems, in fact the crew sounded very happy with the run itself. And today Jerry used the handheld maneuvering unit, which was done with no problems. JOP 18 Delta the viewing of the comet went along fairly well. The crew saw Mercury, which was very close to the comet was it not and compared their magnitudes as about equal in the television that would be a minus .5. And Dr. Munro tells me he's the guy that figured out it was Mercury they were looking at. The TACS usage for the Flight Plan so far today was essentially on the predictions. We predicted 35 mibs, and I remind you that a mib is about 5 pound seconds and when I left, we'd used 38 and we were home free, it looked like it was supposed to. CMGs since we've started managing the bearing heaters have had zero distress. So that appears to be a very worthwhile endeavor that we're in, but I'm here to tell you that it sure makes life tough because we're having to work that - work those heaters about twice a rev. And you get in - you get into a problem there because you can't let them get too hot or they'll get an automatic shut-off and if you get that you've got to let them go all the way to the automatic turn on before you can bring them back up. And the site coverage is just not compatible with a fully optimum management and by optimum I mean letting them go as far down as we want to go and let them go as far up, we have to catch them on the up-swing and catch them on the down-swing and put them in a proper state as a function of how far away the next station is. I guess I don't have a heck of a lot more to say about today with the exception of one small thing that I might mention. At 10:00 this morning that's Zulu, we had what is in my mind the truest sense a glitch. And by that I mean that something in the order of 250 parameters on the downlink associated with the airlock module turned to words. And we tried many different combinations of instrumentation system components with absolutely no success. At 14:00 Zulu it went away. And we have got the people of the world geared up now looking into that to see what it is, see if we can get a mechanism but it was - it has the phenomena of - we have things called multiplexers which are little black boxes that feed several

SI-IV PC67A/2
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parameters. And the appearance is that a few parameters in each of these little black boxes and there's a bunch of them got funny. And it is so far very, very difficult to understand what would produce that phenomena, the obvious thing that you have to do is try to find a point of commonality among all of those parameters, that would produce the problem we had. And haven't got anything more to tell you about that one. The crew's information onboard is unaffected by this. Obviously the caution -

END OF TAPE

SL IV RC-67B/1
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12/23/73

SHAPPER The crew's information on board is unaffected by this. Obviously the caution and warning system was all right. Our monitoring on the ground is still adequate, but it's a lot harder to come by. You now have to deduce a lot of states, rather than read the states of the different systems out directly. Like, for instance, we lost some instrumentation on part of the power distribution system, but we could tell it was working all right because of the - the electrical buses downstream of the distribution system were operating nominally. But the glitch has gone away in the truest definition of a glitch. It came and it went, with no explanation at this time. But, I say again, there's a lot of people working at it. Tomorrow is EVA prep day. We have another TOP 18 Delta scheduled, and of course we have the Christmas Eve F - television, which is crew option television, we have an hour for all three crewmen set aside for that. Have a major medical tomorrow. And that's it. That makes up the day. There are some AIM passes scattered around in there, but there are always AIM passes scattered around, but the name of the game tomorrow is get ready to go do the EVA. Today Rusty Schwerickart visited with Jerry for awhile about the EVA, cleared up some points on the S054 filter wheel work that we intend to do and Jerry sounded like to me that he's happy with the work as outlined in the procedures that we've uplinked and he understands what he has to do to the S054. I think I'll pass to Dr. Munro now and let him talk to you a little bit about the eclipse and field your questions and -

MUNRO Okay. Tomorrow we're going to - Earth and - we're going to see here an annular solar eclipse. This is not a total eclipse. The difference between the two is it happens to be that the apparent size of the Sun and the Moon are very nearly equal. But, the orbit of the Earth around the Sun and the Moon around the Earth are not circular. So their apparent sizes change. And when the Sun happens to be - the apparent size of the Sun is smaller than the Earth - than the Moon, excuse me, then we have what is called a total eclipse. That is that the Moon can then block out all of the sunlight. However, there are other times when the reverse is true. That the Moon is smaller than the Sun, and thus when the Moon passes in front of the Sun, we get a ring of sunlight at the maximum eclipse time, which is about 2 percent or so of the total area of the Sun. Now, Skylab will pass through the eclipse path approximately on three separate revolutions. And the AIM will be observing on each one of these. And also a few others to get essentially two different types of data. The first is that the eclipse of the Sun by the Moon creates a circumstance where the resolution of the various AIM instruments

SL IV PC-678/2
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12/23/73

are actually increased. And the second is that from the observation, the instrumental and engineering parameters can be obtained, which are essential in the evaluation of the scientific data in the postmission analyses. The - like to elaborate a little bit on the first point about the increased resolution of the instruments. In particular S055 will be pointed at - Ed Gibson will point the S055 at bright points in the Sun's atmosphere. And then allow the path of the limb of the Moon to pass between the Sun and Skylab, and in this way, you have a - slowly will extinguish whatever is within the aperture of the instrument. And since this does this in a - almost like a shutter fashion, we can then see things on the Sun. Objects which are smaller than the resolution of the instrument as it is right now. This also can occur as - by -

END OF TAPE

SI-IV 80-67071
Time: 16:38 CST
12/23/73

MUNRO Are smaller than the resolution of the instrument as it is right now. This also can occur a - by taking a rapid number of pictures, like in the X-ray experiments. And comparing the lib of the Moon from one picture to another they then can resolve much finer detail than they can with their - with the present instruments. The other is the sort of engineering and instrumental parameters; by observing the Moon, one can figure out how much scattered light or background is in the instrument and this can more exactly subtract off a low sort of fog background from both films and detector counts in the case of S055 and therefore look farther into the corona with their - the other long exposures that we've taken throughout the mission. I think that's about it we'll be doing this again for about 2 cycles unattended and three manned cycles.

SHAFFER I might remind you that this detection of smaller features on the Sun is not a theory that we have one example of this from Mercury passage on S055 that we got prior to the launch of Skylab IV which was done unattended.

QUERY Phil, on the TV when the - when - when is the TV going to be dumped, and when are we going to be able to see it tomorrow?

SHAFFER I thought you would never ask. (laughter) The - the stateside passes begin at 22:23 Zulu tomorrow evening which is about 4:23. And that is when it will be retrieved on the ground, and sometime after that then it's available. And you'll have to talk to the - to the other side of the IV management, but that's when it's retrieved on the ground as beginning at 4:23 tomorrow evening.

QUERY Are you going to have time for a full 30 minute dump then of video?

SHAFFER It may take a while to get it down the - See we are beginning at 4:23, we have a Texas and MILA which is going to be probably on the order of 10 to 12 minutes. And then the next rev we have Texas and MILA again with Goldstone. So should have it all down by 6:00, about. Certainly I would believe no later than that, that's 6:00 local.

QUERY Phil, do you have an idea how long the EVA is going to run at this time?

SHAFFER Yeah, I believe it's about 5 hours nominally, on that order. And we expect to take every bit of it. There is - there is some pad time in there but you know you always run into some things when you get outside that - that you didn't anticipate completely, so you always put the pad time in.

QUERY In the medical report last night they mentioned that the science pilot had taken something called

SL-IV PC-670/2
Time: 10:38 CST
12/23/73

Dalmane and the pilot had - had taken Tin Tin, I guess that is what it is. Do you know what those are for?

SHAFFER I wish I'd asked you that, no sir.

QUERY What has your crew done in the way of Christmas plans for - for when you sign off tomorrow?

SHAFFER My team, is that what you asking?

QUERY Yeah.

SHAFFER Oh, there's some Christmas cards in

work and -

QUERY I would like to ask Dr. Munro about the - at what time will they be making their first - taking their first looks at the eclipse and where will they be and where will they get the best views and things like that?

MUNRO I think time is 15 - 13:55 is when the first - 52 - all right on the first pass and will be the - with the next three passes they'll be taking a look at the eclipse.

SHAFFER They'll be down in the Pacific headed for the tip of South America.

MUNRO We might like to mention that the United - eastern United States and Canada right at sunrise will be treated to the partial eclipse of the Sun tomorrow, if anyone wants to get up that early.

SHAFFER I can just see Benedict getting up at sunrise tomorrow.

QUERY I'm getting up at 6 o'clock - -

SHAFFER Don't tell me that. (Laughter)

END OF TAPE

SL-IV PC67D/1
TIME: 16:38 CST
12/23/73

MUNRO
up that early.

SHAFFER

SPEAKER

QUERY

partially occluded give you an opportunity to get a good look at Kohoutek, I mean taking away some of the lights - isn't it going to stand out more for the people say in South America where the eclipse is closer to total?

MUNRO
Yes, definitely there are several expeditions down there in order to photograph the comet and study the comet as well as the Sun during the time of the eclipse, yes because there's - again I mentioned about 2 percent of the sunlight will be remaining and that's a tremendous - the - cuts down the scattering in the atmosphere and will bring the comet out and it stands out quite well. Because right now we really can't observe the comet that well from the ground because it's right at sunrise and we get the moon also up at that time as well.

QUERY
Would it also apply to the crew and are they going to be taking associated photography of the comet at the time.

MUNRO
Right after the eclipse again the JOP 18D is scheduled. Above the Earth's atmosphere, one doesn't have to worry about scattered light. And so once one looks away from the Sun, they can see the comet quite well.

SHAFFER
We are taking photographs of the comet with the - in the S233 experiment that's being done in the command module but as far as the corollary Kohoutek comet investigations where we do the maneuver and use the minus E SA, or using the ATM right at that time, doesn't know. Put - But that's not unreal. Okay, because out there in space when you maneuver and look at the comet, okay with the narrow field of view instruments, it doesn't make that much difference it's dark. (garble) so the fact that - that the Sun's - the - guys don't have the problems we have, they don't have light scatter and reflected light and all that in fact they've had the first indication of what might be a problem associated with the comet getting close to the Sun. We may have had a little reflected light making the occulting disc in some places a shadow in the UV here but I can't say that it's our first - we've seen it. But in general those guys are looking at a black space and whether the Sun is occulted or not doesn't - doesn't affect the Kohoutek investigations. From the sky.

QUERY
Isn't there going to be in effect during this eclipse kind of a string of parallel light, isn't the Mercury - Mercury also going to be close to the same field of view.

SL-IV PC67D/2
TIME: 16:38 CST
12/23/73

MUNRO Yes right, Mercury was right near the comet. And the comet, I think, is something like 9 degrees now away from the Sun. So one is going to see again planets and brighter objects but it won't be as spectacular as during the total eclipse, when you don't have to worry about sunlight scattering in the atmosphere and you can actually see quite a few stars.

QUERY What is the Earth groundtrack of the eclipse, where does it begin and where does it end?

MUNRO Well it looks like it begins about Acapulco and runs down the western side of Central America then passes through northern South America, then out into the Atlantic and finally into the west coast of Africa.

SHAFFER Dr. Munro has a picture of that if, I would invite you to look at when we break up here that shows you precisely what the track is there.

QUERY Any official maneuvers required to look at it?

SHAFFER To look at the Sun?

QUERY No, (Garble) the eclipse yeah?

SHAFFER I don't know -

MUNRO Yes there is, mainly because as the Moon starts picking chunks of the Sun away, the fine sun sensor would try to trap the centroid of the light and therefore we have to take the fine sun sensor off and use another type of pointing.

SHAFFER I was saying no, no, no because when you said is there any special maneuvers and the answer is still no but there are some special procedures to keep it from maneuvering.

PAU Okay, that ends it.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 22, 1973
16:16 p.m. CST

Participants:

Phil Shaffer, Flight Director
Bob Gordon, PAO

SL-IV PC66A/1
Time: 16:16 CST
12/22/73

PAO We have Mr. Phil Shaffer, off-going Flight Director, who will give a report on today's activities and the schedule for tomorrow. Phil?

SHAFFER Okay, today was by far the best day I've had with the crew in the execute shifts I've pulled. They executed today's Flight Plan through this point by the numbers. In fact, they managed to stay a little bit ahead of the Flight Plan all day long and were able to do some odd jobs for us as we asked. As we told the crew when we left the console - we were relieved by the bronze team, we'd had a super day with them. No new anomalies, no problems. The CMG heater management that we began last night is on-going and since we began that heater management, we have had no CMG distress. However, it's a bit early to conclude that we won't have any. But the intent of the bearing heater management is to try to preclude that distress. Tomorrow is a typical Skylab day. The only outstanding parts about it are another run with M509, the maneuvering unit inside the spacecraft and another JOP 18 Delta where we look at Kohoutek with the ATM instruments. Other than that, it's of a normal kind of day. That's all I have at this time.

PAO Okay, Phil, thank you. This concludes the change-of-shift report from Flight Director Phil Shaffer. The new flight director here at Mission Control Center is Chuck Lewis. New CAP COMM is Astronaut Dick Truly. We'll play back the stateside pass in a few moments.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

S/L - Change of Shift Briefing
Johnson Space Center
December 21, 1973
4:34 pm CST

Participants:

Phil Shaffer, Flight Director
Harry Clancy, Guidance and Navigation Officer, JSC
Dave Garrett, PAO

SL-IV PC65A/1
Time: 16:34 CST
12/21/73

PAO

Okay, we're ready to get started with our change-of-shift briefing this afternoon. We have with us the off-going Flight Director, Phil Shaffer, and with him is Harry Clancy, who is a CMG expert from the Johnson Space Center. Phil, would you like to start?

SHAFFER

Yeah, Harry is my GNS. You hear a good name that stands for Guidance and Navigation Systems or Gyros something-or-other - Guidance and Navigation Systems. Harry's the guy who watches out for the whole APCS excluding the software. Today, we had a couple of firsts that I would like to tell you all about, at least for Skylab IV. We started the metal working experiment again today - M518. You'll remember that we ran a lot of those during SL-III as - even though they were not scheduled because the crew had enough time to run some. So we ran some of those and we re-began those again today. That piece of equipment powered up all right and was in work. We were a bit late starting with the - the heat up of the samples because it took a while to evacuate the chamber - that chamber runs in the vacuum. We were 4 hours late, maybe, getting it started. All that - all that means to you is that we have to turn it off 4 hours later than we planned to when the samples have reached their heat - the heat specification. We ran JOB 18 DELTA today which is Kohoutek observations with the Apollo telescope mount. And Ed saw the comet in the TV this time. And we feel very, very good that we got comet data through the narrow field of view instrument such as S055 with its 5-1/2 arc minute field of view, and 82B which is 5 arc minutes, but I guess it's 1 arc minute. But it was - it really went nice today. The - the crew was comfortable with it. The vehicle behaved itself, and it really went like a piece of cake. Harry - Harry was the guy that had to do the big job of monitoring today. During that we set out in a JOP 18 attitude for - no it's almost 3 hours from the time you leave solar inertial until you get back. And Harry's gear worked great, and he might want to say something about that here in a minute. The rest of the day went along fairly normally, we did the weekly checks on the command and service module today and there was no problem with that. One of the things you heard new today was we powered up the computer and loaded a state vector in it. And that's part of our ever-on-going vigilance, the - the what-if games. We've got some procedures on board that if we should lose another CMG, we would want to take control with the CSM. With a full-up guidance and navigation system and one of the things - one of the problems that we had was the computer has a vector in it that was left in there from rendezvous. And we're going to have to integrate that thing

SL-IV PC 65A/2
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a long time - and it takes a long time in the computer. So today we powered it up and loaded a vector that is essentially current for all the time. That is to save the crew the time that would be required when they powered the G&N up. Tomorrow is the Skylab-IV day. I can't really tell you anything different. We do not have a JOP 18D, we have a lot of ATM work, and we'll be looking at Kohoutek with the S063 maneuver and the S201 maneuver - not maneuver - S063 instrument and S201 instrument. We're also going to try to catch an atmospheric disturbance again from a rocket launch. You know, we've tried that twice now and haven't made it. We're going to try her again tomorrow. I haven't got a heck of a lot more to say. Harry, would you like to summarize what you saw in the APCS performance today and how well your predictions ran and et cetera?

CLANCY Well, about all I can say along those lines is that everything went real good. We run simulations prior to these maneuvers when we're planning them to see what's the best way to do them. And our simulator shows that today we would fire four TACS - mibs and sure enough, during the JOP 18D, we did fire four. So we felt real good about that. And other than that, everything went real well.

SHAFFER

No distress on the -

END OF TAPE

SL-IV PC65B/1
TIME: 16:34 CST
12/21/73

CLANCY - - four TACS miba, and sure enough during JOP 18 D, we did fire four, so we felt real good about that and other than that everything went real well.

SHAFFER No distress on the CMG. None - that was happier than I was. Which was - it was happier than I was which is I'm the only thing that was less happy than Harry.

PAO Questions?
QUERY Yeah. What time is the Minute Man launching tomorrow night or tomorrow.

SHAFFER Well I can't tell you exactly Howard, the interval is probably around, 3:10, 3:15, that's Zulu 03:10, 03:15. And I - then you said Minute Man I don't know whether it is or not.

QUERY Oh I see, I thought it was the same one they've been scrubbing all along.

SHAFFER It may be. All that means is I don't know that that's it.

QUERY Okay, I have a couple of others here, let's see - you said they were 4 hours late, you mean - and had to turn off - turn off the chamber 4 hours later. That means they have to stay up late tonight or something to do that or can you turn it off from the ground.

SHAFFER No it was nominal; it'd be turned off tomorrow anyway.

QUERY Oh, I see -
SHAFFER You know they got different kinds of metals in there different kinds of materials that they melt in the vacuum and then essentially dissect them to see what happened to the gas pockets and see how round they are and what crystalline forms were doing all that and that's a very slow heat up and chill down. As I remember the thing we started, the - we were to start the heat up at about 14 - about 14:00 today, and the - it was over 24 hours before we were ready to pull the samples.

QUERY Had one more. Did they say - - I wasn't on all day today - did they say anything when they saw the comet in the TV monitor.

SHAFFER He said I see a very faint image at a position of X plus 100, and Y plus 130. And we checked that very quickly and that was within about 4/10 of a degree on the scope of where we predicted the image would be which is as far as we're concerned was conclusive and he by the way did something and I've forgotten now, either shut the door or swapped the TV source. And the image went away. Demonstrating that it was external, that it was not something in the TV. So we're convinced that he did have the comet today.

SL-IV PC65B/2
TIME: 16:34 CST
12/21/73

QUERY
live?

SHAFFER
back yet..

PAO

QUERY

what the latest guesstimate is in case of that other CMG were to go, how long, with using RCS and TACS you'd be able to stay, is there any new figure, the last I heard was 35 to 40 days.

SHAFFER I'd guess it's closer to 30, but- they're all guesses, you know until we do it and see what the propellant consumption rate is. All we have is the results of our analysis and - and when you take ones and zeros and simulate pieces of hardware, there are some uncertainties in it and in my own opinion is it's closer to 30. Harry might have a better guesstimate.

CLANCY No, the thing I'd like to say is it's dependent upon what you do during the time also. If you do - try to do any maneuvers it would - -

SHAFFER That shortens it. That's an excellent point because all of the numbers that you guys have heard assume we do absolutely nothing except set steady state in the rocking solar. inertial - no EREPS, no ATM and et cetera. Those beauties in EREP pass is worth about a day of steady state.

QUERY
didn't hear -

SHAFFER

QUERY

SHAFFER

QUERY

as it was?

SHAFFER

QUERY

SHAFFER

there was something like 40 sunspots in it and when it did flare if it flared, there would be I guess what I understood is sympathetic flares in the same complex of stuff that's going on there and there's a big filament that's part of the system and the chain of sunspots and bright areas -

Did you see it down here or wasn't it

The TV is recorded and we don't have it

Tom.

Just for the - I'm trying to remember

I'd guess it's closer to 30, but-

they're all guesses, you know until we do it and see what the propellant consumption rate is. All we have is the results of our analysis and - and when you take ones and zeros and simulate pieces of hardware, there are some uncertainties in it and in my own opinion is it's closer to 30. Harry might have a better guesstimate.

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Did the big flare ever go off today. I

Hadn't yet.

Hadn't yet?

That - that means we haven't give (sic) up.

Is that active region still is as active

00, yes.

00?

Yes. Yeah, I heard at one point today

there was something like 40 sunspots in it and when it did flare if it flared, there would be I guess what I understood is sympathetic flares in the same complex of stuff that's going on there and there's a big filament that's part of the system and the chain of sunspots and bright areas -

END OF TAPE

SL-IV PC65C/1
Time: 16:34 CST
12/21/73

SHAFFER - - chain of sunspots and bright areas. Apparently it's really a beauty. You guys I see you were here last night when Luther was talking about one of the things we were considering was heater management on the CMGs. We - we intend to start that tonight or tomorrow. And I would like Harry to give you a rundown of what it is we are doing and what it means to our operation. And I guess since Howard wasn't here last night you might be missing the -

QUERY

Well, I - I was listening to it - -

SHAFFER

Okay, so you know that the bulk of the vast majority of the time we have got on this are on low temp - the low end of the temperature scale. So, I would like Harry to take just a few minutes and tell you what it is we are doing with that, and what it means to us.

CLANCY

Okay, right most of the problems have occurred down around the temperature range of anywhere from 59 to 64 degrees on the bearings. And, so, the plan here is to manage the heaters, bearing heaters so that we never get down to that range. And hopefully that will keep the CMG out of distress, we won't see this problem as long as we are able to control the temperature. And the way that we do that is we - the normal heater cycle is between about 60 and 80 degrees. So, we are going to let the heater come on and get up to almost 80 and we are going to turn it off and let it go back down again to around 60 - 67, 68 degrees and turn it back on again. Now, this won't be a great problem except that it is probably going to be occurring every 2-1/2 to 3 hours - that we'll have send commands. So, it will increase our work load a little bit. And essentially that is it.

QUERY

Why can't you leave it on all the time. Just keep it up around that 80 - 80 degree range.

CLANCY

Because it automatically shuts off when - when it hits 80 it automatically shuts off. And we can't then command it back on again, until it goes all the way down to 60 and it - and the thermostat turns it back on.

SHAFFER

The point, Howard, is he has to get in the cycle while both heaters are on in order to stay in it.

QUERY

You say - you say you can't turn it on again until it goes back to 60, well, how can you turn it on again then at 67?

SL-IV PC65C/2
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12/21/73

CLANCY Because when I turned it off it was in the ON mode and there were certain relays set in there that when the temperature drops and I turned it back on again the heater will come on. If I allow it to get to 80 and it automatically turns off, I cannot - nothing I - no ground commander - no command can turn it back on again until that thermostat reads 60. It is just a function of the way the relays are set up within the heater.

PAO com.

QUERY Let me - let me get this straight. You said just before it gets to 80 you shut it off.

CLANCY That is correct.

QUERY From the ground.

CLANCY That's correct.

PAO Are there any further questions?

QUERY Control? - - Santa Claus doing today in the Mission

SHAFFER The Santa Claus in Mission Control?

QUERY They announced that he was about 3 o'clock this afternoon or 3:30.

SHAFFER Unfortunately, Howard, there are those among us that have to work. (Laughter) I didn't know he was there.

QUERY They told the crew about it and the crew -

SHAFFER Oh, yes I remember that now I had a big ditty going on at Rusty Schweickart with all that - And I remember that now that you said it. I - I haven't been the same since Merlin the Magician showed up in the control center one day with - with a pointed hat and the stars and moons all over his black gown. I still haven't figured who that guy was - or what he was doing there.

QUERY When was that?

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Time: 16:34 CST
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SHAFFER
in SL-III.

QUERY

SHAFFER

QUERY

PAO

SHAFFER

END OF TAPE

It was a long time ago, it may have been

Another Kohoutek nut.

Yes, it all gets mixed up.

Okay. (Chuckle)

Anything else. Thank you.

You bet.

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 20, 1973
5:25 p.m. CST

Participants:

Phil Shaffer, Flight Director
Mr. Luther Powell, Skylab Program Office, MSFC
Dave Garrett, PAO

SL-IV PC-6^A/1
Time: 17:25 CST
12/20/73

PAO We're ready to get started today with our change-of-shift briefing. We have with us the off-going Flight Director Phil Shafer and to his right is Luther Powell from the Marshall Program Office who is our resident expert on the CMG. Phil if you would start it off please.

SHAFFER Okay, the only thing that bothers me about a resident expert on CMG is that you guys already remember everything I've been telling you. (Laughter) that's bad. Today was per to Flight Plan, no problems with the exception of TV77 which is a tour of the equipments that are used to study the comet. And it's going to take longer than we had scheduled. And my opinion of why it's going to take longer is that the guys want to do a very good job of that. And they took a lot of time deciding what it is they wanted to do to make that a good TV show. And they feel now like the - that they've got it set up and got it in their mind what they want to do. And it'll take a bit longer and we'll schedule some more time for that later, not tomorrow. The M509 exercise was in progress - the preps were still going on the last time I was - was on the loop. So I'm not real sure where that is, you all probably got better look at that than I do, I was doing pad reviews, checklist changes for the EVA next Tuesday, which is why you all had to wait. You like that Jim?

QUERY Oh yeah.

SHAFFER (Laughter) okay, tomorrow is a relatively busy day with JOP 18 Delta again to go get the comet with the ATM instruments. Have medical runs on all three of the crewmen, the M131 runs, the rotating chair. Lots of ATM activity. That's about the size of it. You know this is the first execute shift that the purple team has pulled since this mission began, I've pulled some occasional shifts for some of the other guys and of course I haven't been on executes for I guess 10 days or so since I pulled a shift. But I - these guys today seem to me to have settled down a lot more than they had before. And they clicked along right on the time line without any significant problems at all. You know we had one small flare today, and Bill Pogue was right there and he saw it before we did. And when we started trying to talk to him about it he was already on it and working it. It wasn't - it didn't amount to much, it's what they call a subflare which is a low numbered C-flare which is the low end of the measuring scale. But today I was pleased with the guys. Questions?

QUERY Yes, what's the TV show, is that the one Tuesday?

SHAFFER The TV77?

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QUERY Yeah.

SHAFFER No, this is one of the preplanned exercises as I understand it Jim wherr they go around and take recorded TV of the different instruments that are used to observe the comet. And talk about those instruments and what those instruments are looking for, and some of what they hope to get out of the information that the instrument gives.

QUERY Well, when is it going to be?

SHAFFER Can't tell, I don't know when we're going to get to schedule the time to finish it. Tomorrow was already full so we didn't get any time to do it. And Ed told us today that he thought it would take about 3 more hours total time to - to finish it and do it right. So it's now a flight planning problem to find him the three hours to do that, it takes two guys you know. I think Ed is narrating and Jerry is the - is running the camera for him to do these. But I'm sorry I can't an - I don't know when it'll be finished now.

PAO Tom.

QUERY How much data did he take yesterday in the JOP on Kohoutek? Is TV the only thing that you can get?

SHAFFER No, S052 took data and I wasn't on yesterday so I'm going to have to flounder a little bit. But the S052 took data, S055 may or may have not taken data and we can't really tell because the data take was in a South Atlantic anomaly and it's going to take some fine-tooth reduction of that data to know whether we got -

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SHAFFER South Atlantic anomaly. And it's going to take some fine tooth reduction of that data to know whether we got the comet or not. And of course the other estimates are filmed, and we don't know whether they took it or not. I - in fact I don't even know if the other instruments ran or not. You know the 82 and S082s, both of them and S056, but I don't know.

PAO Paul.

QUERY Is there anything anomalous in the least occurred in the C&D today?

SHAFFER No. Not to my knowledge. There was a very minor period of distress yesterday afternoon. Is that right Luther? You're probably a little closer to this than I am. Did it -

POWELL There was nothing today, it was yesterday for - for a period of about an hour. We saw some conditions that were of concern to us, mostly increased phase current to the motors of the CMG and the DELTA temperature between bearing 1 and bearing 2 decrease. As the bearing came closer together in temperature. And that's -

SHAFFER They did not come as close as they did 4 days ago. Did they -

POWELL Yeah, at one time they actually crossed over, just briefly -

SHAFFER Did they? Okay -

POWELL - just briefly. But nothing today, today has been very smooth.

PAO Paul, you got another question?

QUERY Does it appear that the frequencies of - of these signatures, as they've been called before. The frequency is - is - they're coming closer together now than they have?

POWELL Well, I don't know if you can call it a frequency. We've had them. We had one Saturday and we had one yesterday. And I think the one before was probably 3 days. I don't think that you can put any kind of cyclic nature to it at all. It's just phenomena we see and we can't give you any conditions at what causes it. We think temperature is a major contributor to the cause being on the lower end of the temperature control band. We feel like that stretching the bearings through the maneuvers are also causes but we can't give you a single cause for it. We think it's probably two to three things coupled together, and you've got to be in the right environment to do it. You take each one of those separately and you can find many many times where the temperatures on the low end of the band will go through maneuvers and have no problem. Other times the temperature can be slightly off the lowest end and have maneuvers, and have a problem. And there's just no pattern to it, no frequency. And it's just - it's a phenomena

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that we're observing that we really can't give you a good straight answer as to what's causing it. We got people now really investigating trying to come up with a fix on it or a cause, and then see if there are remedies that we can come up with. We have remedies now that we're - we're looking at, some that we're about to recommend.

SHAFFER Luther, it's fair to say that the last 4 of these periods of distress have averaged about 4 days, haven't they?

POWELL About an average I guess you could say 4 days.

SHAFFER Yeah, with no significant - in fact this last one is a bit further from the previous one than the one before that. So, it would be very unfair to conclude that the - that the periods were getting shorter between them.

QUERY Okay.

QUERY How about the quality and nature of your concern for this problem, is it remaining static? I mean you feel the same way about it that you did when you first observed it? Or are you becoming more apprehensive, less apprehensive or what?

POWELL Well, we're - we're concerned I guess as much as we were when we first saw it. We're becoming more apprehensive in a sense that we can't give you - you know we can't put our finger on a definite cause. We see it and we think we understand part of it, and because of the nature of it and - and it's critical contribution to the program or to the stability of the Skylab we're - we're concerned about it.

QUERY Is there a possibility this thing is that these little funnies that are happening and it's going to perk along perfectly well?

POWELL It's very possibly, very possible. It could perk along and keep seeing these little funnies and we'll make it to the end of the mission. It's very possible.

QUERY What is a CMG reset? They - they were told to prevent today that was going to occur when they - -

POWELL Okay.

SHAFFER And tell them that it might occur.

POWELL It might occur. We did have one yesterday.

SHAFFER There is a difference.

POWELL Only what happens is that the computer has a momentum profile in the computer and that - from the a profile of what the co - the momentum should look like any point in the orbit any day of the year. And when the

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momentum gets to the point to where we feel like we're going
to into a TACS only mode or the gimbal giving a stop so to
speak, you've heard that term I'm sure, and a reset takes
place where the gimbals go back to a -

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POWELL Like we were going to go into a TACS only mode or the gimbals giving a stops, I would speak you heard that term, I'm sure. And a reset takes place where the gimbals go back to a 00 condition as the angles of the gimbals relative to each other are zero. The angle momentum vector then lines up in the axis where that CMG is placed and then it's released from that point causing the CMG then to go to the H - the nominal momentum at that point in the orbit. And doing that you use TACS to do that. And that's nominally called a reset or - or a nominal H CAGE.

SHAFFER In summary it resets the momentum stage in the CMGs to what they're supposed to be for that point in the orbit.

QUERY But that did not occur?

SHAFFER No,

QUERY Okay.

SHAFFER The - the trigger for that is - is saturation - -

POWELL Saturation.

SHAFFER Saturation no control left plus a an attitude error.

POWELL Right.

QUERY Okay, have y'all established any relationship bet - between the CMGs and this noise that they heard in the CSM, the cloppy-clop?

POWELL Just the converse, we have satisfied ourselves that there's no relationship.

QUERY There's no relationship.

POWELL There's no relationship.

QUERY These remedies that you're looking at - -

SPEAKER Um,um.

QUERY Would - would they inhibit attitude maneuver?

POWELL No, they would not.

QUERY Well, what is it you can do then that would - -

POWELL Well, in order to stress the bearing, the inner gimbal of the CMG is torqued during a maneuver to impart back into the vehicle the momen that it's been storing because of noncyclist torques received during the orbit. This makes the vehicle move into an attitude that is different from solar inertial. And when you torque that gimbal to make the spacecraft move, you stress the bearings. Now, it depends upon how far you want to maneuver in the orbit, how long you - you want to take from the time you initiate until you're in the new attitude, and how far you're off from the attitude. that dictates the rate that you'll

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go from the present attitude to the new attitude. And what we're trying to do is to reduce that rate to where the load on that gimbal is minimized.

QUERY Are you saying it just takes more time to make the - -

POWELL Well, it will take more time, and particular right now we're doing this strictly with the dump maneuvers. We are not - we're not looking to - to reduce the rates on the maneuvers for Kohoutek nor for EREP.

QUERY

Well, is it primarily more time?

POWELL

It's primarily more time. The slower

rate.

PAO

Are there any further question. Not.

Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Press Briefing
Johnson Space Center
December 19, 1973
14:05 p.m. CST

Participants:

Dr. Buford Price - Principal investigator S288, University of
California, Berkeley California.

Ralph Murphy - PAO

SL-IV PC-62A/1
Time: 14:05 CST
12/19/73

PAO We have Dr. P. Buford Price with us this afternoon from the Berkeley campus of the University of California who is the principal investigator for experiment S228. Dr. Price, we'll let you take over here.

PRICE Well, I was asked to say that there are four experiments of a rather similar nature on Skylab, and I thought I would just mention the other three before talking about mine. They all deal with atomic particles in the environment around the Skylab. One of these concerns particles that have so low an energy that they never even make it through the micrometeoroid shield. That experiment is being done by Professor Gice from Barron, Switzerland, and one of the astronauts Don Lind. I just talked to Don Lind and he had an impacted wisdom tooth removed and can't be here. They are looking for very low energy particles that reach the Earth's atmosphere either from interstellar gas or from the Sun or perhaps from the Earth's atmosphere itself and cause the beautiful displays called auroras. Well, a couple of times in each orbit the spacecraft passes through the auroral zones in the northern and southern hemispheres and there are foils of metal which collect these atoms of moderately low energy particles that produce the colored lights. And they are trying to determine the origin of these particles. A second experiment was developed by a high school student. His experiment is to look for neutrons within the spacecraft and to determine their origin. Now the neutron is an unstable particle. It has a half-life of about 12 minutes. That means if you start with a pot of neutrons they are half gone in 12 minutes, and three-quarters gone in 24 minutes, and so forth. The source of these neutrons is the reason for the experiment. They have to be produced somewhere nearby because they are radioactive. And the investigator, the student, wants to find out whether the neutrons come from the Sun, perhaps produced in a solar flare, or whether they are produced when cosmic rays penetrate the spacecraft, or whether they come from cosmic ray collisions with the Earth's atmosphere. The third experiment is being done by Dr. Shapiro from the Naval Research Laboratory. He has a large block of nuclear photographic emulsions and he attempting to study the composition of cosmic rays from hydrogen up to about iron. And my experiment deals with the very, very heavy cosmic rays that go on perhaps beyond uranium and on out into the region that we would call superheavy elements. So let me tell you about cosmic rays and about what superheavy elements might be and about some progress. And let me go down in just a minute and let you look in the microscope at one of the sheets of plastic that we recovered from the Skylab itself. Here is a picture of the periodic table of the elements ranging from hydrogen at the upper left to the very heavy elements in the lower right.

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Now when we get to the lowest row, let me read them off to you. We have actinium, thorium, protactinium, uranium, neptunium, plutonium, americium, curium, berkelium, californium, you note the names of these very heavy elements are devised by the people who discovered them, einsteinium, fermium, mendelevium, nobelium, lawrencium, and then rutherfordium, and hassium. The hassium is element 105, remember that uranium is element 92, and beyond element 105, there's nothing else, and yet there is a spot in the periodic table for element 106, 107 right on up maybe even to element 126 or possibly beyond. And part of the thrill of our experiment is to see if where man has not been capable of making such heavy elements maybe nature is. Now the cosmic rays are just atomic particles that are individual elements in the periodic table but they come one atom at a time. They of course cannot be seen in even the most powerful microscopes and they're moving with nearly the speed of light. They're moving so fast that they've lost all of their electrons and retain only the bare nucleus, which is extremely dense and has a tremendous penetrating power. A cosmic ray that starts way over at the other side of our galaxy can travel all the way into the solar system - -

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PRICE

-- the speed of light. They're moving so fast that they've lost all of their electrons and retain only the bare nucleus, which is extremely dense. And has a tremendous penetrating power. A cosmic ray that starts way over at the other side of our galaxy can travel all the way into the solar system and plunge right through the spacecraft and right through our detectors. Here is a picture of our array of detectors, which consists of 36 modules, each one in a pocket. It's right here behind the rotating chair that is used by the astronauts. And it's against a very thin metal wall of the spacecraft. So there's very little matter between the detectors and the outer space. One of these 36 modules has been returned to Earth after a 115-day exposure. The third group of astronauts took up a new module with them. Instead of putting it in the empty pocket, however, we asked them to put it on the outside of the spacecraft to see if there are any very low energy cosmic rays up in the vicinity of uranium that might not make it through the walls of the spacecraft. So we have one new module that is studying very low energy particles, that was not intended in the original experiment, and 35 more on the inside. Now just for fun, we're leaving one of those 35 for posterity. Posterity meaning maybe 1975 if there is another visitation by a fourth crew of astronauts. So 34 of them will be coming back in February. And the total collecting power that we will have is about 80 times higher than we get in the module that we had been studying for the last month or so. So now I'm going to tell you about the one module that has been brought back. And to describe the experiment, let me show you this plastic model here and then we'll take a look in the microscope. This is a greatly magnified view of three sheets of plastic called lexan polycarbonate. When a cosmic ray passes through it produces on an atomic size scale, much too small to see radiation damage where all the atoms are jostled out of place. And the chemical reactivity along those tracks is very much higher than the chemical reactivity of the plastic itself. So if we plunge these sheets of plastic into a suitable etching solution, sodium hydroxide, we find that while the plastic sheets are slowly being dissolved, getting thinner and thinner, there's a spectacular effect along the paths of the particles. And I want you to see the three mock-up tracks that I have here. Notice that there's one that goes perfectly vertically. And the affect of the etching is to attack from the top and bottom of each sheet wherever there is an exposed surface leaving you with a pair of cones here and here and here. Now this particle was very high in energy, penetrated the whole stack. And you see no change in the size of the cones from top to bottom.

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That tells us that it was a very high energy particle. And we simply measure the sizes of these cones and we can calculate what the atomic number of that atom was. Over here is a much slower particle, that only made it through the top two sheets and stopped in the second one. And it's not very heavy. And then you see the spectacular mock-up track that would be a - an imitation of a super heavy element where it has come to rest in the bottom sheet. And the chemical reactivity is so great that it just eats a hole very, very fast right through the top two sheets. So that's what a model looks like. And now let's look at the real thing. Now I think you'll have fun looking in the microscope. While one of you is looking, I'm going to let the others look at this sheet which was flown in a balloon. Why don't you just sit down here and watch your knees. There are two red ink dots by one particular spectacular event and half way between the two ink dots you should see two cones. If you're - Do you see them? They're just beautiful. They have been etched almost as if a machinist were asked to drill perfect cones. There are many other such events in that same little sheet, but - -

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SPEAKER - - two cones. If you're - you see them? They're just beautiful. They have been etched almost as if a machinist were asked to drill perfect cones. There're many other such events in this same little sheet but this is the one we're proud of, because it is at least as heavy as uranium. Now, what you're seeing there is about a 2 by 2 inch portion of 1 foot, which was 7 by 8 inches in size and there are 32 sheets, one on top of the other, that composed this first module and that fit inside of one of the sail cloth pockets. In the - in the whole stack today we have found two events that are at the very end of the periodic table. This one is the heaviest one and it's very close to uranium. We haven't decided on a final assignment of atomic number yet, it might even be slightly heavier than uranium, which would be very exciting. The other one, which isn't in this 2 by 2 inch portion but is in a - the remainder of the sheet, we think is about as heavy as lead, which is atomic number 82. Now is this what we expected? Yes, it's about the rate of accumulation that we had hoped to get when we designed the experiment based on what has been done in the last 5 years. The way one studied very heavy cosmic rays up until now was to send a huge balloon to the top of the Earth's atmosphere. Such balloons would fill the University of California foot ball stadium just barely, one balloon. They're about 30 million cubic feet of helium, and they stay at the top of the atmosphere for 2 or 3 days, and carry a platform about the size of a 2 car garage. Now on this platform is a huge amount of plastic sheets which have to be processed and it's extremely laborious. In one typical such balloon flight we would have expected about what we see in this one module. The time is shorter, you see, instead of 115 days in space we have 2 days, but the area is very much larger. So we're right on schedule and the marvelous thing that we can anticipate is having 80 times more such events when the astronauts bring back the remainder of the stack. Because we have 34 more modules and more than twice as many days in space; 260 instead of 115. Now, we will certainly be able to see, in addition to uranium which is radioactive but has a very long half life. Some of the uranium atoms from the very beginning of the universe are still here on the Earth, that's why uranium is known about. But the heavier elements, plutonium, and curium, and those others that I read off to you have long since decayed even though they have been formed in stellar explosions, when a star reaches the end of its lifetime it goes up in a big blast called a super nova

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explosion and we are virtually certain that in such explosions uranium is made, and also transuranic elements. So we expect those transuranic elements, trans just meaning beyond uranium, to have been accelerated as cosmic rays and to reach the Earth, to reach the balloons, to reach the Skylab. So we - we think in balloon flights we may have seen 1 or 2 such transuranic elements, but the problem of being certain of the identification is very great when you're studying practically an acre of plastic. Here we can concentrate on a lot of events crowded into a small area and become much more confident about their identification. So we think we will be able to say rather accurately the ratio of such elements as plutonium and curium to uranium, knowing their lifetimes we can then reconstruct a great deal about what is happening in the very places where the elements are made that compose the whole Earth and the atoms of which you and I are made. All of - all of our bodies and everything on the Earth originally was cooked in a star. And the final thing is that possibly after the other 34 modules are returned to Earth we might find 1 or 2 events that would establish the existence of super heavy elements in nature. They have been predicted by theorists but no one in any excellerator has ever been able to make one. And it just may be that nature is - -

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PRICE - - nature. They have been predicted by theorists but no one in any accelerator has ever been able to make one. And it just may be that nature is smarter than we are. So if we do find an event, it will greatly strengthen the ideas that theoretical physicists have about the structure of matter. It will give experimentalists the confidence to try different techniques to make them in accelerators. And, of course it just is a sheer tour-de-force in being able to use ordinary sheets of plastics to learn more about the universe. It would be quite something. To justify this experiment is perhaps difficult in these days when one is concerned with the energy crisis. This country of course is quite highly respected by other countries in the world for a strong program of pure research, and I don't think one needs any justification. We have the transistor and the laser and many things that have come from purely fundamental questions being asked, and I think the attempt to find super heavys is in this category. But of course we also have the unexpected practical examples of the study of very heavy elements that have lead to such devices as the cardiac pace maker which involves a plutonium isotope that's used as a power source. At this point, I'll stop and see if any of you have any questions.

QUERY Do you have - are there other ideas that where the elements, the super heavy elements might be used? Or is it still very much in the stage of pure research?

PRICE Yeah, I asked Glenn Seaburg a few months ago what I should say if someone asked me if whether there were any practical benefits to be expected. He is the one who said why don't you tell them about the cardiac pace maker. They will, such very very heavy elements will undoubtedly have unusual properties. One such super heavy element, element 114 would be expected to be three times as dense as lead. One of them, element 118, is expected to be what is called a noble liquid. You've heard of the noble gases, these gases like helium and neon, and argon, and krypton, and xenon, that do not react with other atoms, do not form compounds. Well this would be instead of a gas, a liquid. Element 118 would be a noble liquid. Other than a few things such as that it's just a matter of faith that when you uncover perhaps as many as four or five totally new elements, there are bound to be unusual properties that we can exploit.

QUERY Is this the actual size of your - -

PRICE No, that's a small piece of it. This is 2 inches by 2 inches. The module is 7 by 8 inches, so we just cut off one corner. In fact one of my colleagues had studied what he thought was every square inch of the 7 by 8 inch piece,

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but he had put it on the microscope with the frame and he couldn't see around the rim. And I came into the laboratory and I like to boast about this because I don't get into the laboratory as much as I would like sometimes and cut off one corner, and happen to find the heaviest event of all right near the margin where it hadn't been seen in the microscope because there was an opaque frame around the edge. So this represents about 10 percent of one sheet, and there are 31 others just below it.

QUERY
PRICE
QUERY
PRICE
QUERY
QUERY

Hexan?
Yes.
And sodium hydroxide is your acting agent?
Yeah.
Thank you.
Have you assigned a number to - -

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PRICE

Thank you.

QUERY

Have you assigned a number to - To this

has a number been assigned?

PRICE

We haven't made a final decision. Each batch of Lexand has been manufactured, has turned out to have slightly different sensitivities. In fact, it's rather marvelous that ordinary Lexan manufactured in bulk quantities can be used for such a demanding experiment as this. But it's fairly uniform. It's a plastic that doesn't have deliberately added components to it. So it's a pure poly-carbonate. We, at the moment, assign a most probably atomic number of about 90 to 92. 90 is Thorium, 92 is uranium. It could change. And our first guess was that it was platinum. And we're now a little bit more conservative. But we will have a much better final answer when we've examined the other 36 modules. And have all of our events together. Then what we can do is look for peaks in the distribution of atomic numbers. We should see nothing between atomic number 84 and 89, which are all of those elements are very radioactive and don't exist on the Earth. And then we should see a little peak at uranium, and a peak at lead, which is quite abundant on the Earth. And another peak in the vicinity of platinum. So I think our charge assignments, or atomic number assignments will be very firm in the spring.

QUERY

Do you see any connection between the light flashes during Apollo in the eyes and this type of work you're doing?

PRICE

Not really, because the rate at which these very heavy particles pass through the spacecraft is very very slow. And the astronauts see eye flashes, probably every few minutes, maybe even several times a minute. I think, we could say definitively that the eye flashes are caused by the lighter particles, as well as the heavier ones. Now they ought to have a spectacular flash when the nucleus goes through the eye. It probably is a lot of times. But we could never account for the high frequency eye flashes without saying that very light particles like alpha particles, or oxygen nuclei, or - the even protons can do it. This is a real basic question. When does the man-made, the natural elements end on the periodic table?

PRICE

At uranium.

QUERY

At uranium - -

PRICE

I'm sorry, you said man-made. I'm sorry. Element 105 is the heaviest one that has been made so far. It has been tentatively given the name Hohenium after the German physicist, Hahn, who discovered fission, and it's squabbled over. Just as some of the elements have been squabbled over.

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The Russian Group at Dubna, in the Soviet Union, has also emphasized several of these elements and it's really a matter of who got there first. The longest lived isotope of this element, 105 has a life time of less than 1 second. And, of course, you ask then why might you expect super heavy elements to live long enough to travel all the way from a distant super nova to the Earth. And the reason is that the properties of the nuclear component of the atom are periodic just as the chemical properties in the periodic table are periodic. That is the lifetime gets shorter and shorter but then if you keep going they go up again.

QUERY
the table?

And tell me again, where is uranium on

PRICE
Well, uranium is 92. So you've got 13 new elements that have - synthetic elements that have been made. Some of these are made naturally in a uranium bomb where there are many neutrons produced and in a sense this is somewhat analogous as to what happened when a star explodes. So you have rather singular conditions. You can make transuranic elements in an exploding star just as you make transuranic elements in a bomb.

PAO
Are there any other questions?
if not, thank you, gentlemen. And thank you Dr. Price.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV Press Briefing
Johnson Space Center
December 19, 1973
9:04 a.m. CST

Participants:

Milton Windler, Flight Director
Bob Gordon, PAO

SL-IV PC-61A/1
Time: 09:04 CST
12-19-73

PAO Okay, ladies and gentlemen - gentlemen.
we have Mr. Milton Windler, Flight Director. We'll have
him review last night's activities.

WINDLER Just last night's. Is that all you
want. I thought I was coming to tell you about the last
week's or something. The - We did the comet maneuvers and
EREP pass, yesterday, as you probably know. The crew is
sounding good to me. In fact, I was particularly pleased
with the way they acted during the EREP performance yesterday.
And I stop it there, because shortly after that, I left, since
I've been working the graveyard shift and Chuck Lewis was
working during the days. But they sounded good to me and
there's a question here from Mary Bubb talking about the
crew's performance. I think they're probably at their
plateau. The - They're doing pretty continuous level of work.
It's not as much as the Skylab III crew did. But it's more
than they were doing as we got up on their learning curve.
So we're actually, unfortunately, I guess, you could say from
a proficiency point of view, we're still doing new things.
For example, today we'll be doing this JOP 18D maneuver,
which is further complicated by the fact that we're running
a little pointing test in the middle of it to get some more
data on the way the control system works and how effective
it's going to be in pointing toward the comet. We're also
trying, if we can, to get a little bit of TV of the comet,
you might call it a noninterference basis, but this is
something here again that's new to the crew. A couple of
days ago they did something else, the 509 that was new. So for
them, anyway, they're still getting into new territory and
consequently they're still having to go through the learning
process. But, I think, that they're settled into a steady
production of scientific work. I was looking at the predic-
tions of what the investigations or what the scientific man-hours
required - required is not the right word, expected for the
various mission days. And I noticed that the ATM was above its ration,
you might say, for this point in the mission, indicating that
they're up on the curve there. Corollary is somewhat
behind, but of course, he was predicted to be that way since his
major thrust is - has mostly do to right now with the comet.
And we're just getting into that heavy activity. Also some
of his experiments were deleted earlier in the mission when
we had to lighten the crew's workload on the first week
or so. Likewise, we missed some of the EREP passes, as you
know. So those are generally speaking, hard to recover from.
the medical people are up to their standard, or a little bit above
it. So basically, I think we're producing now at the Flight
Plan designed level. And I think it's going to continue that
way. It'll probably get a little bit better, but I really don't
expect it to change a great deal from where we are now.

SL-IV PC-61A/2
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The Gypsy moths are starting to hatch and there was some TV sent down yesterday by the crew. It was downlinked over the night. And that looks pretty good. I guess you'll be getting a chance to see that, if you haven't already - if it hasn't already been released. And we think that there's around six, five - excuse me, live moths that came out and that since probably died. And then about five or six that are partially emerged from the eggs. And, I understand, that the ones that are in the control group on the ground haven't yet started to hatch either. So, you know, in a mass. But I believe there's plans to have sort of a more elaborate discussion of that later on today. The biomed indicated they were going to talk to the PI and get with the PAO folks and do that.

END OF TAPE

SL-IV PC-61B/1
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WINDLER

- - elaborate discussion of that later on today. The biomed indicated they were going to talk to the PI and get with the PAO folks and do that. The hardware is still giving us occasional moments of concern followed by long periods of normal operation. For example, the C&D loop, we went through the troubleshooting procedure on that. It did have a small amount of contamination in it that the crew described as being somewhat like dried lubricant or hard lubricant, I should say that when they rubbed it on their fingers it kind of dissolved and went on into the skin. It kind of sounded to me something like what you get when you put grease under water, which of course is a medium that it's in, partially water anyway. And it probably is that sort of a thing. They also reported that there was gas in the loop, and that was a surprise to us because that had been considered as a possibility, and it just didn't sound like a gas-type problem, so the general consensus of opinion was that there wasn't any gas in it. But of course as the crew reported, there was some. They did do the - ran it through the water/gas separator and since that time there have been no anomalies in the loop. The pumps have flowed freely at the normal designed output so it looks like right now anyway that what we did to it seemed to fix that part. The gyros, number 2 still has its occasional moments of slight underspeeds and overcurrents, and they are very small compared to the gyro number 1 that failed earlier. And we've gone a longer period of time since the first one of these was noted. I believe it was about 20 days on gyro - no, maybe it was 10 days. I've lost track of the number of days that it was, but it was, we've exceeded the number of days that the comparable things have happened by about 10 days. We did turn on the secondary - I mean the primary coolant loop to augment the secondary coolant loop, the crew has said they were a little bit warm. The temperature is about 78 degrees, some places it's up 80 or a little bit above. And we're making an attempt there to provide them some additional coolant. And that was turned on this morning, and we plan to run that until either the beta angle comes down and it gets cooler or if we have some difficulty with the primary loop, which of course you know has been reserviced. And as best we can tell the amount of fluid in it appears to be the same as it was after the reservicing. So we're planning on pressing on with that. And I guess that's about where we are now. I'd like to answer any questions that you might have and that might trigger me to thinking of some other things.

QUERY

Several, Milt. You were talking about the in the moths you were talking about the control group on the

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ground. You said they haven't hatched yet en mass. Have we had any hatchings at all?

WINDLER

I hate to say no, because I don't know for sure that there have been not any at all. Yeah, I'd like - We'll check with Dr. Morrison and see. I'm hoping that they'll put you onto a

SPEAKER

WINDLER

more elaborate thing.

QUERY

The other thing, talking about the CMGs, when was the last time we had any hiccups or anything out of CMG-2?

WINDLER

Well, we had a very, very slight CMG hiccup about 10, 15 hours ago. It was so small that there is a small debate going on as to whether it was really a hiccup or just a twitch or something like that. It wasn't - you recognizing of course that the heaters cycle off and on and the temperatures change as they, you know they cool down, the heaters come on to heat up. And the viscosity of the grease and oil inside them changes somewhat, and they require just slightly - The current varies normally, and the variation we had was not, and the other conditions, were not as pronounced on gyro number 2 as these other cases. And I believe it's been a couple of days since -

SPEAKER

WINDLER

Saturday. He's reminding me that we had one before that. So that was one that you know was considered to be a bonafide, what did you call it a hiccup, is that what you said? (Laughter)

QUERY

WINDLER

It's been referred to that way. Yeah, that's okay that's as good a terminology as any. But as I say the one that happened 10 or 12 - it was at 01:00 Zulu was smaller than the rest of them.

QUERY

In that same reference you're talking about these are smaller than what we saw on CMG-1 when it started faltering I guess?

WINDLER

QUERY

Yes. Is it possible that since we are looking at this one so closely with so many people because of our problem on the last one that we're seeing things that we probably would have seen on CMG-1 to this degree had we looked that closely? Are we staring at the problem so hard that we're seeing things that aren't all that bad, or is it that bad?

END OF TAPE

SL-IV PC-61C/1
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QUERY

Is it possible, that since we are looking at this one so closely with so many people, because of our problem on the last one, that we're seeing things that we probably seeing on C&G 1 in this - to this degree had we looked that closely, I mean, are we staring at the problem so hard that we're seeing things that aren't all that bad or is it that bad?

WINDLER

Well, you've asked the question both ways. You're right. We are looking at it very intensely and chances are that we are seeing things now that we would have - did ignore on CMG-1, prior to the problem coming very evident to us. In fact, if you'll recall the first time that we noticed one of those on CMG number 1, we went back and we did look at some other occurrences and I believe at that time, we'd only found about two in the whole mission, as best as we could tell. But we convinced ourselves that it was a normal operation based on the heater cycle until it kept on happening. So I think you're entirely correct in saying that we - in some cases we are seeing things that are not really problems and magnifying them a little bit, because we're scrutinizing it so close. And we really don't know where we are in comparison to CMG number 1. You know, whether we have yet to arrive at the same situation that existed on that or not. But we're, - of course the plan is to minimize the stress on the gyro and also there are a number of fixes in work to enable us to operate better on one CMG, or no CMGs. And we have an effort going on for programming the command module, for example, that'll bring that RCS usage down to a minimum. And enable the guidance and control system on the command module to take the attitude control over a longer period of time.

QUERY

Milt, just how difficult is this pointing job, today, with the ATM and the comet.

WINDLER

Well. I don't know exactly how to put a quantity on that. It's really not difficult given a little bit of experience. Now of course they've tried it in the simulator. As you will recognize, though, it's something that's relatively new. And there hasn't been a whole lot of time to practice on it. We're still learning some more about it. For example, we've just come to realize how fast the comet is moving. And there was quite a discussion about that last night. And this particular day that's coming up has some sort of tweak maneuvers in it that every 5 or 6 minutes will move the vehicle a little bit to follow the comet as it goes along. And the crew has to manually determine what this new alignment is and keep moving the vehicle. Now we plan

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in the future to compute these positions and give the crew a set of angles to go to as they go through the JOP 18. So, I think, that it's a pretty - it's more difficult than an EREP maneuver in the sense that you have to do so much of it manually. And the EREP, of course, is mostly done by the computer program. And it's time-critical. And the crew has to do some of their own even calculations in addition to the manual entries and the maneuvers that they have to do. They have to do some of their own calculations to adjust the fine pointing. Because the pointing requirements are pretty stringent and we feel like the crew is the only people who can, you know, point it to this fine degree that's required.

QUERY Is there any chance that they'll be able to reschedule that missile launching that they scrubbed again last night?

WINDLER It's my understanding it was scheduled again, and I - I was told the day, and it's several days away, and I really didn't remember what it was. But I believe it is planned on a launch scheduled again.

QUERY One more. In that IV of the Gypsy moths they seemed to be shaking them up up pretty good in there. It doesn't seem the kind of good thing to do to an unborn - -

WINDLER I don't know, maybe that's like - Where do they lay eggs, anyway, in trees or something? The trees must, you know - I don't know, got me. I don't know. They did get agitated pretty good, thought, didn't they. And of course, it helped a lot to see them. (laughter) They were also bigger than what I thought they would be.

QUERY How big are they?
WINDLER Well, they tell me that that vial is about this long. The one - -

END OF TAPE

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SPEAKER - - the trees must you know get - got me
I don't know. They did get agitated pretty good though, didn't
they.

SPEAKER That's right.

SPEAKER - - and, of course, it helps a lot to
see them. (Laughter). They were also bigger than I thought
they'd be.

QUERY How big are they?

SPEAKER Well, they tell me that that vial is about
this long. The one that was on the TV, do you know?

SPEAKER (Garble) BB shot - uh - the size of
a BB shot - -

SPEAKER - - they about BB size - -

SPEAKER - - something - something size lead
weight, whatever that - -

SPEAKER - - yeah. You were talking about the
speed of the comet and just really figuring out how fast it
was moving and I guess in reference to pointing and all. I
heard a figure awhile ago and I'm not even sure if this is
correct, but is it 8 arc seconds an hour. Is that a correct -

SPEAKER I don't have any idea.

SPEAKER Well, how fast in common language - How -
how fast is the thing moving in reference to what they're seeing?
I mean is it going to take an hour and it's going - they're going
to have to keep moving to keep up with it, or (garble) just keep
going til they couldn't see it, if they didn't shift or - -

SPEAKER Well, they can see it on some of the
instruments, but not on all of them. Some of the instruments
have a very narrow field of view and - -

SPEAKER Uh-huh.

SPEAKER - - that's the problem, is to get the
particularly the 82B pointed on the - on the comet. Probably
if they - I guess, I don't know how it would appear on the
television screen that they're monitoring. It probably wouldn't
be a real perceptible motion on the TV monitor itself.

SPEAKER But you know, I don't - sense I haven't
had much experience at looking at heavenly bodies in the sky
anyway before but since I've been practicing looking
at Kohoutek and got looking at Saturn and some things like that
in just a very few minutes even in a like a 60 power or
100 power telescope and I'm talking about in a minute or two
of looking at it, you watch it move across the field of view
in your telescope and it's a - it's of some problem to follow
it, with just the Earth's motion. And, of course, this is
presumable moving even faster than that. You want me to
answer some of these?

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SPEAKER
about that one?

Well, you've answered these two. How

SPEAKER
The solar prominence, can you describe the observations that were made of the solar prominences during the night gave any details available on eruptions and was the eruption the biggest since 1946? I haven't hear a real - Going to the last question. This is a very large prominence and it has been said that it's the biggest since 46. One NOAA man was telling me that he thought he remembered one in, I believe he said it was 67 or 68 that was a similar type size and I don't think anybody and maybe it's not even available you know any definite measure of size that you can go back to, it's maybe like hurricanes you know, you can say this is the worse one we've had since 48 or something like that but, it's hard to measure them. But, certainly it's a large one. And, the prominence did lift off last night which we observed on the ground based instruments and the Skylab, the unattended instruments were used on the prominence. We didn't wake the crew up, but we did do that. Now, this morning, we also ran a JOP 26 on kinda a limb scan thing on it, that's technically not correct, but anyway we did run a program on it and the crew commented that it had kinda disapated over what they'd seen before and in fact we're kinda at a phase with the prominence as far as the crew is concerned and we're very excited about active region 00 which is pretty one with the high potential for flares and here's this big prominence and we're kinda going back and forth between the two and as you recognize the ATM people have to design their schedule about 24 hours in advance so their kinda set up based on the forecast and they're kinda - were set up today to look at the prominence and now it looks like the prominence is not too strong and they ought to be looking at the active region so we've had that sort of a problem. But, they are readjusting their - some of their pointing with their activities schedules to compensate for that.

SPEAKER
SPEAKER
SPEAKER

All right.
- - And I think that's answered all those.
Thank you Bill.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
December 17, 1973
4:17 pm CST

Participants:

Charles Lewis, Flight Director
George G. Armstrong, Jr., M.D., Deputy Chief, Medical Operations
Division, JSC
Gerald L. Homick, Ph. S., Principal Investigator, Experiment
M131, JSC
Jack Waite, Manager, Corollary Experiments Office, MSFC
Ralph Murphy, PAO

SL-IV PC59A/1
TIME: 16:17 CST
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PAO We're ready to get started with our change-of-shift briefing for this afternoon, this is Monday. We have with us this afternoon, Mr. Charles Lewis, the off-going Flight Director; Doctor George Armstrong, Junior, the Flight Surgeon who is going off duty; Dr. Gerald Homick, who is the principal co-ordinator for the experiment M131; and Mr. Jack Waite from Marshall, the manager of the corollary experiments office. So we'll start out with Mr. Lewis.

LEWIS Okay, there's been essentially no change in system status since I talked to you yesterday. Flight Plan is basically as I described it yesterday. We've still got the EREP track 58 to do today. And, to reiterate, tomorrow we've got an early wakeup for an EREP geothermal pass. And we have additional Kohoutek maneuvers scheduled, plus, toward the end of the day we've got a 201G maneuver and - to photograph a rocket launch. That's all I have. There's really no change.

PAO

QUERY

LEWIS

QUERY

off the other day?

LEWIS

QUERY

LEWIS

launch.

QUERY

I'd like to ask Dr. Homick his response to the Commander's and the PLT's comments this afternoon about perhaps that there is too much emphasis on motion sickness and it may be changing in body fluids some of the problems they've had.

HOMICK

I listened to the tape on that med conference and I guess at this point in time we're looking at a number of factors that contribute to this thing that we're calling motion sickness and weightlessness. One of those things that we haven't looked at closely but have certainly given some thought to is a redistribution of body fluids. We're aware of some subtle ways which this could influence the - the semicircular canals, in particular, and perhaps aggravate or bring about a condition of motion sickness in flight. Generally speaking we're still gathering information, and obviously we do have quite a bit to learn yet about this type of symptomatology that some of the crewmen have experienced in flight.

QUERY

I'd like to ask Mr. Waite the situation or a kind of rundown of the corollary experiments, how many have been done and things like that like you normally do.

WAITE

All right. I was planning on going through that - would you - Charlie, I was trying to let some of you

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get away early but -

PAO Could we finish with - I'd like to hold
Mr. Waite for last. Dr. Armstrong needs to be - -

PAO Dr. Armstrong, do you have anything you'd
like to say now then maybe we'll get the question and your
comments.

ARMSTRONG The crew's health is still good. We, as
you undoubtedly noted over the weekend they had a little bit
stiffness and a little bit of fullness - the feeling of
fullness in the ear of one of the crewman and it's clearing
up quite well with essentially the same medication you use
on Earth, topically applied decongestants. We have no other
health problem. I might add just a word to the comments,
and that is we certainly agree that there are many factors
that are involved in a feeling of illness or early flight
symptoms that people have, and we certainly agree that we
should and we are in the process of scratching our heads
and looking further as to possible causes.

OPERY Following up on that for Doctor Armstrong
and again Doctor Homick, in particular, I believe it was the
PLI said something about horse blinders on the PIs on the ground
and that they were not - he indicated or said that he did not
feel they were looking thoroughly for other possible causes of the
motion sickness. Do you agree with that or if it is in fact
motion sickness?

ARMSTRONG Well, I don't know that I wear horse blinders
at all. My peripheral vision is pretty good. I think that the
way they have described symptoms that they have had that they
certainly fall within the area of illnesses, or feeling bad
if you will, that we call motion sickness. It is certainly
similar to it. Again, you know there are many things that
can make you feel bad and can upset you like that. Motion
sickness, perhaps, is one. It's - fullness, a congestion maybe
in the abdominal vessels, shifts of fluid - any number of getting-
used-to type things, and I don't -

END OF TAPE

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ARMSTRONG - - - (garble) shifts of fluid, any number of - of getting used to type things and I don't - I don't think that - I - I still would call it anything other than a - a symptomatology that we know that people get when they get motion-sick, sea sick or air sick or car sick.

SPEAKER Let - let me add something here, nobody's disagreeing with what the pilot said. We all think that the investigation should be expanded. And I don't think much will be done on SL-IV because the experiments have been defined. We've got equipment on board for those experiments. We've got to allocate so much time to medical experiments, ATM experiments, corollary experiments and so forth. And nobody is arguing with what the pilot had to say, I think they all agree it should be expanded. But - it's an investigation experiment, just like the other experiments.

PAO Other queries?

QUERY Oh, was any different approach taken, and - in studying this problem in Skylab - an approach that wasn't taken before on the ground or any - in any other exploratory experiment?

ARMSTRONG Can I respond to that. The answer to your question is yes, very definitely Skylab itself represented a new approach. Prior to Skylab we conducted no systematic quantitative inflight investigations of motion sickness. There were a few biomedical experiments during Gemini and Apollo and with the exception of one experiment early in Gemini, no attempts were made to properly study what we're calling motion sickness. We relied solely subjective reporting from the crewmen, which for the most part was pretty good. Skylab provided an opportunity to take into weightlessness techniques that had been developed on the ground to measure crewmen's responses in weightlessness in - in identical fashion, to the way they had been measured on the ground, so that we could then make direct comparisons using comparable techniques between in preflight and postflight results. And I think that the technique developed for Skylab was a good one, it may not be the best but certainly it represented some of the - well the state of the art as much as - was known at the time about investigating motion sickness, utilizing the - the long years of experience developed by the principal investigators at Pensacola. And certainly they did spend a long time developing their techniques. They ran literally thousands of people through their laboratory, accumulating a great deal of normative data. The techniques were tried out in parabolic flight, and everything indicated that this was a valid way to attempt to identify the nature and time course of the symptoms as they might develop in flight. Now

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certainly we've learned a lot from Skylab from the very first mission, we learned that for reasons that we don't fully understand yet, that all of these crewmen have become practically immune to motion sickness. It seems as if the - the lifting of the gravitation load has - must have a great deal to do with it. And this - this was a new finding I think a very significant finding, something that the Apollo program would never have been able to - to ver - verify for us. And with this knowledge we've gained from Skylab, I'm sure that new and better techniques will be developed in the future and - and new ways of invest - investigating the problem and hopefully ways of identifying other stimulus conditions, other physiological changes which contribute to this overall condition that we've been referring to as motion sickness. The pilot seemed to object to the term motion sickness. He said it's more - perhaps more than that as I recall. Well, maybe the term motion sickness is not the best term to describe this particular malaise or collection of symptoms that they experience in weightlessness. Maybe it does need to have a new term applied to it. But I don't think we need to do that at this point in time. The symptoms that they do manifest are the same type of symptoms that occur on the ground with similar types of - -

END OF TAPE

SL-IV PC-59C/1
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ARMSTRONG - apply to it. But I don't think we need to do that at this point in time. The symptoms that they do manifest are the same type of symptoms that occur on the ground with similar types of motion stimuli. And I suppose until we come up with a better word, the term motion sickness will be used. And I don't think, you know, we are overemphasizing the use of the word.

QUERY Out of the three crewmen, wasn't Pogue the dim - in test on the ground demonstrated to be the least susceptible to motion sickness?

ARMSTRONG That's true.

QUERY And he's the one that ended up getting sick earlier on the mission.

ARMSTRONG That's true.

QUERY All right. Is this a puzzling thing to you?

ARMSTRONG Well, it is in a way. It - it what it again tells us is that we don't have any good predictors of who will become motion sick or express these symptoms in weightlessness. We had a couple of crewmen, Pogue the best example, I guess, and even back on Skylab-III, Jack Lousma was one of the more resistant to motion sickness on the ground. However Jack was the one who had the problems in flight. And this no - it doesn't all hang together yet. The other two Skylab-IV crewmen, Carr and Gibson, also before they were launched were quite tolerant to the - to the rotating chair stress. However, they apparently built up this - this tolerance during the - the short period of time prior to launch, during the first month or two prior to launch. Before that they were normal in terms of their susceptibility. And this leads us to perhaps hypothesize a little bit that perhaps this so-called inborn immunity that Pogue has had something to do with his developing symptoms whereas the other two crewmen who acquired their immunity during the short period of time and artificially, as it were, didn't have problems. This doesn't all fit together yet, and, unfortunately in a way, we really need to run another 10 crewmen and do things systematically on the ground and in flight in order to try and get all the pieces of the puzzle to fit together properly.

QUERY Carr used the phrase all of the sickness or all this illness during that conference and it's kind of puzzling. Has there been just more than just the one episode on this flight or was he referring to all the past episodes throughout the space program? Or do you have any idea?

ARMSTRONG I think your guess is probably as good as

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wins. I heard the conference and listened and hadn't had the opportunity of getting further information as to what he really meant. I assume that he meant all of the past early signs and symptoms that the crews have had in Skylab and some instances even further back of - of feeling this way. As I recall, all three of the crew, early in this mission, felt a little queasy, a little upset, a little unhappy, but Pogue was the one who - who was the most ill. And as I recall it was nothing more so than the other crews have felt. So I - I don't think we're making a big to-do about motion sickness per se, but I think that what - what they're saying and what we're saying is that there is a condition it occurs early after the assumption of weightlessness that seems to require some getting used to and some adapting to and it is a period of relative unpleasantness that one doesn't like to eat too much and one doesn't like to think about eating too much. And it's something we've seen on all three Skylab flights.

QUERY One more. What could have been the source of this congestion or stuffiness in Pogue's ears or ear?

ARMSTRONG Nasal congestion, kind of like you get and when you maybe get a little bit of the sniffles. The air - atmosphere - is dry and -

END OF TAPE

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ARMSTRONG The air atmosphere is dry and in - in - in the Skylab and they tend to get a little stuffy. If you've noticed in listening to the voices on the beginning of the flights, then as the flights progressed they tend to get a little nasal - more nasal in quality as they go along. And it's just that his nasal (garble) sort of got a little congested or a little stuffy, and blocked his Eustachian tube just a little bit and then by nose drops were able to shrink it and allow the - inner ear to ventilate again and reduce the feeling.

QUERY But it's not a pathogenic origin com - -

ARMSTRONG No. There's no - no infectious process involved at all.

QUERY Chuck, I'd like to get one thing straight about the gyros. Is that any "fear" in Mission Control that there's going to be an early end to this mission? I know we've asked this question before I just want to hear it again, because of the gyros.

LEWIS If we lose CMG gyro 2, which is the one we've seen a little funny a few times. It - it would curtail activities in Skylab with the different techniques we've developed for TACS only control modes, and use of the service module RCS, the duration of the mission could go as high as 35 to 40 days. Right now, all of our plans on bas - are based on going the full duration, and at - presently, we got the contingency plans laid out in the event we do lose the second CMG, but there's no fear, no, I wouldn't say fear.

QUERY In a previous news conference you used the word concerned, a number of times. Are you going to stick with concerned?

LEWIS I - I - I'm concerned yeah. If we lose it we've got a - got a much tougher job on our hands of Flight Planning and we - like I said the other day, going back and looking at priorities, some maneuvers will have to be eliminated and that type of thing. It's a much more difficult job and you're going to lose some of the science objectives you're after. And that's the kind of concern I perhaps should have expressed the other day.

QUERY You say you have contingency plans, can you explain this a little more in detail. Specifically, as to whether you go automatically to TACS or to RCS, which first or both together?

LEWIS Right now our plans call - call for the following. If we lose CMG 2, first switch to service module RCS attitude control, we've got a ATM digital computer patch that we can load which will let us go to the TACS

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control mode, in a wide deadband, a 16-degree deadband, about the solar inertial attitude. So right off you can see that would affect AIM observations. You know, the vehicle would be oscillating in this wide deadband and it would certainly impact AIM viewing. We could stay that way for number of days, we can use service module RCS, and stay in essentially the same type of attitude and extend several days down to some red line, we'd want to stop using service module RCS. And that's basically the type plans I meant by contingency plans. And any maneuvers have to be with either the RCS or TACS, so that you have no CMG control.

QUERY Chuck, on this - getting back to this rocket launch again tomorrow, now what time will that be? I couldn't - -

LEWIS

Ah -

QUERY

I couldn't find it in the Flight Plan. The data take time is from 142 to

LEWIS

03:18, GMT.

PAO

Any other questions before we get to

Mr. Waite? Thank you.

PAO

We'll excuse our Flight Director and Doctors and then we'll start with Mr. Waite on corollary experiments.

END OF TAPE

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PAO We'll excuse our Flight Director and the doctors and then we'll start with Mr. Waite on corollary experiments.

WAITE Well I'll go ahead and start but - we're tracking very closely to our pre-mission plan on the corollary experiments, I mean there's nothing so golden about the pre-mission plan but it's a pretty good gage of just where you are and we're tracking that very closely. There are only just a couple of areas, we're right on the pre-mission plans with the exception of two experiments and though S019 Karl Henize's UV experiment, we are just - we're up to date on the Kohoutek viewing and slightly behind on the stellar, we need about three more passes to have Karl up to what we planned pre-mission. He hasn't missed any high priority starfields though and it's just been a matter of always since we lost the solar SAL, we've always had a very busy antisolar airlock and another thing that has compounded the scheduling problem in the - antisolar SAL is the Kohoutek program - pre and post perihelion where we're using that for several of the experiments for Kohoutek viewing, S201, S062, S019, S183 Kohoutek as well as the normal stellar program. The only other area where we are a little behind we have made one M509, the astronaut maneuvering unit, we've made one run that and we - you know this requires some 5 hours for 2 crewmen, so it's a very difficult thing to schedule with ATM and EREP and they try to fit the 509 and the T020 the foot control maneuvering unit in anytime they can without conflicting with ATM and EREP, so it's just been a scheduling problem there, so we out of 23 experiments we had hoped to operate but now we've operated 22 and the foot control maneuvering unit is the only one we'd hoped to have one runned by now but we - we're really not concerned about this. It's just a matter of when we don't have - you know during this period of when we don't have good ground passes for EREP, we'll be working those in. There are two or three things that I think are interesting, one thing we had a rather ambitious experiment, I think a very ambitious experiment program and I'm very pleased that we're tracking some ice on it. We have come along very nicely on the Kohoutek experiments. We did miss one pass one day on those when we had the first CMG failure till we, you know, got back into operation with the two but no impact there and we're tracking very good on Kohoutek. We have been able to work in a couple of the science demos as Tommy Bannister was telling you a couple of weeks ago the neutron environment and the charge particle mobility science demos - demonstration experiments. There are about three areas that I though would be quite interesting because we've loaded the crew down with a number of things, one thing we observed in reducing the scientific data from S019 after SL-III, we've - we've in comparing that data with the data from SL-II, Karl Henize observed that we'd

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had some degradation due to gradual contamination of the articulating mirror. So we sent up a new mirror and the first thing, one of the first things the crew did for us was to change out the mirror system in - the articulated mirror system, it was so - the articulating mirror is so important now, because we're using this in addition to all the stellar experiments the S019, S183, S063, and then we're now using it for all of those for stellar and for Kohoutek observation plus the S201, you know Dr. Arruthers UV experiment, so they changed out this mirror and that worked out very nicely. Another thing we had the crew do, we on the French experiment, the S183 UV -

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WAITE - - worked out very nicely. Another thing we had the crew do we - on the - the French experiment, the S183 UV panorama experiment, we found that - we have three band passes there that we're measuring - 1800 and I believe about 25 and 31. The middle band pass is accomplished with a data acquisition camera through a different optical path. It's part of the same experiment with a different band pass, and it has different optics. When we reduce the data after SL-II, we found that we were out of focus with the data acquisition camera. We first attributed it to - to probably one camera, because we'd only used one camera. And immediately prior to launch, we had run a test on the ground using a flight-type data acquisition camera. And we developed the film and we were very - very nicely in focus. So, we didn't feel that we had any shift in the optics due to launch loads or what not. We found out when we developed the film we used about five different DACS on SL-III, and we found out each one of them was out of focus. So, we sent up the complete new optics for the data acquisition camera on S183, and the crew changed that out early in the mission. And so we have S183 back - the - the DAC optics back in shape. We had one - one other repair job for the crew that worked out very nicely. This nuclear emulsion, Dr. Shapiro's, from NRL, we had a motor failure on that package. You know, we have to - we only this - we have a motor that closes - it's about like a book and you want to close it - the two emulsion packages when you're passing through the South Atlantic anomaly and when you're looking at the Earth, and then it's open other times. We had a motor failure, and - and the crew did take up a new motor for S019, and repair - I mean S009, the nuclear emulsion experiment. They repaired this experiment. It's working very nicely. The - the other thing we had - I think you - you know one - so - there was some discussion in the Koshutek meeting. But we had one relatively major new experiment that - it's S201, Dr. Corruthers UV camera that he had used on the lunar surface. So the crew has - has been operating this in the scientific airlock, you know for - for stellar observations, and also the rocket vapor observations, and also for Koshutek. We - we've started on a couple - we've done a couple of our student experiments. And I think we're coming along very nicely. I guess from here, I guess - I might mention one other area that we will probably be starting in the next couple of weeks. The - the man - space processing experiment. We after - we did - we were very fortunate, when the crew was ahead of schedule during SL-III, to run all 11 of those experiments, even though they had not been planned permission.

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After a quick look at the data, there were seven more that
some of the principal investigators thought was worth returning,
worth returning. You know, in some instances they
wanted to change their - you know - in five instances they
wanted to change their temperature profile. And in one
instance we'd had - we were aware of it but we had
accidentally hit a TACS firing when M500 was being
operating. You could see in the - it's a spherical
crystal. You could see everytime the TACS fired. You
could pick it out on the crystal very nicely. So we wanted
to run that one again, although he got very good data
on an extremely large homogenous crystal. But we hope
to get the space manufacturing, those seven, started in the
next few weeks and that's not a big time requirement, and
of course no problem with maneuvers or no requirements
for maneuvers. So they're fairly easy to schedule. So we
haven't pushed for those - well, we hadn't planned those until
some time in January. So, I think I'll just open it up to
questions from there.

Q: How many of the student experiments
have now been done? Is there 19 all together or how
many have now been done?

A: Well, I can't see, Dan, the major part of the amount
on that one. You know, in several cases, we are getting them
additional data. I can tell you we're running on this mission -
let me check how many student experiments -

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WAITE You know in several cases we are giving them additional data. Now I can tell you we're running on this mission, let me check how many student experiments, we have run two this mission and we were planning on running 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, we were planning on running 11. I could probably look down through these. Several of these are piggy back with EREP and we've already given the students, you know like 1011 and 12, the volcano study and the atmospheric attenuation. Those experiments we've already given the student data from the EREP runs on SL-II and III but we're continuing to give them data as the opportunities present themselves. We have a couple of experiments that are going piggy back with ATM, objects in Mercury's orbit and X-ray stellar classes. Well and I guess that, I don't see it on my list but it should have been that X-ray from Jupiter Ed25 that are looking to ATM experiments for data.

QUERY Well have all the student experiments been done at least once on one of the flights?

WAITE I'm trying to pick out - I'm trying to pick out which ones had not - and we had - then you have the one that we had a failure on ED76 I mean 78 this liquid cation, we had, you know the high temperature during the early part of SL-II we ruined - the high temperature ruined a thin diaphragm. We're planning on trying to combine - we're planning on combining that with one of the science demonstration experiments. So he's never gotten any data on that one. The Kepler studies, I don't believe we've run yet, ED72 we haven't run yet. Yeah the bacterian spores - bacterian spores ED31, the high temperature almost wiped us out there, we did get some data for the investigator but we are repeating that this time because the high temperature did kill quite a high percent of the bacterian spores there. Are there any oth - Allright the plant growth ED61 and 62 are planned for this mission. They had not planned previously, I mean for a previous mission. So I - I would guess I'm - I'm - we're - we're probably better than 2/3rds complete with the student experiments, and giving some of them a good bit more data than we'd planned to because we're having additional opportunities with EREP and ATM.

QUERY I have a question. Another - another one of these rocket questions. Is the one tomorrow night the same goal as the one they had the other night but was scrubbed?

WAITE Yes it is.

QUERY Okay.

QUERY Jack, I'm sorry I can't remember who

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- which student experiments are you getting no data from at all, are there any of them?

WAITE Let me - let me think just a little.
At the present time, you know we had just a few that we had no way in the world to satisfy and we just you know - there we had about 19 that we could accomplish their - their objectives, and there were 6 that were just going piggy back you know with other investigators in a similar field. But of those there may be - I would guess and (garble) is our expert on this, but I would guess one that I'm somewhat concerned about now might be this x-rays from Jupiter. You know we have a filter problem on S054, and that is the instrument that would be required from this. And it's a rather demanding maneuver, you know also it's a JOP 13 you know Joint Observing Program type 13 type thing (garble). We may have some trouble on that, they are planning on you know trying to repair the filter, put it to you know repair the filter on S054 during the first EVA, the December 25 EVA. I don't - I can't think of any other off hand that - that we shouldn't have a very good opportunity, a good chance of getting. And I haven't at all given up on that one.

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WAITE - - that we should have a very good opportunity - a good chance of getting. And I haven't at all given up on that one.

QUERY Have you started getting any results from you space manufacturing from the first two missions?

WAITE Yes, just some preliminary results and one thing that might - Were any of you at the press conference at the Cape. Did any of you hear Ernst (garble)? Now we don't have much beyond what Dr. Stullinger did present there. I do have a copy of his paper in November down there. We're - I can't add much to that. I can make copies that are available to any of you that don't have Ernst's paper.

QUERY No, I don't think we have copies of that.

WAITE I'll get some copies run off and make them available to you here. But, you know, all we did, we had some early looks at a couple of the crystal growth experiments, our investigators were quite enthused. The crystals were in one case about an order of magnitude larger than we've ever been able to grow on Earth and quite homogenous. I think that may be - that would be an area where maybe we can plan a separate session for you. But I do have a couple of interesting papers - If any of you missed Dr. Harry Gatos presentation here at the end of last mission, I have a copy of his speech that I think gives a pretty good synopsis, and then I'll make this copy of Ernest Stullinger's speech available.

PAO Are there any other questions? If not, thank you very much, gentlemen.

END OF TAPE

STATE OF TEXAS
COUNTY OF DALLAS

BEFORE ME, the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this _____ day of _____, 19____.

My commission expires _____ day of _____, 19____.

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PAO Okay, we're ready to get started with our change-of-shift briefing today, Sunday afternoon we have with us the ori-going Flight Director Charles Lewis. I'll turn it over to you, then.

LEWIS Okay, let me talk just briefly the Flight Plans. Today's Flight Plan was basically AIM viewing, we had some Kohoutek observations, S019 and medical experiments. In active region in the AIM active region 00, is got quite a bit of activity since 04:25 GMT. This there's been six flares a C3, C2, M1, M3, C3 and M1. This region is right on, just coming around the limb, so we really haven't got a but a side view of that region at this time. Expect - we expect more activity there. Tomorrow's Flight Plan, tomorrow's a crew day off and we do have some Kohoutek observations scheduled and we've got a couple of AIM passes scheduled and late in the day we have an FREP pass. Track 58 scheduled. Track 58 covers the North Atlantic into Europe, down through Italy. The type observations we're looking for there is primarily sea state work, through the North Atlantic and we cross in the darkness and we've got some geothermal sites in Italy that we'll attempt to take data on. The only system's anomaly we've had this morning. I don't know whether previous briefings have told you. We've been having some trouble with the AIM - CCB console and display control and display coolant loop. We get glitches here and there more frequently in our flowrate and we don't know now whether it's a contamination problem. We've got a - or generic pump problem. We have three pumps. This morning to limit the use of the pumps, at night now we're turning the pumps off, no requirement for cooling the equipment during night. This morning we went - we went to turn the pump on we turned pump C on and it came up and then slowly begin to - to - the speed slowly began to decrease and it stalled out. And we had the crew immediately switch to pump B and got our flow back. Now subsequent to that, during the day we went back to pump C to see if it would operate, came right up to a nominal flow rate. We let it operate for about a rev and we turned it off and went back to pump B. On Tuesday we have plans now to troubleshoot the loop, we intend to remove a filter, inspect the filter for any contamination and if we find evidence of contamination we're - we're going to use the - a water gas separator device, that's normally used in the EVA suit loops, and see if we can't cleanse the loop to some degree, to remove some of the contamination and that's about a - that requires about 4 to 6 hours of which couple hours is crew participation. And that's all I have as a summary.

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FAO Okay, do we have any questions today.
CERY Understand you also had some problems
with your onboard computer, late last night and then early
this morning, didn't you?
LEWIS Yeah, last night the crew reported that
they didn't have a

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QUERY - or a computer or like last night and then early this morning.

LEWIS Yeah, last night, the crew reported that they - they didn't have lighting on the C - the AFM C&D console. And they'd taken several steps to try and recover that lighting, and in doing so, they cycled several power switches. Subsequently, we asked them to enter a - we asked them to enter a DAS command to the computer to reestablish a - a TV BUS 1, which had been dropped when they did cycle the power switches. That DAS command, he entered it, the readback wasn't what he entered, he tried again. I think the third time it read back properly. About that point, he got a computer reject light and he entered a code to extinguish that and couldn't. At that point, they went to sleep and the ground continued to work the problem and what we found was a bit is set - an interrupt bit is set by the computer - basically saying, "computer, read the DAS." The computer has masked that - that bit out and refused to acknowledge any DAS commands. We do - we did have a backup enable bit and we set that, were able to get in and read that - basically, that data that I've given down and confirm it, and we corrected that with a memory load. And everything seems to be operating properly this morning. We think that one of the power switches that was cycled may have glitched it, causing the enable bit that I mentioned to be masked by the computer - excessive interrupts and that type of thing.

QUERY Was it a faulty switching by the crew, or what exactly?

LEWIS Well, - well, we're looking now to see - we think when you cycle power switches w - in the past and some of the prelaunch testing that this can cause a type masking I'm talking about. A set troubleshooting procedure is not - was not followed - one of the written troubleshooting procedures. And that may have - I don't think we would have if we'd been working with the crew have had the power switches you know, cycled at that point in time. So that may have led to the - led to the problem.

QUERY So it was an erroneous set of switching by the crew then?

LEWIS I would - yeah, I think at this point, you'd have to say that, yes.

QUERY Are -

LEWIS None of the - let me go back - none - none of the switching should have caused any problem, we're going back through that, with an exception of this funny which they think they've seen in prelaunch, and we're trying to confirm that now. Whether or not that in fact will cause

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a problem. We're not sure, but we think that there is some evidence of prelaunch testing that that can do it. And if it does, we'll obviously caution our operators and - and the crew to avoid that.

QUERY Anything new on the CMG?

LEWIS No, no change.

QUERY No change?

LEWIS Haven't seen any problems.

QUERY No more or less concern than - than

you expressed yesterday.

LEWIS No, really no change there. I might say that either tonight or tomorrow morning, we're going to update the - one of the computer patches. I refer to it as the - as a maneuver monitoring, caution and warning patch to the computer. Basically, what that does - in some of our attitude maneuvering modes, if we - for example - get into a gimbal problem like we did have some weeks ago - a couple of weeks ago, and you get an attitude error up at 20 degrees, it goes into a TACS ONLY mode and you start firing TACS. Obviously to stop increased attitude error. This patch - -

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LEWIS It goes into a TACS only mode and you start firing TACS. Obviously to stop you know increased attitude air. This patch will give the crew a caution and warning indication but will not enable the TACS. The crew can then come up and take whatever action is appropriate either to go ahead with the maneuver, and there's some procedures they can go through to relieve our gimbal problem, or abort the maneuver and go back to either to SI or to whatever. And that's - we plan to go up probably tonight or maybe in the morning. The other patches I mentioned to you quasi-inertial patch, you know if we lose all CMGs and that's still in work, and we expect that in about Friday.

PAO We do have a couple of questions from the Cape, actually we had three but I think you've answered one, Chuck, in what is the flight plan for tomorrow. But the other two was when solar flares happen during unmanned operations of the ATM, what kind of data does the scientist get compared to what they would get if the ATM was manned with a man at the console, is the first one.

LEWIS Okay, well without the crew you've got to be over a ground station to get - to get the data. And that's basically SO55 data as I recall. And on the flares today of those I mentioned, they did get the rise on one of the smaller flares, the C flare and they did not get the rise on the others.

PAO Okay fine. Are there any further questions here? Tom.

QUERY Has the crew seen their flight plan for tomorrow on their day off?

LEWIS Probably not because we've just reviewed that and starting up-linking an hour or so ago, and they're very - I don't think they've probably have looked at it.

QUERY It's awfully busy for a day off, is it not? Or wouldn't you agree.

LEWIS Yes.

QUERY What made you decide that after last week or decide to have a flight plan like that on a day off after last week. It was a very light flight plan.

LEWIS We've talked to the crew before the lay off and asked them what type activity they'd like to have, and this basically meets their guidelines. An EREP, we'd like to have an EREP if it's available. An EREP, we'd like to have an EREP if it's available. They wouldn't mind a couple of Kohoutek observations, and that's about what we've got. And three or four ATM passes we have too. We allow them to sleep in 2 hours late. And that's one reason it looks like the flight plan is a little tight. It is ge -

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6 man hours in the beginning of the day is just like sleeping.
So it meets the guidelines as we've discussed with the crew.
PAO Any other questions? If not thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December, 15, 1973
16:30 CST

Participants:

Charles Lewis, Flight Director
Dr. Dennis Morrison, Gypsy Moth PI
Dave Garrett, PAO

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Time: 16:30 CST
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PAO Okay, we're ready to get started with today's change of shift briefing. We have with us the outgoing Flight Director, Charles Lewis, and later we hope to have Dr. Dennis Morrison who's the principal coordinating scientist for the Gypsy Moth eggs experiment here at JSC. If you'll go ahead and start it off, Chuck.

LEWIS Okay, regarding today's Flight Plan. We had an S063 Koboutek maneuver scheduled this morning. We scrubbed that - CMG 2 bearing temps and currents were such that we elected not to maneuver and let the CMG - or hope - hopefully just let the CMG recover and get back into the nominal operating range. We didn't see anything that would reach the criteria that we've established take action, but it was enough that there was some concern, so we scrubbed the maneuver to reduce the - basically the torquing - on the gyros that would have been required by the maneuver. And - and lost that S063 pass. We did go ahead and reschedule the AIM in the daylight cycle and also we did an S063 airglow. Other than that, there's no change to the Flight Plan and as you may well be aware they've started their M - first M009 run this flight. That's in progress right now. And you may have heard also the crew reported that they had 5 Gypsy Moths, so Dr. Morrison can talk about that more later. Apparently, the first was hatched yesterday sometime. Tomorrow's Flight Plan's basically some more Koboutek support, no EREP tomorrow. I might say, earlier this morning, we did do a E - Earth terrain camera, SI mode - I think it was Paraguay. As far as I know, that one went off okay. And other than the CMG condition this morning, there's been no other systems problems that I recall right off hand. That's all - all I've got.

PAO Okay, do we have any questions? Bob?

QUERY Chuck, what is the criteria that is determined at which point you take action on the CMGs that - that you referred to?

LEWIS Okay, see, there're high currents, to the torque motors, certain Delta temperatures between two bearings or a bearing temperature rise of one bearing. And the wheel speed. And one of those confirmed by the others, we would take action to relieve the situation. And that action can be - first step is if we confirm those as to go to the command module and bring the RCS - well, first - I'm sorry - first is go to TACS only. Inhibit the CMG which unloads it basically. And then we would go to the command module and power that up to use service module RCS for attitude control. And then depending upon what happens after we unload the CMG the action could vary. We go back to the CMG if the condition is relieved. If it's not relieved, we lose the CMG, we stay on RC - service module

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RCS for a period of time and they're working on a patch called TACS quasi inertial which we could go to which would require on the order of 150, 200 pound-seconds a rev to fly. And you're deadbanding quite widely in that mode about 15 degrees, I believe.

QUERY

D - -

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LEWIS - - To fly and you're deadbanding quite widely in that mode about 16 degrees, I believe.

QUERY The PAO again said today that there is no, I believe he said there's no concern particularly about the latest minor problem with CMG. But if - if the things are occurring that will slow down the decreasing of wheel speed is occurring more frequently now. This week it has occurred more frequently than it did last week. Do you have any new thinking about what's causing this, why it is getting a little more frequent?

LEWIS No, not probably - I don't have anything new from what I'm sure that you have heard in the last few days. This morning we were very conservative in our approach. We may well have been able to go ahead and maneuver and not have a problem. But we elected not to do that since we had this problem just prior to the maneuver. We are looking at possible criteria flight plan criteria which would put more priority on different types of maneuvers. If we feel like and this continues the frequency continues to increase in hope that we can save the CMG for mission duration and have it for major maneuvers and perhaps delete some that are of less priority. For example, I inhibit we had an inhibit on a momentum dump right after that for the S063 airglow we elected not to even do that, because that puts a little bit more of a load on the CMG the next rev the next dump. It turns out that as long as your rates aren't high, we have rate - lim - .01 degrees per second you can do that particular experiment without inhibiting the dump. So we made out all right this morning. So there are some things like that we may elect to delete inhibits that really aren't that - aren't required. We can take data without the inhibit, but it's desirable to inhibit we could do without that - that. Other than that that's all we've got going right now is looking at that type of criteria.

PAO Paul, you have any questions?

QUERY Was the severity of this particular signature any greater or lesser than previous signatures observed?

LEWIS No, we saw some when I was on shift last week about the same - about the same thing - same magnitude. The currents were up about 40 to 50 milliamps. We've seen that before. Wheel speed really didn't drop that much. You start looking at wheel speed and we're talking about 1 - 1 PCM counts telemetry and you get a lot of toggling there so you really don't know exactly what the wheel speed decrease was maybe 25 to 50 rpm perhaps. So it's bas - about the same thing I've seen 5 or 6 times

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ago. It seems to occur when the bearing temperatures have cooled down to around 60 degrees or thereabouts. The last 4 or 5 days we've seen it's been that same condition, just before the heaters come on to bring the bearing temps back up. We're looking at possibly using manual control on the heaters - to some degree.

QUERY How would you compare these progressive signatures to those which occurred prior to the demise of CMG 1?

LEWIS They're just not as severe. It's the same type of thing, but you just don't see the magnitude of current change or wheel speed change. We haven't seen it yet on CMG 2. And that's basically what our criteria - described earlier is based on was the sky - the CMG 1 what we saw there, plus a little conservatism to if we see it happening to get the wheel inhibited unloaded and look at it and see if we can do anything that might save it. For example there are some theories that we could operate at reduced rpm some reduced rpm. What some would look at for example would be inhibit and take power and let it spin down some.

QUERY Is there a feeling over there that CMG 2 is going step by step down, down, to it's grave. Or is it just - got a series of

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QUERY Is there a feeling over there that CMG 2 is going step by step down - down to it's grave, or is it just got a series of funnies that may last for the next hundred days or so.

LEWIS No, I think there's a genuine feeling of concern - like f - like it was pointed out the frequency of these occurrences is increased, although the magnitude of the parameter changes haven't really changed that much. So there is - there's more concern and we - like I said, this morning we scrubbed a maneuver on the basis that it could have caused a more severe problem.

QUERY We've been told now for many days that there's concern - is this concern remaining static, or is it increasing or -

LEWIS I'd say it's increasing somewhat. We're example, we're - like I said, we're talking about possibly some manual control in the heaters, so we get around having what happened to us today happen again. For example, we build a Flight Plan. All of a sudden, you come along and whamo, you knock a maneuver out and really perturbate the Flight Plan. We need to express our concern in - in criteria for Flight Planning and perhaps manual control the heaters can set us up for maneuvers so we don't run into a chance of having to scrub one - that's being investigated. We don't know whether the risk of doing that is greater than what we've got now or not. So that's being looked at. You have to go through some control circuitry and so forth to do that type of operation. And you could have problems with that so that's being looked at. There's more concern and it's being looked at 24 hours a day. I think we're all concerned about it. If we loose that second CMG, as you've probably been told, we're talking about a very limited mission.

QUERY Well, has this concern grown to the point where it is affecting flight planning - advanced planning in a more gross sense other than these discrete things you're talking about.

LEWIS No, not yet. Like I said, we were impacted this morning by having a scrubbed maneuver, so it's - it looks to me like it's beginning. It may well begin to. And that's the (garble) of criteria - flight planning criteria - I was talking about. For example, we - we can plot the heater cycles and temperature trends. So we about - you know - how often a heater cycle should occur. And it may be that we end up having to watch that and plan our maneuvers based upon that - that type of cycle. Basically bearing temperature. So all that's being considered, and I don't know how it's going to turn out at this point.

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PAO
LEWIS

Tom?

And like I said, the patches are those computer patches are in work too, and they reflect. We've got another patch called a reduced dump rate patch which we hope will lessen the momentary torque on the CMGs during the normal dump maneuvers each - each night period. That's in work. We expect that sometime the end of next - this next week. So there're several things at work to try to ease the situation with CMG 2.

QUERY

Would you give any odds on it lasting until the end of the - an 84 day mission.

LEWIS

Not me.

PAO

Paul?

QUERY

I don't know about now, but during the Apollo program there was several betting pools going around on several things over in the Flight Con - among the flight controllers. I'm wondering if there's a pool going on on this.

LEWIS

I - I haven't been asked to - to join the pool or to pay my dues in the pool. I don't think there is at this point.

QUERY

You don't know of one?

LEWIS

No.

PAO

Okay, fine I'd - now I'd like to turn to the gypsy moth experiment and what happened today in the S - Dr. Dennis Morrison, if you'll just give us a short recap of the experiment and then maybe some - what the significance of today's events were.

MORRISON

Basically, the experiment is a rather simple one in that we're taking the gypsy moth eggs up and an attempt is being made to see if exposure to zero gravity will cause them to break a hibernation cycle called diapause where the little ar - larvae stay inside of an egg for some substantial period of time. Normally, with the gypsy moth, this particular insect stays in that stage about 6 months. It makes it almost totally impractical to try and rear massed numbers of insects in the laboratory to institute insect control measures on a broad scale. Since it is a rather destructive pest, they are looking for answers to be able to rear the insects. In the insect life cycle, the egg - develops into a little larva, the larva stays in that egg - in this diapause phase for about 6 months. It hatches - -

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MORRISON - insect life cycle of the egg develops into a little larvae. The larvae stays in that egg in the diapause phase for about 6 months. It hatches out. The little larvae starts to eat, becomes a full-fledged caterpillar at some period later on it goes into a cocoon and later emerges into an adult moth, flies away, mates, and the whole cycle begins again. And in the case of the normal moths, only about, oh, 1 to 2 percent of the eggs will hatch before about a 5 to 6 month period. Now, we're about 6 weeks into that cycle now, so the fact that hatching has begun is starting to look a little promising. There's a possibility that these experiment criteria, which in this case is rather simple, just simply a matter of statistically do we get a significant increase in hatching due to this exposure to zero gravity. So, there's starting to be a little hope developed here, since we have started to see some hatching at this stage.

PAO Okay, fine. You have a question, Paul?

QUERY What is the specific timing mechanism that's distorted by weightlessness that causes them to hatch early, or do you know?

MORRISON That isn't known, but the - there's a somewhat documented theory that the break of this hibernation phase called diapause is probably due to some sort of neuro-circuitory mechanism in the central nervous system of the little larvae. They don't know what triggers this, but they do feel that some sort of a neural hormone is probably released. If that turns out to be the case and we will be bringing the specimens back for analysis, both the eggs that have not hatched will be reared to full adulthood, and be looked at very closely, and also any of the larvae that have hatched, even though they will die because of the lack of food, they will be looked at quite closely. If the hatching has occurred, this is thought to be the mechanism that might be perturbed. It can be somewhat substantiated, then we know that not only their hormonal changes from what we see in the astronauts, but also we've seen some cellular evidence of aggregation of materials inside of cells, carrot cells, for instance. And the possibility that little vesicles inside the cells containing this hormone might aggregate together and cause a release affect. Could be a substantiation of why they hatch out early, if indeed statistically they're going to.

QUERY Well, is that one of your aims, to isolate this hormone and possibly accelerate the diapause artificially?

MORRISON That would be nice if it could be done, I'm not sure that that's going to be a practical method. A little more practical thought is that if substantial numbers of eggs can be brought about to hatch out early, there is a possibility that we might consider actually doing launches

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of vast numbers of eggs. For instance, on the Scout Rocket that's becoming available at (garble) Island. Keep them up there for a period of time and then bring them back and recover them and go ahead and rear them up. The eggs are such that there's millions in a half pint bottle. And the thought is that it would be worth it, since it is such a destructive pest. If their substantial hatching could be precipitated by exposing it to zero g. Be worth it to send them up. Get them to hatch the way we want them to, bring them back in mass rhythm.

QUERY The screw worm program, erudition program, has required a constant reintroduction of sterile males over a number of years. Would you expect that for this to be effective that you're going to have to launch Scouts with a fair frequency to maintain the sterile population, or what?

MORRISON There's basically two mechanisms that you can use for insect control. The one you can release sterile adults and that's a technique that is sort of what we're shooting for in this particular case. The other case is that if you can rear mass numbers, you can actually isolate out sex-attractant materials from the females and make lures that can lure the males to disorientate them to the point that they can't function in a normal life cycle. You can perhaps lure them to insecticides that could cause their destruction. Whichever technique is used, it does require constant imple - -

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MORRISON It could cause their destruction. Which ever technique is used it does require constant application for some period of time and usually then a - once the crisis period of large number of spreading is controlled, then some sort of maintenance application just like the screw worm project. So it is somewhat similar and yes it would con - probably look at several launches, over a period of whatever year or two.

QUERY You introduced the word practical now, I'm wondering what the cost would be.

MORRISON Uh, I don't have an exact quote on it, but I understand that the life sciences research module which has just been renamed in - the - another name is somewhere up for deliberation now, they're talking in the neighborhood of about 10 million a launch at this point. Now, that particular Scout rocket capability covers - carries guess well over 300 pounds payload.

QUERY At ten million a launch, how many launches would be required for the initial assault using the - uh - sterile male system?

MORRISON It really depends upon how what the - uh - the increased frequency of hatching can be accomplished. If it turns out to be a rather small percentage - uh - it may not be practical and worthwhile, it may just end up to be too many launches too much to take up. If it turns out to be a substantial percentage of the eggs can be brought back - uh - since such a large number could be sent up at one time. Uh - the initial assault maybe able to carry it out with the first launch.

QUERY Could you define substantial percentage for us?

MORRISON I, really can't at this point. I'd have to check with the USTA people and the number of insects that they would require. It is really based on the survival in laboratory room procedures and you understand you're only starting with the egg in the larvae, you have to rear them up then either sterilize them or whatever other procedure you're going to do with them and then release them in large numbers. The big thing is that the infestation now is spreading - covers a pretty good proportion of the northeastern United States destroying over I guess last year was something like 17 million acres of forest and so when it comes (garble) talk of practical uh - to be concerned you know - where do you decide when you're going to save the forest or not. They have to really address that percentage.

QUERY Does the female gypsy moth mate once as does the screw worm or do you know?

MORRISON I'm not - I'm not really familiar with that much with the life cycle of the gypsy moth to know if that's an accurate description.

QUERY That compounds your problems if she mates - if she's rather promiscuous, doesn't it?

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MORRISON Somewhat yes it does. Uh - in - You still end up with requiring larger numbers to saturate a particular area, but the big thing is - is if you can impact at regardless of what the technique is and drop the total numbers and really get the numbers of insects available to drop off. You can also start to institute other control measures. Even insecticides sprays particularly. The gypsy moth wasn't a large problem until DDT was removed from our uh - armament. And now it sprang up to be a rather substantial problem.

QUERY Is there a chance that these five moths that - that have hatched are just flukes and that the others are way behind?

MORRISON There certainly is a chance. Uh - again there is a certain percentage of the little eggs that will hatch out over the five or six months period that this hyper-nation this diapause is normally invoked but the very fact that we're starting to get some hatching like that - that's one percent of the eggs already hatched in less than 6 weeks, and seemingly hatched together. This doesn't normally happen. In fact ideally a successful experiment would be that we get large numbers to hatch almost simultaneously.

QUERY It was suggested by one of the CAP COMMs that there may be in fact other types of eggs mixed in with this - these 5 hundred. It was from the wild batch that these 5 hatched. Is this true I mean, could there - (laughter)? Could these be wasps or something else instead.

MORRISON There is a possibility that - there some parasite eggs involved. The individual eggs were dissected out of egg masses and counted so we'd have an accurate number of how many were in there, but the ones that were collected in the wild sometimes parasite mo - eggs such as wasp eggs can have been deposited into the egg mass and been counted along with the other gypsy moth eggs. They're about the size of number 9 lead shot and it might have been possible. Uh - the fact that those are hatching out at this point, if that's the case should become pretty apparent because they're going to be a different type of larva and descriptive wise if we take some pictures and that we'll know right away.

QUERY Could you tell then from the crew's description whether or not they were gypsy moths or - all they describe I think is white, high - crawling and hairy - -

MORRISON Right.

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QUERY - - And whether or not they were gypsy
moths or - I mean all they described I think was white and
crawling and hairy.

MORRISON Right. That - that's - now I can't tell
from just that. We do have facility and have it planned in
the procedures that in this event we would go ahead and - and
take some TV pictures with a closeup lens, and from those we
can tell. The insect people who administer this problem and
work with this, USTA people out of Washington can tell readily.

PAO Okay, thank you very much.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 14, 1973
4:52 p.m. CST

Participants:

Don Puddy, Flight Director
William C. Snoddy, Chief, Space Thermophysics Division, MSFC
Terry Watson, Guidance & Navigation Systems Officer
Dave Garrett, PAO

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PAO Okay, good afternoon. We're ready to get started with our change-of-shift press briefing and also a briefing on the - any comet activities this past week. We have to my immediate right the off-going Flight Director, Don Puddy, and his right is Terry Watson, Guidance and Navigation Officer, and in a minute we'll have to his right William Snoddy, the Skylab Kohoutek Project scientist. Don would you start it off, please?

PUDDY Okay, as far as today's Flight Plan more - more or less been going as planned. In fact, when I left the control center we were a little bit ahead of schedule in completing the medical run on the pilot. Tonight of course our big activity is the EREP run and I briefed you on that last night, so we won't go into that anymore. Don't really have a status as far as what handheld photography we have accomplished. Would like to mention a couple of things, as far as we had scheduled and a couple of things we had as optional. The one that we did have scheduled was the current boundaries off Falkland which's off South America. And we're doing quite a bit of studies there to see what effect the planston may have on current flow. We also had a optional resource survey off of Bolivia, and a metropolitan development pattern of the La Paz Bolivia. Also another optional site that we were looking at was the patterns in wheat production, and that was in western Australia. We did have a message go up to the crew today on quad B and I'll let Terry Watson talk to you a minute about that.

WATSON Well, since the first trim burn we did, I guess you are familiar with the PSM and the quads how the PSM is an extra propellant supply and can feed into any or all the quads. We normally do the trim burns on the PSM and the individual quads are isol - the quad tankage is isolated from the thrusters. And during the first trim burn we noticed that in quad Bravo - quad B, the fuel tank pressure showed fluctuations during the trim burn that followed the PSM fuel pressures. And we - because of that we suspect that we might have - either a valve wasn't closed, isolating the quad from the PSM, or that the valve - one of the valves might have been leaking. So we had the crew go ahead and cycle the switches to control - that control the quad B fuel isolation valves, and they cycled it open and closed. But the only positive indication that we have is when we do - again do a trim burn, where we get large change in pressure in the system. And between the trim burns we monitored that the two pressures were tracking pretty close. There wasn't much of a change, but they were tracking pretty close. So we suspect that we still had a leak in there or - or some kind of small flow volume between - across that valve. So when we did this trim burn the other

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day we again noticed a drop in the quad B fuel pressure, which says, there is a leak in one of the valves. So, to get around this what we did - you can isolate the thruster package two ways. You can - you can feed it from the quad or you can feed it from the PSM. The way we're normally configuring is we close off all of the quads and have the PSM open all the quads, what we've done instead - now we've closed off the PSM to quad B. And the reason we've done that is if we developed a leak in quad B, or in the thruster package, the fuel could leak through that valve that is either not closing or has a leak and leak out. By - by closing off the quad B to PSM, now we at least have protected - previously - pre - let me - I guess, any leak quad B could have fed because it was - it is leaking into the - the manifold there. They - they're all hooked together too, now we've isolated quad B from that manifold. It's just a safety precaution, in case of subsequent leaks.

PUDDY Okay, we did have one other ATM C&D coolant loop glitch just as I was leaving the control center this afternoon. That's two - -

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PUDDY

- - loop glitch just as I was leaving the control center this afternoon. That's the only anomaly since the one I reported to you that we had yesterday afternoon. We've continued working the procedures as far as how we're going to react, and I think I talked with you about that last night. And if you have any questions we can go into that later. As far as CMGs no glitches that were reported. So everything is still looking copasetic in that area, and I will go over a little bit more later in detail as far as some of the patches that we're thinking about in our plan of attack. For that particular possibility of future anomaly a little bit later in the briefing. As far as tomorrow is concerned of course we start out today fairly early with a solar inertial EREP pass over Paraguay. The other - couple other highlights of the day is we do have an S063 comet maneuver, and also a - a night airglow observation using the same instrument and a M509 run. Associated with the S09 run which some of you may be interested in we do have some TV. Probably some of you in the room are interested primarily in - in what the comet's doing, so let me turn it over to William and those of you that are still interested in kind of a brief rundown as far as how we plan to handle the CMG problem if it should occur can hang - can hang with us after that, and the rest of you if you want to can - can leave.

SNUDDY

Okay, the status of the comet we had a good description today by Ed Gibson on the comet as he observed it. The transcript just came out. It's mission day 29, 18:06 GMT. And he observed the tail to be about 4 degrees long, this is using the binoculars that are on board. It's rather remarkable that just using binoculars he can see a tail of that length. Now we have to take - on the ground you have to take long exposures to try to see anything of that size. This 4-degree tail corresponds to a actual length of about 10 million miles. And this is quite a bit ahead of the original predictions that were made for the tail length, at this time it was originally predicted by the Smithsonian that the tail would probably be about 6 million miles long. So a 4-degree one, and this was just visual through the binoculars indicates 10 million, and so the actual tail could be even longer than that. So there's one thing about Kohoutek it's tail is growing at least living up to the expectation to say the least. He also reported that he did not see a split tail, and - and nor did he see any color in the tail. And this is to be expected at this time because in the last few days we've

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gone through the plane of the comet's orbit. And the tails of the comet, ever how many there are one or more, always lie in this plane. And so if there were two tails, now split tail you wouldn't be able to tell it because the two would tend to lie on top of each other. So his observation is consistent with the geometry that we now know we have. Also the - if the gas tail which would be the blue one, if you saw a blue tail that would tend to be the gas tail. The dust tail is reflected sunlight and it tends to be a white tail. If there were - we know there is a gas tail there by using filters you can separate out the two tails but just with the naked eye you can't do that. And so - I'm - I'm sure the two tails are there. They have been observed with filters to be there on the ground. And so the problem again is that - that they lay on top of each other and you can't see the blue one because the white one masks it with the naked eye. In any event he gives the length of the tail, length to width ratio of 20, meaning if the tail is 4 - 4 degrees long roughly then the width is about a fifth of a degree. This again is reasonable. And - and he says that he can notice quite a change from even yesterday when he looked at it. Yesterday he estimated it to be about a 3-degree tail length. And he's doing this estimate on the basis of the field of view of the binoculars. He knows what his total field of view is so he can - can estimate it that way. Yesterday, too, he described the end of the tail as being near a bright star. And it turned out this star is Sigma Libra which is about - yesterday it was about 3 degrees back from the head of the comet so we have enough - -

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SNODDY

- - and it turned out this star is Sigma Libra which is about - yesterday it was about 3 degrees back from the head of the comet, so we have another verification on that, the fact that yesterday indeed it was about 3 degrees long so far as he could tell through binoculars. So that's the observation we have from the crew. We've - so let's say on the comet as a whole of course, one of the interesting things done in recent days was the radio observations that were made, the first week or two of this month, which showed for example that for the first time a emission from the comet was observed a molecular emission was observed using radio techniques and the molecule was methyl cyanide, CH3CN. This is a more complex molecule than a lot of people had expected would exist in a comet. And this means that comets are perhaps more exotic than some people had thought. More like the material that interstellar space is made up, the more exotic material that exists in interstellar space. So this is very interesting and makes this whole operation that much more valuable I think. The program of observing the comet has progressed nicely. We are in the period where we're observing it without corollary instruments, the instruments that look out through the airlock. In the S233, the handheld - not the handheld but the Nikon that takes the white light photographs. I think from the discussion we had last week where they were concerned about the comet having disappeared. It wasn't the first time there've been reports throughout the past several months that the comet's varied in brightness and so on. You begin to understand the difficulty in knowing just exactly how bright is that comet really. And that's why we have that S233, this Nikon on board on a twice a day basis, 12 hour (garble). Getting a white light photographic record of the brightness of the comet. So we hope to avoid the atmospheric affect that ground based observers get into which can cause a wide spread in estimating the magnitude. It's rather frustrating perhaps to try to find out just exactly how bright is the comet really. Well, it's that sort of frustration that makes this kind of observation worthwhile. The other corollary instruments S019, S063, S183, and S201 have been observing on a regular basis. We want to watch the comet evolve S019 has observed four times so far, S063 4 times, S183, twice and S201 three times. Yesterday we had an observation by 183 and S019. Today we had a second observation by S019 where they use different exposure times to get a different part of the spectrum. And tomorrow we'll have an observation by S063. Today by the way is an IAU Comet Day, that's International Astronomical Union Comet Day. It's a day when they encourage everybody to try to group

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their observations today, and so we've managed to group ours fairly well with those two yesterday, one today and one tomorrow. Let's see, we passed through the orbital plane of the comet on December the 8th, 9th, and 10th that time frame. We actually went through the plane of the orbit on 07:00 GMT on December the 10th. And so we made a series of observations during this period with S063 and S073 to see if we could see any debris in the plane of the orbit which you might see only edge on. There was a full Moon hampering - further hampering the people on the ground. Together with the fact that the orbital geometry wouldn't lend itself because of kind of complicated reasons to seeing this material if it were there. So I think if anybody is going to observe it, it would be these observations that were made on Skylab. We will be anxious to see the film from that when it returns. We'll be completing our corollary experiments in the next week or so as the comet gets nearer the Sun and becomes more difficult for them to observe but we will be initiating in the next few days, the observation of the ATM which will overlap the corollary measurements and then continue right on through perihelion and out the other side and at which point the corollary will pick up again. I believe that covers the status pretty well. Thank you.

PAO
now. Tom.

Okay, I guess we're ready for questions

QUERY
are there any more revisions of its predicted brightness, the last I heard about it would be somewhat brighter or about as bright as Venus close to perihelion.

SNODDY
around minus - - That's what Smithsonian is still predicting,

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SNODDY

That's what - -

QUERY

Oh.

SNODDY

That's what the Smithsonian still predicting now, of around minus 4 magnitude, right at the time of closest approach to the Sun. The observations are increasing very nicely and we even heard from yesterday to today the astronauts saw quite a bit of difference too in the comet. So, that's remaining the same as far as the Smithsonian is concerned. We depend on them for the predictions of the nature. It's a tricky business, I might add.

QUERY

Would you expect at a later time that they'll be able to see both of the tails? And he mentioned the color yellow associated with the dust tail, is this expected and will this become prominent to viewers on the ground?

SNODDY

You have the additional affects of the atmosphere, generally you think of - of the dust tail - the dust tail is just simply scattered sunlight, it's like fog. And so it's going to appear white or I guess yellow would be close to it as well. And that's - we generally see what looks like a white tail. The blue tail we'll probably never get a good look at just looking directly at it. You have to have the filters to separate out the two tails. You have to use a - you know - the different color filters, can very nicely separate the - the gas tail is - is emitted light. It's sunlight that's absorbed and then emitted in very discrete wavelengths. And so by picking filters that are transmitted only at those wavelengths you can tell how much of a gas tail you really have. So I don't believe that geometry will ever lend itself to us having much of a chance of seeing the two tails from the ground or the astronauts to see the two tails. If they get real long in extents then perhaps out near the end you - they may be able to tell the - the dust tail may curve away, and reveal the gas tail going straight. But there won't be much of - enough separation for us to really count on that effect.

PAO

Tom?

QUERY

All my - the rest of my questions are

for Don.

PAO

Okay.

QUERY

Ready - ready for that.

PUDDY

Go ahead.

QUERY

Don, have - on the CMGs, the theories of what the problem is that were uplinked, I believe today -

yesterday?

PUDDY

Well, no there were - I guess 3 or 4 days ago that we talked to them about the theories as to - a message was uplinked to the crew as to what the possible theories were. And subsequent to that, I briefed you on the fact that

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there was more or less additional ones thrown in because we had related all these to the lower portion of the heating cycle. And that was a possibility of a more or less a lubricant viscosity effect starvation so to speak. Then we were talking about possibly manually managing the heater control in order - the automatic - taking it out of the automatic cycle, and manually managing the bearing heaters, in order to maintain it towards the top part of that cycle.

QUERY Then what - what is the new theory that you're sending up or the advancement of the old theories, or things that you were talking about this afternoon?

PUDDY The air-to-ground transmission that you heard on that today was nothing new. The theories haven't changed, I - I don't think we're any closer today than we were a week ago as far as trying to pin down just exactly which one of these theories is correct. All we were trying to do today was - was merely to bring the crew up to speed and what the signature itself of the anomalies that we had seen on the CMG were - and - and not to advance or to repudiate any of the theories that we had previously forward to them. So, just want to make sure - we try to keep the crew tagged up on just exactly where we are on the ground. We're in - we're in the state right now where we're preparing a couple of messages, and you'll probably hear these discussed over the next couple of days. As far as just exactly what program modifications we're going to make in both the ATM DC, and in the CSM, in order to minimize either TACS or RCS propellant should we have the second failure. And since I was going to talk about this anyway, I might as well get in to it right now. Generally, whenever you have a CMG failure, you do fail over into a three - -

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PUDDY

And since I was going to talk about this anyway, I might as well get into it now. Generally, whenever you have a CMG failure, you do fall over into a 3-2-2 deadband and in TACS only control mode. And this is fairly expensive as far as TACS usage is concerned. In fact, you're talking about approximately 700 pound-seconds of TACS per rev. Only it doesn't take much imagination to figure out that if we - we stayed in that particular mode very long, we'd go through our existing TACS in about 2 days. As far as the actions that we took to alleviate that situation, the first one was to look at a patch where we could actually go to no - normal operations. But using only a single CMG. And the time to develop that particular patch and - I - I don't even think I ought to call it patch, it's almost a whole new computer program. And the complexity of that program - we just had to rule that one out. But we have been able to develop and we presently have on hand and is presently being run right now in the - in the simulator is what we call a quazi inertial patch. Basically what this allows us to is to stay in the 3-2-2 deadband. But we actually have a commanded control of around 16 degrees deviation from solar inertial, in order to minimize the gravity gradient torques on the vehicle. This reduced the overall TACS cost to somewhere around 100 to 150 pound-seconds per day. And in - if you were at the briefing that Mr. Schneider gave the other day, that was the patch he was referring to, when he was quoting the 1600 to 2500 pound-second per day TACS usage. We do have that in hand like I say it - it's being run on the simulator and our plan is to go ahead and load - load that patch probably in the next couple of days. With that of course, we have about a 10 day TACS lifetime and that still leaves us with a 6000 pound-second operational reserve. If you wanted to go ahead and use that reserve up, you could of course extend for 3 days. There is also still some reserve even below that. Our whole TACS budget is - is based on the fact of maintaining at least 10 pound - excuse me - we normally have a 37 pound force thrust on the - on a TACS thruster or - that budget is based on - going down to 10 and we can lower than that. As a result of being able to go lower than that we can pick up addit - additional TACS, and - and there's quite a magnitude. We don't plan to do it, we feel like we could if we had to, and still maintain control on the vehicle as with - with a force of - off of those thrusters of something on order of 2 pounds, so there's quite a bit of margin there. In addition we have the CSM of course, which we can use for attitude control capability. In narrow deadband, it's fairly expensive as far as RCS usage - usage is concerned, consuming about 8 pounds per rev. We can go to a Y deadband,

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which is around 16 degrees, and we can fall back to about 3-1/3 pounds per rev, which will give us a lifetime around 8 days with a CSM. But again we have - had developed a patch which we hope to have available by Monday, which controls the vehicle in much the same way that the quazi inertial patch, in the AT - AIM DC works. The deadband plus the command isolating attitude. And this reduces the cost down to about 1 pound per rev, or gives us about 28 days worth of capability with the CSM. As I briefed you last night, we have - have a couple of sets of criteria that we use on the CMG. One merely, to put us in kind of a stand by posture, while we take a look at it and then a more drastic set of criteria, where we actually unpower the CMG, and - and considered it failed. Our plan of attack would always be to - to - as soon as we have the quazi inertial, AIM DC patch loaded would be to go to that mode if we had a CMG anomaly. Regardless, of which set of limits we've violated after we got to - -

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PUDDY - - MDC patch loaded would be to go to that mode, if we had a CMG anomaly regardless of which set of limits we violated. After we got to that particular point in time, we would continue on up and power up the CSM, continue to take a look at the CMG and would go ahead and initially use the CSM propellants down to their red line prior to going back and actually expending any further TACS gas and the primary rationale for this philosophy is that of course if that CMG does turn out to be usable we certainly would like to have as much of our TACS propellant remaining so that we can go back and do our normal standard scientific observation. And we feel like we got more than adequate pad in the RCS propellant. There's no problem whatsoever in using that. So that's more or less a short rundown on that particular status at this time, problem.

PAO Any further questions? Paul.

QUERY Okay, given that your CMG has failed, totally completely, finally and beyond all reprieve, Okay?

PUDDY Okay.

QUERY What will you be able to perform in the way of scientific recovery data?

PUDDY I cannot give you all of the answers there. We certainly would be able to perform should we elect to expend the time and this is all according to when the CMG happens. Let me make that perfectly clear and I think Mr. Schneider has gone over all that with you. If you elected to go ahead and to continue scientific activities, we certainly have on board several corollary experiments which are not attitude critical at all, the metal (garble), things of this nature. I'm sure you're aware of that type of experiment that you can go ahead and accomplish. Terry can probably speak to you as to some of the costs that they have been working on here recently as far as - what we can do as far as running Z-LV passes, I think he can give you the exact details but as far as RCS propellant is concerned I think you can trade off essentially assuming that we have the CSM quasi inertial pass, I think you can trade off about a half days worth of RCS propellant for 1 EREP pass. I don't know how much else you've gotten into there Terry.

WATSON It's more like 1 day.

PUDDY 1 day.

WATSON Depending well if you got - got to get the oscillating deadband, it's like 16 pounds a day and an EREP will run you from 13 to 20 pounds per day - 13 to 20 pounds for an EREP pass so -

QUERY That's the CSM?

WATSON Right CSM control.

PUDDY Have you got anything on the corollary?

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QUERY

WATSON

That's on the TACS?
Z-LV with the TACS is very expensive. You're talking probably - you're probably talking about 700 pound-seconds per orbit. Which is almost - it's just like being in TACS only control again without any - your deadbands are narrower, I'm sorry wider in TACS only the CSM gives you better attitude control.

QUERY

WATSON

How about the Kohoutek maneuver?
Once again you'd have to go back to a straightforward attitude hold in SI. You couldn't do any Kohoutek pointing if you're oscillating in a wide 16-degree deadband. You'd have to go to a half degree deadband on the CSM which would be the number Don quoted earlier about 8 pounds per orbit. So if we get down to the expected 16 pounds a day. One rev of Kohoutek pointing would cost you half a day's stay time.

PUDDY

So I think in summary what we can say on that particular subject is that experiment can certainly be accomplished if it is deemed at that is what we'd like to do, the only thing that you'd have to trade off there is the cost versus the time that you want to remain in orbit. And certainly - of course one of the things that's been pointed out to you that you want to consider theirs is your recovery points, having your ships - allowing time for your ships to get on station. You certainly - you've got the EVA cost, you certainly want to recover what scientific data you've already obtained. There would be some increased cost for the EVA, there's certain things we're looking at as far as minimizing that cost. Certainly with the loss of the second CMG, we no longer need to worry about such things - -

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PUDDY - - that cost. Certainly with the loss of the second CMG you would no longer need to worry about such things as deflectors on the suits which do precipitate some momentum perturbations. We can take those things off and excuse me, save some gas that way and we're looking into those various things. But as far as the detailed time line on - on the entire sequence, we're still not there. I think we are in the posture however where we got a pretty good feel for what we can do and what the costs are. And we're in a posture where I think we got the majority of the work done on the patches that do the best we can to minimize the cost and maximize the time in orbit.

QUERY I'm not to sure how to put this question but is time a factor in your analysis of trying to determine what - what's wrong with the CMG? I mean if a certain amount of time passes without a repeat of a previous signature will this tell you something?

PUDDY No. I don't think so. It's hard to - it's hard to answer that question directly. If you had some very serious glitches of the type that we have been talking about the - the bearing temperature increases and some of the corresponding current increases. And you had a large series of these one right after the other. One would certainly be more concerned than if you had them spaced at a 15 day intervals. As far as being able to say if if this particular anomaly doesn't occur for 3 days we know just exactly what the anomaly is and prove one theory or another. No, you can't relate it that way. I don't know if that answered it exactly what - -

QUERY

Plau. O was fishing. That's all right.

PUDDY

Well, I was giving you a fishing answer. Well, like - like a problem if it was

WATSON

a lubrication problem. You weren't getting adequate lubrication that could be an intermittent problem. You could get adequate flow for a while and then you could have a hang up in the oil flow. You could see these glitches and then they'd go away. That - something like that may never cause you a problem with the CMG. You may just see these funny little traces every so often. Where as a real bearing problem might reflect itself different. And a total lubrication starvation can cause the whole thing to go in a matter of minutes, complete failure in a matter of minutes. So I just - I don't think generically you can you can relate that to - to the theories right now totally.

PAO

PUDDY

There are no more question. Thank you.
That final 509TV -

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 13, 1973
5:21 p.m. CST

Participants:

Don Puddy, Flight Director
Dave Garrett, PAO

PC-55

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PAO

Okay, we're ready to start with our change-of-shift briefing. This afternoon we have with us the off-going Flight Director Don Puddy. Don.

PUDDY

Okay, I think you'll have had pretty good summary of where we stand as far as the overall picture by NASA's management. So let me just go ahead and concentrate my remarks on what's been accomplished so far today, some of the anomalies that we've detected today and a brief shot at tomorrow's Flight Plan. The Flight Plan has I briefed you on you on last night has been executed up until this point in time as planned. This morning - early this morning and again late this afternoon we had an occasion where the ATM C&D loop flow dropped quite significantly, in fact on this afternoon it went all the way to zero for a very short period of time and then recovered. On both occasions we had coverage and were able to get the crew to go up in the area and to listen to see whether or we could detect the gurgling sound that had been discussed with you previously when we had the pump A problem. In neither case did the crew report that, and I think their most significant report came on the one this afternoon where they said it sounded to them based on more or less a characteristic whine of the loop that the pump itself was loading down. Of course all of these reports haven't been completely deciphered and analyzed as far as what this means. But it certainly at this point in time looks like that there may be something associated with the pumps. We're taking a look at that, should have some more word for you on that tomorrow afternoon. I think the main thing however I'd like to emphasize here is the fact that even if is a problem with the pump C, which we're presently on we still have one other pump which may or may not show the same characteristics, I don't want to imply to you that if we go back to pump B which we were on I think for about 48 hours or something like that, that all this will correct itself. But we still have that remaining pump. And even if we should lose both pumps or the loop for some other reason we have the operational procedures that we can use as workarounds. And from an overall mission standpoint it's not going to effect us significantly in the mission accomplishments that we had planned. Your constraints are primarily associated with panel touch temperatures and equipment operating times but these equipment operating times for instance we're talking something in the order of 30 some odd minutes on the EREP tape recorders. Well, y'all know what most of our data takes have been. So this is - this is really not too significant. Touch temperatures you just don't lay your

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hand on there for an extended period of time and so on and so forth. So there's - the thing I want to emphasize is there's no big constraint. Even if we do the - lose the loop and we're not saying that's occurring. As far as other little anomalies that occurred today we did have - you probably heard on air-to-ground a couple of glitches reported in S082B, one of the ATM experiments. One of them the mirror associated with that particular experiment lost lock on the limb of the Sun. We're not sure exactly what caused this yet. We are presently in the process of bringing back the data at the time of that anomaly and analysing it. It could have been caused by contamination or it could be merely a positioning problem because at the particular time that this anomaly occurred we had just repositioned that mirror significantly and so it could be just merely a positioning problem. Secondly we had a problem where we couldn't switch on the same instrument. We couldn't switch wavelengths. There's two wavelength positions on this particular instrument, what we call the long and the short wavelength. I think this is the first time that we have seen this particular anomaly in flight. But we were aware that the logic did have - could have this particular problem based on some ground testing that we did prior to the Skylab 1 launch - -

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PUDDY The logic did have - could have this particular problem based on some ground testing that we did prior to the Skylab-I launch. It's merely a matter of resetting it, in other words, going back to the wave length that you were originally at and then commanding the other one again. 82B, when I left the Control Center, was cooperating properly and so both of these as far as we're concerned are nothing to be concerned about. On S183, stellar observations this afternoon you probably heard that - that there was a - a - some sort of anomaly reported. As best as I can piece it together at the present time, it looks like all we had there is a hangup in some form or another in the carousel frame counter logic. This in no way, shape, or form affects the operation of the instrument; it just means you have to keep a little closer track of exactly which of the slides in the carousel you've exposed. We certainly plan to go ahead and operate this afternoon on the S183, comet operations with that same carousel - same instrument, so on and so forth. No OP-2 glitches. As far as tomorrow, we're going to do a little preparation for the M099 run, which is scheduled for the commander, on day 30. We have about 4 hours of solar viewing scheduled. We have an ERFP pass that extends from Borneo across to Australia and that's combined with the - with an Earth orbit scan. As far as the type of data that we'll be collecting here, there were five possible mandatory sites, three of which we think we're going to get data on. The first one is where we're going to check the irregularities of the ocean water level in the - the slope, and as you probably remember, we previously done this type of objective in the Puerto Rican slope area. Another one is that we're performing some land use and geomorphology studies around the Alice Springs area, which is in central Australia. You're probably a little bit curious as to why the OP-18D, which was originally scheduled for tomorrow, had been cancelled. And this is due to the fact that the comet brightness was - was not quite as predicted. I'm not saying that there's any indication that the comet isn't going to develop and be more or less, according to previous plans, but it's not quite as bright right now as we had expected. And as a consequence only one of the two instruments that we normally - photographic instruments that we normally use on that side is S052, was going to be able to see that. We plan to go ahead and repeat that on mission day 33. Should we have a - a problem then the brightness is expected to be more than adequate. There's also another consideration that cancellation that is when you've got a - a single instrument with a single objective with the amount of man hours involved in the JFF - OP-18D we - we look at it with a very jaundiced eye and this way about 6 man hours worth of work involved in

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11 minute data take. So until we get more or less a full up program we - we certainly don't want to go into that type of overhead. The early EREP that I also talked about a little bit last night was scrubbed out primarily due to bad weather. There was also in some of the sites not as favorable a Sun angle as we would have like to have had and we'll pick it up again on day 34. You might have heard us talk a few minutes about a change in our plan of attack with the flight crew as far as kind of keeping them apprised of what we're doing in the way of future scheduling. One of our objectives on this particular mission is - is to involve the flight crew to a greater extent in overall mission planning. And we think with the duration of the mission, they - they stand a real good chance of - of providing us some feedback. We've started that a little bit verbally in the ATM conference that we've been holding on a daily basis. And our plan is to - and we've coordinated this with the crew this afternoon, and they wholeheartedly concur, our plan is to more or less send up a 5 day forecast. After each of our science planning conferences that we have here on the ground where we decide which are the best scientific objectives, we hold the science conferences on Wednesday evening and Sunday evening, so we'll be sending up a 5-day forecast to the crew on Monday and Thursday. Somewhere in here I had a little upd - -

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PUDDY - - science conferences on Wednesday evening and Sunday evening. So we'll be sending up a 5-day forecast to the crew on Monday and Thursday. Somewhere in here I had a little update that I - if I can find it - I probably can't - just to make sure we got the latest and greatest on the Gypsy moths. You know last night I briefed you that fact that we had the tame vials and the - the wild vial. Well, the wild eggs were probably laid sometime in last August. And they were collected and shipped to KSC in October of '73, and were refrigerated until the latter part of that month. The tame eggs were laid early in September and were refrigerated until the latter part of that month. The refrigeration is expected to speed the diapause somewhat, but - but not significantly. We feel that a few of them might break diapause in late January or early February, but most of them will probably break that cycle in March unless zero g does indeed have some effect on the eggs. And let me terminate there and see what questions y'all have.

QUERY Several things Don, we go to the JOP 18 on day 33 which I calculate next Tuesday, and according to the 7-day forecast that's also on morning of getting up around 2-1/2 to 3 hours early for an early EREP, is that still on the schedule?

PUDDY Okay, on day 33, right now we're planning a 02171 on the pilot, the 180, and EREP track 63. And I don't remember on the 7-day forecast whether that's the early morning one or not, that's track 63. We also have an S063 cover observation. I take it back - I do know, track 63 is the early geothermal pass which is over the western U.S., I believe and Central America. And we also have hopefully some Schoutek TV.

QUERY Okay. And back to the ATM C&D cooling loop. If we lose it - you were talking about - you know, touch temperatures and all that. Are there any instruments that - would - could burn out without that loop going unless you - if you did not abuse say the running time of the EREP recorder something, I mean under normal conditions of use? Could you burn something out without that loop?

PUDDY I'm - I'm certain that if you - you, for instance, didn't have the loop running and you left an EREP tape recorder on for an extended period of time you could lose -

QUERY Without that kind of abuse, that's what I mean under normal operating conditions, without leaving the -

PUDDY I think the only thing that you - other than with normal operational procedures we'll really have to watch are the ATM TV monitors. And right now we're looking at a constraint of about 15 minutes per rev now. Basically,

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what that means is that during a given ATM pass you bring it up, take a look at the area you're interested, start your programs going, probably turn the monitor down for a while, when you get to another point where you've got a significant change in either your pointing or looking for another specific type of thing to start another program, turn it on again and look at it. That type of thing, but you are constrained on the ATM TV monitors from a - from a continuous monitoring standpoint. From the EREP standpoint, the only two items really effected are the tape recorders and the 192 instrument and neither of these as far as the constraints as we know them today, are we really even going to have to take super special precautions procedurally to - to work around just because of type of passes we're running.

QUERY Well, the other day, the PAO made comment in discussing this coolant loop, that it would probably eliminate back-to-back EREPs because there would have to be something like - as I recall - 10-hour cooling down period.

PUDDY That's correct, that's correct. But as you're probably well aware in general we're not doing back-to-back EREPs anyway, and - and that's the reason I qualified my statement with the type of planning that we're doing right now.

QUERY You could do an early morning and a late night?

PUDDY Oh, no problem.

END OF

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PUDDY - my statement with the type of planning
that we're doing right now.

QUERY You could a early morning and a late
night?

PUDDY Oh, no problem. No problem.

QUERY Have the crewmen got any gloves on board,
I forgot what their wardrobes consist of. Have they got
any gloves on board that would kind of get around the touch
temperature problem?

PUDDY - Uh

QUERY Other than EVA gloves I mean.

PUDDY Well they - of course they've got some
EVA gloves, I'm sure they've got some sterile gloves. And
I'm sure they've got some EVA glove liners which would be
the type of thing that could be used. But I feel certain
that - their operations just don't require to go around
their hand laying on a panel.

QUERY That's the problem is just leaving their
hands instead of just punching buttons or something.

PUDDY Right.

QUERY What is the flight controllers feeling on
- on the possibility of losing the loop? Are they - does
it look pretty likely that it'll go from all the problems
that you've had? I mean you've got a lot of experience
in watching equipment have trouble.

PUDDY Bruce, I guess in my own mind right now
I really don't know. It - there something funny going on
in there, that's for sure. I guess - you know out of
curiosity I'd even like to check the status of pump A.
I'm not so sure that - that it hasn't been shut just down
exactly on the same type of characteristics that we've seen
on say pump C. We're looking at several things. I think it's
very possible that with the three pumps that we'll be able to go
the majority of the mission not in exactly an optimum flow
condition. But as long as we got some flow in that loop
we're in good shape. It's certainly doesn't have to be up
around that nominal 250 pounds an hour to - to do a cooling
job for us. And I just kind of have a hunch we'll have that
loop at the end of the mission.

PAO Any further questions? If not we'll end
the briefing. Thank you.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Mission Day-28 Review
Johnson Space Center
December 13, 1973
1:30 pm CST

Participants:

William Schneider, Skylab Program Director, NASA Headquarters
in Washington
Kenneth Kleinknecht, Skylab Program Manager, Johnson Space Center
Stan Reinartz, Deputy Skylab Program Manager, Marshall Space Flight
Center
Bill Pomeroy, PAO

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PAO Okay. At this point, 28 days into the mission, we're ready to give you a Mission Status Review. And we have with us today, I'm going from my right, Stanley R Reinartz of the Marshall Space Flight Center, Deputy Skylab Program Manager there, William S. Schneider, NASA Headquarters, who is Skylab Program Director, and - pardon me, William C. Schneider (laughter). And the middle initial S. goes with Mr. Kleinknecht who is - Kenneth Kleinknecht who is the Skylab Program Director - Manager here at Johnson Space Center. We'll start off with some remarks by Mr. Schneider.

SCHNEIDER Thank you. Good afternoon, ladies and gentlemen. As Bill said, we're just completing day 28 and have 56 to go. And it seemed appropriate for us to pause for a moment and have a little review of our accomplishments and a little forecast of what we see ahead of us. First let me start by commenting on the crew's health and well-being. We do hold, as you know, regular reviews of their health. And, of course, I'm very pleased to say that their health is great, they're in great shape, their weight is stabilized, they have not lost weight. And the doctors are very pleased, not only with their physical well-being, but also their mental well-being and the job that they are accomplishing. Turning to the accomplishments, there have been many. The medical experiments, I won't dwell on those other than to say, they've all been accomplished as planned. In the Apollo telescope mount, the solar observatory, we have managed to accomplish, to date, approximately 20 hours of solar viewing, which is perhaps about 10 percent less than we had planned prelift-off, but we have consciously shifted time after lift-off from the ATM into the Earth resources area. However, even during those 84 hours we have had several very significant accomplishments. Ed Gibson did manage on the - December the 4th to catch a limb flare, which is very significant to the solar scientists in that it was the first limb flare that has been caught in Skylab. And they're very, very pleased. The principal investigators tell me that the flight crew exercised perfect judgment and perfect execution in getting all the data that they possibly could from the limb flare. The other unique ATM viewing activity had to do with the viewing of a helmet streamer. And I'm not going to try and tell you what a helmet streamer is. I've just about told you all I know about it. We also did have a very successful CALROC firing. As you know, we calibrate the inertial ATM instruments by rocket firing from White Sands. That was done and was very successful. All in all, the ATM performance has been very well, very well done. And that, despite the fact that we

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added nine new joint observing programs to this mission after the Skylab III crew returned. Those new observing programs were primarily aimed at looking at new concepts that the principal investigators had developed as a result of looking at the Skylab II and III data, as well as, one or two observing programs that have to do with the comet Kohoutek. As I said, we did shift time from ATM into EREP on a conscious basis and we were able to get 12 passes. As you know, we did have some problem with some filters on one of the instruments. So we will probably have to repeat some data, but all of the mandatory sites do come up again. And we do have that opportunity. I guess the significant observation that we had there had to do with the - with the ocean currents in the Yucatan channel, where we have come up with some ideas which should help the weather bureau in better modeling the Earth's atmosphere and better predicting the Earth's weather.

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SCHNEIDER I guess the significant observation that we had there had to do with the - with the ocean currents in the Yucatan Channel where we have come up with some ideas which should help the weather bureau in better modeling the Earth's atmosphere and better predicting the Earth's weather. And of course, as you know, during the extravehicular activity we did fix the 193 experiment. Comet Kohoutek, despite some of the early reports in the paper that said perhaps it wasn't as bright as - as previously expected, we have had 45 separate observations of the comet. And just before I came over here, why, Bill Pogue made some very brief comments about the fact that the comet has gotten significantly brighter since the last time he saw it and now has a tail which he estimated to be 2 to 3 degrees long. So it looks like the comet is performing well and moving in there just as the scientists had told us it was going to. I won't go through all of the corollary and student and operational DTUs and science demonstrations that we've had. We've been ticking them off as planned and they've all been going very well. More significant ones were - that we added late were the barium cloud observation, which went very well, and also the laser observation, which went very well. We've had 80 different opportunities, at 80 different times we have done what we call Earth observation. This is a new series of experiments that we added after Skylab III, where we train the crew to observe geological phenomena from orbit. And they are doing that on a regular basis and we've done that 80 times. Of course, the true accomplishments can't really be unfolded after we've analyzed this data. So this is kind of an operational accomplishment. The true science accomplishments won't be known until several years from now, I'm sure. Turning to our the orbit hardware. We have had one control moment gyre that has failed and we're now operating on the CMGs. One of those CMGs every once in a while gives a little alarm, but I guess it's causing mostly trouble for those of us on the ground getting white hairs and wondering if it's trying to tell us something, but we seem to be in good shape, the vehicle's under control, and we have no - no worries right now other than normal worries that you might have in that area. The ATM control and display panel has had some fluctuations in the - in the coolant flow, quite a few of them as a matter of fact. We not quite a 100 percent sure what that means. Although Mr. Reinartz was telling me just before we came over here that the data is now indicating that it's probably a situation that is very controllable. We had instrument that has gone bad in the ATM, the 8054, which is the X-ray telescope built by American Science and engineering, apparently

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has a filter stuck in the field of view, and we will in all probability try to correct that on the next EVA on - on 88 around Christmas. We have a procedure set up that looks as if it's possible for us to correct that. Well we've repaired a lot of other things, the S183 experiment, the S009 experiment, the airlock module coolant loop, and all-in-all for a vehicle that's been up there for almost eight months, I guess it's a little over seven months now, I guess it'll be seven months tomorrow, it is behaving very well and we are very pleased with the mission as it's been progressing so far, and we think we're getting excellent data out of it. Right now, unless something unforeseen happens, we're GO for our 60-day mission, open-ended to 84, as we've explained to you previously, and looking forward to talking to you again in 28 days. You can turn it over to questions.

PAO Thank you, Bill. At this time we'll take your questions, if you'll wait until we get a microphone to you.

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SCHNEIDER Often ended to 84 as we've explained to you previously and looking forward to talking to you again in 28 days.

PAO Thank you, Bill. At this time we'll take your questions, if you'll wait til we get a microphone to you.

QUERY Bill, you made a statement that the doctors were very well pleased with the physical and mental attitude in the job that the crewmen are doing. Dr. Hawkins recently in a briefing made some comments that the crew was working slower on some tasks and they would like to see, and he indicated that, there was no - he said there was no medical reason that he could find and hinted, at least to me I guess, that there was some underlying concern as to this crews' stability as far as doing their tasks and I understand Dr. Berry in Washington has made several comments that doctors are privately somewhat concerned about it. Wonder what your feelings are? Is this crew moving slower? The number of mistakes that have been made, do you check them off as the individuals, as Dr. Hawkins does, or exactly what is the case?

SCHNEIDER Well, well, let me say that I read the same reports you did and did investigate them. I, for example, I talked to Dr. Berry today and he is not concerned and thinks that the report in the paper was overstated. We have talked to the doctors, Dr. Hawkins and all the medical PIs and they are I guess we could even quote them, Ken, you might want to quote them when I'm finished, they are quite pleased with their performance. We have gone back to try and to see if there's any statistical basis to impressions that people may have received and can find nothing that bears out those impressions. Now this crew is more silent on communications than previous crews may have been, but this to is by design. This crew had before they lifted off, had said that they were going to put their comments, the majority of their comments on the channel B tape and they are. And if you read the channel B tapes you find that they are great numbers of comments on there about the experiments and what they're doing, so we had expected them to be more quiet, they are more quiet, they are different individuals, obviously. But we have no concern whatever and I can find indeed when I press people to the wall to see if you really do have a concern. I find no medical concern about their medical, medical condition, or their mental condition and I certainly have not been able to discern any of it myself. Ken did you want to say anything.

KLEINKNECHT Yes I think the error frequency or minor mistake procedural error on this mission has been no different than the other missions. In general across the board. There may be some specific areas where maybe they bunched up. They

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have not made any procedural errors that caused us to lose the bulk of any experiment data or the major part of any experiment data. I think if you look at procedures too, from the procedures standpoint, procedures change, flight data files change, just like hardware changes proportional to the time between missions if you will. If you go back and look at the month previous or just prior to the launch of Skylab II, there was about 6000 stowage changes and that's inputs to our flight data base and stowage data base. The month prior to Skylab III, there was about 8000, and a month prior to Skylab IV, there was about 17,000. Everyone of those stowage changes effects a procedure someplace. Now some of the stowage changes were just taking something out. But that's removing something that a crew had worked on before. We have the same standpoint, from the same standpoint I think in significant activities. The changes and new activities for the Skylab II crew were primarily associated with the workshop problem we had after its launch. Skylab III crew had a number of changes, new activities like six-pack changes, refrigeration modes, new exercises, fixing 8009, twin-pole sunshade, soforth. In these type changes there was twice as many in Skylab IV as there were in Skylab III.

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KLEINKNECHT - - S009 twin pole sunshade and so forth. In those type changes, there was twice as many in Skylab IV as there were in Skylab III. I think the success of this program or this mission isn't going to be judged on how much the crew talks or any minor deficiencies in procedures, as Bill said, it's going to be judged on the returns and the analysis of the data after the mission and after the program. And we see nothing at this time that says that we aren't going to get what we intended to get. As a matter of fact, significantly more than we intended to get out of the program.

QUERY As I'm sure you're aware, this is about the point where they approached the number of days that the Conrad crew had in space. And the Conrad crew had 81 hours and 41 minutes of ATM time, and had 11 EREP passes, and all with the filters in the cameras, had three EVAs, took time to deactivate the space station, and arrived there at a point where they had to work under very hot conditions for several days. With those things in mind, how would you rate these crews at this point after a month?

SCHNEIDER I don't think you rate crews. The - The Skylab program had been designed to have different emphasis as the missions went on, and you can't compare one versus another to say whether or not you are accomplishing the same things. The - if you look at workload for example, the Skylab III crew at the end of their mission were going about, were averaging about 28, 29 hours a day of experiment work. The Skylab IV crew at this point is averaging 25 to 27 hours a day work. And that means that you're talking about differences of minutes of experiment operation, not hours between them. So I don't think this crew has anything to be ashamed about in their performance. I think they can be quite proud of what they're doing.

KLEINKNECHT I think certainly we're scheduling differently for this crew than we did for the other crews. And if you specifically want a rating, I'd rate them all equally. And I don't think you can totally rate them until the program is over either. But don't forget we didn't get everything we planned to do on Skylab II out of the way because of failures. Some things you couldn't do because we didn't have a solar scientific airlock. The Skylab II crew did more - or Skylab III crew did more than we planned to do preflight. We took that experience and we used the experience on the ground. At this stage the ground people have some 210 days of real time flight experience behind them and this crew has 21 days. Maybe we ought to be attacking ourselves a little on the ground too from the hardware stand point. A lot of these procedures change have come about because the hardware is not working 100 percent. There

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isn't very much hardware up there that's working exactly like the crew's basic training was performed on. They're doing workarounds. This crew has also done some repairs. S193 was the most difficult EVA we've done, not from the standpoint of physical exertion and work, but it was a very precise task and difficult to do with gloves on, and that was an outstanding performance by this crew. And if you take the things that the other crew has had to do, when something had to be done, they've all done an outstanding performance, I believe. If you look back at the training, the training is about equivalent for all three crews except that there is more changes from one crew to the next. The Skylab IV crew had to pick up all the changes that came about as a result of the Skylab II mission - as a result of the Skylab III mission and as a result of the additional failures, plus the significant amount of new experiments, DTOs and activities we've given to them. And we on the ground got carried away a little bit. Bill and I have talked about this, is we probably let too much get into this crew at the last few days or weeks before the mission. Now the crew was very enthusiastic about this. You know we increased the mission to 84 days. We needed stowage space, we had to get consumables, food and so forth aboard. And the crew says I want you to take everything off of there that could be interpreted to be more convenience from the operational standpoint, that's a convenience, or that it's a little inconvenience for me to not have it and put things on that will produce science.

END OF TAPE

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KLEINKNECHT - - consumables, food and so forth aboard. And the crew says I want you to take everything off of there that could be interpreted to be more convenient from the operational standpoint, that's a convenience or that it a little inconvenient for me to not have it. And put things on that will produce science. And so we did exactly that.

QUERY Well, I'm sure that they're doing as good job as you say they are, Ken. And I want to know, before I ask this question, that they had the advantage of the experience of six men before them 3 months in orbit. Now I want to ask you, they're going to have to go back over six mandatory EVA passes, as I understand it.

KLEINKNECHT EREP.

QUERY What's going to be knocked out because of that?
KLEINKNECHT I can't tell you at this stage. I think we'll catch them by selection of EREP passes. We'll select EREP passes that get the other requirements plus the six mandatory sites. That's not six passes, I believe it's the six mandatory sites. Now weather, lighting and so forth gets involved in that. But there will be time with the right light in front of us now where we can pick those up. Now take the filters, I don't know why we make such a big deal out of the filters. We have six cameras there. Three of the films - Well one is perfectly all right, two were over exposed, and we can correct that on the ground. Two others are over exposed and we can bring back a significant amount of it - get a significant amount of the data out of it. One film with the I, I guess it's the IR, we will not get. So it wasn't a total loss. Don't forget we have operated 190 in the past with the damn door closed, too. And I don't think we got very much. Now it wasn't very many passes. But you - Why do you jump on something like this? It looks like you want to try to make the news.

QUERY Well maybe we are making too much of it. Why are you going back over the sites?

KLEINKNECHT We said they're mandatory sites. We're going to get them. That's the kind of flexibility we're trying to build into the program. And fortunately we must have done it right in this case. Now, certainly, I wouldn't say that everything that we miss one time that we're going to be able to go back and get, we're also going back and getting a lot of things because of hardware failure. Like experiments that had to go out of the solar airlock, can not. And look at the activity - the hardware changes, the procedures, the crew training that has to go in to do those things EVA. And these crews, all of them have been just as enthusiastic in going back and doing that. And they're covering up for our mistakes on the ground, when they do that. I think you ought to attack us more than them. They can't

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defend themselves. I think they're doing an outstanding job.

SCHNEIDER Don't think we wanted those filters to be left out. We certainly are just as disappointed as they are but, as Kenny says, the basic problem when I think about it in retrospect, is that it probably belongs to us up here. We stowed that spacecraft full of so many things. We took out all of the stowage assistance materials. We crammed everything into that spacecraft. And we literally made it hard for those guys in the first few days. And while that was a good thing to do, I believe in total, for the program, it probably started the crew out a little bit behind the power curve, because they had a lot of things that they had to find, pick up and stow. And while - I agree with you, they had the advantage of having had six guys up there before hand who could have given them some help, and who did give them some help as a matter of fact. They also had the disadvantage of going back to a spacecraft that had been used by six people. And it's perfectly conceivably that even the things that were left up there weren't in - weren't the way we thought they were. And so, therefore, all the procedures that we had up there would not be correct. So, as Kenney says, we're not particularly happy that filters were left out, but we don't think that it's a very Earth shattering castastrophe. It's something that we are going to recover from, just as we have recovered from a great many other things. And we think the crew is doing a fine job.

QUERY How many passes did you say we were short on EREP of the total planned, prior to the - -

KEINKNECHT Yeah, we - -

QUERY - - first flight.

SCHNEIDER If we get, I believe, three or five passes, we've given EREP all the passes that we had told them we were going to before the program - before we started the flight phase. Now, obviously, we expected to give them more than that.

KLEINKNECHT That was a part of the extended mission, is to be productive. But we didn't - We still think we're going to get all that we set out to do on this mission.

END OF TAPE

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SCHNEIDER We had - I think it's three or five more passes we - we've given EREP all the passes that we - we had told them we were going to do before the program before we started the flight phase. Now obviously we expect to give them more than that.

KLEINKNECHT That was a part of the extended mission is to be productive. So we didn't - we still think we're going to get all that we set out to do on this mission.

QUERY Would you summarize what you think are the most important scientific discoveries or discovery so far?

SCHNEIDER Well, you - if, if - you have to talk about Skylab II, which of course is the only dates - scientific data that's had any analysis to date, and there the ATM principal investigator is literally rewriting the book on the Sun, and I'm fairly certain that it'll take five years before all of the new knowledge that comes out of ATM will be fully analyzed, understood, and decimated. In the Earth resources area, why I guess the only - the only real one that I know of today is that - is the - the potential mineral source out in Ely, Nevada, that we found on one of the 190B pictures. I myself personally think that there's a great deal of potential in the materials processing experiment. We developed a crystal, germanium (garble) crystal, in that experiment. That's an order of magnitude larger than any we've ever been able to develop on Earth. Now those crystals are kinds of crystals that are used in all of our electronic equipment. So I think the potential from that is probably very exciting, to me, and could conceivably have long term benefits to all of us.

SPEAKER I'd like to add that Dr. Hemenway with S149 discovered a different micrometeorite flux density than we had used by samples from his S149 particle collector, which is the first time we've had an instrument this precise, as accurate as that. I can't quote this because I didn't hear it directly, but I understand that the - the solar physicists say now that they have more quality data from ATM than they had from all the previous solar observations from the Earth. Now it's obvious that they can see things from space that they couldn't see from the Earth, but they are very enthused about the data with respect to a lot of the EREP data. We're still in a mode of processing much of the S90 - S192 data and the PIs really haven't had a chance to dig into that yet.

QUERY This is dredging up past history and, but this is a 28-day review and - and we have been discussing the quality and care of your astronaut training and its effect.

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Early in the mission, as you recall, Bill Pogue was ill. And it developed in effect the crew was exercising a cover-up as to the extent and nature - precise nature of his illness. And you recall they accidentally bugged their own spacecraft and as a result we were able to get some extremely rare and candid conversation among the crew, and during that Pogue commented that he believed it was the - the preference of the managers on the ground if - if the exact nature and extent of the illness was not known. Now, my question is, that something has puzzled a lot of us, is how a guy who's been in the astronaut training program, gone through this quality training program you've talked about earlier could come to this conclusion, a conclusion he obviously felt - sincerely felt because they were talking about it candidly?

KLEINKNECHT Let me try to address to that first. We - We did - were privy to listening in on one of their private conversations that they thought at the time I believe, although I can't be sure of that. I guess as a comparison, I may hate to hear you listen on some of our management conversations, too, before we come out with a decision. We, certainly everybody can sit around and talk about things that shouldn't be done are ridiculous, but I submit that the crew made the right decision ultimately, and they had made the decision before they were reprimanded for that. They had - they didn't throw that sample away. They kept it. From the comment regarding the managers, I don't know what he meant and what he prompted - what prompted him to say that, but I'll interpret it. And I think what he intended to leave the impression would be that we didn't want sickness, and we would rather not have to be worried with sickness, not that we did not want them to report it, and we certainly didn't want sickness. We never have wanted sickness, but we have never, and no one has ever said anything about covering up.

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KLEINKNECHT - - and no one has ever said anything about covering up. Apparently that wasn't a satisfactory answer.

QUERY No it wasn't because the comments were specifically related to the cover up, the preference he stated that - -

KLEINKNECHT Well, I just addressed to that. That we didn't want sickness, that's right. And you're trying to interpret it what you think he meant. I'm admitting I am, and you don't know. He can't be here to defend himself or to discuss it rationally.

SCHNEIDER You and I as you try to reach a decision why you, at least the way I do it with these guys, is we try many many different things on. And I know I say a lot of things including some things about my bosses that I don't really mean and I wouldn't even want them to hear, frequently, infrequently, infrequently, boss. But as Kenny says, the important thing is that they did make the right decision and they did not throw it away. Now it's useless for us to speculate on what he meant or why, or how he got that impression on anything like that. Even if he had that impression he ultimately gaged us right. He ultimately said, well I guess they really would want to know about that, and they did save it. So that's all we can - all we can do is speculate on them. We can't really say why they said anything.

QUERY In the same reference to that, Bill, I understand that you were rather livid about the coverup itself, and you were quite concerned that the other things in this mission may come up that the crew may not discuss candidly with the doctors or with other, with Program Managers. Have you still got that concern from any of the activity of the crew?

SCHNEIDER Well, your choice of livid, I was alone in my apartment and I don't think anyone knew if I was livid or not. I was concerned obviously and came right in. And we did investigate it and look at it and follow the course of action that we said. I have no concern, no concern whatsoever right now that the crew is withholding any information for the doctors, from the doctors or in the the science world. After all, most of the things that we've been discussing here today, as far as errors are concerned are things that they reported on the channel B tapes, which is where we read their original conversation. Bill Pogue said "I left the filters out." Now if he was hiding things why he could have easily have not said that and when the got back then the data would have been bad. It could have been very easy to do. Some of you looked through those channel B

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tapes there are many things where they say I didn't do this, and I didn't do that, I did do this, and so forth. The doctors tell me they are being perfectly candid with them, they have no qualms about their rapport. They seem to have a very good rapport with one another. I guess I have to say that it's perfectly conceivable that I could have even exercised the crew on this sickness because I was quite concerned about guys getting sick, you know. And I was the one who pushed real hard to make sure they took their pills before hand. And where the procedure had been to do it for 2 days I said no, we'll do it for 3 days, and things like that. So you know it could - it could very easily be that they had in the back of their minds some notion that we were, that we would feel that way. But again, as I said earlier, the important thing is that they ultimately did gage us right, they ultimately did do the right thing, and so all's well that ends well. If we had not read that on that tape, why they would have saved the vomitus and everybody would have been happy, I guess.

QUERY If I understand you correctly when you say they did the right thing that's saving the results of his sickness, right? What about hiding the sickness?

SCHNEIDER Let's see I've got to go back in my memory. It seems to me they were about to report that weren't they, Ken.

KLEINKNECHT We heard the discus - the sickness or the symptoms, I'm not going to get into a discussion of what sickness and what's symptoms. The sickness, oh hell. Well I've come to work in the morning and had heart burn or something and spit up a mouth full of something. I don't consider I'm sick. But anyway, - -

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KLEINKNECHT We heard the discussion, the sickness, or the symptom, I'm not going to get into discussion of what sickness and what symptoms, the sickness, oh hell.

QUERY - - physical evidence

KLEINKNECHT Well, I've come to work in the morning and had heart burn or something and spit up a mouthful of something. I don't consider I'm sick. But anyway it had occurred prior to the time we heard the discussion. We heard the discussion and then they didn't destroy the evidence. They saved it. It was later then the following day I believe, I don't know exactly the timing that Al Shepard talked to the crew and suggested that they do report everything and have a good flow of information, and they said yes, they said they had, so they didn't in a course of the way things normally get reported, they did not report it before they were talked to. But we have absolutely no evidence since then that there's been any restriction or constraint on the flow of information. Now that remains to be seen, too, I guess, until you look at the data and you talk to them when they get home, but we have no reason to believe that we don't know everything and I suspect that maybe we know more about what's going on in this mission than we did the others, because of that and I think they probably bent over backwards now to make sure that they do put everything on channel B or discuss it, during the real-time passes, but that's speculation on my part, too. If I didn't have confidence in the crew I shouldn't have been here.

QUERY On a different subject, Bill is there anything other than the possible loss of another gyro, anything that we are seeing, now like the ATM C&D cooling loop or anything else that could cause anything, any early end to the possible 84 day mission.

SCHNEIDER Well, obviously there are a lot of things that could cause early termination, but nothing that is currently - hiccuping - the CMG if, if the CMG, if another CMG came, failed, why, the way we've been planning it is we would have an orderly, an orderly return. It would not be any emergency situation. We would put our house in order, get as much scientific data into the command and service modu and come down in the best recovery area possible. In all probability if it occurred soon would try to see if we can get the recovery ship out on station and if that took a few days, we might wait for that too. But the C&D panel, if that went out which as I said Mr. Reinartz was very encouraging to me today, if that went out, would curtail some of the experimentation, but would not curtail the mission. Ask him a question, he's just sitting here doing nothing. (Laughter)

REINHARTZ I'll get to that.

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QUERY

I don't know if this question is directed to you or not, but I'd like to know what things you are adding to the mission or what changes you are making in your instructions and procedures for the next few weeks. One I know of is that there's a plan to investigate these eddy currents in other parts of the world. Can you tell me of any other procedures or changes you're making or adding?

KLEINKNECHT I didn't know of any. I don't know of any now that that we're, we're considering some things that we may want to bring home that were not in the original plan and they turned out there's some items of inventory, some special lens camera that we may, we would have to buy, otherwise for ASTP. There's some materials that we can bring home for engineering evaluation of degradation. Materials in a space environment and there's a number of things that we may want to consider bringing home that would help us analyze the performance of some of the equipment after 8 months, 9 months in flight now. We're going to look at those things and probably the most significant things to bring back are things that save us money. Not that we can spend more money on, we'll be very cautious about those things because some of them that have been brought up to date, you would have to remove the last day or so before return and stow and we don't think that we ought to encumber the crew with those kind of changes after 85 day mission, to change their last days stowage and add new activities to them but we will, we had the first discussion of those things yesterday and we're going to be actively pursuing that we do have some volume in weight capability to bring more things back than the planned science. Obviously, priority will always go to the exposed film and data, tapes and so forth that's up there.

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out there, and we'd have to find out if the Navy could get a recovery ship out there. If it's after the first of the year, a recovery ship will be on station, and then we'd have a different posture. So an orderly reentry means we're going to do as much as we can and come back in in roughly as soon as we can consistent with bringing back as much as we can of the scientific data. It's not an emergency situation by any stretch of the imagination, but it's not something where you say you're up there for a month or anything like that. Did I thoroughly confuse you?

QUERY

I understand.

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QUERY - understand. In other words that the CMG fails completely as did the CMG 1, then you would have 10 to 12 days - -

SCHNEIDER 10 to 20

QUERY - 10 to 20?

SCHNEIDER Yes.

Query - plus the balance of your TACS propellant.

SCHNEIDER Yes..

QUERY Okay.

SCHNEIDER But our ground rule is that we would want to schedule a reentry at least 10 days before - at least 10 days before we would run out of attitude control capability so that we retained a rescue capability throughout the mission. That's why - that's why I'm very iffy about whether or not you do an EVA if it happened today.

KLEINKNECHT I think a primary objective is to get to a primary landing area, returning the science we have, and to preserve the capability for a rescue, and we may go then, on like five day increments, when you got to that posture of reviewing where you stood and do you still have 10 days in front of you. It's a new mode of operation or control mode and it could be a little - that's why we get the 10 to 20 days, it could - we could maybe be a little more - say you conserve a little more energy and last a little longer or maybe it wouldn't be as efficient as we think it is. And then - -

REINARTZ The same thing applies to the TACS, Kenny.

SPEAKER - then acts the same way - -

REINARTZ We have not been in that mode, what we call a wide deadband mode of oscillating slowly back and forth. It could vary in the amount of TACS that we would use and then Bill gave what we think is an upper figure or - with a little time it could be as low as about 1600 pounds a day as compare to Bill's 2500. So it would be someplace in that range and it would depend on what we would see after a little time that would help us make that decision.

KLEINKNECHT I think we did get into this five day planning cycle. Then each five days we'd look it as - what is the most significant things we can do during the next period whether it's an EVA or - or EREP or ATM or what it is, and that would change.

QUERY Well, after the first of the year if the CMD goes out totally what would be your reaction in relation to the rescue vehicle? Would you immediately prepare it for launch as soon as possible or - and then put it on standby, or what - what would be your reaction here exactly?

SCHNEIDER As of the 20th of December the rescue vehicle will be nine days from launch, and it will stay in

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that posture. Now we will - we will if - if it went out, if a CMG went out after the first of the year, I would not activate the rescue vehicle, we would maintain - we might not - we might make a decision to wet the rescue vehicle which would put you five days from - from launch, but I would not go down - would not count down to T zero.

KLEINKNECHT Well now that the CMG going out is not a survival thing. It's a - you couldn't do much work after you ran out of control but you might still be able to rescue.

SCHNEIDER Yep.

PAO If there's no further questions I do have an announcement to make. We have a news release ready on the shuttle procurement action. You might want to pick it up on your way out. Thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
HOUSTON, TEXAS

SL IV - Change of Shift Briefing
Johnson Space Center
December 12, 1973
1:37 p.m. CST

Participants:

Don Puddy, Flight Director
Ferry Watson, Guidance Navigation
Al Seeschaaf, PAO

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PAO
Okay we'll start the change-of-shift briefing. We have Don Puddy the Flight Director on the off-going shift, and he's brought Terry Watson his Guidance and Navigator officer with him.

PUDDY
Okay gentlemen. I'll keep it real short. We did do the trim burn this morning as I briefed you we planned last night. It came off right on schedule, no problems. And of course it will be a couple of days before we can gather enough tracking data to confirm we're exactly where we want to be, but there is no reason at this time to expect that we're not. As far as today's Flight Plan, everything has been accomplished according to schedule, and no problems at all encountered. Tomorrow we have a little higher paced day which is highlighted - highlighted by both a S019 and a S183 comet observation, six hours of ATM solar viewing, and a major medical on the commander. We also have early in the morning IV10 which is one on personal hygiene which I'm sure you all will be interested in as you watch the pilot wash his face, shave, and brush his teeth. We've had no new anomalies since I talked with you last time. We're continuing to track the ATM C and D loop flow fluctuations, which I'm sure you've been briefed on many times, and of course the CMGs. We have not completely developed the time line yet but work is still progressing on that as far as what exactly we would do if we did have another CMG failure; which again let me emphasize we don't anticipate we will have, but we're continuing to look into that possibility. And as I told you last night we hope to have that done in - in short order, and I hope to be able to brief it on you before I leave this particular shift. Last night we did have one small glitch where the - one of the CMG bearing temperatures did rise a little bit in temperatures. And without going into a lot of detail, just let me say that there are two bearings that we normally track; one of them normally runs a little cooler than the other one. And one of the - one of the danger signals is if these bearings temperatures should increase significantly in temperature and along with that you have a corresponding current increase. And the reason this is significant is because of course with a bearing temperature increase that's indicative of increased friction, and the current increase going along with that is indicative of the motor which drives the CMG trying to provide additional torque in order to maintain the wheel speed. One possibility that we kicked around a little bit today, and I'm sure that will be discussed considerably more in the future certainly not a definite plan, but it is something we're looking at. A similarity that we've noticed in all of these glitches is the fact they occur towards

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the lower limit of the UMG bearing automatic temperature of heater cycle. Normally, that cycle runs from 60 to 80 degrees and most of the glitches with one small exception that we've had has occurred at at the 60 degree point. This may, and I emphasize the word may, may be indicative of a possible lubrication starvation caused strictly by viscosity. At the - at the lower temperature of course the - the lubrication - lubricating fluid is going to be more viscous, and as such may not - may not be properly lubricating the bearings. So there is an operational - unique or procedure by which we can get around that particular thing, and that is to manually by ground command change the heater cycle, in order to maintain it at the higher temperatures. In other words, just take the automatic out of the loop and maintain it manually. That's one thing we have - I'm not saying that we're going to do that - -

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PUDDY Takes the automatic out of the loop and maintain it manually. It's one thing we ha - I'm not saying we're going to do that but that's one thing we're looking at. You probably listened yesterday to the crew briefly talk about the Gypsy moths, and they were wondering what was going on with the Gypsy moths. And since we always seem to have a lot of interest in animals on board, I thought I'd give you the latest and greatest status on the Gypsy moths. Basically, on board we do have two vials of 500 eggs each. One of these vials is labeled tame and one is labeled wild. And the reason they are so called is because the tame moth eggs were laboratory grown and the wild moth eggs were gathered from the field. And basically, in this experiment what we're trying to find out is whether or not in zero g, the normal hatching period, to put it in common language, you probably heard on air-to-ground a lot of terms kicked around. In six to nine months whether or not that can be significantly decreased. Of course the crew is not observing these continuously, and the action if the hatching does occur - does occur very rapidly, essentially all happens is the egg cracks and a larva about 3 millimeters in length characterized by a white fuzzy nature, comes from the egg. And they're primarily - the Gypsy moths are primarily vegetarians although they may not - they may go ahead and eat the other eggs. And in the wild vial, there may be some eggs of - of other insects which the Gypsy moth will feed on. To date, through the crew single daily observation, at least as far - that's all we've required them to do, we have seen no change in the pre-launch status. In other words, all the eggs are still intact. And with that, let me open it up for questions.

QUERY Several things while we're talking about these great moths. The - the key is if they hatch the experiment has - has proven what they really hope for, is to reduce that incubation period or whatever it is?

PUDDY That's absolutely correct.
QUERY And that's the only really key, cause we - we don't really expect them to hatch unless zero g does have a major effect on the incubation period?

PUDDY That's right.
QUERY Okay.
PUDDY That is the sole purpose of the experiment.
QUERY Okay. Back to the CMG glitch and when you're talking about the - at the lower limit and you can keep and you could go to the managing of - the heaters at a higher temperature. Do you run into any problems of using up your lubrication at a faster rate because it's - it's hot or so? I would suppose this lubrication like most oils burns away

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at a higher temperature faster than it does at a lower temperature?

PUDDY Not, - there would be not appreciable difference in fact, if you were talking about a pure usage rate you'd have to say, that it would probably be more economical certainly when the CMGs were designed and the automatic heater cycle was put in there, which like I said maintains it between 60 and 80. There was sufficient lubricant from the small amount that you are actually going to dissipate due to thermal considerations. There was adequate lubrication there, if we did go to the manual cycling, one thing that we would want to do is to maintain the temperature less than the 80. And the reason we'd want to do this is to make sure we kept our manual operations well inside of the automatic. If we go above 80 degrees we're locked out. And the automatic system comes - kicks back in and starts taking over. So, what we will probably - I - I couldn't give you exact - exact limits, but we'll be maintaining it slightly higher on the bottom side than the automatic and slightly lower on the top side. So, from that standpoint, no, I don't think there'd be any concern whatsoever, over -

Ferry you may have something else.
WALSON No, it's - it's just there's so much lubricant in there and - and it's controlled it just runs out at a controlled rate. And if anything at the colder end it would just slow down the amount that's coming out. And it - it is designed for like 20,000 hours of lubrication or something which - some - some number many times greater than you need.

QUERY And tomorrow's Flight Plan, you talk about S019 and 183. Are those Kohouteks, because I noticed on the Flight Plan they weren't marked with a K as most of those experiments that double over are when they're Kohoutek?

PUDDY

Yes, they are both - -

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QUERY - notice on the Flight Plan, they weren't marked with a K, as most of those experiments that double over are, when they're Kohoutek.

PUDDY Yes, they're both comet observations.

QUERY Definitely, both are.

PUDDY Yes sir.

QUERY Don, when you had this temperature increase on the bearing, did you also get the corresponding current increase that you - like you had in the past?

PUDDY It was - if we had it, it was very insignificant, it was not anywhere near magnitude of any of our criteria.

QUERY And I wanted to ask you about the any - any reason for the scrub of the missile last night, and is it going to be rescheduled.

PUDDY As I've indicated to you, we're more or less doing those observations based on Vandenburg's schedule. My understanding of the reason that it was scrubbed was some sort of a down range station problem. Although I certainly don't have all the details on that. As far as rescheduling it, we're looking ahead towards some of the other opportunities when we might be able to do it, and just checking to see whether or not it's compatible with Flight Planning. We certainly (dropout) to our overall Flight Plan and mission accomplishments just to accomplish that one objective.

QUERY I noticed on Friday night, they're going to bed an hour early. What -

PUDDY They're going to get up early the next day in order to accomplish an EREP pass.

QUERY Okay, was that one of those geothermal passes.

PUDDY Right.

QUERY Okay.

QUERY That's what I was going to - It is a geothermal pass in the dark along California, isn't it?

PUDDY Right.

QUERY Will they use the S190A during that? Do they go and -

PUDDY No.

QUERY They do Z-LV maneuver -

PUDDY No. Yes, we are doing the maneuver, but we are primarily concentrating on 191, 192 and 194.

QUERY Wouldn't the 190A be usable in the IR ranges, even if you don't have sunlighted conditions? I don't know that much about IR, I guess, but it would seem like, since it's heat sensitive and heat sensing and all it would - Is it just come out too much in the mud to be usable or is it - I mean, is it a good -

PUDDY I can't give you a definitive answer on that one. I'll check it and find out for you though.

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QUERY good. Yeah, for tomorrow night, so we
PUDDY Yeah. Certainly will.

QUERY Okay. And looking ahead to next week,
there was a mention the other day about - I believe it was
on the air-to-ground. They were looking toward next week,
like Tuesday or Wednesday, I forget what day of the mission
that is supposed to be, they might be getting up 2 or 3 hours
early for some early work, and I couldn't tell whether they
were talking about AET or FREP or what. I didn't find any-
thing through Tuesday on the Z-day forecast that would indicate
like a 3 hour early wakeup.

PUDDY Okay. Most of the - Most of these early
and late activities, I say most, because last night we had an
exception when we were trying to cover the rocket launch, but
most of the early and late considerations are centered around
FREP. And there is a lot of discussion going on as to just
exactly how much perturbation we want to put into the crew's
cycle over a continued period of time on waking up early one
day and getting them to bed early and so on and so forth. So
that's still being worked and I really couldn't give you a good
feel at this particular point in time as to where we're going
to stand next Tuesday or Wednesday. We're just kind of hitting
them on a daily basis and of course, one of the most important
considerations - we always try to keep track of all the
opportunities that we possibly can have, and you certainly
are going to hear some words that these are being discussed,
and maybe some interchanges on air-to-ground between the
flight controllers and the crew saying, you know, what do you
think about this, and so on and so forth. But as you get
closer and closer of course, the weather starts cropping in
there and a lot of times that you see disappearing, that's
the prime reason they disappear in the weather is just not
that good, and as I've indicated to you previously, other
than say, the weather on some of the daytime passes over
some of these sites that might require early or - early wakeup
or late go to bed, it's just to get that one or two task sites
that we haven't gathered data on yet. And it doesn't take
much at all in the way of weather to turn what was a previously
scheduled pass into an desirability whatsoever.

QUERY Okay. Bob Crippen told - -

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PUDDY - - whether to turn what was a previously scheduled pass into no desirability whatsoever.

QUERY Bob Crippen told Bill Pogue this afternoon that they had to do 6 of these sites - a man - six sites they missed because of the filters that were mandatory. Do you know what sites those were?

PUDDY Just so happens - 5034080, (laughter). That's not fair. (laughter). No, one was of the jet stream cirrus clouds in the United States, one was on the Earth limb observation, one was in the coastal wetlands off of South Carolina. One was a regional mapping site in Nicaragua. One was a study of the stream networks in the Colorado River Basin, in Texas. And one was geological measurement off of the U.S. east coast. And I hope you also caught from that air-to-ground transmission we - we were certain in the reason we - we informed the crew of that there are several other sites of course that - many other sites as a matter of fact, that we have covered and that could have been reported as far as over all accomplishments by not having the 190B filters installed. And the reason we - we gave that to the crew, we knew they were concerned about it and so we've gone back and done a very extensive analysis of the - the exact PL requirements over those individual sites. And in general, most of our requirements can be satisfied by either 190A or 190B. And as you can tell from the list I just read there is a very few number of sites and we certainly don't suspect any major problems in picking these up through the rest of the mission.

QUERY They also mentioned five sites for sensor evaluation, I suppose they were an additional to these six?

PUDDY They are. They - they're - now that's strictly sensor performance - -

QUERY Right.

PUDDY In other words, where we're trying to - say repetitive coverage combined with ground truth and things like that.

QUERY Right. Now of these six and that five you know, of - of mandatory type. How many FREPS does that involve? How many passes is involved, I mean can they pick up two and three a ground, you know, a time or are there going to have to be spread out almost one per each pass, do you happen to know?

PUDDY I can't give you a definite answer. I - I'm certain that you couldn't pick them all up in one pass. Just because the geological - or excuse me, the geographic spread on them. However, I - I feel fairly certain that there are passes for instance, where we can catch the jet stream cirrus clouds and say the coastal wetlands in South

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Carolina, or the stream networks in the Colorado River Basin, so I'm - I'm certain some of them can be caught on the same site and you know, as far as number of sites are concerned - number of EREP passes are concerned we're not even halfway there. So even if we only picked up one of them on a given pass, we - we still don't expect any major problems.

QUERY Well, in the same line, does this really require doing say an EREP to get two or three of these sites where you would not normally go back and do an EREP anyway? In other words are these going to require - see how to phrase - will you have to do special EREPs for these in place of other EREP that you might plan on a different track? I guess is what I'm trying to say.

PUDDY No, no. I think our overall EREP strategy on this particular mission is - is to go after the sites and we certainly will go back when we can and go after these. But our it - it's not so much the number of passes, that we're talking about, although you've heard numbers definitely talked about. It's not so much the number of passes that we're talking about as the number of sites that we can cover. There are just certain specific sites that we want to hit and - and if that takes us over that number of passes to accomplish them fine show, if it takes us under, we'll probably grab a few more of the highly desirable targets with a remaining consumables. It's conceivable that we would schedule a pass to catch one of these targets. And that would be one of the prime objectives of that pass. Yes, that is possible.

QUERY Are we still looking at - at around 35 EREPs instead of possibly 50 or with our new management of TACS with - -

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PUDDY - - that is possible.

QUERY Are we still looking at around 35 EREPS instead of possibly 50 or with our new management of TACS with the partial Z-LV and then all the way Z-LV, is that conserving enough that we might get all 50 in, what does it look like.

PUDDY Oh, I - I don't see any reason this young man right here is - was one of the fine sponsors of that offset maneuver that went into which helped considerably in saving the TACS and our TACS budget can right now can certainly sustain the full planned number of EREP passes, that's barring any other, you know, problems that crop up, but in fact we were even trying another (garble) today still studying various ways that we might even be able to minimize it further but as you've probably been able to tell, from these recent days activities, our TACS cost per day, where we have been talking something in the order of 300 to 500 pounds second per day is being, allowable and still staying within the TACS budget, we're not coming anywhere near that we're running - oh anywhere from 60 to 150, sometimes lower. So, no we're not restraining our EREP pass planning based on TACS or our comet maneuvers right now based on TACS. We're not constrain- ing anything based on TACS.

PAO No further questions, well that concludes the briefing, thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 11, 1973
4:35 pm CST

Participants:

Don Puddy, Flight Director
Dr. Thornton Page, Principal Investigator for S101 Experiment
Dave Garrett, PAO

SL-IV PC-52A/1
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PAU Okay, we're ready to get started with today's change-of-shift briefing. We have with us Don Puddy, the offgoing Flight Director for today and Dr. Thornton Price, the Principal Investigator for the S201 experiment. Don, would you start it off, please.

PUDDY Sure, okay, let me just briefly run over where we're at, as far as today's Flight Plan. There had been some question as to whether or not we could see the sunset and I'm happy to report the crew came down on channel A today and said "Sure enough, we're seeing it out the right window," out of the S-3 window, which is the one that we've been using, and it has the bracket - necessary brackets for the S201 photography. We're now out behind the AIM structure that was blocking us and are getting good photographs of the sunset from that particular window. As I indicated to you yesterday, the Flight Director today was extremely busy. If you've been following our tower and at all, you'll note that as of this now we're right on the time line. I've had no significant problems on any end. The crew is in excellent spirit. You recall the last air-to-ground interchange on the 10th, which by the way was very nothing. We still are quite a bit of activity left in the air. One thing that we did get this evening, I haven't had a chance to go over in detail, but the transcript on it and review it but one of our handheld photography sites today was the Wolf Volcano, and I believe that one last - there was a couple of eruptions they're had on that volcano, one was in 148 and one in 163, and the crew did report that they saw a smoke trailing from that, so chances are we probably will be trying to follow that one and help the ground truth people in that area as far as that particular volcano. We have a couple of other handheld photography sites tonight. Both of them are in and around the same area in northern Australia. One is of a drought area and one is on a range land which we hope to also have repetitive coverage on. Course our big activity this evening is associated with S201, so let me turn it over to Dr. Price and let him say a few words on that subject.

PRICE Well, first I'd like to get away from the earth. We astronauts always like to look at things far away. And, the S201 experiment has been doing this for a couple of years. We had it first on Apollo 16, where we didn't get as many pictures as we'd like, and so the gang up at the Naval Research Lab, where the instrument was built, were delighted that we also got on the Skylab IV mission. The photographs from the Moon, among other things, showed the tropical air-glow belts around the Earth. A picture which hit the front pages of most of the major newspapers, showing two bands,

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starting on the sunset terminator of the Earth and going on around back to the midnight side. They, Syrett, just an expert on the atmosphere, but we hope to establish that they are there, or still there. Their position is fairly complicated, we're not going to observe them today, but I hope perhaps later this week or next. Another aspect of the jet, the emission of light, which we can detect with the ultraviolet telescope or camera, is the effect of things passing through it and so one of the objects, the targets that we go for tonight, is a target that's going to go through the upper atmosphere, penetrate the ionosphere, is a glancing shot, hitting it, and we hope to photograph from above, as the jet goes by, the effects of this passage through the ionosphere, about 100 miles up. The jet is, of course, the jet that starts on the ground out in the West coast test range and we had to coordinate the launch of this rocket with the position of Skellam. I think that we get two passes this week, but in this world we don't know what takes place around here, and

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where we originally stabilize on the first trim-burn. It's a very small burn, 16 seconds, about 1.1 foot-per-second postgrade. Right now, I think, we've drifted off somewhere on the order of 7 or 8 nautical miles to the east of where we'd like to be. And the trim-burns will probably be accomplished in more or less the same interval throughout the remainder of the mission, in order to maintain that groundtrack as close as possible to the 5-day repeating groundtrack over the exact areas that we would like to have the repetitive coverage. The rest of it is more or less standard operations, and so, I don't think there's too much more that needs to be said about it. I did talk to you a little bit last night about the one anomaly that we had had on the 5082 door.

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PAGE - - I did talk to you a little bit last night about the one anomaly that we had had on the S082 door. Indicated to you at that time our preliminary analysis was that that door was - to coin a word - frozen open. It is still in that same - we believe it's still in that posture. There's no definite way that we can prove through looking at thermal data or anything else that the door is positively open. But all of our indications are that we have had a relay failure which essentially precludes us from shutting that particular door. So we're going ahead and continuing our S082A operations anomaly and although there's probably no real requirement, we'll look at the possibility of pinning that door on the next EVA. I can't think of anything else that's significant this evening. So let me open it up for questions.

QUERY Do you have any more indications of any trouble whatsoever of any fashion or form with CMG 2?

PAGE Absolutely none.

PUDDY Completely plain.

PAGE Completely plain.

QUERY Okay.

QUERY Dr. Page, what would you expect the crew to see or to photograph when this rocket passes through the ionosphere?

PAGE The effect of the rocket going through is twofold. First, while it's burning, rocket motor burning, of course it heats up the immediate vicinity and that ought to be clearly visible. Then, beyond that the wake of the moving rocket, disturbs the local conditions. I mentioned in introducing this experiment, the airglow bands - I don't fully understand how they're - how they originate, but the general theory is that there's an updraft in the very tenuous high atmosphere of the Earth. That updraft brings oxygen ions and electrons together and the recombination causes the emission that we photograph from the Moon. And they're quite bright bands which the time we photographed the Earth from the Moon extended on both sides of the Mediterranean Sea and reached or came together on, somewhere over Iran. Now, when you shoot a rocket up through, it can produce the same kind of effect - causing emission from the very low density gases that we can photograph. So we expect to get photographs which show the trail of the rocket across - if we've got everything pointed right, across the middle of our picture as a - as a bright streak. And by measuring the density of the photographs, converting it to the transmissivity of the gases during the exposure times, we take several exposures by the way, on each - in each direction so we have a better chance of getting the thing than it might appear and also the exposure times

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are 3 seconds, 10 seconds, 30 seconds in which the photometry can be checked so that we'll be able to tell what the passage of a known sized object through the atmosphere does to the median through which it's passing. Did I answer it?

QUERY Okay. You said the crew will see a bright streak?

PAGE Oh, now the crew - with this instrument, the crew unfortunately doesn't see anything. And because of the rapid timing, it's literally split-second timing. We've got to have the launch exactly on time. If it's 2 seconds late, I got corrections all worked out and the crew has to change the - in effect the direction of pointing of the camera during the operation and - well, let's see. They can't see anything. They're looking at dials and now however, the commander is going to be managing the - the maneuver. We have to roll the spacecraft 50 degrees. And it may be that he can look out the window. You know, Don is he going to be able to look out?

PUDDY As far as doing the actual data take, he may be able to look out. Otherwise, he will be - his attention's going to be focused on monitoring the maneuver.

PAGE So the trouble is the data take is going to require the - -

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PUDDY - - as far as doing the actual data take, he may be able to look out. Otherwise he will be - his attention is going to be focused on monitoring maneuver itself.

PAGE The trouble is the data take is going to require at least two members of the crew's constant attention on the controls of the S201 canister, which is unfortunate.

QUERY Were he to look out the window - the correct window, what would he see?

PAGE Well, I think, he'd would almost certainly see the burn. That is he'd see the - After all the large rockets have pretty large plumes. But the thing that we're trying to photograph up in the very high atmosphere where just the passage of the rocket, the light that is caused by that passage is in the far ultraviolet that you can't see. This camera's photographing very far ultraviolet.

PUDDY Correct me if I'm wrong, but, I think, all he's essentially going to see is something like con-trail and possible some of the actual burn of the motor itself - rocket motor itself.

PAGE It's in the dark, so it'll be just the burn.

PUDDY I think one point that also probably should be made here, and that is that the operations that Dr. Page has been talking about, which are centered both about the launch and about just the airglow itself, regardless of whether or not that rocket operation is accomplished this evening, that's 201 operation, because of the other objectives that we are - we do have scheduled, will go ahead and continue.

PAGE Everybody likes to talk about his experiment. I ought to say that we have four other targets besides this one, so launch is not the only thing. I guess it the one of the most popular interest, but we're also going to be looking at the crab nebular, which is an exploding super nova remnant; a thing that exploded several centuries ago, a cloud of gases going out many light years. And we're going to be looking at galaxies, which are as far away as any telescope on Earth can see.

QUERY the tropical airglow bands are not visible to naked eye because of the far UV, is that correct?

PAGE This is tricky. The gases which are doing it primarily is oxygen is one, ionized oxygen. And there are lines of ionized oxygen in the visible region. And I believe that people had suspected these tropical airglow bands, quite a long time ago, I mean like 10 or 15 years ago. But our photographs from the Moon was the first one that ever really showed them there. And the packers with the Su63 experiment are taking photographs designed to show up this

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airglow. I'm not sure, are you, whether they have any positive results as yet? But in the far ultra-violet, it shows up much better. As with many atoms and molecules and ions, the - it's either on or off - I mean the sky is dark in that region of the spectrum unless this particular event, well, of the mechanism of oxygen recombining with electrons is taking place. So, let's say the contrast is certainly much higher the way we're looking at it, than the way you would with a human eye or normal camera.

QUERY What's - what's important about knowing what happens when an object of a know size passes through the ionosphere?

PAGE Well, by and large the gang at NRL, who are the experts on the atmosphere and there is a bunch of them there, one of the by the way just came down here to be in on the act tonight. Their names - Bob Myers, one of them and the one here is Charlie Weller. They're doing research on just the structure of the atmosphere. I guess the practical importance has to do with radio communications, with the operation of radar. And the - the things that are uncertain, as I understand it, are the density, ionization, and composition of the atmosphere as you go higher and higher and higher. And of course you like to think the whole thing is spherical around the Earth, but it isn't because the Earth has a magnetic field so you get some weird differences between the polar regions and the tropical regions. Now the polar aurora is another thing - are photographing, and photographed also from the Moon. You know, from the Moon our pictures showed a nice little round cap on the top of the Earth and that's the aurora, which is about 17 degrees away from the north magnetic pole.

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PAGE - -and photographed also from the Moon. You know from the Moon our pictures showed a nice little round cap on the top of the Earth and that's the aurora which is about, what - 17 degrees away from the north magnetic pole and the, I think the aurora is pretty well understood as due to the oscillation of charge particles back and forth from the north and south pole in the Earth's magnetic field. So, it's that theory or model - theoretical model of the Earth's atmosphere or the ionosphere that I think is the main source of interest.

PUDDY Jim, adding a little bit more to that, I think, and correct me if I'm wrong here, sticking my neck out in science and that's a bad thing to do but on the rocket itself I think in the areas that Dr. Page mentioned, radio communications, radar, this type of thing. You're very interested to know what impact or what disturbances that rocket can cause in those layers of the atmosphere to those type of things and I think you can - they hope that they can interpret from the 201 data what that affect might be.

QUERY Let me move on to this CMG 2, Don for a minute. I suppose it depends on where the problem happens along the - the ground track. But how long will it take the Control Center to know that you've had a problem with CMG 2, say at a given point?

PUDDY Jim, I think that is very highly dependent on the - on the type of failure. As you're probably well aware we have had actually 2 CMG failures that we can put our finger on. One was ground test which was a very rapid type failure, and was - was due to a lubrication problem. The other one was the one we've had in flight and I'm sure that's been very aptly described to you. Just exactly what form if it ever occurs, the failure of the 3rd CMG will take is - is certainly questionable. We have - we have set ourselves up some parameters. These are primarily the bearing temperatures, wheel speed or wheel current, motor current, and we have set ourselves certain limits. And we've set ourselves certain steps, in other words we kind of go through a progressive thing whereby first thing we do is - is we look at the decrease in - in wheel rpm, increases in bearing temperature and things like that, from a standpoint of strictly an alert and then we have tighter limits where we start taking action such as putting the break on the CMG, and things of this nature, starting to power it down. While we still continually - periodically monitor to make sure that we're not taking action on - on a transient condition, in other words, the CMG that has had a problem but it's going to restore itself, and who knows may go for another

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month. So, it could be a very short period of time if we had a lubrication starvation problem, it can be almost instantaneous in that case, or it could be something that is drawn out over a very long period of - of time, if it's strictly a transient condition. So, I guess I can't really give you a very good answer to that. Of course, we do have procedures available as far as if we do definitely lose a CMG and we can - we have confirmed that lost as to how we're going to take over control with the CSM. We also, of course, have a patch available, that we can load into the ATM DC, which will allow us to minimize the TACS cost on a per-rev basis, to somewhere around 75 to 100 pound-seconds per rev. Where the nominal cost if we didn't have this patch would be somewhere in the order of about 700 pound-seconds per rev in order to maximize the amount of time that we have available to take the action, but - it's - there's - there's too many possibilities for me to give you a - a true direct answer.

QUERY In just normal nonmaneuvering conditions will the crew realize it's gone when it goes?

PUDDY Again, it is a characteristic of how it fails. If that wheel comes to a stop in 2 to 3 minutes they'll know it. If - -

QUERY Like how, what will they experience?

PUDDY Well, the vehicle - you've only got a CMG, and of course the - the onboard computer is not capable of maintaining control - -

END OF TAFF

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PUDDY Two to 3 minutes, they'll know it.
QUERY Like how, what will they experience?
PUDDY Well, the vehicle - you've only got 1 CMG,
and of course the on board computer is not capable of main-
taining control with strictly 1 CMG. And you immediately
would go over into a TACS only situation. So the repetitive
TACS firings they - they have never ex -

QUERY Still like to hear that?
PUDDY Yes, sir. They can hear the can hear the
TACS firings. So they - they certainly would know it from
that stand point and because of the - the emphasis that we
have placed on CMG monitoring, I feel certain that the crew,
excuse me, if they had any inkling of increased TACS firings
in just normal ops, where we weren't moving or anything like
that, they would certainly go to the computer. And they know the
necessary codes to call up the various parameters on the CMG,
would monitor those. They know the criteria for what constitutes
a possible failed CMG and those that constitute a definitely
failed CMG. And of course they have the procedures then go ahead
and take the necessary actions as far as bringing up the CSM.

QUERY What have ya'll done exactly to increase
your monitoring of it? I mean do you have an extra guidance
officer for instance or - - ?

PUDDY No, no we haven't -

QUERY More backroom support or just what?

PUDDY No, no we're still using - as far as the
control center itself Jim, we have not changed anything. We
have a heightened awareness of that particular area. As far as
on board, yes we have made some changes. And that is during
the time that the computer essentially does not do direct
monitoring of the gimbal logic on the CMG gimbal themselves,
we have a crewman whose duty it is to specifically sit there
and monitor those parameters that are crucial to CMG health.
This had not been done previously on - on any of the missions
or up until we had the CMG 1 failure. But that is his job
and - and that is the only significant change as far as
additional man-hours per se being allotted on a given basis,
and he does that for every maneuver.

QUERY Lets - lets make sure I understand that.
If for instance CMG2 fails as did CMG1 in exactly the same
manner, and when they come - came back into sight they would
be on TACS only then.

PUDDY Um-hum.

QUERY And - okay, and they would be aware of it?

PUDDY Hm-hmm.

QUERY Okay. And you said you set limits on the

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bearing temperature, wheel rpm, power usage, and all that jazz except for those two particular signatures that which I think Neil talk - told us about before, this has not occurred? I mean anything outside of these limits have not occurred since? Is - is that correct?

PUDDY

That's correct.

QUERY

Are those TACS firings enough to awaken them? Or what do you do if they're asleep and they don't?

PUDDY

Oh, each night we have a duty crewman.

I mean one that we can get ahold of, so we can certainly wake them. If they do go to TACS only they will get a caution warning indication which will wake them. Of course we can awaken them. And Jim it's a - I - I can't answer if the TACS firings by themselves will awaken them or not. Skylab has been reported to be very very quiet, when we've taken our - our sound measurements. Pete Conrad described TACS firings as something similar to a 12 gauge shot gun - gun going off inside a drum, which, if that's a good description, I feel fairly certain that a couple of those things is going to wake them up. However, there have been occasions when we have had some TACS firings at night and the crew hadn't said anything about it the next morning. So there is a question in my own mind, but in general I would think yes, they would be able to hear them if they were repetitive. Now maybe one isolated firing in the middle of the night during the deepest part of their sleep they might roll over once and say, "Okay", and go right on back to sleep. But if we ever went into TACS only, and got into anything like 700 pounds a second, I have a hunch they'd come awake.

QUERY

Mr. Hutchinson said last or last time he was here that there - you're conducting some studies as to what you would do if you lost - totally lost CMG 2, down to one CMG as to the effect it would have on the balance of the mission. And he said something, oh rough cut, looked like it might be 2 or 3 weeks and that would be about it, and experiments would be cut into severely during that time. Have you got this planned - were you yourself refined as to what - what would occur in event of such a failure?

GRAFF

Well, I think what Neil has implied to you is probably correct. A fair refinement due to the attitude, it's going to have to answer it very well, that is not been done. I will check and find out just exactly what the latest status is and when we expect to have that refinement and we'll have it for a tomorrow evening. Our primary emphasis the time has been, and a lot of times has been spent on, making sure that we have the exact limits that we want to put on these

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parameters that we're monitoring to insure ourselves that we don't unnecessarily abort a good CMG, because we know we can have some transient conditions, we've seen them.

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PUDDY - - that we don't unnecessarily abort a good CMG, because we know we can have some transient conditions - we see them. And the CMG is working fine now. We - and - and most of the time since Neil talked to you on that particular subject as - has been spent on that. If fact it wasn't until this afternoon that we finally did get to the point where we got a - agreement from all parties. Everybody is now squared away as to exactly what we will use for these particular criteria. So, I can not answer your question, but I do feel that on the information that I have and what Neil is implying to, he is definitely correct. When you go down to a single CMG, and you can look at 75 to 100 pound-seconds of TACS per-sec, it - it's - we're not going to be there long time doing extensive maneuvers, that's for sure.

QUERY And also since these studies have continued and everything do you have any revised opinion as to the prospects for a 84-day mission in view of the - the past signatures on CMG 2? Or would you care to share that opinion with us?

PUDDY Well, that's like putting me out on a 45 foot limb with a saw. Right now, we have no data that indicates to us the CMG - CMG 2 is on the way out in anywhere - anywhere in the near future. We have not started changing any of our operational plans to look at any less than the 84-day mission, of course, with - with the medical reservation. In other words, as you're all well aware we went up with the fact that we were going to look at the sea - standard Skylab-III length mission and on - on a weekly GO on a medical basis. But as far as changing any operational plans right now, strictly on a basis of the CMG, absolutely not. We're planning on full duration.

QUERY To - to aid you just with the duration, I - and not necessary any gross maneuvering, if CMG 2 went out aren't you doing studies on use of RCS from the CSM? Say all and places like that?

PUDDY Oh, yes. Yes, we are Jim, in fact let - let me say one thing that we are also looking at which is probably even a little more significant than that. Right now, during all of your dump maneuvers, for instance, the way the commands are given to the CMG gimbals is more less a step load or a spike if you want to look at it that way. This certainly was to maximize the loading on the gimbal bearings. We've been looking at a patch now, for about 10 or 12 days, that possibly will enable us to - instead of doing that in a step fashion do it in a ramp fashion. In other words, gradually load those bearings rather than do it

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it in - in one surge. To date that particular patch hasn't been perfected to the standpoint where we're on the go ahead and put it in there. At the same time we're certainly continuing around the clock working on that particular patch, and I feel certain that if we can't get it perfected that we'll certainly go ahead and put that in. Even though we haven't seen anything in CMG 2 that excites us to the standpoint that we're looking at an imminent failure. We feel like this certainly is a precaution that at this particular point in time is - is worth taking. As far as far as the CSM is concerned, the amount of RCS propellant that we have available is - certainly equates to a lot more a pound-seconds so to speak, than we have available in the workshop itself. However, you've got to consider the complication to the operations that result when you've got a man up there trying to main attitude control and you - and you've got the other crew members down here trying to do the operations, and you certainly, of course, want to have the necessary operational reserves there. All that hasn't been completely worked out, but we are working on some patches in the CMG, what we call a quaternary patch. The outcome of that - those studies so far, indicate that while we can maintain a degree of attitude control there, we do have to sacrifice something in the way of deadband, and - and this of course, as you're probably well aware from the stabil - -

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PUDDY To sacrifice something in the way of deadband and this of course as you're probably well aware from the stability tests that we've run the jitter tests, all the concern that people have had over crew movement and things like. It's definitely a cruder operation and as such would have a scientific impact, even if we could continue for a long duration using that particular system. So we would lose something scientifically, Jim if we had to go to that system.

QUERY On Things like ATM and EREP would just be about out, wouldn't it.

SPEAKER Well no ATM.

PUDDY Well it's a question when they refine that patch of just exactly how much the experiment pointing control system can overcome. Since that EMP or - I guess you can call it a patch if you want to. You're probably more familiar with that terminology. It's actually an MP, but until that's refined and we know just exactly what deadband and what type of oscillations we're going to get in there it's pretty hard for me to answer that but it'd have to be something that the experiment pointing control system in its canister movements could overcome, in order to have good successful ATM operations. Some of the - some of the comet observations, I think we'd be probably very tight to go ahead and accomplish those because of their extreme stability requirements, especially those that we're coming up on here the JOP 18D's and C's where we have a requirement for extreme stability. EREP - with some of the instruments would probably be one of the things that's the most sensitive if you can afford the cost of making the maneuver to the Z-LV itself and still maintain adequate deadbands for that patch. A lot of work being done, can't give you a lot of good rock-hard answers right now.

PAO Any further questions?

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
December 10, 1973
5:39 pm CST

Participants:

Don Puddy, Flight Director
Al Se-schaaf, PAO

SL-IV PC-51A/1
Time: 17:39 CST
12/10/73

PAO Our briefer tonight is Don Puddy, who will bring us up to date on today's activities and answer any questions.

PUDDY Okay I'll keep it short tonight gentlemen. As you probably are well aware - and ladies. As you're probably well aware today was the crew day off. However it was highlighted by a couple of scientific achievements. The first one being the HCO CALROC, which went off at 19:10 Z, exactly as scheduled. From all the data we have at this point in time, both the rocket itself and the Skylab observations of the same solar area went just exactly as predicted and so we feel like we have a A number 1 success there. We also made a maneuver and used the S063 instrument to view the comet. Typical of the day off of course are the showers. And knowing that you all would be interested I checked before I came over here, and the crew is planning a little bit of optional TV. Exactly what the subject of that TV, and how long it will be I cannot give you that information at this time. But they did say that they were planning on getting some TV. About the only anomaly that we've had today is something that's been more or less of a recurring in nature is associated with the ATM instrument, the S082A door, and you're well briefed on ATM door problems so I'm not going to go into that anymore. If you've been listening to the loops here recently, you probably heard that they've tried a little bit of ground troubleshooting. And we're kind of coming up with no joy. However I think that it's very possible, I'm not going to say that this is the answer. I think it's very possible that what we have is a door that is stuck OPEN so far that we can't shut it. In which case we're in the same posture that we'd be if we went EVA and pinned the door OPEN, and we would be very happy about that. So right now it's where I think we are on that particular problem. I don't - oh we did on the handheld photography today out - let me mention a couple of things. We did take a look at some oceanographic sites in the southwest Pacific off the Solomons, Fiji, and New Caledonia. We also took a look at tropical storm Lottie which is southeast of the Fiji. And viewed the alpine fault in New Zealand which is - it's one that we're using as merely a fault study to give trends about other faults that we can view around the world, it's more or less a classical fault. As far as tomorrow's concerned it is not exactly what anyone could term in any way shape or form as a crew day off. In fact it's a very heavy day. We have been running somewhere in the order of around 26 to 28 man hours trying to hold somewhere around 28, and I haven't added this up exactly but I'm sure the

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figure on this one is somewhere in excess of 32 man hours worth of work. We of course have a very schedule - a very heavy schedule of ATM observations with about 6 hours and 45 minutes of those. We have a M092, M171 or major medical run on the Pilot, an M131 run on the Science Pilot, and we're doing a atmospheric observation using the S201 or the UV camera in the late evening tomorrow, actually it's at 06:00 Z. And we're also doing some atmospheric observations with the S063 instrument. So all in all you're going to find that that's going to be a very interesting day right now our preliminary studies even with all the maneuvers that I mentioned to you still indicate we're not going to use any TACS. One thing you probably all have been following for quite some period of time and again I cannot come here and give you any straightforward answers but I feel only fair to keep you appraised of what -

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PUDDY - - and again I can not come here and give you any straight forward answers but I feel it only fair to keep you appraised of where we stand as far as our state of knowledge on the subject and that's just exactly what happened to CMG 1. I guess they're right now are about three theories that one could consider possible. One is that the bearing race widened, where we normally would expect it to deepen slightly with wear and if this is true then the ball bearings could have actually had too much room and as a clunk - consequence been able to jam together and cause a lockup of the bearing in that fashion. Another possibility is a - an intermittent failure of the CMG bearing lubrication system, as you're well aware of that is the problem that we had on one of the CMGs that during - in the ground testing that we did here. And that possibly the last failure on that was of sufficient magnitude that it did cause the bearing to fail, I guess right now we feel like this is probably the least likely, but it still is a possibility. The other one is what we would like to call race instability. Here you come up with essentially a bearing resonance which causes vibrations and thereby increased loading on the bearing and gradually over a period of time results in bearing seizure. So these are the three conditions that we've kind of narrowed it down to right now. Each one of these is being looked at more extensively and of course we're also working up the procedures just in case, not assuming that there is any likelihood but just in case there should be a failure of a - of another CMG. We haven't seen anything to date that would cause us to believe that this is eminent at all. I guess the only other factor I should mention is that because of the Flight Plan for tomorrow being so long and so full of activities and I forget the exact time but I can check it for you here, the crew will be sleeping in a little bit late on Wednesday. Think their wakeup time on Wednesday, day 27 is 1500 Z, as opposed to the normal time of 12:00 Z. So with that let me open it up and see if y'all have any questions.

QUERY A couple, Don. First of all have we had anymore problems at all with CMG 2?

PUDDY

No.

QUERY

No no one intermittence or anything.

PUDDY

No.

QUERY

Okay, back to the other day in some channel B copy, Jerry Carr was - made some points about Flight Planning and overworking and crew days off and I think today's day off reflected his feeling about what should be - what the crew would like to do on their days off -

PUDDY

Um-huh.

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QUERY How much of a workload, the other thing he talked about was overloading the work schedule. He said they are just - they have gotten accustomed to life up there, they're up on the power curve now, it's not the time to bring them down. Will an 18 hour day with this heavy of a schedule bring them back down on that power curve, will they come back down some and if you going to make - if they're going to have to be up longer than usual and it's - it would seem to make more sense to lighten their load in some respects give them a 16-hour workday and 18 hours instead of a 18-hour workday in 18 hours, you see what I'm - do you understand what I mean there.

PUDDY No, I missed part of that I'm afraid.

QUERY Well, in other words, why not give them the regular work schedule and let them spread it over 18 hours instead of giving them a full 18 hour work schedule, crammed into 18 hours.

PUDDY Well don't get me wrong, there are - there are some spots in here where there are some breathing time and there are some activities in here that are not exceptionally strenuous physically, let's put it that way, where you would actually tire the crew out, but it is a day which is layed out which keeps you going. There's no two ways about it and we're at that point in the mission with trying to coordinate the - the ATM observations, you're probably well aware of one of the things we're trying to do is to make sure that we get our film budgets and everything all squared away to start our -

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PUDDY - - well aware one of the things we're trying to do is to make sure that we get our film budget and everything all squared away to start our - our ATM comet observation. We're trying to - to do our daily viewing of the comet using the corollary instruments, all these things combined could put certain constraints on us and we're more or less forced into keeping a fairly full Flight Plan. Now we have discussed this particular Flight Plan with the crew told them our overall plan, have uplinked to them a 7 day forecast which indicated you're going to have a heavy day or light in the next day, this type of thing. And they have agreed to all of that and see no problems with it.

PAO Don, I have a question called in the Cape, which follows that line of reasoning. Do you think that in trying to get the utmost from the mission that the Flight Controllers have a tendency to overload Flight schedules and push the astronauts as much as they can be pushed?

PUDDY I think I can answer that question by saying that the - it's just like everything else in space operations, it's an (garble) process. We've had cases where the crew has pushed up and we have also had cases where we pushed the crew. And I think that what you will find in general, we invariably start out Flight Planning - I'm talking about the Flight Controller, we invariably start out a mission Flight Planning very heavy. And the reason we do this is because our last experience has been towards the end of the previous mission, and generally the crew reminds us, that hey, we're starting up on the power curve, so we slow down and then gradually as they get on the power curve, they start asking for more tasks to accomplish. So, I think that right now, with the Skylab-IV crew, we're in a process of trying to find that happy medium. We - we think we're somewhere between a 27 and a 29 man hour day, it's going to be that happy medium, tomorrow is one of them that's a little bit longer, but like I say it is averaged out on the next day, somewhere around a 20 man hour day, so we're still - we're still talking an average over a 2 day period of around 27 man hours that I mentioned previously. And we - we may decrease a little bit in the future, we may extend it a little bit in the future. But I think either way we go we're narrowing in on just exactly how best we and the crew can accomplish the objectives that we set out to do premission.

QUERY On the same line when they try to photograph the Minute Man at midnight tomorrow night, it's going - it's - suppose it's going to be very demanding task and it's going to take a lot of know how and skill. Are they

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going to be too tired at the end of the day to really do that properly?

PUDDY I don't think so. Let - I - I can't answer for them, but if - if we had felt like they were going to be so tired that they would be unable to do that job, we certainly would have not scheduled it. And in our opinion right now and after discussing it with the crew, we feel like they can do an acceptable job, agreed it is a taxing job to catch that.

QUERY How - how does the Minute Man thing evolve? Is the - I'm sure it was a regularly scheduled missile but did the - the Defense Department change the launching schedule so you could time it?

PUDDY No. no, no.

QUERY Was it always at this time?

PUDDY Yes.

QUERY And it just happened to be that they're going to be in that area at the time.

PUDDY Yes.

QUERY Okay. I had a question on the S082A door. The way it's stuck open now it's all right you - you can operate it? Is that it?

PUDDY That is correct, that is the best failure mode that we can have.

QUERY So, you're not going to fool around with it any longer?

PUDDY If, continued analysis throughout the night upholds a theory that I just gave you that the S082A door is indeed stuck open, and the limit switches are therefore not allowing another open or close command in, we will keep our hands off and when I left the Control Center everybody had kind of moved their hands away from the command panels.

QUERY Well, why do you need these doors anyway? You've had so much trouble with the darned doors throughout the mission, why do you need them anyway? When - when - -

PUDDY Well, there are certain doors that you need in order not to - to - well, first thing is contamination. And when we - we originally built Skylab, we certainly had no feel as to just exactly what the contamination level was going to be on a spacecraft. And this type of an orbit for this long with all of the various things that we're venting, I think that we have found that the contamination levels are lower by the QCM monitoring the - the quartz crystal micro balance monitoring that we do on a daily basis, also by visual observations of the instruments during the EVA operations - -

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PUDDY - - lower by the QCM monitoring the quartz crystal microbalance monitoring that we do on a daily basis, also by visual observations of the instruments during the EVA operations. So that is one thing that is - that helped us along that line. Secondly, there are some of these instruments that are - are not as critical to direct sun shafting as the other instruments, and 82A happens to be one of these.

QUERY Along the same line, you - you mentioned theory that it's stuck open. Is it possible it could be stuck closed and you not know it?

PUDDY No, with the barber pole indications that we've got right now Art, that's a - we - we don't feel like it can be stuck closed. If it was stuck closed it would be giving us s- should be giving us a - a gray indication and that's not the case we got a solid white indication.

QUERY I have a very general question about the mission. It seems to emerge that many skeptics of scientific space research by manned missions have been convinced of the value of the manned missions. Do you think that this results not only from the spectacular missions saving achievements but also from a change in attitude which brought about the better mutual understanding between scientific investigators and the Controllers - Flight Controllers?

PUDDY Well, I'm not sure I understood the full - - Is there - -

QUERY Impact of your question - -
PUDDY (Garble).

QUERY The Flight Controllers - the Flight Controllers were always for scientific exploration, I mean we went into the mission knowing full well that we were working on a - on a balance of trying to gather some basic information about the design of future spacecraft - long duration spacecraft, but we also went in there recognizing that in gathering that type of information, we had a - a wonderful chance to do a tremendous amount of scientific investigations. And I - I think that our - our object as soon as we got our feet on the ground which was early in Skylab-II, and had confidence that that vehicle was going to be able to operate more or less towards the entire premission plan that we had outlined, i.e., three manned missions, our focus of course certainly changed to maximizing the amount of scientific return and we have tried to maintain that objective foremost in our thinking since that time. I certainly think that the - that the amount of scientific gain that we have realized from Skylab, a lot of which will not become apparent to many of us for many years to come, has had some effect on - and this is personal opinion, some effect on swinging possibly a - a lot of American people and possibly people around the world back into the merits of science and technology. And I certainly hope

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this is true because I feel like once - once a nation or a world decides that they have completed all the knowledge they need to have about what goes on within their own atmosphere and outside this atmosphere then we've stagnated to the point where we can no longer prosper. And that's - I just don't think that's the way - especially of the American people.

QUERY In talking about the bearings, did you call it a bearing race? R-a-c-e, or - -

PUDDY Bearing race, right.

QUERY R-a-c-e.

PUDDY R-a-c-e. It - that - that's just the metal object that you normally see on a - on a roller bearing that holds the - the ball bearings themselves. Normal coaster bearing type thing.

QUERY I thought I heard on the air-to-ground earlier, I (garble) sure, they're going to do the M509 for the first time day 29?

PUDDY That's correct.

QUERY That's the same day as their first Kohoutek ATM viewing, right?

PUDDY No, well let me see. I got to convert here. What's December 13th, when we're going to start the ATM Kohoutek observations. And that's day 28 isn't it?

QUERY Yeah, okay.

PUDDY So, it's going to be one day later.

QUERY Okay. Oh, all right, I wasn't getting my days - days of mission, and days of week together so - -

PUDDY Well, don't - don't feel bad, I mean when you start talking about mission day and Julian day and calander day, there's not a one of us that can't be snookered (laughter) I guarantee you.

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SPEAKER - - Julian day and calender day, there's
not a one of us that can't be snookered, I guarantee you.
(Laughter)

PAO
PUDDY

Thank you very much gentlemen.
Enjoyed it.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 9, 1973
16:30 CST

Participants:

Neil Hutchinson, Flight Director
Al Seeschaaf, PAO

SL-IV PC-49A/1
Time: 16:31 CST
12/9/73

PAO Since we all know Neil Hutchinson let's get on with synopsis of today's activities.

HUTCHINSON Okay, today we had another pretty solid day of orbital operations. Got some good news and some bad news. The good news is that we ran that stability test today that I've been talking about the last couple of days and indeed we found the comet Mercury - planet Mercury right where we expected to. And as you know we have exercised a couple of attempts, one in SL-III and one SL-IV to point the ATM instruments at a foreign body other than the Sun and without an overwhelming amount of success it remains to be seen of course how successful we were on the JOP 13 several days ago. But the data that we were able to get that's of the nonphotographic data we're still not convinced that we actually got the target or not. However today there wasn't any doubt in anybody's mind, we did get Mercury. It was exactly on the screen right where we planned to put it, and the crew went through a series of exercises to maneuver the comet - the vehicle around with Mercury on - using the S052, the white light coronagraph television system and the display monitors to compute the maneuvers. In other words the ground initially gave them the data to find Mercury which they did and they moved it around on the screen by computing some maneuvers based on a grid system on the screen. Now this technique is going to be used of course with comet work with the ATM instruments particularly with the one that requires the find-tuned pointing as S055 and we do have procedures to use the coronagraph - the S052 display system and television system to point S055. We did run into one little surprise and that was the initial look at the data indicates that math - little mathematical transformation which was nothing but A-B-C, nothing magic about it, that the crew went through to - if the comet or as in this case today, Mercury was at a certain point on this overlay that they put on the tube. And they want it up at another place they just do a little X-Y thing to figure out the maneuver. And they have a table that they can use to figure out the - where you have to maneuver the vehicle to move the image of the - the - or in other words the field of view of an instrument. But in this case the image of the planet from one point to another point. And it turned out that we were able to do that with about 5 arc minute accuracy. And we need be able to do that with about 3 arc minute accuracy. And be able to point the vehicle to the field of view of S055. And we're now able to do that with such an easy time getting - getting the planet that they were able to do a better job of finding the planet than we - practice pointing

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than we had anticipated. So we got a lot of data points on moving the planet in various places on the screen. And we think we got enough to maybe make a different equation other than $X-Y=Z$. And in that way improve the accuracy. I think all in all maybe there were some people - doubting Thomas's that thought we weren't going to be able see things with the ATM off the Sun. And of course the ATM - it's hard to use that instrument - that series of instruments because on something like the comet because they were designed to look at the Sun. And it's not the instruments themselves but getting them pointed in the right direction. I think we took a giant step forward today to assure everybody that indeed we are going to be able to find the comet with the ATM, and that the attitude control system can hold the - the instruments steady enough to be able to gather good data without getting blurred photographic images and so on and so forth. So that's the good news. Another piece of good news, we had 82A door stick on us last night halfway open and halfway closed and one attempt this morning to unlodge it was unsuccessful by a ground command using a trouble-shooting procedure. And this afternoon in fact about a half hour ago we ran the exact same procedure again and were able to unstick the door and indeed open it up and it seems to be working all right at the moment. And I think you can probably - well we've gone back to single motor operation on S082A, we've been running dual motor, but it's beginning to look - this is the second or third time it's hung up in the past week. It's beginning to look like maybe the two motor operation is causing it to - when it does hang up it really hangs up good because the motors have more torque and are driving it in the - well it is hanging it up harder. So we've gone back to a single motor operation in the -

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HUTCHINSON - - wasn't it - when it does hang up it really hangs up good because the motors have more torque and they're driving it into whatever's hanging it up harder. So we've gone back to a single motor operation in the hopes that even though it may continue to hang up once in awhile, it won't be stuck quite as hard and we can bring on the second motor and get more torque to get it off of whatever is sticking it. And I'd probably look for an EVA exercise on that door similar to the one we did on the H-alpha next time we go out to pull a pin and open it and leave it open. Somebody asked me last night, I don't know whether it was - I think it was you Paul about the comet and television and the first ATM comet operations are on Mission day 29, 3 days from now - 4 days from now, that's Wednesday - Thursday of next week and that's the first look that we will have of the comet as seen by the crew on the ATM TV system. One thing that ha - a couple of things that happened after I was over here yesterday on that - on the series of EREPs we ran last night, first off, you may have heard some talk on the air-ground concerning some filters in the S190A camera system and let me tell you what's going on with that thing. It turns out last night when we did a film load on EREP camera system, S190A, that's the battery of 6 cameras that goes down up in the front in the MDA, we discovered that the filters that go on the front of the cameras were inadvertently left off during EREP check-out back on whenever that was, mission day 9. So the first 9 - how many EREP passes we have, I believe 9, however EREP passes we have today were done 190A sequences were done without the filters. The filters are put on the camera to spectrally limit the light that goes into the camera to a particular wave length and the films - film in each one of the cameras is different all there are six camera stations there and each film and filter is a match combination to pick up some particular wave length of light. In some part of the spectrum now, the fact the filters weren't there in some cases is gonna hurt the data collection of 190A and in some cases it doesn't bother much, we're gonna be able to correct for the fact that the filters weren't there when we processed the film post light. Those 190A camera stations that are particularly interested in picking up a particular coincident with - commensurate with picking up a particular spectrum without the filter will not collect any data and I believe I have a summary of that thing if anybody wants to get into it. There's a couple of stations that we won't have data for on the first few EREP passes. And one more thing on that EREP yesterday, EREP 14, turned out one of the things when you get a lot of complicated monitoring procedures is bound to happen sooner or later, the crew got faked out - little bit by

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some attitude error indications that came up on the APCS that they thought were abnormal and which under the circumstances certainly would have appeared to anybody to be abnormal and they took action to abort the EREP going into it and turned out the action was not necessary, however given the indications that they had I think you just have to say that - that given the data they had they did the right thing in retrospect it turned out it was not the right thing and it cost us about 500 pounds seconds of TACS that we didn't need to spend on EREP 14. I guess I think if that's the only mistake we make in trying to handle this APCS thing, we'll all be happy. It's a very complicated monitoring procedure that requires the crewmen's attention a good part of all the maneuvers that are taking place including the data takes and it has, as a matter of fact it's about 3 pages long and it turned out that the ground passed up one of the key parameters that we use to decide that there's something wrong are the rates that the CMGs are moving that the vehicles moving to get to a particular attitude. And one of the numbers had a SIGN on it reversed that we sent up and that particular clue connected with the fact the crew was looking at a - at a display that was not the proper attitude error display to look at - there are two separate ones and I won't go into that it's kind of complicated - but that combination of the fact that the ground sent up a set of - a rate in a particular axis, that whose sign was not correct and also the vehicle, the series of events that led up to this thing, the vehicle displayed a attitude error to the crew that was not the correct attitude error to be monitoring caused them to abort the maneuver. Now when I say abort, they actually went through a procedure where they hit a switch and then went return to the Z-IV maneuver and they were able to complete the pass, the EREP pass and we got the pass, it was slightly out of attitude about less than half degree and nothing it, in fact of it, a couple of tenths of a degree, nothing that would bother the data take at all. Tomorrow's a day off and it's pretty much a day off. There's a calendar scheduled which is AIM JOP 12 which is going to take up the SPT the middle part of his day and other than that, there's a couple of other AIM passes and that's about it. And that's about all.

PAU

Any questions? Bruce.

QUERY

The CMG signatures you're talking about last night did that turn out to actually be an (garbled) condition similar to that exhibited with G 1 or was it something else.

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HUTCHINSON We're still looking at it Paul but I
guess I - trying to think whether we ever did discover whether
it was actually via gimbal drive. I don't know the answer to
that question -

END OF LINE

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HUTCHINSON - - trying to think whether - whether we ever did discover whether it was actually bias - gimbal drive - I don't know the answer to that question, whether that's has been yet specifically tied down to a gimbal drive, high gimbal rate, so I don't know. I can find it out very quickly with one phone call when we're finished, and I will find it out for you.

QUERY Have you had anything else on the CMG?

HUTCHINSON Nothing, clean as a whistle all day today and all night last night, if fact, since I was here last. And of course, we did a maneuver today, dumping every rev and so on, and no - no characteristic traces.

QUERY I'm not sure I understand the reason behind the pointing and changing of Mercury's or the comet's position on the viewing screen because if all you're doing is rolling the craft a little bit, and just kind of rolling it's image a little bit on the telescope, you're not really getting a new angle on the comet or a planet that far away, so what is it?

HUTCHINSON Well, the fact of the matter is, as you are. With a field of view as small as - for example, S052, having a nice wide field of view, wide in terms of the AFM instruments, it's a half a degree or so, allows you the capability to literally repoint, for example S055. And S055, without having a Sun reference and - or anything - the ground cannot get S055 on the con - with 3 arc minutes of accuracy, which is what the S055 field of view is on the comet. So, the crew actually manipulates the whole vehicle to place S055, for example - actually - get S055 lined up on the comet. So you are using it to point, and it's not a roll, I didn't mean to imply it was a roll. In fact, today they moved it all around. They moved it this way and that way and, etc. It's not - it's definitely not a vehicle roll, it's a three axis attitude maneuver, to repoint a particular instrument at the comet.

QUERY The filters on this EREP camera, S198, was that lift off during activation, is that -

HUTCHINSON No, it was during EREP checkout, Paul, which I think was back on maybe day 9, somewhere in that area, before the first pass, anyway.

QUERY Whose responsibility was that - Pogue's?

HUTCHINSON I believe it was the PLT.

QUERY There are six cameras there in that system and out of that six, how many are going to be losing data because of the filters? Two, four, six, or -

HUTCHINSON Well, let me just give - I'll try and paraphrase this. I have a detail breakdown, which is certainly preliminary, but let me just kind of briefly go

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through them. In this particular set of film that we have in there now, stations 1, 2, 5, and 6 all were designed to gather particular spectral data. Those four stations, and needed the filters to actually get a spectral band limit on the data. In other words, if you're liable to get just a plain old black and white picture instead of a particular you know, like 7000 angstroms if you wanted that particular spectral line. Let me just - let me basically go over the stations now. Stations 1 and 2 have got - although they are both spectral stations, we expect to get some data out of them. They are overexposed about four f-stops, and we think we can correct a bit of that out during film processing and that whole area is still being looked into exactly how much data we are going to get out of them. We aren't going to get, certainly the spectral bands that we were looking for, but there will be some data there. Station 3 is basically - by the way stations 1 and 2 had black and white infrared film in them. Station 3 has got color infrared, and we think we'll get nothing out of station 3 because the thing - the film that's in there is very sensitive to blue - the blue light part of the spectrum, around 5000 angstroms and down, and therefore, we think without the filter the film is fairly well overexposed, probably completely washed out, in fact. Station 4 has some high definition color film and is not degraded except for being slightly overexposed by probably less than a half of a - half f-stop. We're fairly certain that we can correct for any overexposure on station 4, and so we think we'll get a full set of data out of station 4. Stations 5 and 6 were both - had band-pass filters on them, specifically for the first - they had the same kind of film in them, by the way, black and white film, and are both - were both equipped with particular filters to pass light, one in the five to 6000 angstrom and the other in the six to 7000 angstrom band, and the film sensitivity is sensitive over that entire range, so obviously they're both overexposed. However, again, as with station 4 and station 1, we think that we can - that we can correct a good part of that with the film processing. However, once again, even though you get film out of it, you don't get the spectral line you're looking for. So we get some and some we don't get.

QUERY: I'm not all that up on which of these stations are good for what specifically, you know, but wouldn't this pretty much throw out most of your crop studies, the -

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QUERY - - sure these stations are good for what is specifically, you know. But wouldn't this pretty much throw out most of your crop studies, the insect infestation, and anything - -

HUTCHINSON I haven't got - I haven't got a correlation with exactly all this stuff that 190 is sued for, Bruce, it's used - that - there - it's going to bother some of our 190 stuff, but we're a long way from - I - I think, you know, we're a long ways from the end. We've got 9 or 10 EREP passes out of 50. I hope we'll get - we'll probably get some of this back. We - I'm sure we're going to readjust our target priorities and so and so forth as we go on down the line here to go back here and pick some of it up. And again, there is strong indications that some of this film is going to be processed cleverly and the data retained. And you're - it - it's bound to - bound to hurt some small amount of our - our DTOs that that camera was - that that camera set of set of cameras that was picking up. And I don't know which ones, but I can sure get you - I can get you a list of exactly, you know, which ones we think we've lost. I could - I couldn't even give you a summation of what target we've shot with that particular thing over the - over the first nine passes.

QUERY - - without the filters in the stations, 1, 2, 5, and 6 so (garble) identical, black and white film and - and reasonably accurate. And you get nothing from station 3 and station 4, you get full data.

HUTCHINSON That's a good - that's a good summation, and 1, 2, 5, and 6 all have to be corrected significantly for overexposure to obtain good black and white out of them. But people feel they can - there is going to be - we will be able to do certain - some of that.

QUERY Does this include some of the geothermal studies, or do you -

HUTCHINSON Well, we haven't really done any of them yet. You know, most of those - we're getting ready to launch into a bunch of those - I - I - I'd have to say probably the answer to that is no. The - you know, some - most of the - that geothermal stuff is coming up here in the next few days in early morning, you know - start taking data in the nighttime coming up to sunrise type of thing. And most of the passes that we get here were - were over the continental U.S. in the daylight. Were here over the first few days.

PAO

Thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 8, 1973
16:26 CST

Participants:

Neil Hutchinson, Flight Director
Don Green, PAO

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PAO Okay, we're ready to start the evening change-of-shift briefing with Neil Hutchinson, head of the spider shift, who's going to tell us about what transpired today. Go ahead, Neil.

HUTCHINSON Not sure I am. Go along with that (garble) spider shift, but, be that as it may, I think we had a pretty successful day today. I guess if I had - i - l - it was just a professionally flown Flight Plan today. We didn't have any problems, the crew has worked along rapidly and steadily and they are a little bit behind, but nothing concern us - as well - as far as getting the Flight Plan finished for today. We just didn't have any significance. I don't think - we didn't have any big anomalies. We had one - what I would call possible characteristic signature on CMG 2 today, however, the people are still looking at the data and it certainly not - not a fact yet until we look at it some more. So happens that this signature something very, very close to the signature of CMG 1 can happen when the bearings get - when the bearings get cold at the bottom of their heater cycle after they have been off for a long time. However, we are looking at that. I don't have anything more to say about today's Flight Plan. It all went - all went very well. Tomorrow we've got a fairly full day with the biggie being a thing we're calling a stability test monitor. It's basically a test to reverify to ourselves that indeed - to reverify to ourselves and to allow the crew a little on-the-job training in finding comets with ATM instruments that we indeed can do that and do it right. We are going to go take a look at the planet Mercury tomorrow and the test, if you've seen a CAL COMP Flight Plan, you'll notice that there's a thing on there called pointing stability test in the morning. Right off the bat an hour after the crew gets up, and that's what that is - a couple of hours after they get up. Basically, we're going to wheel the vehicle out there based on pointing numbers generated from the ground and take a look at it with S052, at Mercury. And it will be on our television screens and as you know, they have a device called a common overlay which is nothing but a piece of plastic with grid work over it that lays on top of the ATM monitor that they can use to maneuver the vehicle with some command - commands when they are looking at the comet. The comet'll appear on the monitor as a - as a bright point. By some simple mathematical subtraction, and a look up in a little table, they can say if the comet's up in the left-hand corner, they can move it down to the middle of the screen. For example, what we call a tweak maneuver or a series of DAS entries that have the CMGs just change the attitude of the vehicle slightly. We're going to practice that tomorrow

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using Mercury as a target. We also hope to get a very good feel for how the APCS as a unit, the entire vehicle can hold the ATM instruments on a point object like the comet. And as you know, in SL-III, we did observe a couple of times, for example, in JOP 13 phenomenon, we called at that time, Jitter, and it's been analyzed to death since then. Jitter being the fact that object does not remain inertial in the data take it. The vehicle - vehicle or the ATM appears to have some minor oscillatory motion to it. We've since determined at least to our satisfaction to date that that's caused by crew motion in the vehicle, not anything that the system's doing to us. Tomorrow, we'll be making sure that with the crew very quiet, that the vehicle can be pointed inertially at an object off the Sun and hold a very still attitude, still enough to be able to g -

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HUTCHINSON - - quite that the vehicle can be pointed inertially at an object off the Sun, and hold a very still attitude still enough to be able to gather good data on the ATM instruments which is what we are going to be doing some of the time with Kohoutek. And this test is particularly important in the light of the fact that we still, it looks like we didn't get the JOP 13, UV source Spica yesterday. And maybe I ought to say a little bit about that. I said something yesterday about it. I guess maybe, we might not have given you all the facts relative to how hard it was to get that thing done yesterday. The field of view in the instrument, the prime instrument that we're using to look at Spica yesterday is S055, and the field of view is 3 arc minutes. And it doesn't take much of a gyro drift, you recall that the way you get to the attitude where you're going to look is on the gyros. You know you don't have any Sun to give you the nice inertial reference. A small gyro drift that was uncompensated in our calculations, slight misalignment of the star tracker which is one of the things we used to tie down the Z reference. Anything like that can very quickly can chew up or introduce a 3 arc sec - minute error and cause you to be off. Now, the field of view of course of 52 tomorrow is a full device, that's nice and wide and we fully expect to see Mercury. We got S092 tomorrow and a full day of AIM about 5 hour's worth of AIM. Going after Kohoutek with S063 tomorrow, and I guess that's about all on the Flight Plan for tomorrow. The Flight Plan for the next couple of days - the next day is a day off. Monday will be a crew day off, and it will really be pretty much a day off. We may run a couple of AIM passes, of course we're out of the EREP picture now, as you know. I haven't seen a CAL COMP for the day off, but I think you're going to find it's pretty open, not much activity. And everything is cooking on.

PAO

Questions?

QUERY

Tell me more about this lubricant that you think is cooling off, and has something to do with slowing down the wheels. Is - is that - is that sort of the prime theory now?

HUTCHINSON : I wouldn't call, Tom, I guess it's a proven fact that the - the we have seen in ground tests the fact that these - first off let me tell you about the lubricant. I - I don't know the actual viscosity or trade name or anything of the lubricant. But there is in each bearing a small reservoir, very small. How much does it hold? It - it doesn't hold much at all. I mean not more than a - a couple of erasers - pencil erasers full of this lubricant. And it is

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wicked on to the bearing surface through a small orifice. There's one of these little reservoirs, these full of lubricant on each bearing, or on the - in the structure next to each bearing that allows a very very minute amount of this lubricant continuously over the life of the wheel. It's not a force feed lubricating system or anything else it's wicked, in other words it goes through a small orifice onto - onto - into the bearing race. The bearings have heaters on them, that are continually cycling on and off. They range, they keep the bearing temperature between 50 and 80 degrees roughly. When the heater comes on and heats the bearing - heats the bearing area up it gets up to 80 degrees and the heater cuts off. Then as the thing cools back down of course the heaters continually off until it gets down to the heater trip-on point down around 50 degrees. When it gets down in that lower end we have seen a slight tendency for the viscosity of the lubricant to increase the friction on the wheel and thus slow it down if you will. Now it's extremely subtle to tell the difference between that kind of an - -

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HUTCHINSON - - slow it down if you will. Now it's - it's extremely subtle to tell the difference between that kind of an occurrence and the kind of thing which is a signature of some other friction in the area causing the wheel to slow down namely some anomaly with the bearing or a bearing surface. Nowt the on-set of the trouble on CMG 1 when we started seeing the characteristic signature where the wheel definitely slowed down and the current definitely increased was associated with torquing of the CMGs and I've explained that before, you know side loading on the bearings. The thing that we're still trying to figure out, this thing happened out of cons - out of sight of the ground today, we're still pulling out data to verify whether the CMGs were being moved, you know the gimbals were being torqued if they weren't it's probable that this occurrence today, since it was so small could be associated with that or is associated with that phenomenon on the - on the fluid on the lubricant. However everytime one of these things even blinks its eye, we've got 50 thousand people looking at it trying to see if anything might be connected with the CMG 1 anomaly or characteristic of the CMG 1 anomaly, so - the Deltas by the way were 50 r.p.m. decrease and 4 hundredths of an amp increase in current which is again less than half the amount that we saw in CMG 1.

QUERY That was today?

HUTCHINSON Yes.

QUERY Go ahead, I can't remember the next question.

SPEAKER I think you got some cake (garble)

HUTCHINSON Hard to talk to those mikes (garble)

PAO Okay, while they're gathering their thoughts,

let me pass on a couple of questions that came to us from the Cape. One of the questions is can you give us some kind of indication on how intense will be the comet Kohoutek viewing in the coming week?

HUTCHINSON For the 7-day forecast I brought along - wouldn't you know it, - well no it's not here, let me see - well I can tell you first off I'm sure there will be comet activities every single day, that's one thing and as you know, we're still in that period where we're basically rotating the instruments, the corollary instruments through the SAL that look at the comet getting one or two of them every day. I do have a preliminary schedule. For example tomorrow we'll be looking at the comet with S063, on Sunday I'm not sure whether we're going to be doing any comet work, we may be since it's a day off I'm not sure -

PAO Monday.

HUTCHINSON Monday, I mean I'm sorry. Tuesday we're going to run S183, Wednesday S201, probably 1-day off, Thursday

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S019 and Friday S063. We're pretty much rotating through them of course mixed in with those everyday we're using the S233, handheld work we're now working out of one of the windows in the back in the workshop in the STS section window S3 is the one that we're seeing the comet out of and it just became visible and it becomes visible in it tomorrow, so we're looking at it everyday.

PAO Second question unrelated to that, you've already given us some indication of the status of the CMG 2, this question is a iffy type, they're asking you to estimate the life span of CMG 2? He's shaking his head.

HUTCHINSON I - there's no estimate of that - past the end of SL-IV.

PAO Okay.
QUERY Now what you saw today, that was similar to the little glitches that you've seen the last - the other three times, is that right?

HUTCHINSON Yes.

QUERY Uh-huh, and -

HUTCHINSON With the one exception that it still remains to be seen whether it was associated -

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QUERY - - three times is that right?

HUTCHINSON Yes.

QUERY And -

HUTCHINSON With one exception that it still remains to be seen whether it was associated with high gimbal rates or not. In other words, torquing the CMG and certainly with the exception that it was not associated with any bearing heating, which of course, in a real friction case, you know, ends up showing up if you - you know, there was the bearing - like in CMG 1 the bearing, when CMG finally went, the bearing temperature increased fast and a lot. And there was absolutely no indication of any bearing temperature increase at all, in fact, the bearing was down very, very cool and it was just prior to the heaters coming on - tripping on.

QUERY And yesterday, you said that there was a - people working at Huntsville on a idea of slowing the rate of the wheels.

HUTCHINSON Of which we torque. Oh, well, there's two - yes, go ahead, Tom, and finish your question.

QUERY That - that - I was wondering if there had been anything else done about that.

HUTCHINSON No, that's still - we're still working hard on a couple of things. One is the - the thing I think I mentioned yesterday was that looking at a way to move the CMGs when we changed their position in ord - to control the momentum at a slower rate so we don't put so much side load on the bearings. That's one thing that's being looked at. Another thing that's being looked at is if there is some way that if we do get in trouble, we can modulate the speed of the CMG at a lower rate so we reduce the friction on the bearings and that's the - for example, turning the wheel on and off with regularity, you know. It takes them a long - if you don't put the brake on, it takes them a long, long time to spin down, you know I - 36 hours or 40 - I don't know what the number is, but it's way up over a day. And the theory being that there may be some way that we can - this is provided that we got in trouble with the bearing and it didn't go, but it was heating up continually. There might be some way we could get some use out of the wheel by turning it on and off on a duty cycle type of thing and keeping the overall average speed down considerably below 9000, like at 5000, for example. You don't get as much momentum out of it since the momentum is directly proportional to wheel speed, but you still might get some affective utilization out of the wheel. That's also being looked at.

QUERY When might we know that if this signature you got today is, in fact, an indication of anomalous behavior?

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HUTCHINSON Next couple of hours, I think, Paul. I think we worked on the data a good part of the day, and they just hadn't gotten it all out yet.

QUERY Okay, the - the maneuver tomorrow is - pointing stability test. Does that require torquing the vehicle or -

HUTCHINSON Yes, it does.

QUERY Can you give us some details on the magnitude on the trauma of that?

HUTCHINSON N - well, it's no more trauma to the CMG than it goes through every rev. I don't know how big the maneuver is. It's a considerable maneuver. But the length of the maneuver is basically irrelevant, you know, it's the the - the - if you have to maneuver any - you have to build up a rate to get the vehicle moving in a given direction, and in order to do that, you have to move the CMGs. And the CMGs when they are given a rate command are given a fixed rate command to get the gimbal from this position to this position back, you know. That's one of the things we're looking at reducing. It - what I'm trying to tell you is that a dump maneuver that it does every rev will stress it in exactly the same fashion and exactly the same kind of forces as this thing we're doing tomorrow, as does any maneuver that we would do with a vehicle.

PAO Okay, I've got another question that was handed me from one of the network representatives. We'd like to know if you can tell us when we're going to get the first ATM TV of the comet Kohoutek.

HUTCHINSON Well, it won't be for probably a week or so. I - I'm sure it won't be until we're closer to - the comet gets closer to the Sun. I can't - I can't answer that, but I'm sure somebody in the Control Center could answer that question directly and give you an exact day on - on - when.

PAO Okay, very good. No more questions? Okay, thank you.

END OF TAPE

**SKYLAB NEWS CENTER
Houston, Texas**

SL IV - Change of Shift Briefing
Johnson Space Center
December 7, 1973
5:00 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Don Green, PAO

5:00 p.m. CST

SL-IV PC47A/1
Time: 17:00 CST
12/7/73

PAO
Okay, we're ready to start the change-of-shift press conference with Neil Hutchinson, without further ado go ahead Neil tell us what happened today.

HUTCHINSON Well, it's nice to be back working days again. Today, we had a - what I would consider to be just about a normal ops day. We worked along fairly steadily, didn't have any problems to speak of. We got a good EREP in this morning, cost us about 59 pound-seconds of TACS which is fairly good for EREP of course with this new way of doing them, staying in ER - staying in Z-local vertical for the entire revolution it helps things out quite a bit in terms of the TACS cost. Yesterday, we had a good - since, I think, there's been a Flight Director over here, we've had a good M092 run on the CDR, we had another one today and it was still in progress when I left on the PLT. But was going along fine at 50 millimeters. Yesterday, not on the EREP today but on the second EREP yesterday, EREP 11, we had another non-normal indication on CMG 2 and we have been scrutinizing that data ever since, fairly carefully and it does match the signature of the kind of performance we saw out of CMG 1 back when it was not feeling well. However, it was not - again it was a very very subtle change in characteristics in the wheel speed and in the current although they both matched up pretty well, this characteristic signature that we've seen in the past, it still is not - not anywhere near the kind of magnitude that we saw on CMG 1. However, it does concern us and we're continuing to look at that fairly carefully we had no - no CMG problems at all today, in terms of any abnormal indications on either one of the two wheels, but are still working fine. And I might get back and say a little more about some of the things we're doing in terms of the CMG in a minute, let me kind of finish off the Flight Plan business. We've made a basic de - a decision on our Flight Planning cycle to stretch the M092 runs out to 4 days between runs. We probably won't be doing this on a regular basis but we do now have the prerogative to alleviate some of the scheduling problems we've had with some - getting caught up on some of the other experiments that - to have a basic 4-day cycle on the 92. It's 4 plus zero minus 1, so you'll probably be seeing those every once in a while you'll see a guy get slipped 4 days instead of running him every 3rd day. And we'll be doing this for about the next month or so, probably until around mission day 55 or 60 when we'll take another look at that goal to see that the medicals still all going as well as it is now. And to see if we can continue that practice of spacing them out that way. Today, we ran the first JOP 13 of SL-IV, and the target was a UV target as opposed to the

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SL-III which was X-ray and we were looking for Spica today. Preliminary indication is that we didn't get it now, we still have a lot of data analysis to do yet and I'd say - I'd really underline the word preliminary because I'm not convinced that we've looked into enough data yet, of course the final analysis comes when the film comes back. But we had actually expected to see some indications on S055, which of course is a UV instrument that we had acquired the target and we didn't see it. The indications that we expected that is. The maneuver that we did to get there was a fairly tricky maneuver in terms of the momentum state and where the CMGs were and so on and so forth. We did get a couple of TACS firings.

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HUTCHINSON - - get there was a fairly tricky maneuver in terms of the momentum state and where the CMGs were and so on and so forth. We did get a couple of TACS firings in the middle of the data takes which we're not quite sure yet how much that might have contributed to the fact that we didn't - that it appears we didn't see it. One would have to assume that until we got the TACS firings though as far as we can tell we were pretty much right on the target. You recall that S055 has a very, very small field of view about 3 arc-minutes, which is like 4/500 of a degree or a little less than that. That's a pretty small arc to be looking in a target out that far and of course it doesn't take much of a pointing error to get you in a problem where you can't see it. Anyway, so far the quick-look data from the JOP 13 does not look particular promising. But I wouldn't say that that doesn't mean we haven't gotten it and it certainly doesn't cast at least any serious doubt on our abilities to get the comet in my opinion. I don't think - we're going to be running a stability test here in a couple of days where we're going to go after Mercury pretty much as a measure to see that we indeed can find an object like that, and indeed we can point at it, and the crew can look at it and move it around in their displays, and so on and so forth. And of course this JOP 13 today, also we had certainly hoped that we'd be able to see the star but and like I said analysis may reveal that we did, but we certainly didn't see what we expected to see. Tomorrow we've got a couple of EREPs. Tomorrow we're going to do a EREP cal, that's where we point the EREP instruments at the Moon for the purpose of putting them on a known light source to do just what it says calibrate them. After the EREP cal we will have - well that one's been scrubbed. I started to say we were going to have a photographic pass over the Philippines but we are going to try and shoot some 190A and Earth terrian camera photographs of the Philippines in solar inertial right after the EREP cal maneuver. But it turned out that the obliqueness, they were not exactly lined up right. They were off tracked enough to where we felt we weren't getting - we had to roll out just a little too far to get the really good scientific data we wanted so we did - we scrubbed out of that. However we do have a regular EREP pass, Z-LV EREP pass, late in the day as a matter of fact, it's in the crew pre-sleep activities, it's late tomorrow. And it's over Nepal, Thailand, Java and terminates in - coming across Australia, on the east coast of Australia. So we've got a foreign EREP late in the day tomorrow, track 70 is the track, plus an EREP cal. And other than that the Flight Plan tomorrow is pretty much, pretty straight. We've

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got some Kohoutek work with S063, and standard medical on the SPT. Now let me go back for a minute to the CMG, and talk a little bit about - a little bit about some of the things we're doing. As you know the indications or signatures or whatever you want to call it, we saw on CMG 1, it turned out to be a precursor to its demise back about a month or so ago or three weeks ago, or how ever long it's been - couple of weeks ago. Where an increase in the current that supplies the motor that drives, makes the wheels turn and a decrease in the wheel speed. And on occasion a couple of times addended with those two indications and it's kind of simple to relate them if you think of the fact that the CMG 1 has presumed to have failed because of a bearing failure. If you increase the friction of the wheel, the amount of force it takes to turn the wheel, to keep the wheel at a given speed requires that the motor has to work harder, therefore it draws more current. It's just like loading down your motor at home if you had a grinding wheel for example. The indications that we have seen on CMG 2 - wait a minute before I say one more thing. Of course what we saw in CMG 1 was an increase on the bearing temperatures ever so slight at first on the first ones. And of course when the CMGs finally, when the bearing final went the bearing temperatures climbed dramatically over a very short period of time. The two indications that we've seen on CMG 2 are wheel speed and rpm. And they're very slight, they're like - they're almost in the noise. However they are - they're clearly presentable that there's something going on over that wheel. They're like 50 rpm decrease and a 400th or so of an amp increase in the current, they're synomous, and it has happened now about 3 times. The last time, yesterday during the second EREP pass. Now, the CMGs it appears, of course, we've gone back and poured over the data over and over again on CMG 1, and the failure - It does appear that 2 or 3 times that it acted up that the failures that occurred on CMG 1 of course were all associated with periods when the CMG was being torqued fairly significantly in terms of moving the gimbal, one way or the other. And this happens all the time. If we never take the spacecraft out of solar inertia, it happens every orbit during a gravity gradient dump, several times at three different points in the dump. And it also happens when you're having to come back to maximum torques, for example, at midnight. So in order just to fly around in the air without ever maneuvering the spacecraft off the Sun, the CMGs have to undergo considerable amount of movement of their gimbals around to maintaing the vehicle inertial. So maneuvering per se the fact that this particular instance is connected with EREP really hasn't got anything to do with it. Because the CMGs aren't seeing any more stress on the bearing in that kind

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of a maneuver than they are when they're doing a dump, which they have to do every now anyway. We are looking at a patch, and I mean looking I put that in quotes it certainly still very much in the theoretical stage, to try and reduce the rate at which these gimbals move. Now we had a proposal here before us a couple of days ago that proved not to work that would take the ramp function out of how fast these rates were brought when the CMG decided it had to get from this place to this place, how fast you moved it over there. Of course if you moved it over there slower, you don't have to torque it quite so hard to get the rate up, the gimbal rate up to to move it. We are still investigating such a scheme and right now it doesn't look too promising, but it's being worked at pretty heavily at Huntsville. The theory here being that when the CMGs are torqued, that's when you get the maximum side load on the bearing - bearings. And that is theorized the time at which the number 1 CMG bearing failed, during one of these torque periods.

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HUTCHINSON Right now it doesn't look too promising but it is being worked at pretty heavily at Huntsville. The theory here being that when CMG's are torqued that's when you get the maximum side load on the bearing - bearings. And that is theorize the time in which number 1 CMG bearing failed. During one of these torque periods. However for now - if some let me tell you a couple of the other things we're doing. We are looking at making sure we understand the characteristics this characteristic signature and getting some very definite plans in mind about exactly what we are or aren't going to do if CMG 2 is going to act up in terms of the reactions that need to be taken if we get into any kind of serious trouble with the CMG, if we have to power the CSM up and all that kind of stuff. All that basic planning is moving along in an orderly - in an orderly fashion. And I'm not - I'm not advocating that CMG 2 is on its knees or anything like that. Far from that I am just telling you that we have seen another indication that there's something not right in that wheel, and we are continuing contingency planning to cope with it.

PAO Paul Reiser.

QUERY How far ahead of the time that CMG 1 failed did you see the indications which are similar to what you have now seen on CMG 2?

HUTCHINSON Oh, quite a while Paul, I don't remember. I guess a month or so, something like that the first one. I'm not quite sure of the timing, but it was a lot - a significant period of time. Of course at first when we first saw it on CMG 1 that it was - we had talked for a week, and you know it only occurred one time one isolated instance and the wheel performed beautifully from then on. And it was attributed to synchronous nature between the bearing heaters and the lubricant in the fact that the lubricant was - was acting up a little bit. Of course that since been disproved it's not you know - so we didn't. When we first saw it on CMG 1 for the first couple of weeks in fact until it happened the second time, there - there was a fairly coherent theory around that explained it away, and we weren't concerned with a bearing failure problem.

QUERY I hope this is strictly theoretical but can you run through the contingencies if CMG 2 plays out suddenly like CMG 1 did, what - what would be the sequence of the events?

HUTCHINSON Well, to keep - keep it simple the APCS itself, first off somebody has to take some action on the CMG, if it doesn't shut itself down. We either have to shut it down or inhibit CMG control which means we will quit moving the gimbals around. Quit using it in other words. The APCS

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does not have a 1 CMG control law and in fact we have attempted to develop a 1 CMG control law, and have decided such a development is not feasible. And as a matter of fact we went as far as to lay out the basic theoretical work and to see how long it would take to program one up and so on and so forth. And it turned out the date that the program could be ready was about at the end of the SL-IV mission. So it has been - work on that has been terminated. So once another CMG has to be taken off line or takes itself off line either by turning the wheel off or inhibiting the CMG control which effectively quits driving the gimbals and quits using it, it's still spinning in that case, the APCS automatically will say to itself I don't have CMGs to do my job anymore with CMGs and therefore I'm going to use TACS. And it will automatically flop over to a TACS only control mode 322 deadband solar inertial. That's a fairly expensive way to operate orbit after orbit. It's like 400 pound-seconds in orbit. And we have developed and do have in the control center a patch in simple terms I call it a TACS wide deadband. It's very similar to the EMP51, that's already loaded in the CSM, that was loaded back right during activation you recall that affords us to do attitude control at cluster CSM. We have a patch in house here has been verified, which is effectively a wide deadband attitude control TACS only which could be loaded into the APCS to afford us a much cheaper grossly about 1/4 the cost, about a 100 pound-seconds in orbit. Control of the cluster with the APCS, very sloppy control I might add. It won't do anything for you won't you - it will point you at the Sun well enough to accumulate electrical power, but it doesn't do anything for you in terms of instruments. It's like probably 12 or 15 degrees around the Sun line and it varies depending on what the gravity gradient torques are which of course depend on what the Beta angle is and so on. So the first thing that happens like I said is either the CMG takes itself off line or we take it off line. When that happens you fall over to TACS only control and we probably be in TACS only control for an orbit or 2. And the next move is to go into the CSM and get the CSM powered up and power up the EMP51 with the - we would probably and I'm sure we will have some more firm plans in the next couple of days because we're just getting it all laid out or fine tuned. It's been laid out quite a while since we first saw the first - -

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HUTCHINSON - - firm plans here in the next couple of days, because we're just getting it all laid out - fine tuned - it's been laid out for quite a while since we first saw the first cough up on the second CMG, but the - we probably take over attitude control with a CSM and - with a CSM auto pilot, EMP51, but a narrow deadband to begin with, which is a little costly in RCS not really much it's about 15 pounds in orbit, something like that. Until we can get the wide deadband CSM quasi-inertial - it's been referred to by a lot of names, attitude control initialized still in the CSM now, and that's the same thing I referred to as this TACS, wide deadband except using the CSM RCS, and from there we'd just have to reassess the situation then of course we're not in any kind of hurry in any one of these cases, you know. With the TACS wide deadband if you figure we got 25,000 pound-seconds, or how much we got. You're with a 100 pound-seconds, that's what, 1600 a day. So, you know you're 10 or 12 or 14 days worth of TACS propellant not doing any maneuvers or anything just staying in so - solar inertial. And we've already ascertained with the wide deadband attitude holding the CSM, you got a week or 10 days, something like that. So, nobody is in a rush to do anything, and of course, one of the theories on these CMGs is that we might - might be able to nurse it along if we inhibit the - the high torquing for awhile and let it steam down, who knows, you know, I mean we really don't know a whole heck of a lot about the - the failure modes since we haven't gotten one here we can tear apart and look at. But that's the basic sequence in other words, you take over control with the TACS and then take ov - and then get the crew to fire up the CSM G&N, take over control with a CSM RCS, until we can get a patch loaded in the ATM DC which will allow us to go back to the TACS in a cheap - cheap mode.

QUERY Would it be accurate to say therefore, that if - when you lose your second if - if you lose your second CMG that we - one could immediately conclude that you'll - you've lost the balance of EREPs most of your ATMs, and any experiment requiring a maneuver. Would that be accurate?

HUTCHINSON No, I don't think that would be accurate to say at all. I think it would be accurate to say that we would have lost our ability to fine point the ATM at the Sun. Now, as to how much ATM data could be taken in that mode I don't know. We - o - we can run EREPs as long as you got some gas left, you know, as a matter of fact we've run an EREP in a 332 TACS deadband

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here 3 or 4 days ago, and we failed over to one going in it. You know it's d - it's a matter of budgeting. And I think the program would - would certainly assess the kind of priorities we wanted to place on longevity and staying up there and what it was we wanted to accomplish while we are up there and decide the maximum use - utilization could be made on propellants on board, for all I know it would be a compromise. We'd stay up a week and a half and do 5 more EREFs or we'd stay up 3 weeks and do none. And I - I'm not really sure. And I don't think anybody really has thought about it that far down the line yet. But there is some compromise there. And if you're willing to spend the gas you certainly can do the maneuvers.

QUERY Neil, knowing what you - you have seen here in the last couple of days about the CMG 2, are you giving any odds about it performing like CMG 1?

HUTCHINSON No sir. No - I - I don't par - feel any - personally any worse about it than I did after I talked to you here a couple of weeks ago on this same subject and we discussed probabilities of having a further CMG failure. I think it's - it's reasonable to look at the fact that we've had another occurrence of this thing, it's the third time it's happened and there's something there we don't understand and - and it certainly is a cause for concern but it's not a cause for alarm or anything. And I - I don't - I don't pretend and I don't think many people do pretend to understand the exact mechanism that we're seeing manifested here, since we've run these CMGs 3 or 4 times their mission life on the ground and never experienced anything of this nature. I - I side stepped you, I - gee, I don't know. There are no odds. I didn't answer you very well, but I answered you as well as I could cause I don't know what's going on inside the wheel, nobody else does either.

QUERY Let - let me make sure that I understood you when you did say that you had nothing to look at here on the ground, did you have -

HUTCHINSON Well that's not really true - I meant a - I would like to see in there and measure the amount of lubricant on the bearings and things like that. We do - temperatures on the bearings, wheel speed, wheel current and of course we have the performance of the wheel in terms when the computer issues a command to it whether it goes to the right place and so on and so forth. And it's not particularly well instrumented as far as the tape recorder goes we're out of sight. As you all know the only thing that we have is one phase of the wheel current out of sight. So unless we're over a ground station we got no temps, no wheel speed, now we don't have a wheel speed

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transducer on wheel 3, of course that's not the one that's
acting up. We u - we lost that early in the mission, early
back in SL-II, way back.

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MUTCHINSON - - no wheel speed. Now we don't have a wheel speed transducer on wheel three of course that's not the one that's acting up. That we lost that early in the Mission. Early back in SL-11 way back. But on this one that we've - we're talking about here CMG 2, we have a good wheel speed transducer, but you only get it real time.

QUERY You see no anomalous behavior on the part of CMG 3 though, I take it, other than this sensor loss?

MUTCHINSON That's correct, there have been no typical signatures that anybody can find in the data of CMG 3 that would indicate that it has this characteristic whatever it might be. Keeping in mind that we don't have a wheel speed transducer on it, of course we do have currents and they have been looked at very carefully.

QUERY Neil, I've got two questions from the Cape that were transmitted from a correspondent down there, let me read them to you. In view of the fact that the current crew has complained about being interrupted at duties, what would happen if the Flight Plan was such that the astronauts could get up and go to sleep when they felt like it and each were given an assignment or task which they could do at their own pace and to clarify this slightly, here is a for instance. The Science Pilot for instance do ATM and medical and exercise and work out his own time schedule. Would you care to comment please.

MUTCHINSON Well I think the science of Flight Planning has matured in the Skylab, I think that's one of the real - real bonuses we've managed to extract as far as ground operations go and I genuinely feel that and this is not meant in any way to reflect on the crew or anybody else, but I feel we can manage their time better than they can. Mainly because a lot of the activities in the vehicle require integration, for example, if you let the SPI exercise whenever he darn well pleased, 9 times out of 10 he'd want to exercise when somebody was trying to run a JOP 13 and mess up all the data, for example. So I really think that the Flight Planning thing is complicated enough and can be optimized to the extent that there's really no way that you could give a guy sort of a shopping list for today and say hey go off and do it and do that to three men and let them all go their separate ways and expect them not to end up running into one another, bumping heads both trying to do the same thing at the same time or doing things that conflict. Or that the vehicle can't support.

QUERY I think you've answered the second question but I'll pass it on anyway. Do you think that the psychological effect would be to have a more happy astronaut crew who would work more efficiently?

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HUTCHINSON Well I don't think there's anything wrong with this crew's efficiency and I think they're very happy. And I think that - you know we got off to a kind of slow start but we've gotten off to a slow start in all three of our missions in that - gosh we know that it will take a couple of weeks to really get tuned up and I think that the level of production here in the last week has just improved markedly and the crew's, I have not seen any indication that this crew has an attitude that's any different than any of the rest of them and that they are performing right up to what we expect, now you know as the days go on they get better and better and I think the real answer to that question is that I don't think the crew is disgruntled and I don't think the ground has disgruntled with their performance.

QUEEN Another long distance question, the last one. How long according to current estimates will the mission continue if you lose a second CMG?

HUTCHINSON Well we talked about that and it's speculative at the moment but if another CMG was indeed lost, I've said this before I suspect we wouldn't be in air more than a couple of more weeks after that occurrence. And that depends on how you chose to spend the remaining amount of attitude control gas you have both in the OWS and the CSM you could probably stretch that quite a bit if you for example decided to stay up for the purpose of getting medical runs, and so you wanted to stay up there as long as you possibly could, you know you might get three or four weeks out of it. I don't really have the exact figures but it's up in the weeks category.

PAO

No more questions? Thank you, Neil.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 6, 1973
4:24 p.m. CST

Participants:

Milton Windler, Flight Director
Robert Stevenson, Visual Observations, Scripps Oceanographic
Institute
Gene Marianetti, PAO

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PAO This is the change-of-shift briefing with Flight Director Milt Windler. We also have with us this afternoon, Dr. Robert Stevenson, Principal Investigator of the Visual Observations Program. Milt, why don't you recap today's activity? Then we'll give Dr. Stevenson an opportunity to talk about his program.

WINDLER Okay. Well we had another calm day, which I like to think is good. Commanded an M092 run, that was completed successfully. The - All the experiments went well. As you've already heard, they were - they looked at this eddy area down off the Yucatan and Dr. Stevenson will tell you about that later. Like to mention that people have been asking me about how the crew - what they think about their - or what I think about how they're performing. And Commander Carr put a lot of information on the tape last night. And I assume, that y'all have that. And I was going to ask they do get all of that. Day 340 or tape 340-3, or something like that. If you haven't read it, you'll need to read it. It's about 6 pages of his observations. He essentially says he thinks they're about the same thing I think I said yesterday, that they're getting along well at learning the various experiments and their proficiency is going up. He had some comments to make about what we should schedule him for on the day off and things like that. And, of course, as you recall, we said before the flight that we would frankly discuss the, you know, the things that - that we thought - areas that were confusing to us, or perhaps that they didn't understand. And they would do the same with us. So it's just a straight discussion with the ground, although, it's on the recorder about how to schedule their time. And it fits in pretty well, some of those things that we hadn't been doing, that we'll - we'll pay stricter attention to in the future - more attention to. But, as you well recognize, anything you say you're going to do sooner or later, you have to bend it a little bit one way or the other. So, there will continue to be some exceptions. Tomorrow we have another EREP pass. It's mostly for, I guess you'd call it the Caribbean and South America. It starts in the United States, but the Sun elevation angle is not very good. I think it just barely becomes good enough around the New Orleans area. But the pass is basically designed to go across South America. And we have an ATM darkside pass, you might say, one in which we - we point the ATM at a source in the sky and take data in the dark sky as opposed to the Sun. This is JOP 13. And we also have a Kohoutek maneuver planned. So we're looking forward to doing those maneuvers. We think

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It's only going to cost us around 8 mibs. And we expect that all to work out well. And we're getting into the part of the Flight Plan now, of course, where we've got a lot of maneuvering type activity going on. So we'll be seeing a lot more of that. And everybody has, also, asked me, I guess, about the - whether the crew has seen the comet. And after I left yesterday and they asked the crew, and they said yes, we have. So back a couple of days ago one of them had seen it, and I forgot which one. And the other ones saw it yesterday. So - So they've got it in site. And that's about where we are.

PAO You want to have - You have any questions for Milt so we can let him go? Louie.

QUERY Just one, Milt. I have kept up fairly well on the fuel budget for the TACS, but I'm not really up to date on it. Would you mind just summarizing whether you have changed your overall reserve? And how much you've used, and how much is left? And what will happen in this period of maneuvering activity that's coming up?

WINDLER I really - I can't get you a specific number. I don't have them. I don't remember what they are. We have reevaluated our end of mission reserve. We talked - looked at it closer. At one time we were planning to keep 10,000-pound seconds in reserve. And now we think we can reduce that based on actual experiences with this particular crew and in this particular mission. We've dropped that end of mission to a 6000. We have a - sort of a nominal - This gives us a nominal budget of around 500 pound-seconds a day. And, as you recall, one day here, I don't know what day it was, three or four days ago, we used 1200. Another day we used 700. I think these are the two - -

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WINDLER As you recall one day here, I don't know what day it was, 3 or 4 days ago, we used 1200, another day we used 700. I think those are the two big days. Let's see yesterday, we used about 150. Today we've used none. So, the usage rate probably in the last 4 or 5 days and I don't - I'll have to average the numbers - but my guess would be that this probably been in the order of 500 or a little bit less perhaps. And we see it as being - we see ourselves as being able to stay within this - this 500 pound-second budget from now until the end of the mission. And I - I don't think we're going to be seriously hampered by - by that capability. Of course as you recognize, we do have to change some of our maneuvering concepts in some case we have to add longer times to the maneuvers. We also sometimes have to use additional crew time to monitor the - the maneuver while it's going on. Also, during the period that the spacecraft is holding a certain attitude, and this is - has some effect on our experiment time, not - not a great deal.

QUERY Have you had - have you had to reduce the number of passes, Koshonok passes that require maneuvers or the number of EREPs or shorten the passes?

WINDLER Not because of propellant, the experiment hours are being reevaluated and being reallocated, I guess is the way to say it. And that's in progress right now. We feel like we're just about to what we might recognize as a standard way of operating. We're talking in terms of around 27 crew hours - total crew hours a day for - for experiment plus the - the small systems housekeeping time that's required, which is usually an hour or two a day, sometimes less than that, occasionally more. So, we - we're pretty well homing in on now what we think our sustained operation will be. As you - as I mentioned already there's some words on this transcript that tell what the crew day off should be like. They said they're willing to do an EREP and a certain number of ATM passes, and if they don't do an EREP they'll do additional ATM passes, this sort of thing. So, as I say this is now being reevaluated and the MRD requirements will be reduced certainly somewhat, but it is primarily a crew availability type thing as opposed to a propulsion or IAS consumables problem.

QUERY And does th - does this 27 total crew hours a day represent an increase or decrease from your previous estimates?

WINDLER Well, it's an increase from - from the nominal. It's a decrease it's lower than the Skylab III was able to accomplish. So, that's probably right, that's a good observation. They - they performed at a very high sustained rate, of course, this crew has to - is going to be

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there longer, 30, 40 percent longer depending on how you count it. So, their output is - for this period will probably be somewhat less per day.

PAO Tom?

QUERY Milton, you hav - we have made the last stateside EREP pass?

WINDLER For a while.

QUERY For a while, until - un - -

WINDLER Yes.

QUERY Until January.

WINDLER Something like that, forgot what day it is but it's in January, right. We'll probably take a little bit of data this time but it - it won't be - we're doing it - the pass is justified because of the other - the passes that are in the South American area, not because of the United States, but as long as we're going to be in Z-local vertical anyway, we can turn the instruments on. Right now, we're not to consumable limited, so we can try and get some data in you know, Louisiana, I guess Arkansas - that last little bit there just before it comes to the coast of the Gulf of Mexico. Oh, incidentally, I didn't mention it, you're probably already aware of this, the crew did perform a troubleshooting procedure on the 190A, and that's working satisfactory now, looks like that frame motion compensation is - image motion compensation is working okay. The forward motion compensation, I guess what FMC stands for. Is that right? Thank you. I use initials so much, I forget sometime what they're for, anyway it compensates for speed. We still have unexplained anomaly, I think and why all these mal-functions lights - film advanced mal lights came on, and people are still working on that.

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WINDLER All these malfunction lights - film advance mal lights came on and the people are still working on that. And I - it may be a long time before we figure that out, but the camera is working satisfactorily now - the cameras.

QUERY When are the next Kohoutek maneuvers?

WINDLER This afternoon.

QUERY Oh, okay are you going to have - after today when are the next Kohoutek - -

WINDLER Tomorrow.

QUERY They are going to maneuver too?

WINDLER Yes.

QUERY Okay - -

WINDLER Maybe I'm not answering the right question - -

QUERY Well.

WINDLER These are the corollary type Kohoutek maneuvers. Is that what you meant, or were you talking about the ATM Kohoutek?

QUERY The ATM and the - the other ones like they did yesterday.

WINDLER Yeah, I guess roughly we put them into two categories, maybe - maybe you can say three counting the EVA. But disregarding the EVA, we have the one that we've been doing in the last couple of days where we roll over at 60 degrees that I call a corollary type maneuver. And we're doing one of those this evening. I forgotten what time it is, a few hours from now. And we're doing another one tomorrow, and we'll continue to do those. The S183, if you're looking at today's flight plan or tomorrow's?

QUERY Tomorrow's.

WINDLER Okay, it's on there somewhere, at least I hope it is. And the ATM one comes way later in the mission and I'm not sure - it's several days from now, but it's on - way on down the stream from here. And that will be one way of pointing the ATM maneuver to spacecraft and point the ATM instruments at the comet.

QUERY Some of us were kind of wondering is - is there some constraint on their describing the - the comet or what they've seen, or - or on the ground asking them what they've seen of the comet. Noticed yesterday they - they finally performed this much touted Kohoutek maneuver to view the thing, and we never got any word until - -

WINDLER Well, now other people have asked me that question before and I - I guess - the problem is that the right now the comet is very dim as you're aware. We see some very good pictures of it, however there taken with telescopes.

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with a lot of magnification. The - they're looking - pardon -

QUERY Go ahead.

WINDLER Okay. Anyway, they're looking through the camera, and the camera doesn't enhance the image either, so they really haven't had any real good capability of seeing the comet or making any real good observations. The film that they're using is very sensitive, and - and it just hasn't been anything I think to say yet.

QUERY They both said - -

WINDLER Does that - did I not explain your question?

QUERY No that's fine.

WINDLER Did - well.

QUERY They both said last night, I think it was Carr and Pogue both said - -

QUERY That they saw it.

QUERY Yeah, that they saw it, but not for - -

WINDLER Yeah, there may be something on the dump tape on that I didn't look it up, but - but that's right. But I mean, I don't know what you expect. I went up and looked at it, and yes there's a comet. I guess it's a comet, it's a fuzzy looking object, and it's different from a star, and it's different from a plane, and it's definitely not the moon. I - I wouldn't - Okay, well I'm sure they don't look upon that as being anything, you know, of tremendous significance. And - and when they get to the point where they can do some good with it they will. Well, no you've got eddy currents. He's come to the rescue today.

PAO Anymore question for Milt? Thank you.

Doctor.

STEVENSON Well, let's see, I think I've talked to one or more of you, Paul Recer and I guess that's all. Is that right, other than Bob Gordon? He doesn't count. We'll maybe I should, if it's okay with Mr. Recer to hear this again, we'll start from the beginning. Last week was the first opportunity I've had to look at the SL-II S190A photographs. And in scanning the series of stereo pairs over the Gulf of Mexico and down past Yucatan and Honduras into the Caribbean Sea. There were in the photos in the Yucatan current part some features in the sea surface that could be observed because the Sun's - -

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STEVENSON - - some features in the sea-surface that could be observed because the Sun's reflection covered part of the field of view of the camera. And these features clearly indicated that there was turbulence where rotary type eddies in the current with diameters of from 10 to 40 miles. Some of these are strung together. They pile one right on top of each other, so a whole eddy system in a couple of the photographs was as much as 60 miles long. Now these interfered with the normal smoothly flowing ocean currents. And if you have the photograph, the copy of which I have in front of me, it's easily seen that there are some tiny typically tropical cumulus that are lined up like a row of popcorn balls. That's pretty typical of the tropical ocean. But these are tradewind cumulus, most commonly seen all over the tropics of the world. But, interfering with these linear patterns or linear lines of small puffy cumulus are what, I call, finger prints on the surface or pock-mark surface. And on the borders, portions of the borders of these pock-marks are huge build-up of cumulus, cumulonimbus, thunder-type clouds. And in the stereo pairs that were available in the original photography, you could easily see that these cumulus were putting out cirrus clouds, which means that they have reached altitudes of 25 to 30 thousand feet. So the cumulus on the boundaries of these eddies are carrying vast amounts of energy into the upper part of the atmosphere, whereas, the normal cumulus, which are formed over the gently flowing part of the current are fairly standard things and aren't doing much to the ocean or the atmosphere. Now, also, in the central portion of these turbulent eddies, the skies are basically clear. In this photograph it looks as if it's hazy, but actually what you're seeing there is a smoothly reflecting Sun glint from the surface. And so what appears to be haze in these fingerprints is really the reflection from the sea-surface. Although, you can see some very high cirrus clouds. With no clouds - Yeah, okay. Ask your question.

QUERY Could you point out things - -

STEVENSON Sure.

QUERY Could you point out different things in the photographs that we have? The different things that you're talking about?

STEVENSON All right. Okay. I've oriented the photograph with a number in the lower left corner, because that's really the proper orientation as close to a north-south direction as you can get. The pass was a northwest to southeast pass. So the photo's actually oriented in a direction slightly off from north and south. But if you

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hold the number in the lower left, then in the lower portion, lower half of the photograph and more towards the lower right, you see a whole series of these eddies about which I'm speaking. Okay? And the cloud - linear popcorn strings of cloud you see are moving from lower left towards upper right. So that's the direction of the wind. It just turns out the direction of the wind is almost the same direction as the current is flowing in that area, too. But that was, purely, coincidental on that day. In the very upper right corner of the photograph, you see another crescent shape arrangement of fairly sizeable cumulus clouds and also a clear water patch just to the left of that patch. That clear water patch is not quite as smooth looking as those in the lower right-hand corner. Now looking at the whole series of photos, which covered about a 400-mile stretch, there are clearly series, or a gradation of these eddies from those, which are just barely breaking the surface, which the one in the upper right is a good example. To those which are quite extremely breaking the surface of the sea, which those in the lower right are good examples. Okay. Is that a help? These are mechanical features. That is, they're turbulent features in the stream. And, as you know, anything freely moving, water, air, that moves along at some speed, moves not in a very smooth streamlined manner, but has turbulence within it. If any of you smoke, when you blow - -

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STEVENSON - - moves not in - in a very smooth streamline manner but has turbulence within it. If any of you smoke, when you blow out smoke you know it'll go out in a stream and then as it slows down you begin to get swirls and eddies in the stream. Well, that's precisely the way water moves, that's precisely the way air moves. But I think you can imagine the difficulty that an oceanographer would have in measuring these things or even know - knowing they existed because of their diameter. First of all, you put a ship in this photograph you can't see it. If a ship were to drive across one of these things it would take him probably 5 to 8 hours to get across, depending on the speed of the ship and the size of the eddy. So, this means that he doesn't even know what he's in, and by the time he got to one side or the other he's not sure why the water temperature may have changed. It may be because he's - he got there at nighttime, he thinks, or may be because he thinks he's on the edge of a current or something of this sort. So, it would be impossible to measure these things if you didn't know they were there in the first place. You'd just think you're getting a strange change in water temperatures. Furthermore, these things clearly move with the current, but because they're rotating they move at a slower speed, slower forward speed than the current. And we know from studying eddies in laboratories, that when you have an eddy in a stream it moves at about one fifth the forward velocity of the stream. That's because you're getting a backward rotation in addition to the other circulation. So, these things are going to move but they're going to move at a slower speed than the current is moving and in this part of the Caribbean Sea the current moves at about 2 to 3 knots. And it's going to move much faster you see, it - because it's funneling into that narrow gap between the Yucatan and Cuba, and then into the real narrow gap between Florida and Cuba and eventually you see this floods out into the Atlantic Ocean as the Gulf Stream, that is we're looking at kind of the root, now of the Gulf Stream. So, it's just beginning to pick up speed as it comes to the Yucatan Straits and into Florida Straits. Okay, have I confused everybody so far? Yeah, okay.

QUERY I'm not thoroughly confused, and I'll be glad to have you try it sometime. Two questions, the significance of this thing then - so far - do I - is there any other besides the two points you've made that the - these clouds associated with these eddies are carrying vast amounts of energy into the atmosphere in contrast to other clouds?

STEVENSON

Right.

QUERY

And that these are the roots of the Gulf

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STEVENSON Yeah. Maybe I shouldn't have said that the fact that the - the Yucatan current in effect is the - is the root of the Gulf Stream is really not significant to these things.

QUERY

What is this - -

STEVENSON

Or vice versa.

QUERY

All right - -

STEVENSON

They're not significant.

QUERY

Some - other significance - -

STEVENSON

Yeah, right, I haven't got to that yet.

QUERY

Okay.

STEVENSON

I thought I'd try to make sure you knew what we were looking at and how therefore easily - presumably you can all recognize that they're - once you know what they look like they're very easily seen from - from orbital altitudes, this is critical of course.

QUERY

A couple more basic things. How much area does the picture we're seeing cover?

STEVENSON These are about what John? A 100 kilo-meters?

SPEAKER

- - about 3500 square miles.

STEVENSON

Okay. So, in this picture then, nearly 40 percent of the picture or the area is covered by these features.

QUERY

And did you say that the - the current is moving at 2 to 3 miles per hour?

STEVENSON Two to three knots, yeah.

QUERY

Two or three knots. And - and do you have an idea how - how much - how slow the currents or the eddies then are moving?

STEVENSON No, I don't have any - any data on - on their forward velocity, other than the fact that in - in laboratory experiments, with currents flowing in a laboratory tank with eddies of this kind flowing in the tank, they move at about one fifth the forward speed. They move forward at about one fifth the speed of the velocity of the current.

So, you know that may be a handle, but since we've never seen these before - 10 days ago when - we haven't got too much information on them yet.

SPEAKER

Let me revise that figure. This is a photograph from S190A, and that's approximately 200 miles or something like 8,000 square miles.

STEVENSON

Eight thousand square miles.

SPEAKER

Yes, the S190B, the Earth terrain camera would be about 35 - 3600 square miles.

STEVENSON

Okay. So you see these cover a real big piece of the ocean.

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QUERY These eddies now, as I under - - like
what you would see - -
SPEAKER - - And you know little swirls - -
STEVENSON I think, they are - they do look like that,
although they're not formed in that way, but they do look
like that.

QUERY Okay.
STEVENSON But there's no obstruction here.
QUERY Yeah.
STEVENSON The water's deep, right.
QUERY So these would continue for som - some
time I mean these little - -

STEVENSON Sure.
QUERY Do you know approximately how far would
they continue and were you able to examine this in your film?
STEVENSON Well, the - the distance over the current
that the S190A caught these things in SL-II, was about 400
nautical miles. Now, it turns out that SL-III also,
photographed the same features in - just to the south of the
SL-II area, that is to - these were extended between the
east - northeastern tip of Yucatan Peninsula, which you know
bends out like so. And the tip of Honduras which sticks
out into the Caribbean Sea. Okay. Then - okay - so this
was SL-II, between Yucatan and Honduras, SL-III caught them
to the south of the tip of Honduras. Okay, so that then
extended the total area that we've seen for about another
300 miles, so let's say roughly 700 miles of the Caribbean
portion of the Yucatan current has these features at least
as seen in those two areas. Now, the queer question that
immediately comes to mind, is whether or not these are for
just sports, in other words were they freaks or temporary
events? And when you see them - -

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STEVENSON - - question that immediately comes to mind is whether or not these are - were just sports, in other words, were they freaks or temporary events? And when you see them in two sets of photographs, which differ in time by three months, you kind of come to the conclusion that they are not. But the question was, number one, can the crew see them, and number two, will they see them if they look? So yesterday afternoon, we sent a message up to try to describe these things as best we could verbally. And this morning in their pass, they looked, and all three looked, and all three saw. And they saw them throughout the entire length of that pass through the Caribbean sea. And, apparently, they saw them very easily. Easily recognizable and, further more, they - even though the Sun angle was very low and there should have been no Sun glint in their field of view. They still saw a color change from what they said was a dark blue water outside to the lighter blue water inside. Now that - that in itself is extremely significant. Because this means that the crew and their visual acuity - they can see subtle water color changes that they can't photograph. Now I don't think we ever knew that before.

PAO Doctor, I have a question handed me here. What is the technical name of the eddy phenomenon?

STEVENSON The - well the technical name is an eddy. It's a rotar - turbulent rotation of water or air, which will rotate in a circle or a subcircle, maybe an oval or ellipse, or a circle. And in this case, the axis of rotation is pointed straight down, so they're rotating around an axis, which is vertical. I don't know whether that answers the question. But, you know, the technical term is eddy.

QUERY Perhaps you were going to talk about this after this question, but what kinds of weather activity are the eddies associated with? Would they be associated with tropical storms or hurricanes? Could there be any length that you know of?

STEVENSON No, I don't think that the eddies are related to weather, but I'm not, therefore, saying that weather is not related to the eddies. Okay. In other words, I don't think that these are formed in any - under any atmospheric condition. In other words, they're not induced by an atmospheric condition, a weather condition. On the other hand, they are induced by the flow of the water. Okay. Now, the next point then is to talk about their significance. It's clear that in the central portion of these eddies the water is cold. That is colder than normal. If the water was as warm as the surrounding water, then there would be the formation of the small cumulus clouds over the eddies.

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But they're not. The skies are clear, as you can see. Furthermore on - on the borders of the eddies, particularly on the up, or on the down current border, and you can see in each case where you can see one of these eddies in the water, there's a buildup of large cumulus clouds in the direction the current is flowing, in this picture in the upper right-hand corner of the picture. Okay, this gives you three bits of information about the water temperature. First of all, where the small cumulus are formed the water temperature's normal for that area, probably about 80 degrees Fahrenheit. In the eddies, the water temperature's clearly less than that. It may be the order of 5 to 10 degrees less than that, although we don't have any information - any measurements so we don't know yet. And third, the water on the down current boundary is clearly far warmer than the water in the regular current, because over that part of the eddy, the boundary of the eddy, the water is inducing a great buildup of cumulus clouds, far greater than over the regular current. Normally, as warm ocean currents flow to the north, they're leaking out heat to the atmosphere. They're warmer than the atmosphere, heat is going from the ocean to the atmosphere. So they're continually losing that heat to the atmosphere at a relatively constant rate. And we pretty well can compute that rate. Inside the eddies, however, because the water now is colder there at the surface than surrounding, that water is receiving energy from the air. In other words, it's not losing, it's gaining energy. So we have the circumstance now, which is different from the theories we've been using. And that is that this ocean current, as it flows north, is gaining heat from the atmosphere in part of its flow and losing heat to the atmosphere in the other part. Previously we've always considered the water just to continuously lose heat at a rather slow rate. But on the borders of the eddies, now, on the down current borders, the water in generating these large cumulus is losing heat and water vapor, in this case, at a far greater rate than over the rest of the current. So we have a situation within this area of the current now, where our theories simply don't fit the situation. We have part of the water losing energy at a far greater rate than we had here to fore considered. We have part of the water gaining energy, the cold spots. And all of this is interposed on a normal condition, which is the one we'd always previously used. Now to give you an idea of what this means in trying to determine what kind of heat is being moved away from the equator, and of course, the only way we can really design our atmospheric forecasting models is to have a good solid understanding of - -

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STEVENSON - - forecasting models is to have a good solid understanding of the amount of heat that's available to form storms in the - in the latitudes - mid-latitudes, where we - most people live. We don't have a good understanding of the amount of heat energy available, then our atmospheric models simply don't meet reality. And of course, most of them don't meet reality anyway. But let me give you some examples of how thermal energy is moved from the equator north and south. Probably 10 years ago, the prime theory was that the atmosphere that is the winds, moving from the equator to the north and south carried most of the heat away from the equator. But, within the past year, we have obtained a lot more data, and so we have better estimates. For example: from the equator to 70 degrees north latitude, we now know that the ocean transports 40 percent of the total energy, 40 percent. So this means that the air transport from the equator to 70 degrees north, okay, from the equator to the Arctic Circle the air carries 60 percent, the ocean 40 percent. That's just double what we had earlier estimated. But in the latitude of the Yucatan current, which is roughly 20 degrees north, and so in the latitudes of all warm water currents in all oceans, the ocean carries 74 percent of the heat energy. So this means that north - you can see that north of 20 degrees, then its loss of heat becomes quite rapid. Okay, now if we use those general figures to try to therefore, devise an ocean atmosphere model for forecasting of storm conditions in latitudes away from the equator, if we use that general model, without now, taking into account the fact that all along the course of these currents we're having an unknown increase and an unknown rapid loss of energy over part of the system, and this case, we're looking at roughly 40 percent of the area. Then means our estimates of the heat at any given time can be as much as 40 percent off from our calculated theories. Now, there simply are no useable theories at the moment to account for this kind of circulation or this kind of turbulence in an ocean current, although everybody certainly has been aware that if the water moves in a current, you're going to have turbulence. Now since we've learned of these things only last week, we haven't had an opportunity to measure them. And what we're trying to set up now is an experiment before Skylab spl - before the Skylab crew splashes down, an experiment in mid-January, which will be about the next time that they'll be able to see these features over the Yucatan current because of the lighting conditions. Furthermore, we now know that the crew can see these things and recognize them very easily. And it's reasonable to believe that they not - they're not unique to Yucatan, they're in all similar ocean currents, in the Pacific, the Indian Ocean, the Atlantic. As a matter of fact, we've seen now just yesterday - this morning

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I guess it was, we've seen similar features in the Gulf Stream off Cape Hatteras. So we're going to ask the crew to do kind of a reconnaissance, you know, give us some - some estimate of the distribution of these features in other currents, so that we can have some handle on what kind of magnitude we're talking about in trying to redo a model.
Okay.

QUERY Do you think that this will explain some of the reasons why it's been difficult to forecast the paths of hurricanes? And would it now - would you think it now may be possible to forecast them a little more accurately?

STEVENSON Well, I'll answer that as an oceanographer, okay. If I were answering that as a meteorologist I'd say no. Because meteorologists have a tendency not to believe the ocean has much influence on the atmosphere. But, it's quite clear that the - the source of energy for a hurricane does come from the ocean. And that's pretty well accepted now that when the ocean temperatures fall below a particular critical temperature, hurricanes simply dissipate. So this is pretty good evidence. We do know that - that hurricanes have followed and do continue to follow, every one of them, paths, which are not always predicted. As a matter of fact, they do things that we don't understand why they do them. And sometimes they do them because we eventually find out there's been an atmospheric interference, that is, a high pressure system has caused them to deviate or a low pressure system, or an upper air low or something like this has guided them, but in other cases, none of these things have occurred, and yet the hurricane has done peculiar things. They've made loops, they've dived off in another direction and so forth and so on. And therefore, we seem to have some information that the ocean itself is creating a deviation, and clearly the deviation has to be caused by a change in the heat energy available from the ocean. Now, in this particular field of view, you expect the eye of a hurricane to cover most of this field, as the eye of a hurricane, being say 70 to 100 miles in diameter, it would cover most of this field of view, in this photograph. It does mean, also, that in about 60 percent of the area, there would be sufficient thermal energy to sustain the storm, but in the other 40 percent, there would not be sufficient thermal energy in the ocean to sustain the storm. And therefore, depending on the forward rate of the storm would pretty much depend on which way it moves. The hurricane is going to move in the direction where thermal energy is available, and away from the direction where it's unavailable. And we've seen this in some cases where it's fooling along the edge of an ocean current, you know, sometimes, it fools along the edge of the Gulf Stream and it hits

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the cold side and go back to the warm side. So what you're asking me to do is speculate, you see, far beyond anything I can really do with any assurance. But what I'm saying is that it's - these eddies clearly represent a thermal condition in the ocean that we didn't know existed. They clearly represent a - a - -

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STEVENSON - these eddies clearly represent a thermal condition in the ocean that we didn't know existed. They clearly represent a - a situation whereby the exchange of energy between the ocean and the atmosphere differs tremendously in a short distance. And all I can say is that they therefore have the possibility of creating ocean surface conditions which would decrease the energy available to hurricanes over a fairly sizeable area, an area big enough to influence the eye of a hurricane. But you know that's - I'm hanging by my fingernails when I say things like that.

QUERY Would - would it have any effect upon the path, would you think?

STEVENSON Well, again I say if there's any situation in the ocean whereby there is insufficient thermal energy available to the storm, and there's anyway that the storm can go to obtain thermal energy then it will move in that direction. So, okay by my taking an ex - speculative step. Well, I think there's other things which perhaps are rather interesting too. The fact that the crew saw a color difference between what they said what was the dark blue water outside and a lighter blue inside. I think is also of significance because if the water is indeed lighter blue, you know there is no river down there, there's no river putting any mud into the ocean. The lighter blue color could be due to possibly only one condition, and that's a greater amount of organic productivity. There is in other words, there's more - more animals growing in the center of these things than on the outside. Now the Gulf Stream and the Yucatan current in general has extremely low organic material in the surface waters, matter of fact it's almost zero. But there have been in the past studies by the International Marine Fisheries People in Yucatan, and in the southeastern Gulf of Mexico where they've encountered areas of usually high organic material. It's very difficult to understand those conditions when normally the waters are so devoid of organic material. Furthermore, in the past and I guess occasionally they still do the Japanese have fished for tuna in the Caribbean Sea, the Soviets have fished for tuna in the Caribbean Sea and the southern Gulf of Mexico. And these occurrences of tuna have been difficult to explain, because tuna normally like warm water but they also feed on fish that like cold water. And the question always was, where's the cold water that these fish are sitting in that the tuna like to feed from. So it seems possible therefore that these features which must have a persistence of several days if not weeks may account for some of these rather peculiar what we thought were peculiar associations of high seas fish, that is tuna

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and other kind of migratory fish in these waters. Now, in this - in this current the - the upper levels of the current have a - what we call a mixed layer in which the water temperature is almost the same from the top to the bottom of this mixed layer, and that mixed layer is about 300 feet deep. So this means that these eddies have got to be circular or have got to be extending through a depth greater than 300 feet in order to bring cold water to the surface, because the cold water is deeper than 300 feet. So they have at least that - that amount of influence in depth and they probably have, this probably goes down to 500 feet or greater. That's sufficiently deep to - to bring the - the more nutritive water up to the surface. So I think the prime - for my point of view and I think from everybody's point of view, the prime interest here is a totally unknown turbulent feature and therefore a totally un - previously unknown mechanism by which energy is transported. And - and this clearly has to be extremely significant to the development of - of both ocean and atmospheric forecasting models. And because there is no reason to believe that they don't exist in other areas of the ocean then it means it's a rather significant feature in ocean currents.

QUERY If these eddies occur in other warm currents, particularly ones that are in the tempered areas that were - that are subject storm fronts coming in from the Arctic, and stuff like that would these be big enough to cause these fronts as they come in the temperature contact to cause these fronts to give up their moisture for instance. I mean affect the weather like that.

STEVENSON Sure, certainly.

QUERY So in effect a front colliding with something like that could rain where as if these eddies weren't there it wouldn't.

STEVENSON They could, that's right, the atmosphere could lose it's thermal energy which would create rain. Right.

QUERY Over these eddies.

STEVENSON Right. You know every - every other condition being equal. Right, yeah. You mean - I think we we're - It's nice to speculate but I don't even have a water temperature measurement in these things yet, well, I -

QUERY Which brings up the other question. Do you plan to get, I - I guess you call it water truth or (garble) truth - -

STEVENSON Yeah, right, this is what we're going to try to do in mid January. The easiest thing to do is to get a - a long range aircraft flying over the area and drop, you know expendable temperature probes from the airplane that will

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give us a - a thermal profile of the water down to 1000 feet or something like this, and drop a series of of these so that we know we're getting you know one side through an eddy, and back to the other side again. And we what we're trying to do is get this flight timed at - at a Skylab orbit or timed with a Skylab orbit. And so that's why we're looking to mid-January which will be the next best time to look at them. It's not - it's an easy area to get to you know you - -

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STEVENSON Skylab orbit or timed with the Skylab orbit. And so that's why we're looking to mid-January which will be the next best time to look at them. It's not - it's an easy area to get to, you know, be tougher if we were trying to look for them in the Philippine Sea, for example, or the Indian Ocean, or something like that.

QUERY Okay, well, that - that leads into my next question. You said that you request that they do a kind of worldwide reconnaissance for these things.

STEVENSON Sure.

QUERY Could you name some of the other warm current areas - -

STEVENSON Well, clearly the Philippine Sea and the - the Japanese Current that eventually flows out of the Philippine Sea pass Taiwan and past Japan. That's the direct corollary with the Gulf Stream. And the water in the Philippine Sea would be, you know, a pretty direct corollary to the water in the Caribbean Sea. In the southern hemisphere the water flowing south in the Coral Sea from past Australia is - is the counterpart and the water flowing south along the Brazilian coast and the Atlantic Ocean would be the counterpart. And then there's the Benguela Current in the Indian Ocean, and also the current which is more less un-named that flows up in the Bay of Bengal and the - in the Indian Ocean. So there are any number of areas where we're going to ask them to look.

QUERY How do you spell that Benguela current?

STEVENSON B-e-n-g-u-e-l-a, Bengula. And tha - all of those currents are - have the same kind of temperature and flow conditions as the Yucatan current. The main difference is they're just not flowing through a strait as the Yucatan eventually does.

QUERY Wi - with something like this given and was large enough - and given all other factors were probable be big enough to affect say the monsoons in India, that come or do not come - -

STEVENSON No, no.

QUERY Something like that?

STEVENSON No. They - the monsoons are really major features of the Earth's atmosphere. You know, you're talking about the Asian continent versus the whole Indian and south-west Pacific Ocean, you know. That's a really - on the other hand, there's a very interesting situation that takes place in the e - Pacific equatorial current, and that is that there are occasions when for one reason or another the eastern part of the Pacific equatorial current is colder than normal. And the western part is - is warmer than normal, and th - when that happens it reverses the atmospheric circulation from

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west to east on the Equator. And it changes entirely the - the typhoons season, in the western Pacific. And the hurricane season in the eastern Pacific. And we just don't have a clue as to the - the mechanism which initiates this major deviation. Now it seems logical that - that in a current of that magnitude, which flows at about 3 knots, 2 to 3 knots, that these kind of features must also exist. But, the catch there is that the - this evenly heated mix layer, that I mentioned here was about 300 feet thick and in equatorial current is of the order of 500 to 600 feet thick, and so even though these things may exist, they may not be deep enough to break down to the cold water. But, on the other hand, maybe they are. So, we're going to ask them to look at the equatorial current system in the central Pacific.

QUERY Is it possible that there are differences of heating like this in some areas or straits in the temperate zones, so that you could find similar eddies further north?

STEVENSON I think these kinds of things are very likely in the current that flows into the Mediterranean Sea for example. And so I'm waiting for them to look at -

QUERY - - passage of the Straits of Magellan? Or around Cape Horn between that and the Antarctic?

STEVENSON I - the point there - that's a pretty interesting question. Because we have seen in photographs taken from Apollo, mainly in translunar injection because that's when they can get the whole Earth, but we have seen unusual massive areas of cumulus clouds over the south Pacific, South Atlantic, and Arctic - Antarctic Ocean, in areas where you really wouldn't expect cumulus to exist in such massive areas. You know because the water's cold, you know, it isn't warm like it is around the tropics. And we - we are, therefore asking this crew to look at an area just off the west coast of southern Chile, for another purpose but also for this, because there's an arteac wherea although you have quite cold water flowing from Antarctic up along the coast. There are occasions when you have very cold outbursts of air coming over that water from the interior of South America, and it may be therefore that we have occasions when the cold water from the Antarctic is actually warmer than the air under which it's flowing. And if that happens then this kind of condition is going to take place. I guess the best answer to your question is that we really know so little about the whole system that - -

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STEVENSON - I guess, the best answer to your question is, that we really know so little about the whole system. When you can find something new like this from, you know, from photography that's a very good clue that - or pretty primitive in our total understanding. As a matter of fact, I told someone today, and I don't know who it was, that there has never been a manned mission - There's never been any photography from a manned mission in which I didn't see something new, that I hadn't known existed in the ocean before, or that I didn't see something that I didn't know existed in that place before. But this is the best one yet.

PAO
STEVENSON

Any more questions? Thank you, Doctor.
Okay. Thank you.

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SKYLAB NEWS CENTER
Houston, Texas

SI IV - Change of Shift Briefing
Johnson Space Center
December 5, 1973
4:08 p.m. CST

Participants:

Milton Windler, Flight Director
Dr. Jerry Hordinsky, Flight Doctor
Terry White, PAO

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PAO Okay, change of shift briefing with Flight Director Milt Windler and the crew physician Dr. Jerry Hordinsky. Milt why don't you brush over the day's activities and then we'll go to questions.

WINDLER Okay, we thought we had a very good day today. The EREP pass was - was excellent. I think the crew's performance was super, and the weather cooperated and we had a real good day. We did wind up using 8 mibs which was a small amount. And I think we have the EREP maneuvers anyway, pretty well in hand, at least for the kind of conditions we have now. The crew did another medical run today without any known problems at all. And of course we'll get the data down later on. We're in the process right now presumably doing the maneuver for the 201 and we'll later on do another comet maneuver, a maneuver to take data on the comet. So there's a question here about all the excite about today's photography, and of course they're excited in anticipation, but we don't have the results yet to know whether the maneuver went okay or any comments from the crew, so really can't add too much to that. Tomorrow we don't have a EREP because the weather wasn't satisfactory. So we're going to make another medical run and do plan to spend a lot of time on ATM. We'll get several cprp;aru experiments out of the way and have one comet maneuver involved. So it's going be what probably be our standard operation in the future when the EREP ground tracks get unsatisfactory for the United States.

PAO Do you have any comments you want to add?

HORDINSKY Yes, at this point - no as far as the briefing on today's activities I'll let Milt address that. I'd like to just if - when the questions come up on the board general topics cover them.

PAO Milt, anything else to add before we go to questions?

WINDLER No that's - we can go to questions.

PAO Who's first, Sir? Howard, got a question.

QUERY Milt, what was the problem with the DAC they had today, did they lose some photography or something?

WINDLER There is an experiment that's a sort of a - a motion study type thing, if you want to call it that, M151. And they take install a DAC camera and take relatively slow running motion pictures to be used for observations of the crew performing various tasks. And that camera has malfunctioned before and it malfunctioned again today, and we have some time allocated in the flight plan tomorrow to do the troubleshooting on it. It's a - it's a kind of an

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experiment where we are able to get a lot of data on it because they - you know they do like EREP. For example they do the task over and over again. Of course the PI would like to observe the crew and their changes in proficiency as they do something, but it's perhaps not as critical to miss one of those runs as it is to miss another kind of a run, another experiment.

QUERY You were going to give us your evaluation tonight.

WINDLER Okay, I think the crew is - is progressing along very nicely. They were right up on the flight plan today. We're scheduling them just a little bit tighter you might say, not including quite so much extra time for the learning curve, although we haven't crossed the threshold of reducing the time significantly from their nominal pre-mission training. So I'd say that they're at least performing up to the, certainly to the normal standards that were expected in the training, and I expect them to continue to improve in their proficiency in doing these various tasks. We still haven't you know done a lot of the experiments - some of the experiments, and several of them we have done only one time. So we have a ways to go yet as far as getting into the repetition type operation. But you'd notice, if you listened to the EREP operation today for example that they've done many times, it was a very smooth operation. They made all the right calls, handled the malfunction, and it worked well, very well.

QUERY Ed at one point said he'd like to have more ti - not to be rushed so much, he'd like to have more time to sit back and think at the ATM rather than being told what to do every minute. Are you going to let him do that?

WINDLER Yes, there's time, in fact today there was some time in shopping list - not shopping list is probably not the right terminology, they call it viewing time where he pretty much is given time to do what he - what he wants to do. And we'll have more of this. Up till now the time has been at a premium as you well know, and the active regions have been kind of going away, and we've had a lot of surges in activity there. So we will have time. I forgot to mention tomorrow, a fairly significant thing, we'll launch another one of these calibration rockets for the ATM from White Sands, and we'll be doing an observing program in the afternoon that will be associated with that.

QUERY It's going to be in the afternoon some time?

WINDLER Yes, and the rocket is launched roughly around noon. Yes, I believe. I have the window here, let's see. 19:00 to 19:30 -

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WINDLER Yes, the rocket is launched roughly around noon.

WINDLER Yeah, I believe. I have the window here, let's see, 19:00 to 19:30 that's 13:00 to 13:30 local time. And we have to wait a few minutes for the - the pointing data to come up here to us so we know where to point the ATM instruments. And then we'll be running the rest of the afternoon basically, roughly from oh about 21:30 on. Next 3 or 4 revs, 3 revs there.

QUERY Do you know anymore about the 190A?

WINDLER No, well I do know a little bit about it. We apparently outsmarted ourselves in turning the mechanism in there, that screw that was adjusted. And as the crew suggested that by backing that off a little bit more, we could avoid the motion compensation from striking the stop and kind of jamming, you might say, and blowing that circuit breaker. And so we do need to make that adjustment, and we plan to make that tomorrow. As far as the problem - the reason the camera stopped, we still don't understand that. And - and it's apparently not related to the motion - motion compensation, and even though it appeared to be. So I don't have any better words for you on - the thing seems to have run very well today though, so we - plan on pressing on.

QUERY You - you may have answered this question or someone else has, but I can't remember now. In this - this current series of EREPs before you lose - lose good lighting when will the last one be?

WINDLER We don't have one tomorrow because of the weather. And I think it's doubtful about the next day because of the lighting. So, we may have already come to the end of the present series. I haven't looked at the weather on down the road, but we are essentially getting to the threshold of being too late.

QUERY It would definitely be this week sometime.

WINDLER Yes. That's for the United States of course, Continental United States. There's other opportunities in other parts of the world.

QUERY How much more EREP outside the United States will you be doing. You know like one or two a week, or do you have some idea like that in between these two periods of state-side EREP.

WINDLER Well, this is a educated guess and put the category in it. I think we'll probably do a - a wind up doing on the order of about two a week, every maybe every other day or something like that. It depends on what other activities are going on. As we get into the high density comet activity, it will probably be less than that unless there is really some-

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thing really unusual happening. There are several volcanoes that are erupting around the world, and that's of interest of course. However, it's kind of hard to justify making an EREP pass for just - you know - just one task site. But if it turns out that there is a track that's particularly attractive, why, we would perhaps be able to do that one.

QUERY Have they given any indication of being able to see the comet with the naked eye yet? Do you know, I haven't heard of any but?

WINDLER No, I haven't either. I haven't really asked that particular question other than a couple days ago they did, probably more than that now, they mentioned they could see it with the binoculars, but I haven't heard them say they could see it. I don't think you can. I looked at it yesterday morning and I - this morning I mean, and it's still pretty dim.

QUERY Dr. Hordinsky could you give us a good evaluation of the crew and the state of their health right now?

HORDINSKY From the straight point of illness, there are none, there are no illnesses. And there's a question here that could perhaps be answered at the same time. Does this crew appear to be suffering more or less, or about the same cardiovascular deconditioning? Certainly not more. Now the problem in the sense of this crew is its greater variability of response. And the M092 principal investigators could probably you know give you the numbers that show how variable this is. For instance the run today, no one really knows how - absolutely how Ed Gibson is going to do, or has done, because we'll hear that data in due course tonight. But the types of failures they've had have been within the range of the types of failures they had on the prior two missions, and both as to the time of the mission and as to the type of response that's demonstrated during the failure - the type of blood pressure called pulse pressure narrowing, blood pressure drop, heart rate increase. In other words there's nothing unique in failures per se. The only uniqueness you might say is the more randomness and greater unpredictability. And they have not really you would call absolutely stabilized in that regard, but they certainly not giving evidence of more deconditioning than any other two crews at this time.

QUERY All three of them, I think, have had problems with the lower body negative pressure, having to stop runs early and so on. Is that primarily because of low blood - blood pressure I think it was?

HORDINSKY Well, the type of response, first I guess it pays to point out that Gibson and Pogue had rather sudden onsets of symptoms and a dropping out of the blood pressure.

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SPEAKER Gibson and Fogue had rather sudden onsets of symptoms and a dropping out of the blood pressure at about 4 minutes into 50-millimeters. And that Carr, actually in his termination, had symptoms and an increasing heart rate - at already at the beginning of delta 50 and he sort of as it were tolerated the symptoms to about the middle of delta 50. But the pattern, when it finally goes, is the systolic and diastolic pressures tend to approach each other, your pulse pressure narrows and you then get the very obvious explanation why the fellow feels dizzy or faint as - as that becomes then his dominant symptom. And usually at that point or before that becomes significant, they punch out or have it punched out for them. So, like I say, that - that's the pattern response. But I do want to - point out this difference in two of the men from the third as to the time of onset of this rather precipitous change in the parameters at the time of failure.

QUERY Then you would say they were in very good health right now? No problem.

SPEAKER Yes, definitely so.

QUERY Could you give us a little insight into what these private medical conferences are like at night, what type of questions do you ask them and so on?

SPEAKER Well, I tell you, in a sense, probably the best generalization is to look upon them as - in the format of a patient doctor conversation in the office. You - to get the most out of the conversation, duration is usually between 5 and 10 minutes, you more or less just have to structure it according to the body systems. If you don't have as it were, another category that's been a specific problem that day, you know, to address. If - if you don't, then I merely try to review the body systems and that way I feel I get the most information for the time available. And if we catch a point, it may or may not be finished up that night, and may continue it on the subsequent evenings. By points, I mean this could be anywhere from the kind of discussions that involve themselves at time of their early motion sickness, to the dryness of the skin, the head fullness, the nasal congestion. You pick it. These aren't illnesses per se, but these are the things we've seen in adaptation to zero g that persist and these are the kind of things that we've discussed, either on single days or on consecutive days. And I might add, it's not considered an illness, as such, but a factor of their level of fatigue and their level of adaptation to their input workload. The workload asked of them. These are the kind of things that are discussed too. Because, as you expect you know it's the old conglomerate mental and physical health. So we - Wherever it's appropriate we focus on that subject.

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QUERY Would you compare them at this stage of the flight with the previous two crews at this stage -
SPEAKER On what -
QUERY On 20 days - after 20 days in general health.
SPEAKER In general health, good. As I say, in this - really it's in the lower body negative pressure area that they perhaps stand out on this veribility a little bit, but in terms of their response to the other experiments, everything is - As I say, they're experiments, but we use them for monitoring their health too, obviously. The - for instance, the vectorcardiogram, the inputs from the PI, were that there were no - significant changes, nothing for any health problems. On the 171, also, the 131 data is good and solid, it shows Gibson doing much like Kerwin showing deeper stages during the sleep that he does get. But I want to stress that - they fit into the - well with- in the health - good health limits of the data on all these things. Now one of the things that the PI in the 92 brought out today was that - their calf girth of this crew has not decreased as much as the calf girth of the prior two crews. Although during the lower body negative pressure itself, they get a rather significant distention, change of leg volume. Now why they have less calf girth loss, may very well be answered by the presense of the treadmill. That may or may not be the answer why they get such a significant distention when they are exposed maybe even what seems to be more distention of the leg to lower body negative pressure than the other two crews - that's a speculation. But it seems to be what's happening. Those are merely a couple of deltas that have you know become obvious, but again not pointing to anything health endangering.

QUERY Are they getting as much exercise as you would like them to get?

SPEAKER Well, I've - I was even looking at that quite closely. They have been really slowly increasing the amount that they actually do. They have an hour and a half allotted. They actually exercise - at least some part of their body is moving in an exercise fashion for between 40 to 50 minutes of that time. And they have pretty much - at least the last the last few days, they have stabilized on an exercise protocol, man to man. They've got - each has their own little favorite. Gibson tends to be most erratic in that he - there were a couple of days where he dropped out his exercise. But I would say, you know, to be specific in the response to your question, yes, I'm satisfied that they are adhering to a - what I would consider a satisfactory protocol, but I do hope, and I'm sure the crew plans to increase the amount of actual time exercising within the hour and a half block even. And I'm

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talking about expanding the hour and a half, but just getting more out of that hour and a half.

QUERY

Yeah.

PAO

Tom Beldon.

QUERY

Dr. Hordinsky, they - the crew doesn't - this crew doesn't talk a great deal during - during the day. I was - my question is - is very general about how you would evaluate their - their total mental and - and - mental health right now. How - what is their attitude like and also do they - or have they felt fatigued - now that - that they have gotten their flight - flight plan fair - fairly well squared away? Does the average flight plan - do they feel fatigued at the end of the day, or do - do they feel like they've done a good day's work and they are not ex - exceptionally tired. It's just that they have done a normal day's work.

SPEAKER

Well, the first part about the mental health, I'd say, their mental health is excellent. Really their - their personality - they reflect it in some of the early dump tapes that they put down comments as to why they thought they were getting behind and reflecting -

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QUERY (garble)

HORDINSKY Well the first part about the mental health, I'd say their mental health is excellent. Really their - their personality that they reflected in some of their early dump tapes that they put down comments as to why they thought they were getting behind and reflecting their frustrations really, in my mind just showed they have pretty good insight into what's going on with them as far as trying to adapt both to zero g and the workload that's coming their way. These - I'd say that the heaviest volume of comments from them were probably between day 7 and 10, that's at least the ones that crossed my desk. And these - if you check back on those days they're explaining why they think they are getting behind. And they're doing - there's contribution of commentary from each one of them. Now between that time and now it's - let me see been little over a week, I think probably - well there's no question the mental health stayed fine, but I'm just saying they documented the reasons for their irritation. And I think the flight planners have responded appropriately. We have held up as a group the amount that - of work that's been inputted or requested of them as compared to the other 2 crews. And then getting to the thing about fatigue, recent fatigue. You know they were all quite dominate in their comments about fatigue back in the early phase. But in the last few days it's been primarily Gibson asking that he be allowed to get the amount of sleep which he considers normal, 8 hours plus minus, closer to 8 hours than to 6, 6-1/2 which he had been averaging. The last couple of nights he's been having that, so I suppose in a sense you almost have to wait for a little feedback on a daily basis to see how well this is coming - how well of an effect you're getting from the fact that he is now sleeping 8 hours. And the other 2 fellows haven't complained so much of fatigue as a direct factor, I'd say that if they think they're getting too much work it probably shows up more as a element of irritation. They just comment on it to the ground. And this is where - up comes this question of do you think the crew talks less than the other crews. Well, if talking to Dr. Buchanon just coincidentally on that topic earlier today, you know the SL III crew surgeon. He mentioned there were several points in the mid part of SL III where the crew really talked very little also. And you see there are phases to life up there as it were where people sort of get - working hard and heavy and really just don't reference back to the ground as often unless it's really necessary. I don't know if you can explain away the quiet now on that basis but - because in addition to that there's just the fact that this crew is keeping busy. They are

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working up to what they think is - what they can well do, and they just don't talk. It may reflect their on personality, no more than that. You know sometimes the simplest answer is the best one.

PAO

Howard.

QUERY The first 2 crews reached a plateau at a certain time - more or less a plateau and I'm wondering, do these people seem to be approaching a plateau?

HORDINSKY

A plateau of work efficiency?

QUERY

Yes, and also -

HORDINSKY

Maybe Milt could comment on that. I'd asked Milt about that and I think it would probably be best if he would comment on that as to how they are adapting to the exact items in the time line.

WINDLER

I think they're still climbing towards this plateau, I don't think they have gotten there yet. But they're - they've obviously progressed quite a bit since they first started doing the experiment activities.

QUERY

(garble) So they'll be there?

WINDLER

I would think so. They will have had all the various experiments by then.

PAO

Any further questions?

QUERY

One more for Milt. What is the Kohoutek experiment tomorrow? You mentioned one I think.

WINDLER

S060 - no S - yes - no it's not 201, I'm looking for it and can't find it, 183. In fact we do that almost all the day tomorrow as far as the corollary is concerned the solar airlock. And 1, 2, 3 of those plus 1 for the Kohoutek.

PAO

Okay, any of Mary Bub's questions unanswered there before we wind it up?

QUERY

There is a question here about Dr. Gibson having problems getting enough sleep and if he is why is he not taking sleeping medication.

HORDINSKY

The getting enough sleep I think is based on operational - has been based on operational problems, not because he's had difficulty getting to sleep. That's why this question about sleeping medication really doesn't quite fit what's actually been happening. And this question about exercise, slowness of the crew in adapting to zero g and besides that (garble).

WINDLER

They're probably getting as much - question about getting as much average exercise as planned, I think they are.

HORDINSKY

Well yes I - in a sense I think that maybe that was answered earlier. but we're were saying that they're

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going to fill out that hour and half a little more effectively as time goes on. They've got a pretty good plateau now, but they'll probably improve.

WINDLER In fact that may be part of the operational evidence as you might say. I think this crew is - seems like to me they've been more conscientious about the exercise. I know Conrad of course came back and said the exercise was really a good thing. And Bean I think probably did it more so, but even Al's crew - times when I think that when he didn't say much about it they did tend to do the exercise late or they - they had to slow down on it some. But I would get the impression, and I haven't looked at the numbers, but I think this crew's probably been pretty - they have more exercise time, and I think they - and more different kinds of devices. So I think they are probably doing pretty well in exercise -

HORDINSKY Right (garble) actually they beat the SL II crew completely. It's true the SL II crew didn't have as many devices, but in terms of that old parameter that we count by watt minutes the SL II crew is averaging maybe 2000 to 3000 watt minutes per man and these guys are now putting out a measureable exercise between 4 and 5000 for the CDR and the SPT and the P - I'm sorry and the PLT and the SPT has been running on those days where he definitely rides the bike up to 7000 to 8000. So - and I might mention that compares to SL III quite favorably. In fact toward the end of the mission when they were doing quite regular exercise in SL III, the CDR was at approximately 6000, and the SPT, the smaller of the group, was at 5000, and Lousma kept up at around 8000.

PAO
thing, did he?

HORDINSKY

PAO

Thank you very much.

Right, not yet.

Okay, I guess that wraps it up then.

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SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
December 4, 1973
4:52 pm CST

Participants:

Milt Windler, Flight Director
Terry White, PAO

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PAO Okay, we're ready to start here, change-of-shift flight director briefing with Milton Windler. Why don't you run down the day's happenings and then go to questions.

WINDLER I'm going to leave, I can't answer any of those questions right there. (Laughter). We - I think had another good day today, might touch base with the crew - the crew performance seem to be - be very good. They did the M092 run this afternoon and I don't - we didn't get any results from it of course yet because it was - most of it was done out of contact with the ground station. So - but they seem to be keeping up with the timeline in good fashion and I think that we're continuing to see an increase in their capability and proficiency and they're still on the upward swing on the learning curve. I said yesterday they - it would be a couple of days before I could tell you what I thought of it - how long it would be or how they were doing, so well, I'll have to try and tell you that tomorrow. The EREP today was a good one; the weather turned out to be very good. It essentially, as probably you are already aware of, started down around the central part of California - Southern California and went down across I think probably touched a little bit in Nevada and on down through into Mexico and into - into Central America, and on into South America. And I said yesterday that the geothermal features were in Southern California that wasn't exactly correct, cause it was one as far down as - the last one was in Guatemala. The rest of them were in - were up in the Southern California, I think perhaps in the - just over the border there in - in the Arizona area but primarily in Southern California. The question is asked here from Mary Bubb (?), about why the - can I tell in simple terms why the maneuvers today used less gas than the other maneuvers and will the technique be used again? Now, I don't know how simple I can make it. It'll have to be fairly simple cause I - I don't know that much about it. But, I think I indicated to you that as the maneuver cost is a function of the point in the orbit at which you decide to leave solar interial and go into Z-local vertical to take the Earth resources pictures. And as you pass through solar noon or local noon, orbital noon, whatever you chose to call it - of course essentially, not counting the beta angle but the Earth resources attitude and the solar interial attitude are the same. And today, we - we went into the Z-local vertical maneuver at noon, where the - the attitude change was essentially zero, or very small. I think it had about 19 degrees in it to take out the beta angle, 14 degrees, I've forgotten the exact number. in for complete re - revolution all the way around week ago - again at noon on the next pass. And this reason why the - the cost was

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considerably less. The obvious question is how come we haven't been doing this all along? And there's two disadvantages to this method. One is the fact that we are of course out of the proper configuration to get the power from the Sun for a long period of time; we're - we're maneuvering through a complete revolution which reduces the solar energy on the - on the - on the solar cells. The second one is that it does take more of the crew time to do it this way; we're occupied with a maneuver and the associated activities for a longer period of time. And it did cost us part of a AIM pass today when we - when we decided early in the morning to - to use this technique. We had to give up one that we had previously thought that we could get. And that's the reasons why we hadn't been doing it earlier. However, it's working out so well and we're having such a hard time in making the - the EREP passes work out using the other technique that this method looks like the best compromise. And, in fact, we have better confidence in the monitoring of this maneuver now. And this would relieve us somewhat of the crew constraint, in that we - we expect to be able to use the SPT, Ed Gibby, to - to do useful AIM work right up until the time of the maneuver and also right after the maneuver ends. What about these maneuvers also - another feature of them is they tend to be short, like 4 minutes instead of the 20 and 30 minute maneuvers that we've experienced in the past. So, we think that this - -

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WINDLER - - instead of the 20 and 30 minute maneuvers that we've experienced in the past. So we think that this - the advantages out way the disadvantages. And we - still think that even though tonight we going to turn off the command module fuel cells, we still think that we'll be able to handle the power requirements doing this for the next 2 or 3 days while we do these - last of the Earth resources runs over the United States. And then we'll be looking at - over the next couple of weeks, looking at different techniques and perhaps can come up with something better for the EREPs that will be occurring later on in January. And that's about where we are, I think. If there are any questions I'll be glad to try and answer them.

PAO Howard.

QUERY I noticed tomorrow you've got quite a bit of maneuver associated with the Kohoutek, the S201 and S063 - S63. What did the computer run show as far as the TACS usage on that.

SPEAKER Well we have a good computer for that; we have experience. We really haven't completed the runs when I left; they were still evaluating those. But those two runs are both very similar to runs that were made in the past that didn't - I think one of them cost us one mib and the other one was zero, so we have a pretty high degree of confidence that there won't be any problem with that. The one that you recall that we had so much trouble with before was the barium cloud experiment. And there was a large maneuver associated with that, over, I believe, a hundred degrees in one axis and - oh, 30 or 40 in another. And these are both just rolls of about 65 degrees. And as I say, we've done a similar maneuvers before and I feel pretty good about it.

QUERY How many mibs have you used today.

WINDLER 34 total. I believe it was 178 pound-seconds is the cost of that.

PAO John (garbled)

WINDLER That number must not be right it must be 158, I guess. I'm not really sure of that pound-second number, but 34 is the number of mibs.

QUERY Do you know more about the problem with the S190A?

WINDLER No we really don't, as you know they have a common shutter mechanism so it synchronizes the cameras. And the crew is quite properly - two times now you could say gone through the malfunction procedure to evaluate it. And we're still trying to think of something that we can do that would further pin down the problem, but it looks like it's something that's malfunctioned in the drivemechanism. And we're -

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right now don't have any real good ideas on how we can fix that; of course, all through the night people will be working on ways to do it. Right now our best effort is just to recycle the circuit breaker and check the power cable. And there's some talk of checking the - part of the shutter mechanism but that's still very much in work.

PAO Howard.

QUERY How much are you losing by not having any S190A.

SPEAKER Well it's - I don't know exactly how to put a quantity type value on that. As you know, that was considered to be one of the prime sources of data before the mission started. It's a group of six cameras which have different kinds of film loaded in them and they're all bore sites to work at the same place. And it's very useful to tool to get that different type of spectral response. And it has been the most popular, I guess you could say, sensor that was requested by the scientific community. However, I would like to point out that the Earth terrain camera was a relative late comer to the stable of Earth resources instruments, and it's turned out to be a very excellent performer. The resolution on it is even better on it than the 190A, of course, it doesn't have the advantage of being a multispectral type of instrument. However, we do have two different kinds of film that we can put in it so that does give us some capability in that area. I'd also point out that something, I don't know how much publicity this has gotten, but the 192 instrument is a very complexed instrument. It's got many channels and I guess there was a lot of skepticism as to whether or not the instrument would work or whether the data reconstruction part that goes on the ground would work. And that's turned out to work very well. What little bit of film that I've seen put together from all little bits that they bring back on the magnetic tapes is, I think, very impressive. The resolution is good and I believe the scientific community is very happy with that. And that - I believe those two things tend to make the potential loss of the 190A somewhat less of an impact, but certainly we - we have - if we've lost an 190A, we've certainly lost a useful tool, there's no question about that.

QUERY Did - Did you - would you have lost any of the geothermal data, for instance.

WINDLER Yes, we certainly would have lost some of it, however, we - we did have the other instruments on. And we did probably did get the first set of pictures which would include some of those sites, but we certainly didn't get all of it. I guess as best that we can tell it - the first

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sequence worked okay.

QUERY I have one other question, did - is
Kohoutek close enough so that -

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WINDLER We can tell that the first sequence worked okay.

QUERY I have one other question. Wou - is Kohoutek close enough so that when they look through these instruments like, S063 201, tomorrow, they'll be able to see the comet, do you think? Very fairly - -

WINDLER They have said to date that they haven't been able to see it. The magnification in the - in the lens systems that they're looking through now is not really very - very - in fact some of them are not as good as the naked eye. So, there's no enhancement there and I doubt very seriously that they will be able to see it. They did say of course earlier that they had seen it with - with the binoculars on board. And, I know, I've gone out and looked at it - looked for it and it's not easy to find and there of course it's not - not bright enough yet for them to see it with their - with the naked eye. Although it had been reports of people seeing it from two different places on the ground, at least two that I know about, perhaps there's been more.

PAO Tom? Any further questions?

WINDLER They - there's a question here about compared to the first two crews do doctors think that this crew is showing more or less or about the same amount of de-conditioning due to zero g at this point in time? I really don't feel like I can - I can answer that. I haven't looked at the - the data with the other two crews and I'd like to ask that we answer that tomorrow with a - with a surgeon or somebody from the medical world that can give you a more meaningful comparison. I can - I can only speak that you know operationally how - how they seem to do and I think we've already said that - that they're probably not quite as proficient at this point as the Skylab-III crew was, or at least they haven't been able to get as far ahead of what we consider to be the nominal as Skylab-III did. But they - they're gradually getting there. And the other question is what kind of things will the photos of Kohoutek being taken tomorrow try to determine? And here again, I'm not a very good one to answer this one either. The two - the one - one of the two experiments - both of them really mostly work in the ultraviolet range, particularly the S201 experiment which you know we already carried a - the same experiment essentially to the Moon, and took pictures of the - of the sky from the Moon and it - turned out very well. But what we're trying to do of course is to add to the spectral knowledge of the comet by - by taking the pictures tomorrow. Now, we don't get the data back of course till after the fact, but I was noticing in a report that they mentioned today about the brightness and so forth, I believe it was an

SL-IV PC41C/2
Time: 16:52 CST
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element called sodium D, that they were looking for in - in the comet. And if they found that in the next couple of days it was going to be a very good indication of the - of the ultimate magnitude of the comet as it went through perihelion presumably in - indicating how at - this element would be out gasing and would be helping to increase the incandescence of the visable incandescence of the comet. So they are looking at these kinds of things and in general, the massive study of Kohoutek, of course is to try to get the spectral signature of the comet and to learn a lot more about the different elements. And the way - manner in which the - they're given off at what - what they're relation is to the Sun and that sort of thing. An interesting observation was made today about - by some of the people that - that work in the solar physics world and ATM world. As you're probably are aware we've had several activities associated with these active regions that are just now going around the limb of the sun. And there were several surges today that were observed from the ground and the crew observed a - in some cases the - you might say the residual effects, they didn't come around from behind the Earth in time to see some of the earlier ones. But they have gotten flares previously a couple - yesterday I guess it was, and perhaps some before that. But anyway, this solar wind is - is almost pointed in the direction of the - of the comet itself and it may be observed - to the particular eruptions that we've seen today wou - would not - are not in the right direction to strike the comet or to effect it. But in just a few more days as this active region rotates around behind the Sun, it will have a potential for having some - some effect on it. So it would be interesting to observe that phenomenon.

QUERY You got any feel for what the EREP is going to be looking for tomorrow? On track 20?

WINDLER Yes, that track goes through the - I guess you'd call it the central southwestern part of the United States, comes down across Texas and crosses the Rio Grande Valley. They'll be looking at some sites down around Weslaco, Texas which is a research station the - Department of Agriculture and - and then it continues on down through Central America and winds up in the northern part of South America. And they'll be doing some mapping studies and this agriculture - I don't believe there's - the weather's so good there's not any storm or that-oceanographic or meteorology type things going on.

PAO

Okay. Thanks very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
December 3, 1973
4:31 pm CST

Participants:

Milton Windler, Flight Director
Terry White, PAO

SL-IV PC 40A/1
TIME: 16:31 CST
12/3/73

PAO Okay, change-of-shift briefing with Milton Windler and go.

WINDLER Yeah I think we had a good day today, we did two EREP passes back-to-back and we were able to monitor the maneuver and the crew and I think we're beginning to understand quite a bit more about the idiosyncrasies of some of these control laws that govern the way the OWS operates and it causes sometimes to use excessive TACS. We used around 800 pound-seconds today, a little bit more than our so-called nominal average, we're trying to stay in the order of around 500 pounds but we did two passes today and we expected to use in the order of around 650 and so we were not too much over that. The crew I think is continuing to improve in their operations, look like they were getting all their Flight Plan activities done, in fact one of the items that wasn't set up to do until around, noon local time was actually done early in the morning so we think that they continue to get more proficient as they go along. They're in the process or were when I - probably they're through now and doing another medical run and I haven't got the results on that well I'm sure that will be told to you later on. Tomorrow we are looking at another Earth resources pass. Right now it's a little bit different type of pass than we've done before and it's more toward the sunset and it really, right now the control system won't hold the attitude quite good enough to get the kind of data we want so we're looking at ways of modifying some of the parameters there and we may find that we are not able to do that particular pass. We also expect to be able to over the night and early in tomorrow to evaluate the comet maneuvers and get a better feel on what the problems if any that might exist in doing those Kohoutek support maneuvers. And I guess that's - no real system problems that I can recall, we're coming up to what we think is going to be nominal Skylab-IV mission.

PAO Paul.

QUERY I didn't quite understand about the EREP, you mean the possibility that you won't have one at all or are youcribe one of them or what?

WINDLER No, tomorrow we only have one scheduled anyway because of the weather and in the preliminary schedule, we might have to not do that one. That's correct.

QUERY Can you go into a little more detail on the reasons why you may not?

WINDLER The cluster is up against the control gyro gimbal stops and it drifts out of attitude and it doesn't hold the attitude well enough to - with the kind of TACS firing that we're getting. I predicted that, that is of course, it's not holding the attitude well enough to take the data that we want - the Earth resources data.

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QUERY What - Go ahead.

WINDLER Well I was going to tell you, the thing that happened today, we got up against the stops during the maneuver itself today, but during the actual Z-LV maneuver the gyros were off the stops and they controlled it and held the attitude satisfactorily through the maneuvers on both of the passes today. Whereas tomorrow, it's predicted that they will be bumping the stops with the small firings that we've experienced in the past, that's not good when you're doing the data takes, of course because it's not - the attitude keeps drifting off.

QUERY What are the factors that are different about the one tomorrow as compared to today?

WINDLER Well, there's a couple of things that are different, each data take time is different or can be different, it turns that the last three or four that we've had have all been about the same time of day; they've been taken over the United States and I say the day, I'm referring to the orbital day, the day-night-sunrise-sunset time. This one is at a different part in the day orbit and apparently it's I think you're well aware we don't completely understand all of the parameters and how they all affect us. We know that the maneuver time has a very pronounced effect. That is whether we take 12 minutes to get in from solar inertial to Z-local vertical or 15 minutes or what have you has a pronounced effect and apparently we of course from both analytical and in simulator work that it occurred before the mission even started and since the mission's been going on we knew that the time you went into -

END OF TAPE

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WINDLER - - occurred before the mission even started and since the mission has been going on we knew that the time that he went into the - the orbit that you did the Z-LV. I think you can easily see if - for example, if you go into it at noon, the maneuver required is - is not any. And all you have to do is to set up a rate, whereas if you go into it at midnight, then you have to essentially do a you might all it 180 degree maneuver. So, it's that kind of effect, and we're doing this at a later point in the orbit than we have been, more towards the sunrise part of the orbit I suppose - I'm sorry, more towards the sunset part as opposed to early after sunrise that we've been doing it in the past.

QUERY What - what time of day, Houston time would it be? What time of day would it be how - how far ahead of sunset - -

WINDLER Okay.

QUERY And - and - -

WINDLER That has nothing to do with the time of the Houston day.

QUERY I realize that.

WINDLER Oh, okay. And, I don't know the answer it's - it's in the morning along about 9 or 10 o'clock as the other ones have been, is when the overall FREP pass is scheduled.

QUERY Any details about sites that you're aiming at and what you'll miss if you don't get it?

WINDLER No, I can't tell you there. They're - they're sites off the west coast and it's - we're looking for some so called geothermal type sites that - where we're looking at hot spots and - in the Earth. You recall we tried to get some of these in the last mission around New Zealand, for example. And we didn't get them on that pass either.

QUERY Are - are these geothermal sites in California or - or - -

WINDLER Yes.

PAO Tom?

QUERY Let me make sure I understand that the problem with the maneuver that - that you would like to do tomorrow is that you - you be using TACS at - at - to hold the attitude (garble) after the maneuver? And that would upset the - -

WINDLER During - during the data take itself.

QUERY During the data take itself and this - this would upset how accurate you could be in the pointing and that sort of thing?

WINDLER Yes. We - of course we require to be fairly stable while we are actually taking the data.

QUERY And how much - how much total TACS would you - would you - do you think that you might use in - in

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this - -

WINDLER Tomorrow?

QUERY Uh-huh.

WINDLER I don't have that number the - the - they were still jockeying around with the parameters and the numbers hadn't settled down when I left. And I don't really - I can't tell you the - the number that we're liable to arrive at. Right now the primary problem though is not the quantity but it was the attitude, stability or whatever you want to call it, the pointing control part of it.

QUERY What - what - how many more data takes or how many more EREP passes of this sort do - do you foresee? Where it - where you - you would into a problem using too much TACS just to hold the vehicle so you could take data accurately? It would - are - are there enough of them - -

WINDLER I - I can't give you a meaningful answer to that question because each one of them - the way - we don't know enough about it right now to be able to look at it in advance and say, you know the 40 passes that we might do, this number would be - give us a problem and this number would not. We - we essentially think we - we'll get the - a large number of passes we're getting the monitoring scheme down and we're able to control the - the TACS usage to - to a level that is satisfactory and maybe more important is that we know in advance a much better, you know when we have problems and what - what it is going to cost us.

PAO Paul.

QUERY From - from my understanding if - if you decide that you can't do this one tomorrow, and why would you go ahead and relinquish any chance of having an EREP in the view of the fact that you're losing daylight altogether on the eighth and I understand per - it's pretty precious and couldn't you do another track?

WINDLER Tomorrow you mean?

QUERY Yeah.

WINDLER Well, the weather doesn't look very good for other tracks. So, it doesn't look like it's the right thing to do for tomorrow. We - we've been evaluating that.

QUERY I take it the odds are pretty good - -

WINDLER As one time as a matter of fact we had two - we had it two days ago we had two tracks scheduled for tomorrow and we had to drop one of those because of the weather already.

QUERY Can you give us the odds on the chances you think that they might actually have one on tomorrow, EREP?

WINDLER Sure I can give you odds, 75 percent.

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QUERY Against - -
WINDLER Probability, for.
QUERY For, okay. And - -
WINDLER What are you going to do with that number,
could I ask? (laughter).
QUERY It'll give us an evaluation as to what we
intend to write about. (Laughter). Could you define pound-
seconds for us?
WINDLER Oh, me. Well, it's a pound of thrust for
a period of a second. I - I probably can't give you a real
detail type answer. It's - it's a measure of the control
system capability, let's put it that way, kind of like
analogous to horsepower. Which is - okay.
PAO Or foot-pound.
QUERY It's a pound of thrust for 1 second?
WINDLER Yes.
PAO I got one question here - -
WINDLER Oh.
PAO From Mary (garble) if you might - -
WINDLER Okay. The question is, are you satisfied
with the decrease use of fuel, but since - I - I guess let
me answer that one.

END OF TAPE

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WINDLER - - question is, are you satisfied with the decrease use of fuel. But since - I guess, let me answer that one first. We're not as satisfied as we'd like to be, but we're - we're getting there. We're - as I've indicated already, we're - we - each day we feel like we know a lot more about it. In particular today, I felt real good because the correlation in particular with the Skylab simulator, the one over in the crew procedures area, was - was very good. The correlation was very good. Says since more fuel was used than anticipated, will it be necessary to cut any EREPs in the future? I think it's kind of early to be saying that. I think we still think there will be more opportunity limited than - than we are fuel limited. And right now, I don't know any reason to - to change that estimate.

PAO Further questions here? Tom?

QUERY Milt, you said that you believe we are still - and I'm paraphrasing here - you're still coming up toward what you think is a nominal mission. Do - do you think that -

WINDLER You - you're referring to the crews amount of comments regarding the crew performance and activities today?

QUERY Right, right.

WINDLER I guess my, of course, our experience with Skylab III, we - we kind of look upon that as the - as a goal that we'd like to get it. I don't know if we'll ever get there on this particular mission because, for one thing, of course, the hardware is not doing the same things that it was doing then. But I think as far as the - the basic crew proficiency, they are continuing to improve and they're - that's what I had reference to that we were still seeing improvements and I think they're well on their way towards - to that high level of proficiency.

QUERY In - in other words, you don't think they - they have reached their - their highest level of proficiency yet?

WINDLER No, I don't think they have yet, no.

QUERY You have any idea about - you know - when or where that might come?

WINDLER No, I've got day shifts for 3 more days, so why don't you try me about 2 days from now? I'll be able to tell you a lot better then.

PAO Paul.

QUERY As I recall, the fuel cells in the CM room playout day after tomorrow. Is this going to require any crew activities as to shutting them down or anything like that?

WINDLER Oh, yes. That's very small amount, though. Configuring a spacecraft for that situation. We

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and that (garble) is scheduled tomorrow towards the latter part of the day. Yes.

QUERY When you lose that additional power that you're getting from the CM, are you going to have to reconfigure or make any changes in the - as far as the power getting from the other sources?

WINDLER Of course, that depends on - from - from EREP pass to EREP pass as you're well aware. In fact, the control system limitations that we in trying to reduce the size of the data take. In addition to the fact we don't have as many sites that we're trying to cover as we used to. All tend to make that power situation better - it doesn't require any more. To date, we haven't had to do anything and we - As you're aware, we - we did some capacity tests that showed the batteries to have not degraded as much as we were afraid that they might have. So right now, the power situation looks real good, and we - we do have the capability of - very easy capability to command from the ground five, six, or seven hundred watts of - of power without any real problems at all. And also the crew can make some power adjustments that doesn't - just little - almost like a thermostat setting, you might say. That's very easy to do, not - not time consuming. That gives us a capability. So I think that with those two things that we are not going to have any trouble with the power system pending any kind of further problem, of course.

QUERY You said that you're doing sims on Kohoutek viewing. Do you expect to have the results on that? Do you have any feel on that as to how TACS traumatic that will be?

WINDLER I wouldn't even try to predict that. That's - I hope they'll tell you something about it tomorrow night, though.

PAO It will become easier as the comet gets closer to the Sun, won't it? Less maneuvering to do.

WINDLER Yeah, in some cases, it will be. Especially when it gets right next to it. (Laughter) That depends on the instrument we're looking at it with, of course.

PAO Any more?

WINDLER It'll be a piece of cake with it's - with - with the ATM instruments.

PAO Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 2, 1973
5:00 p.m. CST

Participants:

Phil Shaffer, Flight Director
Ronald Lerdal, G&S Officer
Terry White, PAO

SL-IV PC39A/1
TIME: 17:00 CST
12/2/73

PAO
Phil Shaffer and his G&S officer Ron Lerdal - L-e-r-d-a-l. Did I spell that right?

LERDAL
PAO
Right.
Okay and Phil why don't you run down through the day and then we'll go to questions. Today was the first day we've done back-to-back EREPs with the two-CMG configuration and it reminds me a lot of learning to ride a bicycle. We're kind of bruised up a little. We used 960 pound-seconds of TACS on the first EREP and used about 200 pound-seconds on the second EREP with - on the order of a 100 pound-seconds over that part of which is attributed to the problems we had with the first one was used in between the two EREP passes and then used subsequently after the last one. And the only reason I point that out is that as I keep telling y'all our predictions are only good to 4 or 5 mibs and I think we got the high side of what was going to be required after the second EREP pass was over. The first EREP pass and the problems are not fully understood yet and the reason I say that is that all of the simulators again the simulator we have at Mission Control that Ron and his guys run, the Skylab simulator over at Building 5 all agreed that we didn't have a problem today. Although, if we did change some things in the way we executed those maneuvers, particularly the time we took to do the maneuvers we could get into a problem. The gimbal angles today at Carnarvon, you know we come up Carnarvon, Guam and then LOS over the Pacific and the maneuver starts the CMG gimbal angles which in the past 2 or 3 days had been tracking our predictions pretty closely did not at Carnarvon this time. And Ron and his guys and the people at STAC reran the first EREP pass with the gimbal angles and therefore the momentum state that we had at Carnarvon and it still looked okay, no problems. We saw - Ron, did we see the beginning of the maneuver to Z-LV on the first one or did we pick it up during the maneuver at Goldstone?

LERDAL
On the first one, we picked it up, we did not see the initiation.
SHAFFER
But at Goldstone AOS the gimbal angles were tracking the predictions again and we say "Hot dog Buddies, we are home free."

LERDAL
That was seen during the middle of the maneuver.
SHAFFER
Yeah, in the middle of the maneuver. And when we got to the point where it stops the maneuver to

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Z-LV attitude and ramps in the race to maintain Z-local vertical, the thing went and did and looked just exactly like those runs to get us in trouble. Like we had the wrong maneuver time or something and people are scrambling very busily now to try to understand exactly what happened, if you remember 3 or 4 days ago I told you that there were some places in the logic that apparently a choice has to be made and that it's a very sensitive problem and that we were still having trouble getting the 110 percent confidence level in our predictions. So we used three times as much as we expected today on the first FREP pass. The rest of the day as you know is a day off with ATM activities, by the way we did both the data takes in the EREPS, we got both of the EREP passes. It just - it cost more than we wanted them to.

END OF TAPE

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SPEAKER With ATM activity. By the way we did both the data takes in the EREP. We got both of the EREP passes at this - it cost more than we wanted them to. The rest of the day was normal. Tomorrow it's back to back EREPs again, looks very very similar to what we did today. The data takes are a little bit shorter, and the ground tracks that we're doing are essentially 200 miles east, both of the ground tracks we did today. The rest of the day is made up with a major medical run. And I've forgotten who that's on right now, and ATM activity. Ron do you want to add anything to the problem today before we go for questions?

SPEAKER No, I believe you've covered it fine, Phil.

QUERY Phil if it comes up tomorrow that you're - you use as much TACS as you used today, what will be your thinking tomorrow afternoon about the EREP from there on?

LERDAL You mean if the predictions show that we're going to use as much or if we actually use that much?

QUERY Both.

LERDAL Well, it's almost a definition that the predictions won't show we used that much because we won't do the EREPs if they cost that much. That is my opinion at this point, that we - that we have the Kohoutek exercises and the rest of the mission to fly. And we cannot go plan - flight plans that use that kind of TACS. Okay we've got - we're too early to start doing that yet. If it uses that much TACS, we're going to have to try to understand why it did. But let me say that - that the TACS loss today, or TACS use is not a waste because we're a whole lot smarter now than we were before. And one of the things that we now know is that the symptoms of at least this particular problem are very discrete, and we can see it coming. And the fact of the matter is, if we had taken action 20 to 30 seconds earlier than we did - is that a fair number?

SPEAKER Right.

SPEAKER Then in fact we would not - we would have used 400 pound seconds less. Okay, but as I've told you for the past several days we are in a high incline learning curve yet. And today we've - it was - it was - the signature was there. And we knew it was there, but we had never new data, first time, all around say we're good, no way to get into it, and 20 seconds made the difference, 30 seconds. Tomorrow, since we now recognize the signature, and because the kind of problems we'll get into tomorrow are identical to the kind of problems we had today, we will use that 20 to 30 seconds lead time, and it will not cost us much. That does not preclude a completely

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different problem than - that we haven't uncovered to date or haven't seen in the simulations. Okay. But the problem we had today is now a known problem with a known signature and a known response to the problem.

QUERY We were told when this problem first originated, I think it was the EREP or some - no it was on the barium cloud maneuver - that the operational reserve of TACS was 10,000, and now we have problems and suddenly the operational reserve we are told is 5,000. Is there some reason for the change?

SPEAKER Well, that's a very interesting question. We're conservatives, and you know that, don't you. Okay, and when we established the 10,000 pound operational reserve we were all very very comfortable with it and anticipated absolutely no problems of staying above it. Okay, it was super comfortable. At the time we established it, we knew that the hard line identified questions or requirements plus a reasonable pad was a lot closer to 5,000 than it was 10,000, Okay. But we went ahead and established it at 10,000 anyway. Besides being conservative there's at least one good technical reason for doing that, and that is when you violate that red line, however arbitrary it was that you stop and make a conscious decision to go below it, okay. Now when the CMG 1 failed, the reevaluation of that red line to get rid of the conservatism in it and get it to the requirements began the change over to the 5000-pound seconds is not a result of the problems we've had with 2 CMGs but rather -

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SHAFFER - - began the changeover to the 5000 pound-seconds is not a result of the problems we had with two CMGs, but rather an anticipation that we were going to have some problems and that the TACS usage was really going to be quite a bit higher than we had expected. That way, you're seeing now in the change of - of the red line which I might add is not firm yet, that's the working number right now - is a response to the CMG problem itself, not a response to the problem we're having here. And getting rid of the - the hard line conservation that it - Still conservative, by the way.

QUERY What does that 5000 allow you to do, and why are you holding it in reserve?

SHAFFER 5000 pound-seconds of TACS let us stay in steady state solar inertial with two CMGs for 10 days, minimum. It allows me to try to dock twice and fail to dock, and then successfully dock, as we did on both SL-II and SL-IV. It allows me to do an EVA. And it's got a 40 percent pad on it.

QUERY You want to cut it that short, so you have to - you're talking about 10 days to fly a rescue mission and that type of thing my - and -

SHAFFER How - - ah - I flipped one right past you. All of those things that I just told you about, the requirements cost 3000 pound-seconds. And we've added 2000 onto it, so we're not cutting it short. I mean, it is still a conservative number.

QUERY Back to what you were saying earlier. I'm not quite clear about this 20 to 30 seconds lead (garble) type thing. Would you explain what you can do to save yourself 400 pound-seconds.

SHAFFER Let - Let Ron field that one. He's been worried about it all day.

LERDAL Yeah, it's bothered me because the thing that happens is we're looking at the vehicle's attitude when it completes its maneuver to Z-LV. And it's at Z-LV attitude, in other words, it's right at the attitude at that point in orbit. Now it has to crank in the rate, the pitch rate, to keep it in Z-local vertical attitude. And at that point, if it falters, it immediately starts going out of attitude and today, what I saw was a good Z-LV attitude, but we had those gimbal problems and it started putting in the rate, the orb rate, keeping Z-LV attitude. And at one minute, that one data point, and we're at attitude and everything was fine, and all of a sudden, the vehicle started building up a rate in the X-axis because it was trying to use everything it had to put in the orb rate in the Y-axis. And it started - started rolling over in X and by the time that I had punched out the commands to force it to TACS only, that X rate was almost a

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tenth of a degree per second. And that means that in 10 seconds, the vehicle has already gone 1 degree, and in 20 seconds it's gone 2 degrees. And today, it took - normally it takes me about 10 seconds to send up the commands, and today, I had a problem the first time I pushed the button. And it took me about 9 seconds to recover from that to make sure that my systems were okay, before I send another command. And so in that 20-second time span there, the vehicle had moved 2 degrees. And the point at which I had intended - the vehicle was about 3-1/2 degrees out of attitude in the X-axis. When I initially wanted to go to TACS only control and in the subsequent 20 minutes, it had gone out 2 more degrees in 20 seconds, it had gone out 2 more degrees. And the problem arises in that if we can recognize that we have a problem and get it into TACS only before the X attitude gets out 3 degrees or the Y and Z get out 2 degrees, we can save a lot of TACS because of the way the TACS deadbands operate. Now, in other words, we were out of the X attitude deadband when we went to TACS only and that causes a lot more TACS firing because it tries to get back in the deadband very quickly, as fast as it can. But if we're within those deadbands before we go to TACS only, then all the vehicle has to do is basically hold the attitude where it's at.

SHAFFER Do you - you guys understand the problems - that the problem originates when the CMGs are asked to deliver so much energy and produce a rotational rate, and then in a process of doing that, they get against the stops and are unable to deliver the energy. Then - that is no relief from that. And the choice that I alluded to earlier is in which direction the CMGs are going to go if the thing is sitting there instead of being at - at center line where it can go 50-50, but if it's setting at 70-30 and all the simulations and everything show that it's going to go the way of 70 which is a max available energy, and it goes the other way, and gets on stop. That's when we get in trouble. Okay, that - that's what Ron's telling you about, when - when we see where the thing is and we know which way it's going to go, and it's supposed to go the right way on the energy and doesn't and it goes the other way, and hits the stop. And then the attitude goes away because there's no energy left to hold it, then we're in it. And that's what I'm saying by discrete signature of the problem, at least for the cases we had today. It's a direction, the gimbal angles on the CMGs went plus the attitude losing attitude control that Ron's mentioned to you.

QUERY How much TACS do you have left now, or - do you have a figure on that?

LERDAL It's about 28,000 and 200 pound-seconds, roughly.

SL-1V PC39C/3
Time: 17:00 CST
12/2/73

QUERY And you're definitely going to go ahead
with these two EREPs tomorrow, is there anything overnight
in the data that's - that could make you scrub them?
LERDAL Nothing in the data, unless something
breaks which is highly unlikely, but, I think what you mean
is -

END OF TAPE

SL-IV PC39D/1
TIME: 17:00 CST
12/2/73

LERDAL. Nothing the data, unless something breaks which is highly unlikely, but I think what you mean is in our evaluations and running our simulators over night is there any reason that we would scrub them in - all I can say is there could be that possibility but these are very, very prime EREPS and we may come up like you know, like Phil said we're in a big learning curve and we're getting smarter and we learned a lot today and the guys that are on tonight may learn more from what happened today and we may come up a little bit smarter and be able to do these EREPS without a tremendous expense in TACS fuel.

SHAFFER If every run we run tonight, every simulation goes the wrong way and we're guaranteed that the situation we had today and by guarantee I mean 60 percent chance 70 percent, 80 percent chance occurs, then there's going to be some very serious sole searching go on to determine if these EREP passes are worth it. But there are a very many great number of things that Ron and his guys and the guys that relieved them can do to try to preclude that problem. And that's what's going to go on tonight.

QUERY Are the two remaining CMG's responding as you would respect, I mean is there any evidence of anything at all wrong with them.

LERDAL We haven't noticed anything abnormal about their two remaining CMGS, they're perking along very well.

SHAFFER Well other than we got a broken tacometer on one of them, which has been broken for months.

QUERY Will any of the Kohoutek maneuvers, for to observe Kohoutek put as severe strain as an EREP?

SHAFFER I'm going to let Ron try that one first and then I'll come later after I've pulled myself together.

LERDAL I think that the Kohoutek maneuvers really are not quite - they're not the same as a Z local vertical maneuver in that the fact that in a Kohoutek all we do is maneuver to some arbitrary well it's not arbitrary attitude but a specific attitude to point a specific instrument at Kohoutek. We maneuver to that attitude in ~~hold~~ right there and we don't try to put any more rates in the vehicle, in other words we put in rates and then we stop those rates and simply hold the attitude versus the ZLV where we put in rates stop those rates and then put in the ZLV, the (garble) attitude and some studies have shown that it appears that the Kohoutek maneuvers, probably won't be quite as traumatic as doing ZLV's.

QUERY Probably?

LERDAL That's right I can not say definitely we haven't done that many studies -

SL-IV PC39D/2
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SHAFFER That's what I wanted to follow up with. We have been so busy working the EREP problem, that we have not treated the Kohoutek exercises in anywhere near the same depth. But the fact of the matter is the maneuvers are smaller than the EREP maneuvers they are steady state maneuvers, you go over there and set there and then come back instead of putting all the different maneuvers in. The other fact of the matter is that the S232 barium cloud exercise which is a go over there and sit still and come back gave us a problem. But there are always - all I would like to leave you with on that is that we have not studied those things in the - in the depth yet because we're not to the point in the mission where we've got to do them. Okay and that's why Ron has to say probably, he can't conclude anything for you yet.

QUERY Let me understand, there is in fact then an element of uncertainty in regard to maneuvering properly to observe Kohoutek then.

SHAFFER Because of ignorance, we haven't studied yet in the right depth and at this point you're absolutely correct there is an element of uncertainty because we don't have that data yet.

QUERY Would it be more likely that if you got into further problems that Kohoutek or EREP might be curtailed first or - or would one have a priority over the other one, if you had to.

SHAFFER Currently, Kohoutek has the priority and whatever it is we do between now and December the 9 - 8, we're running out of EREPS at this point because we're getting the wrong sun angles, you know the EREPS are very early in the morning and they tend to be getting somewhat earlier and I believe it's the 8th or 9th and then the quote EREP window closes and there aren't any EREPS to speak of, then like I think it's one a week or something on the schedule and I've forgotten what the ground tracks are and then it becomes a Kohoutek exercise. And we're not going to do anything between now and the close of that window, that jeopardizes the Kohoutek investigation. That give you one other data point, that I could stand a couple more days like today which I'm not going to have and it still have not jeopardized Kohoutek.

QUERY The EREP window reopens though I believe in January doesn't it?

SHAFFER (Garble) Kohoutek is over.

END OF TAPE

SL-IV PC-39E/1
Time: 17:00 CST
12/2/73

QUERY The EREP window reopens though I believe
in January, doesn't it?
SHAFFER And Kohoutek is over.
QUERY And Kohoutek is over?
SHAFFER Well you're in the tail-end of the Kohoutek
investigation.

QUERY The post-solar period. How about the EREPs
for January, are they endangered?

SHAFFER Well they got the same problems. You
know, but it's a different class of problem in that the big
maneuvers now are coming at the beginning of an EREP pass
because they're in the early morning side of the orbit.
You got a big maneuver to do to get into the Z-LV attitude,
and then you got a big rate to establish going back. Now
when the EREPs are in the afternoon you may have a very
small maneuver to get into EREP and all you got to do is
start the orb rate and then you got a big maneuver to do to
get back out. And you got no data - you're ignorant.

LERDAL That's right.

QUERY Well let me go at it another way then.
When the mission was launched there was - the goal was 50
EREPs. How does that number look to you now?

SHAFFER Not very good.

QUERY Not very good?

SHAFFER No.

QUERY What would be a more logical, reasonable
number to shoot for at this point in time, would you guess?

SHAFFER Probably something less than 40. I
wanted to - but let me qualify, that's not all due to the
TACS problem. We got started late. We were supposed to
launch a week earlier than we did, 5 days earlier than we
did. Okay, and once we got in the air we slipped EVA, which
was originally on day 4 of the mission to day 7, and EREP
checkout came late, and all of those things cost an EREP
pass. And I - I would estimate that we were down 10
EREP passes - 8 to 10 EREP passes just because of the slip
in launch plus the delay in getting the EREP equipment
checked out and ready to use. So to say that I've gone
from 50 to 40 because of the TACS problem is hardly the
right thing to do. And I would just off the top of my head
estimate, I would look forward to 35, 30 to 35 EREP passes
is kind of no problem. Is that fair Ron, based on what you
know now?

LERDAL Yes, the way we are going now I believe
so. And Mike Phil says we're getting smarter.

PAO Further questions? Why don't you
field those questions from Mary up there?

SHAFFER Mary, I guess the only question that I

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don't feel like's answered now is how many flares did the crew see today and what size. And the answer to that is 1, it was an M-2, they caught it just before the peak, so we missed the rise, and we took some data on it but not very much because we were coming up on the EREP pass and it - and we didn't catch the rise and we really need to catch the rise. There was another flare of C-3 that one of these satellite observatories reported to us and we did take some data on the collapse of that flare. But in terms of what the crew - how many the crew detected the M-2 flare but we were too late to catch the rise and then we asked them to look at the C-3 flare later on this afternoon.

PAO Any further questions? Thank you very much.

END OF TAPE

MEYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 1, 1973
16:31 CST

Participants:

Phil Shaffer, Flight Director
Terry White, PAO

SL-IV PC38A/1
TIME: 16:31 CST
12/1/73

PAO Okay, let's get rolling here in the change-of-shift briefing with Flight Director Phil Shaffer.

SNAPPER With a short "a."

PAO Yes, with a short "a," For purposes of the transcript, we have a bare quorum here. The UPI represented, Phil.

SNAPPER Okay, today was a trouble-free day, if you will, with the only problem that we had to address, the only new problem a residual from yesterday. The S183 instrument is still breaking glass or we had found some more broken glass entered on the slides that are used to take the data. I can't say a whole lot more about that, the guys are continuing to look at it and analyze and we don't really know what's wrong with it, but one of the magazines broke a slide last night and we don't know why, we're still looking at it. We did the EREP pass again today that came down across the local area and through the HATS area. And it was very much like yesterday except we did one thing different late this morning, well late is about 6 o'clock. We took the momentum state directly from the vehicle, via telemetry and ran the prediction again and we came within 1 mib today, 5 pounds-seconds. We used 39 mibs and that late run predicted 33 and it's about 200 pound-seconds of TACS. Again very encouraging, we're learning about that and the crew's performance again was flawless on this one, just no mistakes at all. The rest of the day has been relatively quiet with the medical runs and ATM activity. Yesterday if you remember the canister did not uncage at one of the sunrises, it subsequently did uncage as I told you and today we've been operations normal, and we've had no problems with that. The continued analysis that went on beginning from the unmanned phase and kind of culminated overnight last night has indicated to us that we really don't have to wait if we catch it in time. You know when the thing doesn't uncage, some of the motors are setting at stall and they warm up and if we catch it in time, we can go ahead and try to uncage it then. And there's no reason to think it won't work because it - our best estimate at this time is it's mechanical jamming of some kind that we don't know the mechanism of it yet but the analysis shows that in an additional 2 or 3 cycles on the uncaging device will not hurt it so we uplinked procedures to the crew today that if it does not uncage when they're running it to go ahead and reset the logic and try it again and we'll do the same thing on the ground here. The difference between the manned operations and the unattended operations, you know we run the unattended is that it will always be longer as a general statement between failure and uncaged and when we first

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it uncaged so things will be hotter and we may have to wait and let it cool off from the motors being stalled, then it's just a matter of doing it. But it's all ops for the ATM all day today and for the foreseeable future. Tomorrow is the crew day off so we're only going to do two EREP passes and 5 ATM passes and the Science conference and take showers. But other than that it's a day off. The EREP passes are back to back and it's a new challenge for us with our momentum management, TACS management problems and the guys are still working very hard to try to minimize that and Rusty Schweikart has been with us most of the day and is running the same cases in the Skylab simulator now to try to get some more data on how that's going to go. But we think we're going to be able to do it -

END OF TAPE

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SHAFFER - - and is running the same cases in the Skylab simulator now to try to get some more data on how that's going to go. Bu we think we're going to be able to do it and we'll find out tomorrow. Bruce, anybody with questions?

QUERY A couple, have we had any more things go bump in the night or anything like that?

SHAFFER No sir, and we don't have any explanations either.

QUERY On the back to back EREP tomorrow, do you go back to solar inertial after the first one?

SHAFFER Yes, you do that for a couple of reasons number 1, thermal and number 2 electrical. You know while you're in the Z-LV attitude you roll out the Beta angle and you go through the pitch and you tend to point the solar arrays away from the Sun so your electrical energy available goes down. And with the meteoroid shield gone, you also have pointed the sail away so the vehicle would tend to warm up so we don't spend any more time out of solar inertial than is required.

QUERY Well, how are the tracks set up then? Because I had been told that they didn't go back to solar inertial because it was track 34 begin - and the beginning of 35?

SHAFFER Well premission and by premission I mean pre SL-I before we had electrical problems and thermal problems and now with the attitude maneuver units and problems the passes were a lot longer, like 40-minute data takes were not unusual at all. And when you're doing that length of data takes, you start the maneuver to Z-local vertical in the dark and you come out of Z-local vertical in the dark, so there is no electrical thermal advantage to be had. But now the pass is typically half that length, 20 to - let's see today we were 23 minutes doing the data takes. And we did the maneuvers in sunlight so it's a different situation. Now we don't get to do a momentum dump or any of that kind of stuff we just get back over there and charge up the batteries.

QUERY Well are you - are the EREP passes on separate orbits?

SHAFFER

QUERY

SHAFFER

QUERY

they were 34 over U.S. and down to 35 over South America which made no sense to go back to SI in between so - on 34 and then you come around to 35 again, huh?

SHAFFER Yeah, 34 will start over the Continent U.S. and will probably go - I forgot exactly where the

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tracks go but it probably goes East to South America and then the next one tends to start over the West coast and go down through Central America and South America and you know these groundtracks are shifted 200 miles east everyday so in these passes are about the same time of day and so one of the passes will be 200 miles east of where we were today and the other one is probably 800 miles west.

QUERY Are you going to be able to do again tomorrow morning another run - -

SHAFFER I'm sure we will. That improves our predictions and it's a matter of predicting, you know, the problem is as we've been telling you is very very sensitive and the longer you have to predict in the future the poorer the initial conditions are and by doing that run late you get a better handle on exactly what's going to happen. We may have very well have been lucky this morning and came within 1 mib. Because I still believe that our uncertainty tends to be 4, 5, 6 mibs on any given run.

QUERY What does making a run like this morning when coming within 1 mib even if you were within a couple, you know, off even a couple more, what does that give you other than a little confidence because you're going to use the same amount of TACS?

SHAFFER Oh, no.

QUERY Okay you make corrections based on this morning's predictions?

SHAFFER We might have.

QUERY Okay.

SHAFFER Okay, as it - understanding what's going to happen and being able to tell the crew if there are any supersensitive areas to watch out for is probably the number 1 reason because we're not going to use a lot of TACS unless we just drive the system to its knees. Okay and then we get into cases like we had during the S232 maneuver where the system yielded and its only recourse was to go to the TACS only mode and then we'd really use the TACS and those are the things we want to stay away from, so the better our estimate is the better we're able to understand where those are if they exist at all.

QUERY I can't think of anything else.

PAO Okay, thank you very much.

END OF TAPE

**SKYLAB NEWS CENTER
Houston, Texas**

**SL IV - Change of Shift Briefing
Johnson Space Center
November 30, 1973
5:07 p.m. CST**

Participants:

**Phil Shaffer, Flight Director
Bill Pomeroy, PAO**

SL-IV PC37A/1
Time: 17:07 CST
11/30/73

PAO All right we'll start our change-of-shift briefing. We have with us Phil Shaffer who just came off duty - Shaffer pardon me. Go ahead Phil.

SHAFFER Okay, we did our first normal EREP pass today. And by normal I mean we went in to Z-local vertical, as we've done them in the past. We took EREP data yesterday, but we stayed in the solar inertial mode. That is that we did not do a maneuver to keep the instruments pointed toward the Earth. The predictions on TACS consumption before we did the EREP pass today was 35 mibs, or about 180 pound-seconds. In fact it took 40 mibs, which is another 25 pound-seconds. No problems, it was essentially according to plan. And the EREP pass itself was fairly involved. It was long, lots of switch throwing and much like the ones we did during SL-II and SL-III and this crew didn't - didn't miss a lick. It was for all practical purposes a perfect execution of that data take. At about 18:00 Zulu today, or I guess it's about 12:00 noon, at AOS Goldstone we found that the ATM canister had not uncaged at sunrise as it normally does. And if you'll remember we had the same problem 2 or 3 days before launch. And that at a sunrise the computer was unable to uncage the canister, and the canister has to be uncaged in order to ATM data - I'm sorry to take solar data. The canister has it's own set of Sun sensors and it compensates for all of the little vehicle motions that go on all the time, and keeps the instrument pointed at the Sun. And without being free to make those adjustments then the solar data gets badly smeared. While we were waiting - I'm sorry - because that had happened earlier we - there was not a great deal of concern. We were going to wait until we'd be - were sure all of the electric motors and such had cooled down, and then we were going to attempt to uncage it again. So I really don't know what makes it hind. It could be contamination in the area getting under some rollers, or there may be a little bit of asynchronous timing between a pin that has to be pulled before the lock can rotate and free the canister. We really don't know what it is since we can't see it, and there is not a great deal of instrumentation there. While we're waiting for that we were checking out the command module in the normal weekly checks, where we run the coolant loop and take some measurements, and that sort of thing. And Jerry Carr reported that the vehicle was vibrating. And the vibrations appeared to begin at the same time we turned the secondary coolant loop on in the CSM. So we turned the loop off and the vibrations didn't stop. They - the vibrations appeared to be on frequency of about 2 cycles per second. They would last for about 10 seconds and there would be a minute or so of no vibrations

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and then they would start again. Those vibrations went away we haven't - they have not come back. We do not have an explanation for them. There are some very remote things that - that you could attribute it to - that are associated with the unlock/lock problem on the canister. Now that locking device is a little device that rotates 90 degrees and it's essentially hor - horizontal when it free and vertical against some pins. And there's one for the up/down axis fore/aft and there's one for left/right. And if the left/right was - was unable to lock up for some reason, and it got started just rotating back and forth and that would produce the kind of motions they were seeing. Unfortunately all of the instrumentation we have is inconsistent with that, because the instrumentation indicated that we got a normal lockup in the left/right when we safed the can after the up -

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SHAPFER - - is inconsistent with that because the instrumentation indicated that we got a normal lockup in the left/right, when we safed the can after the up/down accuator wouldn't free. It's gone, the commander told us it wasn't anything to be concerned about. We could see it in our attitude control system data and it was very small. And it's so small that he has to be out in the CSM to even detect it. He has to get out on that big long moment arm to feel the vibration. Just as I left the Control Center we went through the command sequence that we had intended to do when this vibration thing came up. And the canister freed. That looked completely nominal to us. So, we'll be picking up the ATM pass this evening that's scheduled in the Flight Plan which Bill Pogue will be executing. Tomorrow is another EREP day. And it has a bit more ATM activity in it than - than we had today, looks like we have oh, maybe it's the same. We have three ATM passes, we have a major medical - and I'm - I was right the first time. There are four ATM passes. And two more executions of the rotating chair. We did one of those today, and we have the other two to do tomorrow. Those are the M131-2s. I believe we're getting a handle on this attitude control situation we're in with the failed CMG. And that we're turning up lots of numbers and running lots of computer runs and beginning to understand what the two CMG environment really is. And the EREP pass this morning was very encouraging. In fact, the whole day has been encouraging. Because the thing has done for all practical purposes what we predicted it would. And if we're able to predict how that system is going to perform then we're going to be able to manage the TACS, and do the things we need to do which is execute all of the EREPs and the Kohouteks, et cetera. Questions?

QUERY I came in a little late. Did you get -
SHAPFER Ummm. And - and since you got a little bit late you didn't miss a thing. (Laughter). No, no, Howard we don't know what was going on there. I - I told the guys here that there's some very very remote chance that the left/right caging device while the up/down was - was unable to unlock - that the left/right might have gotten itself into a do loop and was not able to lock up, and had been producing it. But the telemetry was inconsistent with that, it said we got a good lock in the left/right. It's gone away.

QUERY No more concern about that?
SHAPFER I didn't say that.
QUERY Okay.
SHAPFER I said it's gone away. We still got a lot of looking to do, to see if we can find a mechanism that - that produces that kind of a cycle. You know there's not very

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many thing on that vehicle that can shake it. But we've looked at everything we can look at, all of the vents and looked at the CMGs, looked at the cam, looked at the TACS, and we don't got - we don't know what was causing it. But I must impress that it's very very slight it - that the commander could only detect it when he was in the CSM, out on that big long moment arm. If they were in the workshop they couldn't detect it going on. In fact one of the guys said, you know the old state steam when you used to turn them on they used to clank and jump and - since it happened when we turned on the secondary coolant loop in the CSM, we thought that might have been some phenomenon like that at first, but it was not associated with the coolant loop. We shut the loop down and it quit. It did not quit.

QUERY While we - before we got the canister uncaged' did we miss an ATM pass?
SHAPPER We missed some unmanned - unattend activities, yeah. Let's see it's ah - what time is it now, 23:00 we just - we missed unattended operation between 18:00 and about 01:30, which is going to be seven hours about four or five day Sun passes. By the way we took some ATM - we can run some of the instruments in - in solar interial mode without the thing uncaged like S - -

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SHAFFER - - five dayside passes. By the way we took some ATM - you know we can run some of the instruments in solar inertial mode without the thing uncaged, like S054 that doesn't take images, it just takes intensity kind of data, so we did take that information.

SHAFFER I guess from the figures on TACS gas, I figure between 11 and 12 percent error, more usage than say, nominal 100, a figure which we had been given earlier.

QUERY Is that to you within a good ball park, is 12 percent a good error use?

SHAFFER Bruce, before we had the problem with the CMG, we never expected our momentum runs to be accurate, more than 2 to 4 mibs, okay if the thing said zero we can spend two to four and it wouldn't make any difference, if we said 6, it could come out 2 to 10, I mean it's a basic accuracy in the system and the fact that it came out 4 mibs more than we predicted doesn't bother me at all. It's interesting that you could take the percentage and do that but in fact there's just a - we can't predict it any better than that - we couldn't predict any better than that and we only had 2 - 3 CMGs.

QUERY In other words, you're not only not concerned, but like you said, you're encouraged by coming that close with only 2 CMGs?

SHAFFER Oh yes, you betcha.

QUERY Do you think you can continue to do that or do -

SHAFFER I think it's going to get better - wait, I'm sorry, when I say it's going to get better, I think we're going to predict what the CMGs are going to do throughout the data takes better and that is we'll be able to predict the trajectories of those gimbal angles, predict better how close they come to the stops and predict the problem areas better, but we're not going to predict the mib count any better.

QUERY Getting back to the vibration, how long did they last and did it just happen once?

SHAFFER They have - yes, they only happened once, let me see if I can give you an idea, they started at about 20:15 Zulu and by Vanguard at about 21:30 or so they were gone. Now somewhere inbetween there they disappeared but we don't know where and I would, if I had to guess, I would guess they went on for half hour, I can't nail it any better than that because we weren't in contact with them.

QUERY On tomorrow's Flight Plan there's something called a stability test, what does that amount to?

SL-IV FC37C/2
TIME: 17:07 CST
11/30/73

SHAFFER That's when delayed for awhile. And I'll tell you what that was, the Kohoutek data takes require great stability, early when we start taking the data because the comet will still be fairly dim and if the vehicle bounces around very much then it will smear the data and since that information is taken on the dark side of the orbit if you will, that is, the ATM is pointed away from the Sun, then we don't have the privilege of the experiment pointing control system which has the fine Sun sensors and little wedge drives to keep it centered and we have to keep it locked in the (garble) and then we're very sensitive to the basic stability of the primary control system. And what we intended to do was go over and take a look at Mercury, because Mercury is a nice bright source and the crew would be able to see it and see the jitter and we would get the APCS data and we also were adding some OJT in there so that they can do some maneuvers around with a point source rather than the full Sun filling up the instrument. And it - get a handle on how all of that's going to work before we start going for the comet. We have since by continuing to look at the data, we have discovered that all of our basic stability problems which we are concerned about are all caused by crew motion. The attitude control system jumps around and produces what we were calling the jitter from SL-III when we took the JOP 13 data and it's conclusive, you take data before the crew goes to bed any time of the day and then take data while they're asleep and it's night and day. The APCS is nice and stable. The rest of the time the crew moving around makes it jump around. So there's a very straightforward trick, when you're taking data on the comet, don't move around. Okay, now the part that's left is the OJT and the pointing exercise on Mercury which has been slipped until day 20. And it is fairly easy to slip that when we got into our CMG problems, we had to get some time to try to understand what it was that was going on and do the EREPs and the Kohoutek exercises that involve maneuvers to let the corollary instruments look at it. But that's what the stability test is all about and the guys are all bent out of shape at me - but I insist on calling it the jitter test and they think it's got no class.

QUERY As a result of maybe getting a little extra sleep last night, did Gibson feel a little bit better today, you know he was so fatigued yesterday, he asked to take time off the ATM as a film dir -

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QUERY - - maybe getting a little extra sleep
last night, did - did Gibson feel a little better today?
You know he was fatigued yesterday, that he asked to take
time off the ATM, is he feeling better today?

SHAFFER Well, you know this is the first execute
shift they've pulled, and those guys sounded good to me.
They sounded bright cooperative and doing good. And as I
told the guys before you came in they executed that EREP
pass perfect, there was no slips in it at all.

PAO

Okay.

SHAFFER

Good night.

PAO

Thank you very much.

SHAFFER

Good night, Dick.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Status Briefing
Johnson Space Center
November 28, 1973
3:17 p.m. CST

Participants:

William Schneider, Program Director
Bill Pomeroy, PAO

SL-1V PC34A/1
Time: 15:17 CST
11/28/73

PAO Okay, at this - today we have with us from NASA Headquarters, William C. Schneider, the Director of the Skylab program who will give us a status report on the Skylab as we're about two weeks into the mission. And I might announce before he starts that we will not have a change-of-shift briefing today because Chuck Lewis had a doctors appointment or some other thing. He couldn't make it, anyhow. We will not have a change-of-shift today. Dick?

SCHNEIDER Okay, first thing I'd like to apologize for any inconvenience I may have caused you by being late. But, unfortunately, I was unavoidably delayed. We just in the past few hours completed a TAG up between the Marshall and the Houston experts on control momentum gyros and attitude stabilization and the general problems that we have been having in - in the CMGs. And we have concluded that we really do understand what is going on and that we had a specific maneuver yesterday which was very sensitive to initial conditions, and that there was nothing wrong in our understanding of what happened. That was the maneuver that we had put in. Our simulation did not have exactly the right initial conditions in it. And if you put the right initial conditions, why, you get out the amount of propellant that we used. So based upon that, why, we feel we have essentially eliminated the restrictions on - on maneuvers for the remainder of the mission based upon, obviously, any successful simulations of all maneuvers, which we always do. And our plan now is to carry on with the flight plan as published yesterday for tomorrow, which has the solar inertial EREP pass in it. And then on Friday to do a first Z-local vertical EREP pass. The reason for not doing one tomorrow is it takes us about a day to do all of our pad updates and all of our simulations and everything that's required for the - for the maneuver. And all of our people in computers yesterday were tied up analyzing the problem, therefore, Friday is the first day we can do it. We believe that the remainder of the mission will continue essentially as planned. We'll obviously, be a lot more careful about maneuvers than we were in the three CMG case, because with two CMGs you do use TAGS attitude gas for all maneuvers. But we anticipate that we will allow ourselves a budget which will permit EREP passes - excuse me - EREP passes, Kohoutek observations, and all of the other kinds of maneuvers that we have in our - the flight plan to continue. As I said, there will undoubtedly be detail changes as we go through the mission, but fundamentally, why, we'll continue on as planned. We don't anticipate any early curtailment of the mission because of - because of

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attitude control problems and indeed we still have our nominal 60 day open end to 84 ahead of us. As far as crew health is concerned, the doctors tell us that they're in great shape. They each initially lost a little weight. One - Jerry Carr lost a pound, the other two lost, I think, about 4 pounds, and they've remained steady at that. Ed Gibson has asked for a little more food, and we're looking around to see if we can find a few extra bits and pieces to give him so he doesn't get hungry. But he's not losing weight. And in essence, why, the mission seems to be off on - on a - on a pretty good start. Let's see, did I not cover anything? Well, I think I've best just go to questions now. Huh?

PAU Okay.

QUERY Bill, I understand essentially unchanged, but, can you list how the mission will be changed. What will be the scientific loss if any in EREP and com - comet observations and so on.

SCHNEIDER Well, it's difficult to say. We'll probably be much more careful about how we do things. For example, we will probably plan our EREP passes essentially so they're around noon, you know that - that they are around no - -

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SCHNEIDER We will probably plan our EREP passes essentially so that they are around noon, you know that - that they occur around - around noon time not noon local time, you know, solar noon. And we had not been 100 percent that careful in the last missions. We allowed ourselves to drift on either sides of it, which gives you a little more flexibility, so in essence we think we'll probably - there'll probably end up being some EREP sites that we probably will not be able to get. But we won't know that until we go through the simulations and try. As far as Kohoutek is concerned right now, I think we'll - we'll probably be able to do all of that, although, we're going to be hard pressed to do more than one maneuver a day, I think. We'll probably set up a budget for ourselves and stick to you know, so many pounds a day average, as a - as a goal.

QUERY Can I press you just a little further and ask you for some kind of percentage on the amount of EREP that you don't think you'll be able to do? Would you guess something like 5 percent of the planned photography and observations?

SCHNEIDER It - it certainly would be a reasonably small number; it's not like half or anything like that. It's - it's some percentage but I don't have any way of saying what percentage that is until I - I see what the detail results come out. And we - you know we kind of play this 2 days in advance and everyday we're going to be looking at what we can do 2 days hence. Now, we were going to be hard pressed to get all of the EREP work in this mission anyway, because Mother Nature hasn't - doesn't cooperate. We don't get light on the U. S. after - about December 10th until January or so. We - we had some sites that we'd - we thought we wouldn't get in the - in a normal mission.

QUERY Bill, if - you say you're planning 2 days in advance and it takes a full day just about to run through all your sims on the maneuver and you come up say on Friday and the weather's socked you in. Can you easily go to a Kohoutek maneuver in place of the EREP maneuver for that day.

SCHNEIDER We always plan two - two Flight Plans for each EREP day. One EREP and one non-EREP, just for that contingency. So we always have two - two Flight plans for each EREP day in hand.

QUERY I'm aware of that, but I mean are you - do you - can you run an EREP sim and a Kohoutek sim and be ready to do either one?

SCHNEIDER Yes, yes.

QUERY Okay.

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QUERY Can you go into a little bit more of what the maneuvers are to observe Kohoutek? How much TACS fuel do you think they'll cost? And will you modify the viewing a little bit?

SCHNEIDER The maneuvers are basically roll maneuvers for Kohoutek. The one that we did yesterday there was roll, pitch, and yaw. And that was one of the problems. So the Kohoutek we basically roll so that we can look out the anti-solar airlock at the Sun. Now, you asked how much - how much each - each specific one takes a given amount of fuel and I guess Kohoutek is like a couple of hundred pound seconds. And you asked what we - what we would modify. I think what what we're probably going to end up doing is having a lot more soul searching in the Flight Management team, deciding what to do rather than modifying the - the observations. The EREP as I said will be narrowed down probably around noon and the - the Kohoutek we'll probably make some modifications to it to do it at a more optimum time, but the basic science results which would be the obse - observation of the comet will probably remain unchanged.

QUERY Bill, I don't know what the numbers were but I assume that there was a plan for unmanned ATM operations after this crew comes back. And I wonder if that's going to be effected by the - the use of the TACS gas during this manned portion?

SCHNEIDER No, there were no plans to do unmanned ATM observations. As you probably know, there's only one experiment up there that could have gotten back data in an unmanned mode when you don't have any film up there. So - and the cost of keeping the - the network and everything else alive after - after the mission was just prohibitive for just that one experiment. So we - we were planning on deactivating the ATM at the end of the mission.

QUERY What type of data can you get with a solar inertial ER - -

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SCHNEIDER - - of the mission.

QUERY What type of data can you get with a solar inertial EREP run tomorrow?

SCHNEIDER Well - fundamentally, pretty good, because that specific task happens to be one where the lighting is good and the Earth is - Earth is in the view of the - view of the instruments. We'll get good 193 data, that's the microwave experiment. The 192 data probably won't be as good as the we would with Z-local vertical.

QUERY Bill, how would you characterize the performance of this crew as opposed to the first two crews. These - they seem to have gotten off to a slower start and do you think the possibility that they're all three rookies has something to do with it?

SCHNEIDER No, these guys are well trained. I - I believe that they have had a fairly slow start. I believe the problem there was one where we sent up, you know, a thousand pounds of things in that command service module and we took out a lot of containers and we used stowage material in place of packing material and - I suspect they got themselves into a great box initially in just having a whole lot of things strewn around the spacecraft. They seem to be getting into the swing of it now and those couple of days off we gave them to catch up really paid off. No, I think - I don't think they have - the fact that they're three new guys has anything to do with that. Everybody goes up new sometimes or another.

QUERY We have a question that had been phoned in asking what will be the effect on EREP passes over Europe this mission?

SCHNEIDER Let's see, we have EREP passes over the U.S. and over South America. I'm - Yeah, I guess we have - we have some EREP passes over Europe in the - in the middle of December. The same - the same restrictions on those passes as on the U.S. passes. We probably will try to center them around noon, and we will probably go into the passes in - in - in a slower manner, and we probably will shorten up the length of passes, just as we will in the U.S.

QUERY Is it correct to assume that there may be more passes than originally planned, but shorter passes to make up for the - - ?

SCHNEIDER No, I don't think there'll be more. I think we'll be lucky if we still get the fifty, only because we run out of lighting.

QUERY Or shorter.

SPEAKER I suspect that they'll be shorter in duration. We'll center them around noon. Whereas, what we had been doing was not necessarily centering them around noon,

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so we could get passes early and get some sites on one side of our pass and not necessarily keep up on the other side. So we'll center them around noon and that generally shortens up the pass.

QUERY Can you give us a comparative figures, approximations?

SCHNEIDER - -

QUERY 15 minutes versus 25 or does that fall apart?

SCHNEIDER That - that's the kind we were talking about. But I really can't give you any specifics because we're going to run ea - we're going to set up each EREP pass and run the simulations and make the decision on the basis of the simulations of just how long they'll be. I'm generalizing in saying that from the kinds of things we've seen, we'll probably have shorter passes centered around noon.

PAO Okay, thank you very - Well, we have one more.

QUERY When you say noon, you mean noon local time over the area that it's passing? Is that what you refer to when you say noon?

SCHNEIDER No, it's centered around when - when the Sun is - Sun is right on the spacecraft noon.

PAO Okay?

SCHNEIDER Okay, thank you.

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SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
November 27, 1973
4:51 pm CST

Participants:

Don Puddy, Flight Director
Terry Watson, Guidance & Navigation Systems Officer
Bill Mayes, PAO

SL-IV PC33A/1
Time: 16:51 CST
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PAO Gentlemen, you all know Don Puddy the off-going Flight Control Director is with us today. And he has with him Terry Watson who is the Guidance and Navigation Systems Officer with him. We have a statement by Don (garble) take your questions.

PUDDY Okay, I think we pretty well went over last night what the expected Flight Plan was for today. And this morning we did start out on the S232 operations which was a coordinated observation with some Alaskan sites and with Skylab and viewing a black brant launched barium cloud. We made the maneuver into attitude for viewing of that cloud very smoothly had an excellent data take of the cloud and during our maneuver back to solar inertia as I'm sure you all probably heard. We did run into a TACS only situation where we - we did not follow our pre-planned maneuver back to atti - back to solar inertial, went into TACS only and expended a little more TACS gas than we had originally planned, in fact we - I think the sum total of it was around 600 pound seconds. Originally, we had anticipated that the combination of the S230 operation - S232 operation followed by the EREP pass, the total for those two maneuvers would be around 200 pound seconds. Subsequent to that we did cancel the EREP operation, both from the standpoint that at that time it appeared that the weather was indicative of a decrease in the amount of mandatory sites that we could cover. And from the standpoint that it did involve another maneuver. We went over to the alternate Flight Plan and used that for the remaining portion of the day, with the only exception being that we did have an S183 operation which involved inhibiting one of our momentum dumps. And again because of a incomplete understanding on our part of just exactly why we had used the increase TACS cost. We elected not to do the 183 operations. The remaining portion of the day, was accomplished and I'm sure y'all have looked at the cal comps so I won't go into a lot of detail there. The remaining portion of the day was accomplished as programmed and everything seemed to go very well lot of conversation with the crew today, good exchange of information. As far as tomorrow's Flight Plan is concerned at the present time we are redoing that Flight Plan but to summarize it for you if you have looked at the cal comps for tomorrow, it is essentially the alternate Flight Plan. Basically, what we are using to - what we are using as the prime items that we would like to accomplish are the two M092, M171 runs with the Commander being the subject on the first and the Pilot being the subject on the last. Both of these runs being accomplished with the blood flow, DTO. We are not going to accomplish again the S183 maneuver but we will be accomplishing both of the S233 operations, at least we'd plan to do that when I left the Control Center. For those

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of you that are interested in the TV aspects of it this will cancel the TV 83 which was of the S183 operations. And right now we are trying to schedule the TV 3 which is of the crewmen eating, in its place. As I'd indicated to you last night we did attempt to get the TV 3 for you yesterday. It was recorded onboard however, due to one of the SIAs or one of the TV input stations upstream of the station that was used for the TV camera. It did not actually get - -

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SPEAKER - - and one of the SIAs - or one of the TV input stations upstream of the station that was used for the TV camera it did not actually get on the VTR and as a consequence, we were not able to provide it to you. Our overall plan is to use tomorrow - I should say, the remainder of today and tomorrow to regroup, find out just exactly what in our math models that are we - that we are using to predict what the momentum state is going to be when we get into these maneuvers. Why these math models aren't showing us just exactly what we can expect in the way of momentum buildup, gimbal angles, how the CMGs are hanging on their stops, so on and so forth. It appears right now, from the analysis that we have done, that in the two CMG state, we are very sensitive when we do get a gimbal on the stop - and I'm talking (garble) CMG gimbals. If I can go ahead and talk in rather technical terms for just a few minutes, and - and Terry can fill you in, if you have any additional questions. Basically, the run we had today, we did predict that the two CMGs would both get on what we call their negative stop. From an overall momentum standpoint, this should not have caused us any problem, it just so happened that one of the CMGs instead of going negative went positive and this caused us in turn to build up a momentum at a much greater rate than we anticipated and subsequently caused us to go into the TACS only mode and this is fairly expensive from a - from a TACS standpoint. In order not to convey to you, however, that this was something that was catastrophic as far as overall TACS usage or planning. We're - we're simply talking about something that is around 2 percent of our overall planned and allotted budget for Skylab IV and is certainly something that we don't expect that we're going to be able - we expect to be able to recover from it with no problem whatsoever. We do, when we get into the maneuvers, we do expect, as I've indicated to you previously, to use a little bit of TACS each day. We don't, however, expect to use this amount of TACS each day. And I feel very certain that going back and looking at this data, which we understood could possibly - very possibly be a test case, and as it turned out, it was. We - to run a check between what our ground models were showing us and what the actual bird would show us. We will find out just exactly what is causing this DELTA be able to correct it, and again be in the same situation that we've been on Skylab II and III where we - where we were able to use these programs and I'm talking about the one here at JSC, and also the program that we have at Huntsville, Alabama at Marshall Space Flight Center. To accurately portray what to expect when we get into maneuvers. I think that's really about a

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synopsis of - of today's Flight Plan and tomorrow. I'm sure you all have several questions, so let's get into those at that time.

QUERY Don, in your analysis, of this problem, have you eliminated any further problems with the CM - the two remaining CMGs, are they functioning normally?

PUDDY There is absolutely no problem with the two remaining CMGs and anything that has come up to date, is certainly not indicative in any way of a problem with those two CMGs.

QUERY Okay, have you eliminated all other possible sources of - of thrust such as outgassing or leaks, or anything like that?

PUDDY I would have to answer that question that no, we have not. As you're probably well aware today, there was some question in our mind that we might be leaking at one of the SALs. And if you copied air-to-ground, we did run a test today to make sure that while the SAL was pressurized that it was not leaking overboard. The test that we ran indicated that this was not the case, and - although the data is still being looked at right now, we have eliminated that as a possible source of venting. One of the other things that you're probably well aware of was - and something we took care of early in the mission, before - before we actually lost a CMG was - as you know, on each of the M092 runs, we must vent the can. And we are now plumbing that into the waste tank, so this is not causing us any problem. We're still keeping a - a very close eye out for anything that we feel like could be causing some sort of an external torque and thus aggravating the situation that we're seeing. But to date, we have not found anything.

QUERY Have you eliminated the possibility that the space craft, in effect, there's something wrong with it's software. It doesn't know where - where it is - it's balance mechanism is out of kilter or - -

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QUERY

Spacacraft in effect something's wrong with it's software - it doesn't actually know where - where it is. It's balance mechanism it out of kilter or - as for it's determining its attitude?

PUDDY

No, no I don't - I don't think there's anything in the onboard software that is indicating to us or anything in the spacacraft's actions that is indicating to us that it doesn't know exactly where it's at and what's its doing. We do know that in the two CMG cases, there are several points where the software and the hardware combined are very sensitive to certain momentum conditions. And as a result of that we can get ourselves into situations where we can expend more than predicated TACS gas in order to bring ourselves back into complete attitude control and - and the exact orbital position we'd like to be - be in as far as attitude is concerned. But no, we don't have any indications whatsoever, that are any software or hardware problems. It's a learning curve. That's - that's about the only way I can really summarize it right now, it's a learning curve. And I feel very confident that given a few days here we're going to have this well under control. If you remember back in - in Skylab III, when we started making back to back EREPs a few things like this we went through quite a few days there where we were using a little TACS gas. We've always had occasions where we've used some during the EVA, things of this nature and - and you will notice that each time we go through one of these activities again the amount of TACS gas that is used is minimized because we find new and different ways of attacking these problems. But - but it's a very hard thing to take a computer model and - and simulate this and then convert that into procedures that realistically protect against.

QUERY

Would you explain what happens when one CMG goes towards its positive stop and the other goes towards its negative stop instead of both going toward their negative stop?

PUDDY

I have brought an expert who I think can - I - I can probably do that but I'm afraid you might not understand it and he can put it in words you probably can. So let me let Terry Watson answer that question.

WATSON

Okay, you've got a basic problem in any a CMG hits a stop. And that is that the CMG is driving a direction to - to move the vehicle in some desired direction. And when the CMG comes up against the stop it can no longer drive in that direction and the other gimbals have to drive to give you the desired rate and attitude change. Now, when we were in three CMG control, one gimbal against the stop left you with 5 other gimbals to take care of that problem and

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help pull that gimbal off the stop. The situation we have now is that we only have three other gimbals that can pull you out of gimbal stop problem. Now, your specific question about one going to a positive stop and one going to a negative stop versus two going to a negative stop. What - the problem there is that once the CMG started doing that it did - it did not longer - no longer follow our predications and we had no idea of what the outcome might be in that case. In other words we predicated them to go a specific way and at some point in the maneuvering logic program branched in a direction we didn't expect it to. And - had the subsequent problem.

QUERY For us laymen could you tell us which direction it went? Did the - did it roll left when it should have rolled right, or what hapened?

WATSON Let's see we were - we were trying to do a negative roll, we were commanding a negative roll and actually - the roll maneuver actually stopped. It came to a complete stop and - and negative roll it went to zero rate it just hung there at some attitude.

PUDDY In other words instead of each one helping the other, one counteracted the other. Basically, what that summarizes into.

QUERY Different question. Does this mean you're cancelling the EREP or postponing the EREP until you find out what to do about this or will there be an EREP tomorrow?

PUDDY There will not be an EREP tomorrow.

QUERY Is it because you're - still want to learn?

PUDDY We - we're basically allowing tomorrow and - and we hope to be able to - to pull everything together by tomorrow. We are essentially making no maneuvers of any kind either the remainder of today or tomorrow.

QUERY Don, okay, you get a better understanding of the problem but are you going to be able to - once you say you understand it, I forgot what's wrong with your math models - Are you going to be able to cut down the amount of TACS usage or is all you're going to be able to do is predicate what it's ac - more actually what's it's going to be? Are you still going to be using 600 pound-seconds to get back off the 230 maneuvers - like the 232, or - are you ju - are you going to be able to cut that down?

PUDDY Oh, I think - I think there's no way that we're going to be able to completely eliminate TACS usages for some of the maneuvers, in order to accomplish the objectives we'd like to accomplish. I - I don't believe we're going to get to that point. But I do believe that we're going to be able to understand the situation. And once we understand the situation we have several things that we can do such as

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biasing the momentum going into a maneuver, intentionally performing certain resets coming out, monitoring for attitude errors by the crew members and possibly saying, if you get to this point you're building yourself up into a dangerous ei - state. So go ahead and stop the maneuver back to solar inertia attitude for instance allow yourself to damp out and then we'll come back much slower. Things of this nature where we will eliminate spending 600 pound seconds to accomplish the same type of objective. I think this is what you're after Art.

QUERY Yeah, okay. And then at the same time when do you realistically foresee you - you'll be making EREP maneuver, are you looking at Thursday or more realistically Friday or ?

PUDDY We hope to be able to put ourselves in a posture where we can make - begin making maneuvers again on Thursday.

QUERY That's - the preliminary Flight Plan for that showed a back to back EREP that day. Would that probably be out of the question or would you probably just want to go ahead and try one?

PUDDY We will prob - -

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QUERY That's - preliminary flight plan for that showed back to back EREPs that day. Would that probably be out of the question, or would you probably won't to go ahead and just try one?

PUDDY We will probably try to move in this fairly slowly. I will not say that is going to preclude a back to back EREP. However at this time I would have to consider it unlikely.

QUERY If you went many more days of having to postpone EREP both because of the weather and if you end up on Thursday trying to make a maneuver and finding out you don't really yet have the understanding, do you foreseeing yourself not getting in as many EREP passes as you had planned. I think there's a minimum of 30 planned up to our 50 they had hoped for.

PUDDY Well, it certainly says that we cannot go - we probably would not be able to obtain as many U.S. passes as we had hoped to, because as - as we briefed you before the way the lighting is moving at the present time. However, be advised that - that we do have a second opportunity later in the Skylab mission to come back and pick these passes up again. We have done the trim maneuvers, so we are on the repeating - repeating ground track et cetera et cetera. We can't continue to go along with this path and meet all the EREP objectives. But I certainly do not feel that if we are able to - to begin our operations by the end of this week, that there is going to be a noticeable decrease in accomplished EREP objectives.

QUERY Can you just - can you just kind of go through what you expect to do to on the ground to find out where this problem is? I mean are you all doing computer runs and you have people working through the night and et cetera or - can you just kind of review - -

PUDDY I tell you - -

QUERY - the process?

PUDDY I tell you one thing that will probably give you all a fairly decent appreciation of this, you probably heard us talk over the loops quite often about what we call the MMP which is the momentum management program. Well, Terry is the gentleman along with his backroom team that runs this particular program and supplies the flight directors and the remaining portion of the team with just exactly what it's going to cost. So let me let Terry take a couple of minutes here and just basically explain to you what that program does and how he runs it.

WATSON Well, basically the program tries to simulate the onboard environment. It - we - we start off the

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program by putting the CMGs at some position which we observe - we observe on board where the gimbals are going after each start. And we start off this program - as much like the real system as we can. And then we simulate the maneuvers, we simulate the gravity gradient torques, we put vents in. We do everything in the program that we can that goes on on board. And then program spits out the data that tells us how much TACS we're going to use, where we have problem areas. One of the problems with the program is it's an iterative process. It doesn't give you the best answer. You put in a EREP maneuvers or comet maneuvers it only gives you the answers for the specific conditions that you put in. Therefore if you do have a problem area you have to retrieve all the data from the run then go over it and try - try to understand what the problem is and how you can best go about correcting it. We got pretty good at this on the previous two missions. Just alone in EREPs - the EREPs started off on the first mission and the second mission they got a lot more ambitious we we're doing back to back EREPs and all. We have learned a lot about the system how it worked and how to solve the problems we were running into. But on the two CMG operation the whole thing is a lot more sensitive than it was with two CMGs. And we've just got to go back - right now we're just doing studies and studying different maneuvers. And we're running into problems but a lot of the solutions we had before don't work and don't apply in the two CMG case. So we got - got to go through - like Don said it is a learning process and we got to - got to kind of learn how to constrain these maneuvers and how to perform properly, what's the best way to do it. And it just takes a - it's just a matter of time and getting enough data out of the machines so you can start making generalizations.

PUDDY To add a little more to what Terry has just said it - it got to the point on Skylab III where in general we could have successive maneuvers and successive dump inhibits where we actually change our momentum state. We could just more or less plan these pretty much at will. The one - the one constraining factor that we had that we were always working around was how we took the medical vent and - and worked it in because it did pro - pentubate our momentum state. We thought that we had that problem finally resolved because we worked up a procedure and as you probably well aware installed it during activation where that was plumbed into the waste tank and essentially got away from the propulsive state of that particular event. So basically, we were at the point where during the planning shift that we went through between midnight and 8 o'clock in the morning we could lay out a flight plan

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and we could almost ask the CNS officer if that looked anywhere realistic and he would nod his head and we would go ahead and be fairly certain that there would be no problem. And - and although he might later come up and say that that's going to cost you 100 pounds-seconds of TACS. In his first run he subsequently would bias a momentum which could be done in the background and by the next morning when we got ready to execute that flight plan we loaded those biases and performed the day with essentially no TACS cost. The problem we're running into now which is delaying the entire process is that he hasn't yet got enough experience behind him to have the capability of nodding his head and saying yes we're go with that. So as a consequence the entire planning process is - is slowed down to some extent. And when I say we're on the learning curve this is something we expect to be able to at least get a good simulation that we feel we can accurately use as far as - -

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SPEAKER You at least get a good simulation that we feel like we can accurately use as far as estimating TACS cost over the next few days and hopefully over the next couple of weeks, but we'll get back to the point with 2 CMG's where we get on a fairly realistic planning process where G and S can again say yes that looks like that's a very feasible plan, everybody can go ahead and do their work and I'll make sure I get the TACS cost down to the absolute minimum during the day with the runs. But the runs right now are taking for a given day are taking just about the entire day to accomplish from the time we lay out a preliminary flight plan at 1 or 2 o'clock in the morning at 8 o'clock in the morning we're still pulling data out of the machines and making sure we know exactly what we're doing. And we've got to get away from that.

QUERY Did he nod his head the day before your maneuver?

SPEAKER Yes. We had looked at this in various options. I think I talked to you about this last night where we had - we knew we had 2 maneuvers there. One associated with the S233 - S232 the barium cloud, and one associated with the EREP. And we were investigating the various combinations of those and what each TACS - what the TACS cost was for each one of these. Both separately and collectively. And I think one of the biggest problems we ran into was the way the EREP pass was centered in the orbit, and I think I went over that quite extensively last night and that if you then centered around orbital (garble) the cost is almost minimum. We had an overall estimate when we went into this thing, approximately 100 to 250 pound seconds, and I'm giving you that type of granularity because we're not estimating down to the nth degree of TACS cost, and we knew we couldn't at this particular point and time. So to put it very bluntly we used about 3 times as much TACS as we planned. And we don't like to do that type of thing, and we certainly don't want to continue to plan to do that type of thing. But we were willing to spend up to 200 to 250 pound seconds of TACS today to accomplish those 2 scientific objectives.

QUERY Well Don you say you used 3 times as much TACS as planned, but you used that for just 1 of the 2 maneuvers. What was the TACS planning for only 1, do you happen to know for the single 232 maneuver?

SPEAKER It was on the basis of the predicted numbers this morning it was approximately a 50 50 split.

QUERY At most 125 then?

SPEAKER Yes.

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QUERY

So it's a lot more, okay.

SPEAKER

We have some questions called in the Cape, we'll take now and then come back if you gentlemen have any more. So while we're on this TACS system, if it turns out that we have to use the amount of TACS for each maneuver as we did today, will we do all the experiments and cut the mission short or will we do the full mission and cut the experiments short?

SPEAKER

Well, let me answer that question by saying that we will not use the amount of TACS that we used today to accomplish the maneuvers, and we feel very confident that we're going to be able to accomplish the majority of the maneuvers and not cut the mission short.

QUERY

Okay, in either case: all there be any scientific loss or what would that loss be?

SPEAKER

Well of course if we can't accomplish the maneuvers we certainly would not obtain all the scientific objectives. There are - there are so many options left at this particular point and time I think it would be very premature on my part to go ahead and answer that question fully. One of the things, and I think we have talked about this before, but one of the things that we certainly can do in the case of EREP. One of the things that make EREPs fairly costly from the stand point of TACS is where you accomplish them with respect to orbital position and the length of the arch the (garble). We can accomplish the same number of objectives by making sure that we only perform those at a time where the lighting is sufficient that we can make the maneuver in and out of attitude at the optimal orbit positions and also that we can decrease the (garble) to an interval where we don't use the TACS. This does however imply that we would have to make more maneuvers to accomplish the same number of objectives, and we're willing to do this.

QUERY

How long do you think it'll take to decide what course we'll follow to establish a pattern on this with these conditions?

SPEAKER

I definitely think it's going to be a energy process and probably will be so for the next lets say couple of weeks as a real gross estimate. We hope to be able to - to start the maneuvers again the day after tomorrow. I feel fairly certain that when we start those maneuvers again we certainly will not be at the peak of our learning curve, and there may be a couple of other surprises still facing us. But I think at the end of a couple of weeks we certainly will have all of the ground rules that we're

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desirous of following as far -

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PUDDY - - facing us. But I think at the end of a couple of weeks, we certainly will have all of the ground rules that we're desirous of following, as far as flight planning, so that we can optimise the amount of scientific gain while fully utilizing the amount of TACS capability that we have left.

QUERY Okay, what will be the total ATM observation hours for - for Friday, and did they see any solar flares yet?

PUDDY We have not yet actually observed from the ATM console itself in manned operations a solar flare, unless it is - unless it's been accomplished since I left the console. There have been some solar flares. There was one solar flare occurred in active region 87 both yesterday, and I believe there was a small one this morning. We have not observed them from the console yet.

QUERY Let me correct that Friday bit. That's a total ATM observation hours today.

PUDDY Total ATM observation hours today? Let's see, we had 3 hours and 15 minutes scheduled plus we did put in an extra - an extra pass. So let me - let me make a rough guess and say we are talking almost 6 hours of ATM viewing time today.

QUERY Okay, and did the crew take any photographs from shopping lists and if so, which ones?

PUDDY That's one thing that I - I - I would like to correct in a couple of statements that I have made to you over the last couple of days. In going back over some of the Evening Status Reports the crew has made, on day 326, they did accomplish - did accomplish some handheld photos over the Sinai area. They did accomplish some on the subtropical jet clouds, and on the FR triangle, if you're familiar with that particular area. One 32 - day 327, they accomplished some over China and Japan, some over the United States, and some cloud formations both over Africa, over the east coast of Africa. On day 330, they had some - they photographed some clouds over the Tokyo Harbor. They got some very good views of Benard cells over the ocean, and some of the snow covered studies that we wanted to catch over the mountain areas, and these were in Siberia and Mongolia. They also got some in the Atlas Mountains and some cloud linear - cloud linear features, and I don't have the - the exact area that they - these were accomplished. But in going back over some of the transcripts, it appears that the crew is accomplishing a high majority of the handheld photos and visual observations that you're seeing show up on the cal comps, and doing so very successfully.

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PAO
QUERY
to this mission?

PUDDY
QUERY
the other failures. In other words, would - would you simulate one CMG going out?

PUDDY
QUERY
take care of that situation.

PUDDY
It - it has been simulated from the standpoint that the - the - the original programs that were developed both here at STAC (?) and at JSC. Originally we had capability to delete one CMG and to simulate the momentum state to make the predictions. And I - I see exactly what you're driving at and the question basically is if that was true, why then are we having so much trouble now? I think if you look back on the Skylab I) and Skylab III, you'll find that we also had these programs and had simulated for three CMGs. And we still had some problems there. Basically, Skylab is a vehicle that loves solar inertial. And when you begin to take that vehicle out of attitude, you - you certainly have a lot of things that you must take into consideration. We have gone through the learning curve on the three CMG operation. Finally, they had that perfected, and - to be real honest with you, Jim, there just has not been enough time even considering the unmanned periods to go into an extensive analysis of all of the scientific capability and maneuver capability that we have with two CMGs. We spent the entire unmanned period between Skylab III and Skylab IV developing what we considered to be the optimum EREP strategy and best to combine that with common observations using the three CMGs. And with the limited amount of computer time that we had available during that time frames as we had - -

END OF TAPE

Okay, gentlemen, any more questions? Jim.
What's this two CMG mode simulated prior

In - in what fashion, Jim?

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PUDDY - - comet observations using the three CMGs and with the limited amount of computer time that we had available during that time frames as we had to allow these computers to go down for maintenance, modification at cetera. There was just not time to go ahead and to do the same type of thing with two CMGs.

QUERY Well, let's see while you're on this learning curve you're going to miss EREP and Kohoutek.
How about ATM?

PUDDY We certainly Jim, will not - will not lose any ATM observations because these of course - you're talking about ATM solar observations? No, we will not lose any of those. In fact while we're on this learning curve the ATM solar observation if anything will gain time as will the biomedical experiments, because all of these are accomplished in the solar interial attitude. And I hope Jim, and I'm speaking to you in all honesty, I hope that you will not see here in few days any significant loss in the EREP opportu - in the EREP objectives or in the outer of attitude corollary objectives. I believe we're going to be able to get there.

QUERY I hope - -
PUDDY It's going to be a little rough but we're going to get there.

WATSON Can I say something about that two CMG operation?

PUDDY Go.
WATSON As far as the two CMG operation too, most - most of the two CMG operation that was studied pre-Skylab was restricted to Z-LV EREP passes, because these were the majority of maneuvers we'd be doing before the comet came along and all these other observations that we're doing. The other problem with two CMG case is that for each CMG that fails you're in a different case, so if you wanted to do a two CMG asimulation of anything, you have to pick one of the CMGs and then you've got to go through three separate runs on that alone. The other thing is the data that was run pre-program on the Z-LV maneuvers do show that they're pretty costly. And for one CMG out a normal EREP centered about noon, some cases may cost you up to 500 pound-seconds of TACS, so there is a TACS penalty you will have to pay. And it was known but we just did not spend much time studying these cases.

PUDDY In fact we didn't even go to the point during the unmauned period to - while we were working up our predicated curves. We did even draft up what we thought our predicated TACS cost was going to be for the Skylab IV -

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IV program, both with three CMGs and two CMGs and there was a significant difference. And today based on what we've seen if with the problems we've had we have no reason to believe that we're not going to be able to live within that allocated budget. I don't know if that answered all of your questions Jim, but - -

PAO We have any others? - go ahead.
QUERY Well is that allocated budget still
the 500 he was talking about for an EREP is that ?

PUDDY No, no, we - we - -
QUERY Are - are was that just a - -
PUDDY We started out essentially with right
around 3100 pound-seconds of TACS. We - we set aside an
operational reserve, which is fairly conservative, of around
10,000 pound seconds which left us 20,000 pound-seconds of
TACS that we were willing to expend strictly from the stand-
point of gathering scientific data. And the original estimate
of the amount of TACS that we should have used with three CMGs
- I believe that was around 9 to 10,000 pound-seconds of
TACS.

WATSON And - and that was a high estimate.
PUDDY And - and from our standpoint that was
extremely conservative. Which meant if you want to look at
it right now, that we can spend twice as much TACS with the
two CMG operation and still not get ourselves in any
problems as far as the operational reserve that we are trying
to retain at the end of the mission. And that operational
reserve at the end of the mission is also conservative.

QUERY John, you said you can use twice as much
but the way I got it is that two CMGs will require more than
twice as much TACS usage as three CMGs. What will be your nominal
use of TACS, I mean generally, with three CMGs on an EREP maneuver?

WATSON Normally, I don't know 0 to 5, TACS
fires which will be 0 to 25 pound-seconds of TACS.

QUERY Okay, if you use up to - to - you
planned the day up to 50 to 125 for the EREP alone, then you're
more than doubling and you know you're playing a numbers
game here - you're just not going to make it.

PUDDY I - I'm playing an operational game, Art,
but I'm also playing an operationally flexibility game. And if
you'll remember I said in order to stay within that allocated
budget I might have to take one EREP pass which would have
cost zero with three CMGs and split it into two EREP passes it's
still going to cost me approximately zero TACS.

QUERY Well, do you still expect to have a
fighting chance to accomplish all of the EREP objectives
that - that you had hope to accomplish on launch day - let's
put it that way?

PUDDY I think we have a good fighting chance

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of doing that.
QUERY

But with all the Kohoutek - -

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QUERY And hope to accomplish (garble) (garble) day, put it that way?

PUDDY I think we have a good fighting chance of doing that.

QUERY Plus all - all the Kohoutek and the other corollary out - out of experiments that require maneuvers? I mean are you going to have to cut anything at all - prospects right now?

PUDDY I - I just can't h - sit here and honestly tell you there is not something that's going - that we might have to - that we're going to have to give up something. We may have to give up something. Right now, I just - I don't know exactly what that is, for instance, some of the JOP 13 maneuvers if you're familiar with those. These require us to in a lot of cases to take our principle axis out of plane, those type of maneuvers were costly with 3 CMGs they're certainly going to be much more costly with 2 CMGs. And unless we can figure out a way of having both the target availability and a time frame in the mission where we can make those maneuvers and still keep the X-axis in the principle plane then I feel that that type of operation will probably have to be scrubbed, because it's just too expensive. But we haven't given up on that because we haven't investigated all of the possibilities as to when those may be available. I - I guess to summarize to you there is a - there's a lot of operational flexibility still left in planning and we think that we can also come up with techniques by which we can change the momentum state of the vehicle intentionally, prior to going in to some of these maneuvers such that we can minimize the cost. And it's the combination of those two items that we really haven't had an adequate opportunity at this particular point in time to investigate to the fullest. And - and I really can't tell you that we're going to be a hundred percent but I feel very very certain that we're going to be very high in our percentage of scientific accomplishments that we planned pre-mission.

QUERY Okay, when will you lose the proper lighting conditions for EREPs over the United States and when do we regain it?

PUDDY Let's see we lose - we lose optimum lighting over the U.S. I believe it's right around December 6th to December 10th it's according which part of the U.S. you're talking about and we regain that again early January. Of course a lot of our objectives also are in South America and as we lose it here in the U. S. we automatically of course move it to the South American

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passes. And we have also several other foreign objectives
that we'll be going after.

PAO Are there other questions? Okay,
gentlemen thank you for coming.

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SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
November 26, 1973
5:15 pm CST

Participants:

Don Puddy, Flight Director
Larry Bourgeois, Corollary Experiments Officer
Dave Garrett, PAO

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PAO We have with us the off Flight Director Don Puddy and also Larry Bourgeois of the Corollary experiments. And if you'd like to start off Don.

PUDDY Okay, let me start off with - by letting Larry start off. As you're well aware last night - said that - asked the question whether or not you all would enjoy just a very quick synopsis of some of the corollary experiments that are going to be used in the comet observations and how operationally we plan to - to use these instruments and Larry very - very graciously consented to come over and say a few words on that. So let me let him kick it off with that.

BOURGEOIS Okay. Let's talk about the Kohoutek observation with the corollary experiments. I guess first I'll give you a list of experiments; S183, S019, S201, T025, S233. On S183 and S019 you have - you're probably aware of we were using the pass for photographing celestial targets - star fields. We were using them for Kohoutek observations as well this mission, (garble) a roll about the vehicle's X-axis to acquire the comet. Using anti-solar SAL attachment to the articulated mirror system - the S019 articulated mirror system; we plan to space observations approximately a week apart for each of these - -

PAO Excuse me, could we have you to move over just a little bit. You're a little off.

BOURGEOIS Okay. Thank you. We plan to space observations for - for these experiments about a week apart, in other words, each of these corollary experiments we plan to - to schedule one approximately a week - every week until approximately 4 or 5 days prior to perihelion. At which time they - the comet gets too close to the Sun to observe from the SAL. Okay, S183, we will be taking UV spectral photographs, S019, we will also be taking UV spectral photographs. The spectra of these two experiments overlap, although S019 extends more towards the extreme UV, we'll get some some emission spectra there that we could not get with the S183. And likewise with S183, we'll get some emission spectra we could not get with the S019. Also when we're in attitude for these two experiments for Kohoutek observations it gives us an opportunity to pick up some star fields that we - we were not - been able to get otherwise. That is in Kohoutek attitude we can pick up fields we could not have picked up in the solar inertial attitude, so we get a bonus there. Since Kohoutek observation does not require the full nightside pass. S201 is a new experiment added to Skylab IV for Kohoutek observations and we also have some objectives to photograph other celestial targets. For example, with

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S201, we plan to - to photograph the Moon, to try to verify the existence of - the existence of a hydrogen atmosphere around the Moon which was observed on Apollo 17 or 16. We also plan to photograph some airflow rings about the - about the Earth which was - which were observed from the Moon with this S201 instrument which was carried there. We also photo - photograph some other celestial targets. Again, S201 we'd like to schedule about every 7 days up until about - this - this is S201 SAL operations up to about 5 days prior to perihelion and again starting again 5 days after perihelion. In addition, we have S201 we plan to take EVA on two occasions, December 25th and Decemb - 29th, we will photograph the Comet Kohoutek during this EVA. And we have - use a slightly different technique for this EVA - these two EVAs we haven't done before in that we will be maneuvering the vehicle to shade the instrument. The instrument is mounted on the ATM truss outside the fixed airlock shroud. We maneuver the vehicle such that the ATM solar panel shade the S201 from the Sun, so that we can take - photograph - take photographs with S201 near perihelion. That way we - -

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BOURGEOIS - - S201 from the Sun, so that we can make photography - take photographs with S201 near perihelion. That way we can photograph the development of the hydrogen and oxygen halos about the comet, near perihelion which would not have been able, we would not have been able to do otherwise. Okay, the next experiment is T025, which is a EVA experiment only. T025 Kohoutek ops will also be observed, be performed on the 25th and 29th of December, that's the current plan. T025 is a coronagraph so that we can occult the Sun with the coronagraph and photograph the comet near perihelion again. T025 spectra is essentially near UV and visible photography. S233 is a strictly handheld photograph out of the workshop windows, we are now doing that about, essentially every 12 hours every day. And the objective of S233 is to record the development of the comet in visible light. To see size and intensity as it develops, so for Skylab, we have a better viewpoint from Earth observations of the visible spectra because naturally as the comet - you see the comet through a long slant angle through the Earth's atmosphere and get a lot of attenuation. So we have a good opportunity to view it from Skylab and we will be keeping track of essentially synoptic data, to see how the comet develops. S063 operations will also photograph Kohoutek from the SAL with S063 with roll maneuvers. 63 will be using unique band pass filters, in the UV and some visible. Again we terminate S063 ops about 5 days prior to perihelion and then pick it up again about 5 days after perihelion. And that's about it for the Comet Kohoutek operations.

PUDDY Okay, as far as today is concerned, of course we had a major medical run on the Commander. As Larry just pointed out to you, we did have a couple of the comet observations, we had a S233 run this morning, had another one scheduled during the pre-sleep activities tonight. We ran a S019 operation on a regular star field, not a comet but a regular star field, which was one of our last - which was the last opportunity this mission that we would have the opportunity of catching this particular star field. And this evening we have one of the S201 which does require the maneuver. Of course one of the big items that I mentioned to you last night that we were going to accomplish today and we did accomplish and it seemed to go very well was ATM checkout in preparation for starting our ATM ops tomorrow. We had several other small things as we continue to set ourselves up for the full 84 days assuming everything goes okay and that is the calibrations on the mass measuring devices. We still may have a little TV I know everyone is interested in getting some TV, we do plan on asking the crew tonight, if there is any possibility of,

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if they have time to set up the TV and possibly catch the evening meal, that should go up shortly and you should hear the answer on that. We know that we haven't had as much TV as we would have liked to have and we are trying to get some. As far as tomorrow's Flight Plan is concerned, we do plan to go ahead and catch the EREP pass as you're probably well aware, we did have one scheduled today and we were forced to cancel that last night due to the fact that the weather more or less clobbered us and there just wasn't enough of the mandatory sites to warrant going into that maneuver. For tomorrow we are covering track 48, our primary objectives there are some of the snow fields at Colorado and the Sabine Forest which is north of Beaumont. In the Sabine Forest, we are primarily looking at land classification which is more or less one of the sensor development aspects that we run on the EREP operations where we are trying to determine just exactly how the 192 instrument and the 190A instrument, how good they are as far as determining the various types of land that we are overflying.

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SPEAKER - - sensored development aspects that we run on the EREP operations where we're trying to determine just exactly how the 192 instrument and 190A instrument - how good they are as far as determining the various types of land that we are overflying.

SPEAKER In addition to that, we do have, of course, the beginning of our ATM operations. In fact, we have approximately 3 hours and 15 minutes of ATR - ATM operations scheduled for tomorrow. I think those are probably the highlights of tomorrow's flight plan. There are - we are starting also one new thing. I'll just mention it to you, and it is - it is being done on a - on an optional basis. But we are starting out the handheld photography that, of course, we did some work on during Skylab III. As you are probably well aware, during Skylab III, one of the - one of the penalties that we had was the fact that we did not have a real good set of onboard crew maps and a good set of the sight descriptions. But we wanted to get a real good field, as to just exactly what was required. We have developed what we call a visual ops book, and if you have an opportunity, I certainly recommend that you take the chance to thumb through that and see what we got. Two of them tomorrow that we are looking at, and all of these will be designated on you CAL comms, which I know periodically look at by number, HH numbers. Two of them tomorrow, HH90 which is really the - some photographs of the inland delta on the Niger river and what they're trying to determine there is - due to the drought that has been prevalent in that area, in Mali. They've actually been losing a lot of the vegetation in these areas where normally they periodically have the capability of - of storing water. And as a result of that, they're losing a lot of the capability that they have in that area of agriculture. And the objective of these particular photographs is to - is to help those people assess how they might stop that area turning into a desert by giving them a real accurate mapping of the vegetation that still remains. The other one is - is handheld photography 82 which is in the (garble) Desert in southwest Africa. Basically, there you have a rather unique wind eroded bedrock and sand depositions and basically what we're trying to do there is just to get a better feel of what you can determine from space as far as the erosional and deposition processes in the arid climates. And to study the transition from dunes to wind eroded rock. So, we'll be, of course, picking up more on those as time goes on and as time becomes available, we'll move, of course, some of those from the optional basis into the scheduled basis, and probably still will retain a lot of these on optional basis because one thing we did learn during Skylab III

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was that if we schedule them, chances are the rev that we schedule them, the weather won't be apropos, and the - the rev that we don't schedule them, it's just perfect. So, we - we learned to leave a lot of that to crew option, although it certainly will be some that will be scheduled at a particular time. Also, we do have TV77 scheduled tomorrow, which is of the Commander working on the treadmill, which is a new exercise device that we're using on Skylab IV for the first time. And one that the crew has indicated is - is a very effective exercise mechanism. That's about all I have, so let me open it up at this time and see if you have any additional questions.

QUERY (garble) the handheld photography today? They had about 6 targets read up to them. Do you know if they took any of it at all?

SPEAKER Are you talking about as far as the EREP type -

QUERY No - no the handheld. They - they gave them 6 targets on a shopping list last night, including these two you gave us today.

SPEAKER To the best of our knowledge, none of the handheld photography was - was taken today. They were - the flight plan for today was, as you are probably well aware, was pretty full this morning. And they fell a little bit behind initially. When I left, they were caught up and there is a possibility some of those might get taken this evening, but I don't think there was any opportunity this morning to take any photography.

QUERY Larry, would you explain what the S201 - exactly what kind of instrument it is? Is it camera or how is it - you know very briefly.

SPEAKER Okay. The instrument itself mounts on top - on the back of the articulated mirror system. The S201 hardware consists of - essentially of (garble) optics. It's unique in the fact that - well, it's unique for Skylab in the fact that it uses essentially an image intensify system where the - the light is focused from the primary mirror onto a photocathode which is sensitive to UV light. Photocathode, it emits electrons proportional to the UV light hitting it the electrons are propelled towards the (garble) (garble) film. The electronic - electrical potential of a minus 24 (garble). And we have permanent (garble) throughout the periphery of the instrument and they focus the electrons onto the (garble) - essentially what you get is a - -

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BOURGEOIS Permanent magnets throughout the periphery of the instrument. And they focused the electrons onto the motions - essentially what you get is a multiplication of the light, that's a multiplication by 10 so you can take shorter exposures than you would with a normal UV camera.

QUERY Don, I noticed that, I guess Jerry Carr more than the others, seems to be a little cranky even still this far into the flight, and he's seems to have admonished the flight planners here and there for not giving him enough time to do this or that. And in comparison especially the last crew who seemed very very efficient and just whizzed through everything and stayed ahead all the time. How would you compare this crew to that crew and back to Pete Conrad's crew even, and especially in the temperament area?

PUDDY Oh, I think - I think from the temperament area there is, to me anyway, there is a very little difference. As you probably remember back on Skylab II Pete specifically was very vociferous right at the beginning portion of the mission until he got past his learning curve that it was very easy for us to plan too many activities for him to accomplish. And once they got past that point things really began to zip and there was never any other problems. Certainly the Skylab III crew got off to a real big bang and got cracking away right away in the experimental area. I think the significant difference that we're seeing now between the Skylab III and the Skylab IV operations is that there weren't near as many items that required the minor repair before you actually started in on the experimental activity on III as there has been on IV, and I think you all have probably seen that list, but there's 25 or 30 items that were necessary. And we've been spending a considerable period of time taking care of these, and you can note in Ed Gibson's voice his desire to get cracking away on the ATM operation, and in fact when we told him this morning that had been a M-class flare out of one of the active regions his only comment was please try to hold those back until we can get on the ATM console and get after them. As far as what you might interpret Jerry's frustrated comments coming down over air-to-ground and the comments that he's made from the standpoint of flight planning, I think these are the same type of comments that we've seen from each crew and that is give us a few extra minutes the first time that we perform any new activity in order to make sure that we can go through that activity and not make any mistakes, and do it to perfection. I think all the crews of course have striven

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to do everything that they possibly can to do things error free, and when you are doing for the first time in space you just - it takes more time. And in general I think we are seeing the effect of about 15-20 minutes tacked onto each one of these items, and it's probably as much ground's fault as anyone else's from the standpoint that the last thing we remember was a crew very high on the learning curve and a Flight Plan that we were forcing ourselves to try to find things to add, and we didn't think anything at all of adding 45 minutes to 2 hours worth of work during the day on an already full Flight Plan. But I think you saw today that the crew was keeping up with their time line and you probably noticed that we did indeed add on top of that during the day almost another hour's worth of activity. We asked them to run a special 190A camera check which they completed very very promptly. We've been asking them to complete a film inventory which I think is well underway. Let me think what else was it that we had in there. There was a couple of other items that we had mentioned today that we were desirous of adding in, and we felt very likely that by the time the crew goes to bed tonight these will be completed. And I think their frustration is primarily at themselves. They want to get up there as fast as they possibly can, and they feel like maybe they're running a little bit slower. From our standpoint we don't feel like this is the case, and we don't feel it's going to be any problem at all, this will disappear in a day or so. We're very happy with what's going on up to date.

QUERY Larry, on the comet, any time during the flight can we expect any live or recorded TV on the comet itself?

BOURGEOIS I don't know of any plans to look at the comet with the TV. Right now it's visible in CSM left window and once it leaves that window it's going to be awhile before we can see it again. And one of the STS windows I think it is. I don't know of any plans to look at it. Do you know, Don?

PUDDY I'm not aware of any.

QUERY For Don, on the EREP pass tomorrow are you because of your gyroscope problem, are you shortening it at all from what it might normally have been?

PUDDY No more than we talked - I guess you weren't here last night. In general we're trying to keep the EREP passes a little bit shorter than we did on Skylab IV. Of course this is kind of balanced by many factors, certainly one of them is the TACS cost consideration by the fact that we're

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only operating with 2 CMGs. Also one reason for some of the shortened EREP passes is the fact that our strategy for Skylab IV is to pick up primarily the mandatory sites, I think there's around 130 of these that we do not have any data on to date, and as a consequence where we used to come over and talk to you about EREP passes with 25 and 30 sites, don't be at all surprised if we come over and talk to you and say that we had a very good EREP pass today and we covered 2 to 10 sites.

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PUDDY EREP passes with 25 and 30 sites don't be at all surprised if we come over and talk to you and say, that we - we had a very good EREP pass today, and we covered 2 to 10 sites. In fact the one tomorrow we're really talking 2 to 3 sites as far as the mandatory sites and there's a few other desirables - in other words a repetition of data which has been official but it's not the first time we - we've covered it. And this in turn has an effect on shortening the passes because you're only going after discrete areas.

QUERY Tomorrow also is the first day that you could possibly have the barium cloud experiment and when - when is that going to be now? Do you know?

PUDDY Well, right now, the barium cloud is - is scheduled the first thing in the morning around 14:20 Z is where we would actually start into the maneuver for that particular experiment with the data take in the 14:56 region. We are assessing right now; the total TAUS penalty of being able to accomplish both the S232 or barium cloud observation, followed very shortly thereafter by an EREP pass. And it - it may not be possible that we will be able to accomplish realistically both of these experiments tomorrow morning. We certainly could if we didn't have the barium cloud requiring the maneuver but right now it does require maneuver, in order to be able to put the camera in a position where we can hold it fixed for the time duration necessary to get a - a real accurate exposure. These require about 5 seconds, the only other place that this would be visible without making a maneuver is the right-hand command module window. And as luck would have it there is no device there to which we could fasten the camera and hold it steady for 5 seconds, so it's strictly will be a handheld operation. That's still under discussion over in the Control center but it may be that we will opt to pick several of the other days when we have the opportunity of accomplishing the barium cloud experiment rather - rather than tomorrow. But that's still being looked at, tomorrow is an opportunity, November 29th is an opportunity I believe December 1st is an opportunity and there's three others.

BOURGEOIS The third and fifth of December.

PUDDY So although it is on the Flight Plan in summary it - it may not actually occur tomorrow.

PAO We had some questions called in from the Cape, Don.

PUDDY Okay.

PAO The first one is from Mary (garble), aren't they going to do any ATM photography tonight they were suppose to, and if not, why?

PUDDY There was some talk of doing an ATM pass

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this evening during the pre-sleep activities. And when I left the Control center that was still the plan and there's no reason to believe that we will not catch the - an ATM synoptic pass during the pre-sleep activities tonight. As far as doing other than the synoptic we will start that tomorrow.

PAO Okay, there was one other question. I think you've probably covered most of this. Do Flight Controllers think they will have to relax flight schedule because of slower pace of crew or do you think the crew will pick up speed?

PUDDY Well, we are not relaxing the schedule significantly at this time. And we certainly have no plans to do so.

PAO Okay, thank you.

END OF TAPE

SL-IV - Change of Shift Briefing
Johnson Space Center
November 25, 1973
5:00 p.m. CST

Participants:

Don Puddy, Flight Director
Bill Moon, EGIL
Bill Hayes, PAO

SL-IV PC31A/1
Time: 16:58 CBT
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SPEAKER Gentlemen, today we have Flight Controller, Don Puddy and with him is Bill Moon, the EGIL. We'll start with a statement by Don and then take it from there.

PUDDY Okay, well, let me just kind of hit what's been going on the last couple of days since we didn't tag up yesterday. As you're well aware yesterday we took what was kind of a modified crew day off. In our opinion, the crew was a little tired. We knew that there hadn't been sufficient time allowed for them to get the cabin completely polished up from the standpoint of making all the transfers, getting their food organized. And we had had a fairly busy activation in the initial few - the first days of the Flight Plan. In addition of course, as you're well aware, we had a CMG problem. All those factors combined indicated that it was best for everybody, the crew and the ground to regroup. So we did that yesterday, but in addition, we also had a couple of things in the Flight Plan that were very beneficial from the standpoint that they're fairly hard to schedule especially during the time frame that we're in right now, i.e. the command module is still supplying its own electrical loads. And these were the battery tests. So yesterday, we did run two of the CBRM or ATM batteries and one of the airlock module or PCG batteries. On the AM side we certainly had no surprise, the battery capacity was as predicted. On the ATM side, we had a little bit of a surprise, but at the same time, it was a surprise in the right direction. We actually ended up with the battery test showing a little more capacity - I should say, indicated capacity - than we had planned. The two batteries that we tested were CBRM 10. This was the - the fifth battery test we had on that one. We had predicted at the beginning of Skylab IV to have - and I want to give these numbers - I don't know whether you're interested in the exact numbers. If you are, we can go over those, but I'll just give you some numbers and we add a bias to them just to give you a relative feel. In the bias, if you want to add it in as we go, is 1.1 amp hours. We had predicted that we were going to have around 7.9 amp hours at the beginning of Skylab IV, and when we ran the test, we actually ended up with 12.0. On CBRM 18, we had predicted 9.4 and we actually ended up with 11.0. Considering the fact that on the - on an average EREP pass, which is where we generally tax the batteries greatest, we've generally run about 4 or 5 amp hours out of an ATM battery with a maximum somewhere in the vicinity of 8. We were - we are certainly in good shape with the ATM batteries based on these figures. However, I - I'd like to make sure you understand that - that this battery test did occur after a long period of not too

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deep a discharge in the - in the ATM batteries. That may have had some effect on capacity. In addition, since the CSM was supplying its own loads, we had to do this over a longer period of time, additional daylight cycles being interspersed between the - the nighttime that we did discharge the batteries than the other test. And as consequence, the batteries might have had a chance to restore a little bit more under no-load condition than we've had in the other tests. So, the spread may not be as great as the numbers themselves indicate, but I think what the test indicates is that we certainly are not experiencing any degradation in these batteries greater than what we predicted. And that's what we were really after and so we're very happy with the test results themselves. Bill, you want to add anything more to that.

MOON: No, I think you covered it pretty well there. But I'd like to emphasize again that it looks optimistic now that we did come up with a little more than - than we had anticipated to - -

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MOON - - looks optimistic now because we did come up with a little more than we had anticipated but of course we know that it's due to these reasons here where we had the lower discharge currents and the shorter night periods and a little more time for the batteries to recover during that day period. So we just - right now we're planning all the EREPS just going OPS normal now. Probably later on we'll do a few more tests, after we've given the batteries a little deeper discharges on the EREP to see if we are maintaining that capacity.

PUDDY Okay, that's really about all I'd planned to say about the - the day off. One of the other things that we were doing as you probably did detect yesterday was joking around a little bit more with the crew, giving them a little information, they got their first news update yesterday and I don't know how many of you had the opportunity to hear the crew wake-up song but it was a - one of team three's jovialities, any of you who haven't heard the Lonesome Stardust Cowboy yet ought to get an opportunity to hear that and imagine what it is to wake up to that. The crew's spirits yesterday I think were heightened in that I think that they did catch up, I think that attitude has certainly carried over into today's operation and I think we are definitely at the point where we're reaching the top of the learning curve as we gone through with both the other crews and I think certainly within the next few days the comments that may have been passed on to you that we're following a little bit behind in the Flight Plan will disappear from the agenda. So before I move on to day 10 and the future do you have any questions on the ATM batteries or anything that occurred yesterday.

QUERY The thing of it here, I - it seems like to me it was a pretty heavy exchange regarding CBRM number 5, I believe. Was it some switching problem?

PUDDY Okay. The chances of me going through this one completely without stumbling are remote but let me try. Basically what happened yesterday when we were off console at that time but at the end of the battery 10 test which is the CBRM, you finish up and then you bring the charger back on, well when they - when they brought - let's bring the charger on (garble)

MOON Yeah.

PUDDY When they brought the charger on, they also brought the charger for battery 5 on which they shouldn't have and when the crew -

MOON That one switch actuation should not have done that if it was -

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PUDDY You have independent control over the regulator and the charger for each of the ATM batteries. But when they were exercising their control over the battery 10 charger it also brought the battery 5 charger on which it shouldn't. Basically all that boils down to say is that we've got some sort of a crosstalk somewhere in the spacecraft that essentially says anytime you exercise on board, anyone of the charger on switches for any CBRM, you're going to bring the battery 10 charger also on -

MOON Battery 5

PUDDY Battery 5, excuse me. And the procedure that was up linked last night was to say, if you do this be sure that subsequently you go back and turn the Battery 5 charger back off line and it's that simple. Now exactly what the mechanism of that crosstalk is, we don't know, but there is some sort of a crosstalk and it will occur whether it's done by the crew on board or it is done by the ground unless we do it by ground command and the crew has placed the switch in more or less the null position, in other words, no CBRM selected, if they do have it in the null position we can turn a charger off and it will not bring - or the charger on and it will not bring the battery 5 charger on. If that came across.

QUERY Yes, I got it.

QUERY Do you have any news on the CMG in particular, did the people in Huntsville come up with any answer to the cause of the failure of the CMG 1.

PUDDY About the only way I can start out discussing CMG 1 -

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QUERY - news on the CMG in particular did the people in Huntsville come up with any answer to the cause of the failure of the CMG 1?

PUDDY About the only way I can start out discussing CMG 1 is to say it is a gyroscopic type device. You're very familiar with the rate gyro failures that we had earlier in the mission. The extensive analysis that was required before people started homing in on just exactly what the cause of the anomaly was. A considerable number of people have brought - been brought into this analysis, more and more data has been gathered, still being analyzed. As far as the exact cause of the malfunction, I cannot tonight tell you what that is. We did tag up with Huntsville around 3:00 o'clock this afternoon and discussed the results of their latest findings. We still do not know what that is at the present time. Based on what we do know however, it certainly does appear likely that we have had a bearing failure in the CMG, and at the present time appears very unlikely that we should be able to return that CMG to service. So, until the analysis is completed, or new facts come to light from the operation side of the fence, we have continued our planning towards running the remainder of the Skylab IV mission in a two CMG configuration. Okay. Let me just briefly hit a few things on today's Flight Plan, and come back if you have any additional questions. Our intent after we took the modified day off was to get ourselves in a posture to go ahead and be able to start the EREP and ATM operations. A couple of things that we wanted to get accomplished before we started ATM was to exchange out the monitor that we lost on the last mission, and put in a modified timer for operation of a couple of the ATM intru - one of the ATM instruments, a E82B. which merely enabled us to use that instrument more efficiently as far as film usage. In other words, we had determined that the original automatic sequence that we had on that particular instrument overexposed several frames of the film, and this timer just enabled us to use what we consider to be only the efficient exposures of the film, and get away from the manual operation. We did - We did accomplish both of those tasks today, and are ready tomorrow to go into a full-blown ATM checkout. We ran through the EREP checkout today, and as you may have monitored on air-to-ground, we did have a little bit of trouble loading up one of the film magazines, however, that has now been accomplished and we have to the best of our knowledge, completed the EREP checkout and are planning on, if the weather behaves properly, which is a little doubtful at this point in time, if the weather behaves, we are planning on starting out on our first EREP pass tomorrow. We also completed an S183 optics replacement, had a major

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medical run on the Science Pilot, and are planning on doing one of our SO19 comet observations the latter part of this afternoon. As far as tomorrow's concerned, we are planning on doing the ATM checkout, having our first EREF pass, and the subsequent day beginning our ATM operations. So that's kind of the plan for tomorrow and the day after. Of course, all of these being supplemented with the medical runs and comet observations sprinkled in throughout the plan. Let me turn it back over to you for any questions.

QUERY What actually were the difficulties with the SO19? I recall the CDR couldn't see the stars they have through the SO19 when he checked it out today.

PUDDY Okay. We pondered that one for awhile, and basically, after we thought about it for a few minutes, it became intuitively obvious. There is a viewing mirror, a mirror that if positioned properly, allows him to simultaneously view what the camera itself is seeing. And what had happened was that that mirror was in the down position, or in a position that did not allow him to view. There was absolutely nothing wrong with the instrument, the instrument if initiated, would have - and positioned properly would have scientifically accomplished all the objectives. But it did preclude him from seeing it. And when we asked him if that was the case, he thought about it for a minute and said, "That's it", off he went. We are planning - there's no real reason to have to view to accomplish the operations, and the SO19 comet observation this evening will be accomplished without that mirror being in the position for him to view it.

QUERY Don, what are the general sites like tomorrow on the EREF pass?

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SPEAKER - position for him to (garble)
QUERY Don, what are - what are the general sites like tomorrow on the EREP pass. What kinds of things are you going to be looking for?

PUDDY Let - let me say a couple of words about general EREP philosophy this mission. And hopefully tomorrow or the next day, I can get Dick to come over and give you a full blown explanation of this. But in - in general, our EREP strategy this mission is to go after those sites that we have not obtained any data whatsoever on. And to accomplish those objectives that we haven't yet had an opportunity to - to catch. And of course, being the season that it is, a lot of these are associated with winter phenomena. Of course, as we begin the mission, our lighting is optimum for the United States, and as we go on through the first few days of the mission, it also becomes a very good for South America. Tomorrow our pass - we had a couple of opportunities. One track would have - takes us over Montana and down through the coast of Carolina and on out to sea. And that is the - the track - it's track 33, that is the track we presently plan on - on flying. Basically in Montana it is an ice study. We have several regio - regional planning sites in the - right off the coast and Carolina and we have one storm objective that we are trying to accomplish mid U.S. And, of course, as we go out over the water, we have a water objective, that we're trying to accomplish strickly, clear water type objective. And the area off the coast of (garble) is clear. The other one which we certainly like to get one of these days because it is an objective we have not met yet, which is the hats area or the Houston area test site appears to again to be eluding us. We're just hopeful that the one we're on right now doesn't clobber in from the standpoint of weather and the NATS area clear. Because it would be very difficult to turn around.

QUERY Don, can we expect any out of the window TV during the EREP pass and what generally is the outlook for TV over the next couple of days?

PUDDY You probably will be aware of the TV we got today on the S192 align. We did get about 30 minutes of that, we'd have hoped to get ED41 which is a maize TV. We used up all of our recording capability and we're not able to dump and recover, so that we could get ED41. We do not have any TV scheduled tomorrow. And will not be getting any from the VTS as far as day 12, I don't remember seeing anything scheduled although I feel fairly certain that - that there probably will be a requirement - Let me check, maybe I can find something for you here. I don't know whether I brought one of those with me. No, I didn't. I can't answer you

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specific question on day 12. We do have, as you're probably well aware, a lot of TV scheduled for Skylab IV. And that does include TV during the EREP passes. It just so happens, tomorrow, we have none of either.

QUERY On that S019 mirror, do you plan to go back and get that fixed and -

PUDDY Let me - let me correct one thing. It's not a problem.

QUERY (Garble) wrong numbers.

PUDDY No, no, it's not a problem. It's strictly a positioning. Something before he put the back on, he could have flipped that up and it'd been that way forever. And it is not associated with the replacement of the mirror itself. This is a separate mirror that we're talking about.

QUERY Do you expect to - to go back and reposition that mirror so that the operator may see what the camera sees.

PUDDY Yes.

QUERY And in that event, would - would you expect him using that device to get a good view of Kohoutek, that is visually?

PUDDY Yes.

QUERY Okay, and so - such that he might, since there is a lot of interest out here, might even put a description down on us.

PUDDY Oh, I don't think there's any question that you're going to get several verbal observations of the comet between now and the time we quit observing the comet. There's no question about that. Whether it will come during the S019 operation or during S193 or S201, whatever, I'm not sure, but, we're going to get plenty of comet observation, verbal observation.

QUERY Okay, do you know whether or not they've got the handheld 35 millimeter today Kohu - Kohoutek.

PUDDY They haven't - they haven't as yet.

QUERY They haven't said?

PUDDY They haven't as yet.

QUERY Don, I believe that it was Friday night that the cap came, and I - I can't remember who it would have been. It was talking about some sort of asking if there had been any sort of venting going on and it all - it turned out that it was just a matter of learning to live - as he put it, learning to live with two CMGs. Are - are there new things that you - that you've learned since Friday I know exactly how you're going to have to control the attitude now with - with two CMGs -

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QUERY

Are the new things that you learned since Friday on exactly how you're going to have to control the attitude now with 2 CMGs.

PUDDY

Well let me say that we're on a learning curve there and that we haven't peaked. In fact we're still probably several days away from it. We do have a workable program, we feel like we can realistically simulate the momentum of the given flight plan using 2 CMGs. We are of course doing an evaluation each day on the flight plan, I think it can go without question that we are going to use more TACS than if we had 3 CMGs, no if, ands, or buts. The exact magnitude of that right now, I would be probably premature in predicting but it's going to be a significant increase over what we had predicted that we would use for the 3 CMG case. However the point that I would like to emphasize, there isn't anything that we've come across yet that would tend to indicate that we will not be able to complete all of the Skylab IV objectives with the amount of TACS we have remaining and so we are not at this point in time nor do we plan right now to start curtailing operations in any fashion. The thing that we may get into, however, and again I can't say positively but things that we're looking at right now are cutting back a little bit on the duration say of an EREP pass. This doesn't say we won't get the objective because we'll probably just run more of them. But it does say that we'll probably have to limit the arc, the length of the arc that we're able to stay in and still maintain an allowable TACS usage. It also says that you may have to put a little more spacing between maneuvers in order to allow the momentum state to recover. Constraints like that but at the same time I think we can meet all the objectives, but we're still learning.

QUERY

What - since we have Mr. Moon here, I just wondered in view of the fact that you got one CMG out and it's going to take longer or at least that's what we were told before, in the maneuvers to return to solar inertial after an EREP, and you now have a fairly good handle on the condition of your power processing equipment and everything. Do you have any concern that this longer maneuver back to solar inertial is going to impact you on down the line as far as power is concerned?

MOON

No not really because we have some powerdown cases where we can power down some gear on board. The ground command to keep us within our constraints on the battery DODs that we are allowing for EREPs there so and also we do have some checklists that are formulated on board

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that the crew can power down certain gear for us to limit the discharge on batteries.

QUERY Okay.

PUDDY Let me add a little bit to that, Paul if I may. I indicated to you that we're cutting down the length of the arc for the actual data take, so this in itself, without taking any additional electrical power out gives you more time in which to make the maneuvers, so the five and 8 amp hour spread that I was talking to you a minute ago is what we normally had discharged out of the ATM batteries on Skylab III, we were talking in the order of 30 to 40 minute data takes, last mission. We're talking right now around 15 maybe 20 minutes of data take. We're talking about maneuver time last mission in the order of 13 minutes, we're talking this time around 20 minutes. So you can see we're working into a certain time balance there as far as the overall maneuver in and back to maneuver into ZLV and maneuver back to solar inertial time. In other words, there's a compensation because we decreased the data take time right to keep everything balanced.

SPEAKER But you are charging while you're in the ZLV mode because you're not, you know, totally on batteries there so you are helping yourself out there too.

PUDDY The longer you take to make that maneuver the more effective charge capability, you also get as long as you're in a daylight regime. The longer it takes to pitch completely over the more effective charging capability, yet. Secondly as Bill indicated you certainly have the capability for many levels of power down and we've only during Skylab III in general, we're only touched on the ground powerdown, we have the crew powerdown and a couple of levels of that. In the third case which we haven't even begun to attempt to use yet, we have a considerable power reserve left in the airlock module batteries which by what we call LCV adjust, we can go ahead and use that additional power, so - We're a long way from having a problem from the power standpoint.

QUERY When is the CSM - when is its internal power exhaust itself, the fuel cell.

MOON Usually about day 20.

QUERY Day 20

MOON What day are we today day 10, so we got about another 10 more days or so.

MOON That's all based on the hydrogen quantity we got left.

PAO That will be all, thank you very much.

END OF TAPE

WALLACE WALKER CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
November 23, 1973
4:27 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Dave Garrett, PAO

PC-30

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Time: 16:27 CST
11/23/79

PAO We're ready to start our change of shift briefing this afternoon. We have with us the out-going Flight Director, Neil Hutchinson. Neil.

PAO Testing, 1, 2, 3. All right. We're ready for our change of shift briefing today. We have with us Flight Director Neil Hutchinson.

NEIL HUTCHINSON Okay, I'll talk a little bit about the Flight Plan today before we talk about the CMS. We had some problems again with the Flight Plan today. Basically, I guess I could say that the crew was tired last night and got to bed a little late. When they woke up this morning they expressed a desire to sleep in awhile, which we certainly granted them. They ended up getting about 45 minutes to an hour late and then right off the bat this morning, we ran into a problem with one of the things we had on the Flight Plan to do. A thing called the limb volume measurement, which you've probably heard some about here in the last week. It goes along with this set of data gathering things we're doing on the bodies of the three crewmen relative to the early redistribution of fluids in mass, and it's nothing more than a tape measure, or a thing goes down the arm or - and down the leg with a lot of little tapes around it that you measure various diameters. It takes a long time, it's cumbersome, it's hard to work with in one g, and it looks like we just missed the boat on how much time it was going to take them in zero g, I mean and it looks like we just missed the boat on how much time it was going to take them. Anyway, this morning we had one of those scheduled for all three crewmen right off the bat, and the fact that that thing is difficult to do, plus the fact that they got up late, contributed to pretty much tear the Flight Plan up today. We, by the time we got to lunch time today, about the only thing we'd done in the morning was some housekeeping and this limb volume measurement. So, in order to account for that and to try and get them to bed tonight on time, we pulled a few things out of the Flight Plan. And I won't go through them. A bunch of experiments that were scheduled for this afternoon, a couple of ED experiments, some more work on the body - body mass redistribution and so on. Let us just say something about flight planning in general, it looks to us - it's beginning to look to us like we're going to have to kind of back off here and regroup a little bit to try and get the crew a little better organized. I think that - I'm not sure what's going to happen. If you've been listening to the Flight Director loop in the last couple of hours, you know that we're talking about giving them the day off tomorrow. That decision has not been made yet, there's still several things to consider, but I feel pretty strongly

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that if we don't give them the day off, they'll probably take all of the activity that was the morning of the Flight Plan tomorrow out of there. I think it's evident that we've got a situation here where the crew has just been working - working extremely hard to try and get some of these anomalies sorted out and to try and get the workshop into a configuration where they'd feel comfortable with it and know where everything is. I think - Maybe in retrospect - of course, pulling the EVA off yesterday was a super thing as far as we're concerned and as far as they're concerned in terms of getting a big block out of the way that had to be gotten out of the way prior to us being able to do a lot of things like ATM and EREP. Now that we've passed that particular hurdle, I think it's time that we kind of regrouped, took a real good look at letting the crew have some time on their own without any scheduled activities to put this book here and that book there, and this washcloth here and so on and so forth. And I hope that when we get through looking at this thing tomorrow that they're going to end up with the day off tomorrow. If they don't, they ought to end up with several hours per crewman of free time with nothing going on. And in the end, I suspect that if we do that, we'll see an increase in the productivity of our amount of work we get accomplished per unit time, because I really think they aren't organized yet. And I think it shows. I think when they can't find checklists and they can't find a part which they have to have to put together a particular experiment, that just means that's nothing that -

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BUTCHINSON I think when they can't find checklist and they can't find the parts they have to have to put together a particular experiment that just means it's nothing against them. It just means that - that just transferred them over from the command module and stuck them away where there suppose to go but they just haven't ever retrieved them and they don't know where to go to get them. And until you got everything in its neck that you like it in I think you're going to see a certain amount of this kind of thing. Like for example today we had a activity scheduled and the crewmen couldn't find the checklist and matter of fact, we can't find it now. So we're going to send him up a new one tonight. We looked everywhere we knew where to look but we know it's on board somewhere. It went up with them and they transferred it and it's in workshop somewhere. And I don't think it's any big deal. I think it's a completely natural reaction that we're seeing here that the ground has continued to fill up the Flight Plans fairly full. Of course you know we have a lot of troubleshooting left to do before we get the ATM going. We've got to replace the monitor and so on and so forth. And there's been an impetus to try and get - get the science work underway since we are in mission day 8. Course we are gathering science on all the medical experiments. In the long run though I suspect that we'll make money if we'll let them regroup a little bit, and I think that's going to happen. Over to the CMG - CMG thing. We don't know a heck of a lot more about it now than we did - did this morning. Mainly because most of the failure as you probably know occurred out of sight of the ground. The amount of data that is associated with that system that's on the on board recorder is minimal. As matter of fact the only thing we got on CMG1 directly is one phase of a 3 phase AC current that is used to drive the CMG. No temperatures, no wheel speeds, no anything like that that would give us some insight to the exact parameter and their performance when the thing stopped. Based on every-thing that we know to date and there are - And, boy I emphasize that to date because there are an awful lot of people looking in a awful lot of things and we have not, we certainly aren't at the end of it yet. I guess you have to say that the going theory still is that we had a bearing failure in bearing number 1 in CMG 1 and there are lots and lots of people here and at Huntsville, looking very hard at every nook and cranny of data that we can get our hands on in terms of past performance of this CMG performance of the CMG's so on and so forth trying to pinpoint what happened. But all - all the data that we got to date really - really pretty much points - points towards

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a bearing failure. Now as far as health and well being of the other 2 CMG's. We are looking very hard now back at some data about 2 or 3 weeks ago on CMG number 2 where we had an occurrence where we think we remember we had an occurrence it takes a while to get the data - to get the data all pulled together. But we think we had an occurrence that was similar but of nowhere near the magnitude of the initial occurrence on CMG 1 which you know happened during the unmanned phase. The initial time that we saw this phenomenon of the wheel slowing down and the current to the motor that makes it spin going up. And as you know at that time that particular, although we saw - saw it happen and had fairly good set of data on that situation. It was look at by all the people in the know on CMG's and - and decided that - that time what we were looking at on CMG 1 was the basically the density lubricant situation on - on the bearing that was causing the wheel to have just a slight bit more friction. The numbers that we're playing with here when we look at one of these wheels and say that it is or isn't working right are very very small amounts of variation the wheels of course as you know turn - -

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HUTCHINSON The numbers that we're playing with here when we look at one of these wheels and say that it isn't working right are very, very small amounts of variation the wheels of course as you know turn up in the 9,000 RPM range. And the kind of variations that we're using as clues are like 50 RPM in 9,000, and that's not a heck of a lot. As a matter of fact, it's not uncommon to see a wheel speed transducer bounce like that such in just PCM noise, that's only a couple of PCM counts. So, anyway, we are going back and taking a very close look at the data on CMG2 and CMG3 to make sure that if there are any other occurrences in the data that ever remotely resemble the thing that CMG1 exhibited 3 weeks ago, we find it and see if we can understand it. In the mean time CMG2 and CMG3 continue performing completely nominally. We of course, last night when a failure occurred, the software system was switched, the CMG was shut down and which automatically switches the Computer system over to - it tells the computer you only got two of those momentum devices instead of three and it goes into a different set of routines to manage the way it maneuvers the other two CMG's that are remaining. We did have a problem this morning earlier, we were getting TACS firing every orbit, 2 or 3 or 4, that turned out - turned out to be one of the things we do when we get into a two CMG case is that we deliberately bias the computer's knowledge of where - where the momentum ought to be stored or in other words the computer's knowledge of a nominal momentum profile so when we go through a dump maneuver at night and get rid of the excess momentum it takes the CMG's to a more optimum place. Now this dump bias is as it's called a momentum bias, that we load in immediately after the anomaly or shortly after the anomaly, turned out, that the number that we put in there was one that was not quite optimized for the particular Beta angle that we are, and of course we know momentum is a function of how far that ATM is tipped out of plane, to point towards the Sun-out of the orbit plane. And consequently this morning until we figured out what it was that was getting us, we endured about, oh, 3 revs of a couple or three firing per rev, I think we ended up with 8 or 9 minimum impulses. However since then we have recomputed this bias number based on actual Beta angle that we currently are flying at and have reloaded in the computer and I expect this is going to end up being a standard procedure from now on, where were continually, not continually probably once every few days updating this number in the ATM computer - in this bias number to keep the - keep the system from firing the TACS just in normal attitude hold as we go around, anyway it looks

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favorable because since we loaded the new biases, we have not fired any TACS. We are looking at the maneuver planning as you know we have a trim burn scheduled for tomorrow at about 02:30 Zulu in the Flight Plan to get the EREP ground track squared away for the EREP passes. That trim burn is currently under evaluation, give you some numbers, the burn is 5.8 feet per second delta V, that's 134 pounds of CSMRCS. We've got of course a very healthy margin of CSMRCS. The rendezvous is you recall we mentioned it a few days ago was one of the best ones we've ever had, so we've got about 625 pounds of command module RCS to spare and by to spare I mean we got that much of what I consider to be the minimum we have to keep in the command module for deorbit purposes for back up deorbit purposes, in case the SPS didn't work, you recall we keep two ways to get down, both the RCS and the SPS. The TACS situation, we currently have about a 30,000 -

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NUTCHINSON The TACS situation we currently have about 30,300 pound seconds more or less these numbers are fair - are close enough I guess. That total we had - we are working in Skylab IV, we were working and p - and still are working since the failure to a red line of 10,000 pound seconds. Now that red line is based on us - on having to do a rescue and having to hold attitude for 10 days, I believe or something like that while waiting for rescue and so on and so forth. So, it's fairly conservative it also takes in account - a CMG failure which we have had now and - so that gives you if you subtract the numbers in round numbers, 20,000 pound seconds of TACS to workwith for the SL-IV flight. And if you just run out the kind of numbers that we used in SL-III for typical EREP maneuvers and JOP 13s and so on. And if you think about the fact that you only have 2/3 of the amount of momentum you used to have to make those maneuvers that of course is going to increase the TACS cost, there's no question about that. If you do like maneuvers in your fondest imagination it's pretty hard to believe that we haven't got enough TACS to complete the nominal mission without any problem. Now it's going to take a lot more looking but from a very gross look at it, it just doesn't seem like if the numbers all - all stand up that - that we've put ourselves - this failure has put us in a posture where it will compromise anything as far as the maneuvers go that are required to complete the mission. Because of that I think unless - unless we get some more information here tonight I suspect that the trim burn is going to be done tomorrow. Of course there - the trade off there is that the CSM is capable of doing EREP maneuvers, using this the CSM attitude control system in the CSM RCS we have a prog - programmed CMC to do it and of course we got the gas to do it, the propellant and - However, it - it just looks like the margins in the workshop, attitude control systems as far as TACS go are adequate to cover the planned use of that commodity. In general anyway, for the SL-IV, Kohoutek and EREP operations so I really think that we'll probably spend the propellant about 20 percent of what we have available in the CSM to do this maneuver tomorrow. If we don't do that it puts the EREP folks in a pretty difficult position, their ground track not only is not on nominal but the darned thing is regressing continually about 15 miles or so a day so it - it's not even - it's not only not on nominal it's not repeating and that makes their data takes very tough. And of course it would mean a lot of the crew training on VTS sites and everything pre-mission would go down the drain because they - they wouldn't be looking at the same piece of ground. Anyway, that's about I think I've answered all

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these questions from the Cape. But there - What in general the crew will be doing tomorrow I hope they're going to have a day off. If they don't, they'll probably have the morning off and be doing medical runs in the afternoon. Any chance of any EREP pass tomorrow? There is no chance of an EREP pass tomorrow. We have no further insight into what caused the CMG failure the going theory still is a bearing. Anything new on the possibility of another CMG going out? Well I've already talked about what we're doing to - to look into that and there aren't any good answers yet on that subject.

PAO

Okay, other questions? Warner?

QUERY

What are the chances for having TV

tomorrow?

MUTCHINSON

I don't believe we'll have any Warner. Tell you why, the one thing that we had set up for TV tomorrow was the EREP checkout and that's being done in the morning and I really don't think we're going to do the EREP checkout tomorrow.

QUERY

Are you considering at all to - -

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MUTCHINSON And I really don't think we're going to do an EREP checkout tomorrow.

QUERY Are you considering at all to throw the CMG on again? Number 1 I mean.

MUTCHINSON No sir. Not at this time.

QUERY What will the trim do - trim burn do to the - the path of the workshop?

MUTCHINSON Well, tomorrow it - what it will do Howard, vary simply tomorrow the ground track has regressed to where it is exactly nominal. At this time we're going to do the trim burn and the burn you can think of it as stopping the regression right where we are. And this single trim burn will establish a repeating ground track on the SL-IV nominal. And we don't an - well we will have to do some little tweak burns here probably every 3 or 4 weeks to keep it exactly on the money. But basically it sets us up in a completely nominal configuration by stopping the regression at the proper point over the surface of the Earth, so that the ground tracks are repeating every five days over the proper land areas.

QUERY Will student project experiments be done tomorrow?

MUTCHINSON No. I doubt it. Well we had two of them on the schedule for today and they - we had to pull them both because we got behind the power curves this morning. I would suspect the first ones day 10 or day 11, now.

QUERY Do you know if they saw the comet and photographed it?

MUTCHINSON Jim, I think that thing was not scheduled - let - let me - let me find out. Yeah, I know, I'm trying to find out when it was. It was at -

SPEAKER Two - -

SPEAKER 2:48 this afternoon.

MUTCHINSON Yeah, I - no - I don't know whether we - we had intended to press on and get it if the crew was at that point in time. We decided not to inhibit the momentum which meant the vehicle would be maneuvering but felt that the comet would still be in the field of view and it would be slightly smeared on the film. But they felt they could - ought to go ahead and take the data. And - and I don't really know whether they did or not. And I have not - have not heard whether - whether we got it or not.

QUERY Even if they take the day off tomorrow would they still take additional Kohoutek S233 photos tomorrow?

MUTCHINSON No. If they take the day off tomorrow, it's going to be a day off. I think about the only thing we would do, we'd probably run the battery checks tomorrow. Because we do want to get - but that doesn't really require a lot of crew work - I mean - you know you have to sit up at

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the panel and for a couple of nightside passes and I suspect that no matter what happens unless we cancel it, the trim burn will be on tomorrow. But if it's going to be a day off it's going to be a genuine day off.

QUERY Neil, do you have any idea how long it will take them to get organized and over these - these initial problems?

MUTCHINSON I think they need a day. And I think it'll do wonders for us if we got a day off because in fact I don't even think they need a day. I think if you had - if they had 4 or 5 or 6 hours with nothing that they had to do that they'd get everything pretty much in its right place and start thinking about, um boy I'd sure like to get at the ATM panel or something. And that's the kind of - kind of thing we have to get going as opposed to this feeling which I'm sure they must have, which has got to be frustrating, that they're always running behind the power curve. Everytime they wake up the first activity they have you know in 15 minutes later. It's kind of hard to go through your work day with a set amount of work that somebody wants you to do and knowing damn well that when you get to the end you aren't going to make it, aren't going to - and that's just a bad way to be. So, I really don't think it's going to take all that long, I - I just think that they need a day to - to get sorted out.

QUERY When can we expect a decision on the day off and if they do take the day off tomorrow what will Sunday and Monday look like? And when can we get the first EREP and when can we get the first ATM?

MUTCHINSON Think you pretty much move them down one day. Each one of them and as far as when the decision I would suspect in the next couple of hours.

QUERY I didn't understand what you said earlier. Do you think JOP 13 is in danger?

MUTCHINSON No sir.

QUERY Oh.

QUERY What kind of deviation of the orbit is it? Is the orbit to high or to low or out of plane and is the bu - burn going to be plus or minus?

MUTCHINSON Well, it - it's let me see - is it going to be retrograde or prograde? You've really got me let me - -

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HUTCHINSON Well it's, let me see is it going to be retro-grade or post-grade, you've really got me, let me - let me just think about it a minute if we must be going to - if we're moving west, that means, I guess it's going to be retro-grade so that means the orbit's too high so you got to take a little energy up. I remember somebody asking me this during one on SL-III and I completely winged it and accidentally guessed right, I think that's right, you ought to check, somebody ought to check that, for that's very easy to check, just find out whether it's at noon or midnight.

QUERY

What is it that's keeping you from saying, just go on and take the day off fellows.

HUTCHINSON

I think we want to make sure that we aren't getting ourselves behind the power curve on any of the scientific work, particularly getting started on Kohoutek. And there I guess we started talking about it this afternoon about 2 o'clock, I started thinking about around lunch time when I begin to realize, how far behind they were today and then Jerry made some comments - the CDR made some comments that he was going to have some things on the A channel for us that's relative to scheduling which probably meant that he had some comments against the Flight Plan today. The - the thing, it just takes awhile for all of the machinery and everybody to get tagged up to do something like that. I - we have to make a decision on whether when we - if we take the day off tomorrow, are we gonna still let them have one on day 13, they were scheduled for a day off on day 13 and I really suspect that if we take one off tomorrow, we'll probably revert to this being the seventh day day off cycle and not take one on day 13. There are a lot of little odds and ends like that - excuse me - to get ironed out, it's just a matter of time. Nothing more than that.

QUERY

Neil, I don't think I quite follow you yet on this problem that you're having with the crew or that the crew is having with you or what? Could you get in a little more detail or more specific as to what seems to be their problem in getting going?

HUTCHINSON

Well - I - in a nutshell we have given them an awful lot of work to do in the first 8 or 10 days to this flight. They had a very tough day yesterday with that EVA, I think they're a little bit tired. They didn't want to get up this morning. They evidence the fact in terms of their ability to get things done that they are having problems with just plain old being organized and as long as we keep, for example, this overage food organization thing has been with us since activation, you know, and we keep putting it in the flight plan, we had it in the flight plan today and

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they didn't get to it. And as long as they keep getting japped with little things like everytime they want to eat, they got to go sort out a bunch of food, the pantry is not organized you know. Everytime they want to - they're looking for this checklist or that checklist, they brought all the checklist over you know, a carton full of them, this thick, put them in a locker down in OWS and they never deployed them and I think - I don't think we're having a problem between them or us in any way shape or form, I think if anything it's on the, it behooves the ground to recognize that they are having a problem getting organized since - leave them alone and let them get organized for a little while and then get after this daily flight plan routine. And I don't think it's anything, I think it's just a set of circumstances that were in here, based on the work level we've had in the amount of work we've been putting into the flight plan and we just need to - to give them a little time to get straight and get their space ship straight.

QUERY What are the medical condition of the crew, have we had any commensys from the flight Surgeon on that.

HUTCHINSON No I think - they're certainly feeling fine, I think they're tired and I think they're tired from the EVA yesterday, it was a long hard EVA and they did sleep in late this morning, however, you know they've put in - they've put in a pretty good day that even though a lot of things took them a lot longer, the fact that you gave them some - a task to do, that we misjudged the amount of time it was going to take to do, doesn't mean that they weren't working just as hard to get it done. So even though they didn't accomplish everything that we had in the flight plan, they've been just chunking away at it all day long.

QUERY Neil, what's your assessment on what would happen if we lost another CMG?

HUTCHINSON Well, right now I guess I'd have to say we're in a come home case with another CMG gone. Certainly not any kind of jump out of there in the next 24 hours type of thing because you've got a lot of capability in the CSM to hold attitude of the vehicle. There are some people working at Huntsville on a thing called a one CMG control law. I don't know how that quite works but it - they are thinking about ways of trying to modify the onboard software to at least partially control the vehicle attitude with a single CMG.

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HUTCHINSON They are thinking about ways to try and modify the on board software to at least partially control the vehicle attitude with a single CMG. The software that we have on board now with another CMG failure is totally inoperative. It wouldn't work it wouldn't control the vehicle attitude. And of course with a single CMG you could not control 3 axes you could only control in 2 directions. The 2 degree of freedom gyros now. So you'd certainly have to have augmentation of some kind either from the CSM or from the TACS and any kind of a control law that you'd devise it would only use a single CMG and you wouldn't have much momentum. And there are - lot of things that you would have to think about. But we are working on such a scheme, and its not totally far fetched. The come home situation is you know just based on the fact that if you can't control attitude you can't do anything. And you know we'd probably stay - and when I say we wouldn't come home in a day I'm not sure we'd come home in a you know we might stay there a week.

QUERY Under the present circumstance say another CMG went out tonight away from the ground station. And what would happen to the spacecraft then. If the Astronauts were asleep and you lost another CMG and you were out of contact with the ground first of all - -

HUTCHINSON Well, they'd get a caution and warning.

QUERY They didn't get one this morning.

HUTCHINSON Well, but it turns out that the - the way the CMG went down let me see why didn't they get a caution warning. Because they didn't get - didn't get a CMG saturation immediately when - when we loss the CMG. Would 2 - with 2 CMG on and the computer if anything happens to 1 more of them of course you're going to get attitude control lights going off. Because your going to drift out of attitude, because with 1 CMG you can't hold attitude. There weren't any big attitude deviation when this CMG went down, because the other 2 were doing the job. The - they'd get a C&W and of course they always have the perogative and the checklist and everything else necessary to control the vechile attitude with the CSM. Which is exactly what we do when we do trim burns for example. That trim burn tomorrow is a CSM control burn.

QUERY What CMG was last then?

HUTCHINSON Well, CMGs operate in 2 planes and my gosh, I can't believe I can't say that question. It's CMG number 1 and I'm sure it's X and Z which is - I don't know I can't answer the question. But it's 2 - it's 2 planes of course and it's CMG 1. And somebody can get them the answer to that, very straight forward. Each CMG covers 2 planes so you've got

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that's why with 2 left you get - you can get 3 cover all 3 axes.

QUERY Neil, how would you assess the - the chances the percentages now on that another CMG going out it was very low this morning. But Phil said he was, they were refiguring the chances.

HUTCHINSON I don't, I wouldn't even care to speculate I don't think. I wouldn't even describe it as there being a chance. I think you know were looking at the data very hard on these other 2 CMGs to see if we see anything that might resemble the characteristics this one exhibited. And we haven't found that yet. However there are some folks around that think they remember some things like that happening back during the unmanned phase on CMG 2. However we haven't been able to dig the data out yet. And that's in work. And - and I would like to think that that the chances are nil that we'll loose another one. I think that's a reasonable statement.

PAO

Any further questions. Thank you.

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**SKYLAB NEWS CENTER
Houston, Texas**

SL-IV - Change-of-Shift Briefing
Johnson Space Center
November 23, 1973
Time: 9:22 a.m. CST

PARTICIPANTS:

Phil Shaffer, Flight Director
Milt Reim, PAO

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Time: 09:02 CST
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PAO Gentlemen, we'll get started with this morning's change of shift briefing. We have with us Flight Director Phil Shaffer. We'll just - We'll turn it over to Phil now.

SHAFFER We had a nominal Flight Plan shift. (Laughter) Well it took you a little while to respond to that one. We, as you all know, the grave-yard shift, or the midnight to eight shift does summary Flight Plans while the crew's asleep, planning activities for the next day. And at about 2:45, local, at Bermuda AOS, CMG 1 was stopped. And that has to bother you a little bit. If you take power off of CMG with that big old wheel in there, it takes something like 24 to 30 hours for it to run down all by itself. And from Honeysuckle to Bermuda was 38 minutes. And it was going 9000 RPMs at Honeysuckle LOS and it was going zero at Bermuda AOS. Our preliminary indications are that bearing-1 seized on CMG number 1. And our indications from that are, obviously, that the wheel was stopped. Bearing-1 temperature was about 180 degrees. It normally runs about 80. And the currents on the CMG motors were something above 2 amps and they normally run just above 1 amp. We deactivated the CMG at Canaries. We would have deactivated it at Bermuda, except it was a very low short pass. And there just wasn't time to do it. The temperatures in the CMG never got hot enough to sound a caution and warning on board the vehicle and the caution and warning is sounded from bearing temperatures on the CMGs. They got at 180, the caution/warning sounded at 200. So the crew was unaware that all of this was going on until we woke them up this morning and told them. The effect of losing a CMG, first off, is that it's going to take a little more TACs, fuel propellant to do the things that we have to do, such as, the maneuvers to view Kohoutek and EREPs and JOP 13s. All of those things require maneuvers and it'll take a little more gas to get there now. The other thing that it will do, it will take more time to do the maneuvers. Strictly because we don't have the energy in the CMGs now to drive over as fast as we might have gone before. And it will turn out now to be a time versus tacs trade off. How much time it takes to get there versus how much TACS it takes to speed it up a little. At - One of the other considerations is that we've lost out redundancy in the CMGs. You know, two CMGs, theoretically, is all it takes to hold the vehicle. The third CMG served as a backup plus a reserve energy source. for the theoretical two that it takes. The other two CMGs are healthy. It's no - no concern there. The remote concern is, should we lose another CMG, that one very nearly equals 0. Now there's some work in progress to use that CMG

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to minimize the tacs. But that - it's not worth a lot. But I just say that in passing. We're not that concerned, you know they've set CMGs up that have run for years. I guess, I would say, that our posture right now with the two CMGs and the tacs situation is, that it's going to take a little longer to do the things involving maneuvers and we intend to do them all. Like I said, it was a nominal shift.

PAO Start right here with Bruce.

QUERY There are 30 planned EREP passes, I understand, with the possibility to go up to 50, if this crew's as ambitious as the last one. Are we still in a posture to do 50? Have we got that much tacs?

SHAFFER Well, it's early to say, in all seriousness. The position in the control center that's called GNS has begun the analyses of what the individual maneuvers will cost. And to give you an example, tomorrow there is a maneuver planned to view Kohoutek with the experiment called S201. In the three CMG configuration the tacs cost for that maneuver was 0. His first nonoptimized run in the computer costs 10 mibs - or minimum impulse firings, which is equivalent to about 50-pound seconds. His statement to me was I can fix that and do it for 0. It's just going to take a little longer. And let me give you a little - little - try to give you a little intuitive feel for that. We typically try to do those maneuvers at about .07 degrees per second max rate in any given axis. And the reason for that has to do with the accuracy of the control system. It switches scales, it's ability to read, and it's more accurate if we stay slow. It takes a certain amount of energy out of the CMGs to establish that .07 degrees per second. It takes half as much energy to establish 0.35. So it is fairly obvious, you know, without getting into the real subtleties of it that if I double the maneuver time, I can get by for zero tacs. Okay. It's not a good idea to double the maneuver time, because you're talking about 10 minutes versus 20 minutes. But at some point I can trade minutes for a mib or two. A mib equals 5-pound seconds. Then it's noise level stuff. So that's the kind of game we're in now. We're going to end up doing tomorrow's Flight Plan for essentially zero. As soon as the guys get that analyzed they'll be looking at the day 10 EREP. And there are some very straightforward things that the guys can do to reduce whatever the tacs cost will be for the day 10 - We don't know what that is yet. Because they haven't had time to look at it. But your first option is always to lengthen out the maneuver time. The second option is always to pick - to change the location of the event so that it starts and stops at a more favorable momentum position in the orbit. And sometimes two or three minutes change in where you start and stop. It has a

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tremendous effect on the results of that. And those are the kind of things the guys will be doing to reduce the tacs cost and minimize the time to do these things.

QUERY Speaking of time. What is the normal time it takes to do an EREP maneuver to get it into position?

SHAFFER It's a function of where it is. The - If you're doing a EREP pass that starts at Sunrise then you have to do a 90-degree pitch maneuver. You know, the vehicle stays the - in solar intertial, you have to get a 90-degrees pitch and then you have to roll out the Beta angle. If you started at noon, all you've got to do is roll out the Beta angle, because you're already pitched right. If you're over near sunset, coming out of it at sunset, you've got to pitch 90 degrees and roll in the Beta angle. So it's a function of where it is. The count of rule of thumb number tends to be 3 degrees a minute.

QUERY How much tacs have you got left, both in foot pounds and in percentages?

SHAFFER Well, we have about 30000 pound seconds, which is - which is 45, 50 percent of what we launched with. Now, remember we used tacs like there wasn't any tomorrow, trying to keep the vehicle cool, until we got the CSM up there and got the par mol up.

SHAFFER You'd probably like to have a better number than that for the tacs remaining. I'll tell you what I'll do, I'll get Neil to bring that to the - to his change of shift this evening.

PAO We had one earlier, 31265.

SHAFFER Yeah, but I don't know what percentage that is.

PAO Oh, I see.

SHAFFER Okay.

SHAFFER And the other thing Neil will be able to tell you is what today - tomorrow's Flight Plan and day 10 Flight Plan are really going to cost, because the guys will have had time to run those today and see what they are.

QUERY If a second CMG should go out, would this be - give some consideration to shortening the mission?

SHAFFER Yeah.

QUERY I mean immediately, or will they stay up for awhile - -

SHAFFER It would immediately be considered.

(Laughter)

QUERY I didn't mean - But (Laughter) - -

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QUERY Immediately or would they stay up for a while?
SHAFFER You would immediately consider it. (Laughter)
QUERY But no matter if they stay up and do
medical and things like that or would they - -

SHAFFER It depends - There are some very preliminary numbers that I had a chance to look at are about 2 pounds in orbit to maintain an attitude control mode called quasi inertial with the CSM and RCS. And at this instant, I have 600 pounds of surplus RCS on board, which converts to 300 revs or about 20 days. The problem with quasi inertial is that it doesn't point at the Sun. It just kind of wanders around. Okay, with a max deviation of pointing the ATM at the Sun line of about 14 to 16 degrees and it does that - it oscillates twice a rev. The same sort of control mode exists in the workshop attitude control system. And it takes about 500 pound seconds a rev, which converts to about 60 revs which is another 4 or 5 days. So the answer to your question, how is the function when it happens? But we believe we can fly for 20 or 25 days without a great deal of strain. However, can't do ATM if you do that. You find the corollary experiments that use the airlock and the minus-2 SAL like S019 and S183 and S201 and et cetera very difficult. However, you can veer that by going to true solar inertial attitude with either control system for short period and paying the high cost of attitude control to get data. And then go back to quasi inertial for the - certainly, the sleep periods and for all the bio-medical periods and et cetera. We can do it all without the other CMG. It's just that the TACS cost goes in order of magnitude, like 10 times as much or so for the same period of time.

QUERY I got several, I guess. First of all, what would you assess the chances of losing another CMG? What kind of odds would give it?

SHAFFER Well, the preliminary numbers and when I say preliminary, they were like 2 years ago, the preliminary probability of losing a CMG over the course of the mission was 20 per cent. The probability of losing 2 CMGs was like 0.3 per cent.

QUERY 0.3?

SHAFFER Yes.

QUERY Okay. What is - I would feel that after you've lost one, your percentage to lose another would go up a lot more than 0.3, would it not? If you reassessed today?

SHAFFER Statistically, that's correct.

QUERY What, in your own mind, how do you assess it in your own mind, Phil? You know these systems?

SHAFFER I don't know. If you'd asked me how - what's the chances of having trouble with two RCS quads for SL-III, I'd told you zero.

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QUERY

Yes.

SHAPFER

We'll be better able to answer that after we have really dug out all of the data surrounding the problem and build a hypothesis as to what the precise failure was and get a better handle on what the chances are of that kind of failure or equivalent failure happening and in all honesty, it's too early for me to answer that question.

QUERY

I'm not real sure I understand why this one failed. I understand bearing number 1 ceased. Now, what causes a bearing - did it shatter, does it freeze or -

SHAPFER

Bearings are lubricated. Okay? One potential problem is that the lubrication stopped flowing which makes the bearing get hot, swell up and cease, just like the bearings in your car motor do. Now that's one thing.

QUERY

How many bearings are in each CMG?

SHAPFER

There are 2 main bearings that the rotor runs on. One on each end of the shaft that the big wheel is mounted on. And it's one of those two that that appears to have the problem.

QUERY

Let me run down a couple of things. The CMGs are your primary controlling mode of the whole SWS?

SHAPFER

Affirmative.

QUERY

Your tax is your backup to any CMG failure, is that correct?

SHAPFER

It's better to call it a reserve because the TACS is used to relieve the momentum state when the CMG saturate. When you've asked them to do something that it's more than they can handle. Okay. They - the TACS is not a one for one backup because it doesn't provide anywhere near the fine control that the CMGs do and of course, the TACS is not replenishable. The CMGs, you dump the accumulated momentum into the gravity gradient vector and rezero them - the TACS is not like that.

QUERY

That was the X-axis of CMG -

SHAPFER

Yes.

QUERY

- - which is the axis through the center of the vehicle from end to end. Is that axis more critical to maneuver more than any other axis or which would've been - I mean, they all the same. Do all - how do you make a maneuver? Let me put it that way? Go through that.

SHAPFER

Do you understand gyroscopes? As a concept or in detail?

QUERY

Concept.

SHAPFER

Okay. Then that's the way I want to talk to you and if you want to talk any other way, I was going to get some help. (Laughter) Gyroscope when it's spinning is very happy when you leave it alone and sits very still. When you push on it, it goes 90 degrees to the way you push on it. Don't ask me why, but it does. But it still resists that. A CMG is nothing

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but a great big gyroscope. You know, the rotor in it weights about 70 pounds, the wheel does and in it stores a whole lots of energy. And it's got these big wheels are mounted in gimbals so when you want to move - I'm sorry, and the gimbals have the electric motors tied to them that are mounted to the frame of the workshop. So when you want to do a maneuver, you try to drive the CMG, but it resists that. As a result, you drive the workshop the other way. That's all there is. You have three of them oriented essentially in a triad and you take one away, you still have one that resists this motion, this one and this one resists this motion and this one resists this one. So it only takes two to provide three axis control. Okay. What you have lost is the ability to transfer momentum out of this surplus one over here into these two as required. You've lost one-third of your energy source, with CMG 1 gone.

QUERY When you move to make a maneuver to an EREP pass, do you push or put a force on three CMGs?

SHAFFER Yes.

QUERY The fact that this thing stops so fast, does that indicate that a lot of damage might have been caused to it and is there any chance that it could be fixed during EVA or something?

SHAFFER There's no chance you can fix it. Okay. There is a remote chance that - and it's terribly remote, and I'm not sure it's even worth repeating, that the CMG is usable under certain conditions for short periods of time. And what that means is that after it cools down and sits steady state for a while, you might be able to turn it on and it work all right for a while. But we're not giving any odds on that.

QUERY A sudden stop and the damage - could there've been a lot of damage caused? You say you were going several 1000 miles rpm and -

SHAFFER I have to say yes. Yes, because I don't - You take something with that much energy and stop it that fast, it gets hot. And the heat would be the thing you'd be concerned about. Boy, it's like hauling your car in from top speed real quick. Old brakes and things get hot. You don't do that many times until you've got a problem. By the way, I did that two summers ago in Colorado and my brake drums were all full of fractured crack, little hairline cracks all over them from the heat that put on it.

QUERY I missed your figure when you said how many rpms it was going - 9000?

SHAFFER That's about nominal. It oscillates a 100 or 2 around that as a function of temperature and they run in about 9000 rpm.

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QUERY How do you start - how would you start back up through the motor? Is that - I mean it starts expanding and builds up the momentum - -

SHAFFER Yeah, and it's very, very slowly. We did that right after Skylab I launch during part of the first day activation you start spinning the - It takes several hours to get them up to speed; and normally takes several hours to stop them.

QUERY Have we seen any indication of trouble with the CMGs previous?

SHAFFER We don't know what to call a problem. Okay, we have seen the currents oscillate; we've seen the wheels - wheel speed oscillate. They are - sometimes they normally follow the heater cycle. And sometimes there's been some noise super imposed on the heater cycle; somethings we can't explain away, and they've been there for a month or so. Now, to say that that was a precursor of the problem presumes a lot because we're not sure what the problem is yet; we haven't finished the analysis. We don't know the precise failure mechanism yet. One of the things that confuses you, for instance, Stan (garble) told us this morning that the bearing had started cooling off before we took power off of it.

QUERY (Garble)

SHAFFER Well, that mechanism's possible if the wheel has stopped; the friction source is gone and the heat radiation is more than the heat input from the motors, which are now stalled. They got to understand that mechanism. It may very well be that the thing had temporarily frozen up and freed itself, or was about to. And you got to understand there's a lot of noise on the transducers that tell you how fast those wheels are going. It's - it's early.

FAQ (Garble) you have another question?

QUERY One - Phil - We've gone through all the technical and you said, you know, how it's going to affect us and all. Do you consider this more than a nuisance?

SHAFFER Yes.

QUERY Okay. But, well - -

SHAFFER But let me answer that. The reason is that it makes flight planning and flight plan evaluation a lot tougher to do. And SL-IV was not going to be a piece of cake, because of all the maneuvers we have in it, the Jop 13's and the EREPs and all of the Kohoutek observations. I mean from a flight plan evaluation standpoint both from attitude control and from electrical, SL-IV was a fairly rigorous flight planning exercise. And that has been compromised now. Because if you take longer to do the maneuvers and spend more time out of solar inertial that has a feedback effect into your electrical power situation because

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you spend more time pointed away from the Sun.

QUERY It's a flight planning problem. Is it also a flight control problem?

SHAFFER We don't believe it is, however, we must demonstrate that. We believe we can handle this problem. It's not like we're terribly caught by surprise. As I told you earlier, we went into this thing with the understanding that the probability we'd have this problem was about 20 percent, and two CMG control law was already implemented in the on board computers automatically. When a CMG stops it automatically switches to a C - two CMG control law; and it's all there. The analysis had all already been done about how - what special things we had to do with two CMG controls to make it run steady state. We had already done the analysis that told us what it was su - nominally would cost to do these different kinds of maneuvers and et cetera. And from the time the failure happened it took 20 minutes to relax in all honesty, and we were there. We were in control and it was a matter of watching the system to be sure it did all right. It was not a big trauma at the time, is the point I'm trying to make to you because it was just not unexpected. We really expected it to happen sometime. We'd have liked it to happen, you know, on February the ninth, but it didn't.

QUERY One last question I asked Milt earlier on rundown. After we leave Skylab in February, or whenever, we've been told - given figures anywhere from 5 to 10 or so years Skylab would stay in orbit. Without a management from the ground what would you then guess?

SHAFFER First of all, I think you've got it confused. The lifetime of the Skylab, and that is the time between when we leave it and when it reenters, is one thing. The time between when we leave it and it loses attitude control, or electrical power capability or something is something else entirely, and we don't know the answer to that. Okay, now, as long as we stay in solar inertial and things are stable like it will be when it's evacuated; no vents, no torques, no leaks, and et cetera, two CMGs work just fine. It's when you're doing maneuvers that you get into trouble; maneuvers other than the momentum dump maneuvers. If we were to sit there in solar inertial, we could sit there from now on until something else broke.

PAQ All right, thank you Phil.

SHAFFER Thank you.

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SKYLAR NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
November 22, 1973
7:04 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Don Green, PAO

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PAO Are we ready John? Okay, we have Neil Hutchinson here to give us the run down on today's activities go ahead Neil.

HUTCHINSON Okay, well we, as you've probably been listening, finished our first of several EVAs on the mission. To say the least we had a rather successful day outside. I won't go into a lot of stuff about things that went on getting up, ready for it except maybe a couple which you may or may not appreciate. After all the - after all the things we went through on that primary coolant loop, to get it up and ready and running, when in preparation for the EVA this morning, we go through a procedure since there's going to be two crewmen on - on a single SUS loop to - or in other words, on the single airlock module coolant loop we run two pumps. We'd been on one pump and we shut the loop down this morning to bring on the second pump, which is a standard procedure we brought this second pump on and lo and behold no flow in the loop. It turned out after a little soul searching that we lost the transducer between the time we turned it off and when we turned it back on. That tells us that the liquid is - that the cooling is circulating in the loop. That started the day off, we also lost another flow transducer of the same type in liquid loop that the crew uses that run the water through the suits - through the liquid cooling garments. This hapened in about the middle of the EVA and that one also caused us a little start because it happened right at a LOS, and it turned out that at the same time we had a slight rise in the gas temperature for - could have been for a number of an - reasons it's not - not an abnormal thing but connected with the fact we lost the flow and the telemetry indication in the flow of the SUS loop that gave us another start. So anyway, that turned out to be telemetry also, as a matter of fact the transducer proved to be erratic, it came and went, as the day went on. So we had I guess if we wouldn't have a - any telemetry we - we would have had a little calmer day. Let me go over the EVA. The EVA activities, and you probably all are aware that - that we were out about 6-1/2 hours I don't have - excuse me - the exact timing because the hatch closure was out of contact with the ground. But that's probably within 5 or 10 minutes, anyway. We got everything finished that we wanted to accomplish for while we were out there. We did have a couple of minor anomalies, in fact we really only had one anomaly that I know of. That was in TO25, TO25 of course as you know is - is a - a - has a camera - a Nikon camera on theback that's used to record the data after it's - after it's goes through the optics in the instrument. The camera is one of several Nikons that we have onboard and we had our mal-function in the camera after we got out. It's pretty simple it's a knob with a lever on it that it used to set the exposures.

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And the knob is basically of - has a - well it's hard to explain but let us just say that it has a mechanical linkage with the actual exposure setting device on the top of the camera. And the knob would free wheel was the failure mode. This caused us after getting 5 of the 40 frames of T025 data that we expected to get to abandon the T025 operation. This was the only scheduled use of T025 for atmospheric particle examination, I'm not sure what affect it's going to have on using it in that mode on future EVAs, of course you know T025 is scheduled for Kohoutek use in the next couple of EVAs. So I guess we'll have to see how that all comes out. Anyway as far as the task we were going to accomplish that's about the only one that didn't come off right. The one that - the real biggie of course was the S193 antenna. And we pretty much followed - -

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HUTCHINSON As far as the tasks we were going to accomplish, that's about the only one that didn't come off right. The one that - the real biggy of course was the S193 antenna, and we pretty much followed the procedure about as - right down the little cook book as we planned at prelaunch. They went out there and tried to clean the gimbal pots and were unsuccessful. There apparently was no foreign material in there, at least any that was of any consequence that caused the antenna to malfunction. We went through the check out of the axes 1 axis at a time, and the roll axis checked out and the pitch did not. And that lead us to the conclusion that the pitch axis on the antenna was inoperative and the crew successfully pinned the pitch axis to the antenna in a zero position and we then verified that the roll axis of the antenna was completely operative, which it is. And if we had to have one of the axis - of course we would have certainly preferred that nothing be wrong with either one of them, but if we had to have one that wasn't working that was sure the one, because we probably got back some 70 or 80 percent of the capability of S193. The thing that works now, it'll go back and forth sideways if this is the longitude and axis of the spacecraft, it works in roll, and of course since it works in roll and it's pinned at zero in pitch it means that we have full capability from the altimeter plus we have the cross-track contiguous on the - on the - the radiometer and scatterometer. So we're awful pleased with that. We essentially recovered the experiment and the EREP guys - we had about 50 folks over there with big grins on tonight, on their faces. I think the ATM film replacement went pretty much as planned, we didn't have any problems at all or didn't run in to any surprises and we didn't expect to. The ATM was all loaded up and there were no anomalies there. We did - the only other trouble shooting we did while we were out was on the H-Alpha 2 door, and it was successfully pinned open. S228, S149, D024, and S230 were all successfully deployed. And all in all I think it was a remarkable day. We - we managed to salvage another major experiment in what could have been - it was a fairly difficult task, and I think the people that layed this thing out before the mission and the crew particularly today they were just impeccable, they worked slow and steady and ran into some real tuffys, we had a heck of a time getting the screws out of the clamps on the S193 for awhile there, we thought 1 of them wasn't going to come out, and of course we had to remove 6 of these screws that kept the electrical connectors from the gimbal fastened in.

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And I think all in all it was just - you just get to give these guys a great big star. They really did great. We're looking forward to getting on here with the mission. Tomorrow is going to be a day of - not a lot of heavy work. We do have a couple of medical runs scheduled on the chair and - trying to think what else there - and of course there is going to be some clean up from the this EVA since the EVA went so long we'll have some things to get straightened out. The crew yesterday made a request that they wanted to sort out the entire food situation in terms of getting themselves organized so they knew where the bread and butter was kept, so to speak. And they are going to be given several hours tomorrow to do that. I think you can probably look tomorrow for - look for tomorrow to be a fairly light day since we had a pretty intense day of activity today. There won't be an EVA tomorrow, however. And that's about it.

QUERY Two quick ones Neil. First of all as I understand, they're going to do the preliminary looks for Kohoutek tomorrow using the Nikon or I think a Hasselblad maybe, do you know?

HUTCHINSON Oh, the S233 handheld - Bruce I can't answer that question directly. I -

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QUERY Nikon I think a Hasselblad maybe? Do you know?

HUTCHINSON Oh the S233 handheld - Bruce I can't answer that question directly. I - it wouldn't surprise me if we do some handheld work on Kohoutek tomorrow. There - I - I don't believe we're going to be putting anything in the SAL until day 9, because we've got another thing that's scheduled tomorrow we're going to - now that we've got everything on the outside fixed, we have to go to work on repairing some of these corollary things and I know that tomorrow the S183 DAC is scheduled to be fixed and so is the - we're going to change out the - the mirror system on S019, the one that's used to look at Kohoutek for all the stuff that goes out the SAL without the - except for when we roll around to look at it.

QUERY The other - you said a few days ago, a couple of times in fact that you would fully expect they could go an easy 8 hours today and they finished within well the nominal was 6:15 which is very tightly bracketed and they went - whatever little 6-1/2 or whatever. Why do you feel that they got through that early because you did say that they move slow and so forth and how did they finish was it because the T025 fouled up?

HUTCHINSON No, no I think Bruce we ended up spending almost as much time on T025 as if it had of work because they tried for a while to fix it and then basically before they abandoned it they ac - they waited for a station contact to talk to us. I think that's probably a function of a lot of things. Now if I had to describe they're - I wouldn't describe their pace as slow; I'd describe it as deliberate and certainly they worked at a level as far as just getting task complete I'd say faster than the SL-III fellows, which really that doesn't say much except that some crews like - they all seem to have their own rhythm at getting things done. I think that we tend to be a little bit conservative when we through out numbers out of the - we get out of the water tank, mainly because we part tasks these things. I mean we've never done an EVA in a water tank where we put all this stuff together. And you know that - in general they - they - for example they do a D024 installation and they time them just on that, and they say well I took 5 minutes, well let's see it's going to take 5 minutes to get out there so we'll add 5 to - et cetera. So you pick up time and you - and you - you take away time, I think you'll find that if you look at the way the time line went today versus the way we had it laid out in terms of the amount of time we spent on each task. The 193 work took longer than we ex - than we had allotted and we were down there about 3 hours. And the - the ATM work and the S149 and those things they breeze through those. Actually,

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a little quicker than we anticipated. As the day started out we - we - by the time we were a couple of hours in the EVA we were actually a couple of hours ahead of where we had predicated, and we slowly but surely dropped back to about the predications as we worked through the 193 thing. But we did spend more time on 193, mainly because it took us so long to get those darned screws out of - out of the clamp. Plus the fact, the crew did all the malfunction tests several times, when they wiped the pots, they wiped them, tried the antenna. It didn't work. And then they decided they'd try it one more time. They went in there and - I don't know actually we haven't had a chance to really debrief it. I suspect they went in there and cleaned them out again and tried the test again. And they were - were very very deliberate when they were going through that malfunction procedure. So - -

QUERY Can you describe their positions a little bit more in other words, the - how they were actually standing before the antenna.

HUTCHINSON Yeah.

QUERY And talk about the difficulties they had, they always seem to be sort of slipping away, and I hold you, I've got you - you know I don't - have you?

HUTCHINSON Yeah.

QUERY And then I've got you.

HUTCHINSON Don, could I get - could somebody bring that thing over here and I - I could point it out probably. The - first off - you're right as far as the 193 work goes, that's the whole ball game down there it's restraints and there aren't any. And the - it was not made - of course we never in our fondest ideas anticipated - anticipated having to - having to go down there and do something like this. So there are no hand holds down there, there are no restraints systems of any kind. The basic - the basic - the antenna of course that we were working on is this thing right here. The basic - the basic way - -

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HUTCHINSON The ba - the antenna course that we're working on is this thing right here. The basic - the basic way they got down there the EVA hatch is right - is over here I'm almost agraod of this thing. The EVA hatch is over here and the basic way we got down there was climb out the hatch. And we crawled around this way on a pipe called the nol sieve condensate vent, which is a silver pipe it is about 3 inch diameter or so and it goes around here and comes out in a T down by the antenna way. That was used as an EVA trail to get from the hatch area around to the antenna area. Now the basic way the crew worked on the antenna we had a set of - I'm probably gonna get this backwards. I guess it really doesn't make any difference. I'll just use this side, lets see we came across it's over on this side. The - we attached there are - this modle does not have all the - all the struts struts that are down in the area. But there's one that goes across this way and we attached a - a foot restraint which we flew up for 1 of the crewmen to stand in on this thing. And he is standing more or less - this guy, more or less up this way. Now he stayed in the foot restraints the whole time. The other crewmen laid pretty much perpendicular to the hall of the vehicle right through here with his head and shoulders and body facing right up here on the antenna. Now we were doing all the work right up here at the base of the antenna on both sides of it and around behind it here on the electronic boxes. It's also not a good representation of electronic box it goes all the way across here and it's about this wide and about that deep. It's maybe 3 or 4 feet across here on the back. And so the 1 crewman is standing here on the foot restraints and the other crewman is laying sort of across this way and the crewman that is in the foot restraints is the fellow thats - that is he has all the tools laid out in front of him. He's kind of like a surgical assistant in an operation and the guy that's doing the work on the antenna is Bill doing most of the work on the antenna's is the one that is laying across here. And the guy that is in the foot restraint is able to hold him by the shoulders and push him up and position him around, and turn him around and that's basically the restraint system that was used was, of course Bill also had a chest tether which he had tethered onto one of those struts going across here. But the crewman which did most of the work on the antenna, which was Bill was basically held into position by Ed. Who was held into position by being in foot restraints, that we took with us and installed down there. So, that's the reason you keep hearing them say, "Hey, I floated way out of position." and

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everything. Is you know you let go and there - there's not no handrails, there's nothing down there hand - except for the struts and everything to hang onto. And of course they were moving back out of the way a lot because every time, they after they finally got the electronic's connections made with a jumper cable, with a jumper box in there. They were a lot of test that had to be run, they'd position a switch in one position and back off. And the man inside would operate the antenna. And these guys would set there and watch it. And of course you had to get out of the way because it's moving around. And then they'd say "Hey it did this and that" and then they would go in and position a switch in another position and try it again. That's how the failure the diagnosis thing that we went through to discover that it wasn't working in the axis pitches it this way, back and forth.

QUERY Two questions. Did they bring the T025 back in manned or did they leave it out on the strut?

HUTCHINSON Yes, that is it was planned to be brought back. It was not planned to be left out. It - it's something that in S020 and S201 which are the 3 cameras optical devices that we carry out are taken out and brought in each time. And yes it was brought back in.

QUERY The second one, what actually are we losing because there's no picture available on the S193?

HUTCHINSON Well, you're losing 1 of the modes that the 193 can operate in completely it's called in-track contiguous. And it -

END OF TAPE

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HUTCHINSON And I wanted the modes that the 193 can operate in completely it's called intrack contiguous and it's basically the scan pattern where the thing stays in place and mans up and down this way. In - in the plane if the vehicle is moving along it's - you've lost the ability for the antenna to work in that - first off you've lo - maybe I ought to tell you what you haven't lost. You've lost nothing as far as the altimeter goes, because the altimeter - the antenna doesn't move it stays at 00. Now you've got it pinned at 0 at pitch and the electronics will position it properly in roll which is cross - across this way. So the altimeter is great and most of our - of course you know - as you know if we hadn't been able to figure out what was wrong - which axis we had trouble with we were going to pin them both. And pin it at 00 because the alti - the most data that we still have yet to gather with a 193 instrument is altimeter data for SL-IV. Now, the cross track mode which is where radiometer/scatterometer is working and it's going back and forth this way. We still have except the mode used to include a small pitch movement you know you go out pitch down come back, you know you had a scan pattern like that. So I guess that means you're not going to cover quite as much ground with it but the mode - the cross track mode is still is operative. So, you can say we got all the altimeter back and probably 50 or 60 percent of the radiometer/scatterometer it would depend on - I don't know how many - how many EREP sites that require the particular modes we have left in these variety. But I'd say all in all we probably pick back up probably 70 or 80 percent of the total capability of the instrument, tagged against the items that we have left to do with it.

QUERY Neil, why it necessary to - to scan the ground path you're going to be passing over in a couple of seconds anyway? I - I can see the scanning side to side but I can't see what you gain by scanning up and down.

HUTCHINSON Well, I don't - I'm certainly not - not don't even claim to even know a lot about the 193 thing. But if you think about it the thing you're gaining when - when you're scan - when you're going forward is you're gaining - well just take an object on the ground that you're trying to find the shape of or to find a particular characteristic of it. As the vehicle moves forward and the antenna is scanning this way, you're getting a - a many angle look at the same piece of property. So you're defining - and of course the - the way the thing works is it sends a signal to the ground and the signal pounces back and it measures its intensity when it gets back up there and that tells you something about the characteristic of the thing you're looking at. Well, it's like as if - I had

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a - I had a rock down here. And if I only could bounce, - bounce off in one direction and only see the - the reflectivity of one - a single surface of that particular rock, I don't know anywhere near as much about it as if I could see a whole bunch of looks at the same piece of ground. And - probably not all right but - -

QUERY You said that this EVA was probably the most difficult of all the EVAs since the first one when they fixed the jammed solar panel. And I was wondering if you still believe - feel that way and why a little - why was this one so incredibly difficult?

HUTCHINSON Yeah, I sure do still see that way and it was the 193 antenna and the fact that we - just like when we worked on the solar panel we're working in an area that was not designed in the vehicle to be worked in before and therefore it had no EVA aids whatsoever, whatever aids there were we either put there or devised when we got there. And the whole trick in EVA when you're doing anything is to have - the fact that your body is a - you know if you're standing beside the vehicle and you reach out to grab something you turn your hand this way you go that way, you know, and if you're trying to turn a screw you know if you had a screw driver in your hand and you haven't gotten anything to hang on to and you're not anchored anyway and you turn this way the screw won't turn but you will. And that kind of a thing is the kind of a thing that leads us to get involved in difficulties in an area like this that wasn't designed to be worked in. And I - yeah, I still think that it's the most difficult task we done since - since we did the solar panel EVA.

QUERY Are they going to have time to do the EREP checkout tomorrow and still do the first EREPs on Saturday?

HUTCHINSON I don't believe we're going to tr - -

END OF TAPE

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HUTCHINSON For ground EVA.
QUERY Think they will have time to do the
EREP checkout tomorrow and still do the first EREP's on
Saturday?

HUTCHINSON I don't believe we're going to try to
do the checkout tomorrow, just because we'd like to keep
the day a little light, but I don't that precludes to doing
an EREP on Saturday because I think we could start it
early in the morning on Saturday I wouldn't rule out that
thing on day 9. I think tomorrow evening we should at
the press conference we should have a pretty feel for how
the next 3 or 4 days stack up, because tomorrow we will
sort of get everything organized, get the EVA cleaned up
and from here on you know it's fix the ATM panel, and we
got several corollary instruments to fix and then we're going
to be off and running. So I think tomorrow we'll have a fairly
good feel for how much we have to do to get all the
instruments back up and going.

PAO For the record, let me pass on this
information about the photography of the comet tomorrow.
The Pilot will be the one who's charged with the comet
photography using a 35-millimeter Nikon with a 55-millimeter
lens. First frame - well let's say comet rise is
scheduled for 19:50 Zulu. The first frame, a 60 second
exposure at 19:53, second frame 19:54 for about 120 seconds,
third frame 19:56 Z for about 60 seconds, and the location
is command module window number 1, which is the left
most window. And with that we conclude tonight episode
of Skylab IV.

END OF TAPE

STYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
November 21, 1973
5:34 p.m. CST

Participants:

Neil B. Hutchinson, Flight Director
Terry White, PAO

SL-IV PC27A/1
Time: 17:34 CST
11/21/73

HUTCHINSON Each day as we proceed along here we're seeing crew pickup on learning curve a little bit more. We started off today of course with this flight plan fairly full. The crew did request last night that they be allowed to go to bed or be scheduled such that they were given the opportunity to go to bed an hour early tonight. That was accomplished and as the flight plan has developed throughout the day today they're fairly much on time. All the preparations for the EVA that were done today getting the T025 instrument ready, S149 servicing up the water - water in the liquid cool garment on - in the umbilicals for the liquid cool garment and of course right now they're in the - the actual pre-preparations for the EVA. All that activity came along fairly well. We did complete the last major medical runs so we've had one on each of the three crewmen and we also did a M131 one without rotating the chair. We just had the men sitting in the chair during the head motions and that was done on both of the fellows going EVA with successful results. As far as tomorrow goes there have been no changes in the EVA plans, we intend to - the scheduled hatch open time on the flight plan is 10 o'clock, like I've told you the last couple of nights it wouldn't surprise me if we ran a bit behind that, cause I fully expect - that takes a pretty - a pretty awfully smooth morning to get up at 6 and eat and get preped and get suited up and get the hatch open by 10, however, we expect to be somewhere in that range between 10 and 11 Central standard tomorrow. The EVA is still scheduled for around 6-1/2 hours, and as we look at it now - looking at the coolant loop and the crew condition and the - all the EVA gear that has to be prepared to go out we're all set for doing a successful EVA tomorrow.

PAO Okay, thank you Neil. This is Skylab Control back in 11 minutes for the Tananarive pass at 23:37 GMT, Skylab Control. Out.

END OF TAPE

**SKYLAB NEWS CENTER
Houston, Texas**

**S/L IV - Change of Shift Briefing
Johnson Space Center
November 20, 1973
6:01 pm CST**

Participants:

**Neil Hutchinson, Flight Director
Don Green, PAO**

6:01 pm CST

SL-IV PC25-A/1
Time: 18:01 CST
11/20/73

GREEN Well, we're starting the change of shift briefing tonight with Neil Hutchinson. Proceed Neil.
HUTCHINSON Okay. We had a fairly - fairly straightforward day today. The crew ran through the first - first two major medicals without - without any anomalies. We haven't gotten the data back.

GREEN Go ahead - go ahead.
HUTCHINSON We haven't gotten the data back - -
GREEN Up a little more .
HUTCHINSON Back to analyze but what we saw - what we were able to see -

GREEN Okay. Ready to start the change of shift briefing with Neil Hutchinson. Go Neil.

HUTCHINSON Okay, we had a pretty straightforward day today. Today we did our first two major medical runs effectively without a hitch. It took quite a while, about as long as we thought it would take. It took about the morning to get the CDR done, about 4 hours. What we did see of the data over the sites as the vehicle passed over while they were actually in the LBNP looked fine to us. We'll have to wait until tomorrow until we get a good look at it but I'm sure it's not going to turn up anything. And it looks like we got the medical - the major medicals off to a good start. In fact the only thing - only thing of any consequence today in that whole area of medical that we saw today that - that's of any concern at all is that one of the tape recorders that we use to gather the medical data on the first 4092 run produced some data that had a lot of dropouts in it. I don't think it's going to compromise the data at all, as far as making an evaluation of how the crewmen are doing. However the - it had more dropouts in it than we like to see and we're not sure we understand why, because it's one of the recorders that we have been using during the unmanned phase consistently with good success. So that's being looked into. The other system anomaly that went on today really didn't go on today, but we did some further work on it, and that's the ATM C and D coolant loop. And I think I remarked the other night here during one of the press conferences that when we turned the ATM C loop on, the pump - And by the way this loop is - lost a pump in at the end - towards the end of Skylab - 3 pumps in it. The pump did not - it didn't start in the same fashion, but it didn't start exactly like the other pump when we started the one up after having started it and a half at the beginning of SL-3. While we were trying to sort that out, twice

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since we turned it on - and we turned that on in day 2, mission day 2 - twice since we turned that on, it has exhibited a characteristic which is indicative of a - a non-normal operation in the loop. And the characteristic it exhibits is all of a sudden it appears to not flow as much coolant, which would indicate the pump is slowing down or there is some restriction in the loop or something of that nature. We're continuing to look at it. In the meantime we've turned the loop back off this afternoon. We don't need it until we power the ATM up, the ATM panel up - fully up. Or until we run an EREP pass or do EREP checkout. The loop is basically used to cool - it's a water loop. It's used to cool the ATM control and display panel, the EREP tape recorder, and EREP C and D, and that's basically it. As far as the consequences if there is something wrong with this pump, we have another pump, a third pump in the loop, which will do the job. And when we had trouble with the first pump back in SL-III, we did a fairly extensive look at how we would go about operating if we didn't have any pumps at all. And that is certainly feasible - requires some - fairly good amount of equipment management on the EREP side of the house, and a minor amount of equipment management on the ATM side of the house. Basically, the loop in the ATM console is used to keep the touch temperatures down from burning the crews - not burning their fingers, but - our touch temperature requirements are 110 degrees. That's kind of like a lukewarm cup of coffee maybe. They're fairly conservative and -

END OF TAPE

SL-IV PC 25B/1
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HUTCHINSON Our touch temperature requirements are 110 degrees. That's kind of like a lukewarm cup of coffee, maybe. They're fairly conservative, and the idea is that the coolant is not in the ATM C and D to protect any electronics or anything. It's basically in there to keep the touch temperatures of the console down. Now in the EREP area, that's not the case. And the biggie in the EREP area is the tape recorder, which of course has 90 percent of the EREP data on it, all the EREP electronic data. And - however, the tape recorder can be run without the C and D loop, and you just can't run it continuously over an entire pass. You have to modulate it on and off, so there would be some restrictions there. However we're not in that posture by a long shot yet. As a matter of fact, there's nothing - we have only seen two glitches on the pump, plus the funny startup, and we turned it down until we can look at the data some more and see if we can understand a little more about what it's doing. We ran our first private comm today and it went off pretty good, considering it was the first time and all the problems we had with configurations and switches and so on in SL III. Changed water tanks today; we're now on water tank 3 for drinking water. We'll be on that for a month or so. I think the crew's progress today was slow but very, very steady. We had to drop out one of the medical runs, one of the M131 runs, to pick up the rest of the transfers that we missed yesterday. However today we stayed right on the flight plan, all day long. The flight plan was designed to, again, to allow the extra time to do things like the M092 - 171 runs. We allowed them 4 hours to 3-1/2 hours or 3 hours and 40 minutes, something like that, to get those done. And on purpose, and they were getting them complete in the time allotted. As far as tomorrow goes, tomorrow is another big medical day, with the last of the M092 - 171 runs. And we've got a couple of 131 runs tomorrow, plus the EVA preps. The EVA is still on for Thursday. The coolant loop is looking absolutely great. And so we will be doing a liquid-cooled EVA. That's it.

PAO

Questions?

QUERY

Saw some reference in the DSE to - one of the crew commenting that their faces seem to be a little red, maybe a little distended or enlarged, I forget what his words were, due to less gravity blood sucking out of your upper extremities. How long has that been exhibited in last missions.

HUTCHINSON That's a phenomenon - a known phenomenon I - I, out of my element here, but the redistribution - You remember all these measurements and photographs and so on and so forth we've been making are an attempt to understand better

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the mechanism in the time - timing of the redistribution of body fluids and body mass that takes place immediately after getting into orbit and for the first 3 or 4 days. This puffiness, as it were - the face that was described in a - redness is, as I understand it, a result of the redistribution of fluids, blood, and just body fluids in general to the upper extremities for the very reason you cited. And it's a known fact and has been observed repeatedly as far as I know and is now being studied with a fair amount of detail with all these photographs and body measurements and the IR photos and so on.

QUERY Related to that, when do you expect to get this body and mass distribution data? Will that wait till the end of the mission? I guess the part that's on film does?

HUTCHINSON Yes, Certainly but the anthropometric data, the tape measure things, have been coming down on the B channel - A channel.

QUERY Do you have any measurable gains yet?

HUTCHINSON They're still looking at the data.

QUERY Heard some comment today about decreasing humidity, which apparently caused some - I don't know whether it caused some complaints or not. I heard the tail end of it.

HUTCHINSON No, I guess if we aren't at one side, we're at the other. You know we're always afraid that if we don't get enough water out, we get condensation on the walls and so on and so forth. The humidity in the workshop -

END OF TAPE

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HUTCHINSON If we aren't at one side we're at the other you know we're afraid that we don't get enough water out we get condensation on the walls so on and so forth that the humidity in the workshop has been running a pretty low it's down in - dew point's down there on 45, I think, somewhere in that area and the crew has - it's to the point where they have made comment, 2 or 3 times about it, if you remember reference several days ago about drinking extra water and their talking about their skin being dry and their eyes - mucus membrane and their eyes being dry and so I think we'll probably - we haven't figured out yet exactly how we're going to do it but we are going to take some kind of steps to try and increase the humidity and make it a little more comfortable in the workshop. The SL-III crew had some comments about the consistent very dry atmosphere that that - that that water removal system maintains you know it gets it down there around 45 or 46, or 47 and it may go up to 48 or 49 in the day and then it's right - you know it takes it right out again as soon as they quit moving around and perspiring and so on. And it does - so it does keep it consistently fairly low and think we'll probably the - some of the initial things you can do - we - we're not going to do anything like wet a bunch of towels and hang them around or anything. We'll probably be modulating the water removal system by closing the valves that let the water go from the condensate plates, the things that take it out of the atmosphere into the tank. The plates will get real wet and then they'll lose their efficiency and quit removing, because there's no place for the water to go. And we may have to develop some kind of time line to manually control the humidity level.

QUERY Bruce seemed to show a little suspicion that some of their stomach awareness was due to gas in the water. Did you get to the second drinking water tank today?

HUTCHINSON Yes, we changed to water tank 3 and we've asked them to specifically comment on the gas in the water. It turns out that when we swapped tanks when he was breaking one of the QDs it didn't reseat and he thinks he got a teaspoon or so full of air into the lines anyway, so we may be - may have introduced even a little more gas here in the process of changing tanks. But a day or so worth of use ought to clear that up and we expect-fully expect in the next couple of days for them to quit having this gas in the water problem.

QUERY You referred to the coolant loop as being absolutely great. Do you have any figure on the pressure that the increase decrease or did it stay steady?

HUTCHINSON It is - it decreased a little bit after as you know we first turned on one pump and then two pumps.

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The two pump configuration is the way we operate it in EVA and we checked it for leaks and so on and so forth and we turned it off and the next site which was about 15 minutes later, we turned it on - it's been on every since on one pump. Static pressure was about 27 psi, under flow conditions right after we started it up it was around 26.3 or 26.4, it's now down about a psi, however, everyone is fairly convinced that that one psi pressure drop and it has leveled off it's holding fairly steady around 25.3 or 4, that one psi pressure drop was pretty much due to the loop stabilizing and cooling off because the loop of course was stagnant and it was very hot in places and very cold in places. Also, we're running with two loops now all the time so the general coolant system is colder. And it really looks pretty good. It hadn't been running long enough for us to really get a hack on the leak rate as to whether it's the same as it was or higher or lower, but it's certainly is of nature that have any problems important to the EVA.

QUERY This is a question because I'm leaving tomorrow and I won't get a chance to watch bags developed under your eyes in the course of this mission. I just wondered if you'd talk a bit about working an 85 day mission or a 59 day mission towards the shifts at that job compared to what you do in between what it's like, is it dull and if you're worn out when you finished and so forth?

HUTCHINSON Oh no, it's not - I wouldn't - anything but dull I - I think that - I personally prefer the manned activities. Head and shoulders above the unmanned activities, I mean we just finished a couple of months of unmanned and of course we operate a 24 hour day operation just like this except with a few - fewer people none of the experiment folks are there except for the ATM fellows in the unmanned phase and it's a little calmer atmosphere and a little more casual and not a lot of conversation on the loops so on and so forth, but of course this last unmanned phase we per - practically had 2 months of genuine baby sitting without anything to do you know nothing broke and - -

END OF TAPE

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HUTCHINSON - - forth. But, of course, this last unmanned phase we practically had two months of genuine baby sitting without anything to do. Nothing broke and routine commanding and so on and so forth. So I find that even though the level of activities are a little higher and the days are longer and you never get out of here on time, the manned phase is considerably more interesting and more of a challenge and I think you'll find all the guys will probably agree with that. The work schedule, you know we have 5 teams, 5 complete groups of fellows. Five Flight directors and five groups of guys. And the rotation schedule is such that generally, we're having a little long stint here at the beginning of the mission because one team is trained to do the activation and we have two teams to do EVA's, probably we'll have a third team do another EVA here on SL-IV, so it just so happened that just the way the schedule fell out, we, of course you know the EVA was originally on day 5, I think something like that, when the EVA got moved back before we lifted off, you know when we were doing the pre-launch planning the EVA was on day 5 and we moved it on day 7 to get some more timing here to do some of the filling up coolant loops and so on and so forth. We ended up with an extra long stint, now we got a 8 day stint here of my particular bunch of guys on continuously every day. However in the normal rotation with 5 teams, you're only on for 5 days and then you have either 2, 3 or 4 days off. Now the 5 days of activities is fairly tense and the days are long and they probably average about 12 hours. If you are on one of the other shifts where the crew isn't awake quite so much you might get away with 10 or 11. But I don't find, I don't think I'll come out of this with bags under my eyes or anything. And I think most of the guys really enjoy the manned phase, it's pretty much of a challenge to keep that place cooking.

QUERY Neil, there is a chance, I guess, thinking back to previous EVA's that were scheduled for less than 6-1/2 hours that the one on Thursday could be more than 6-1/2? Is that -

HUTCHINSON Wouldn't surprise me one bit. Not in the least.

QUERY And - okay at that - I thought you were going to say that so my real question is are there any medical constraints on how long it can go and it just depends on their fatigue, if they get fatigue?

HUTCHINSON You answered it just exactly right, there are - with liquid cooled EVA it's, you know if the crew is feeling well and it's really pretty much an assessment on our part and their part about how they've been doing, and about how

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hard they've been working and it's you know it's a lot of subjective factors that aren't really black and white that go into it but there is no reason at all that the EVA can't - couldn't go on longer than 6 hours or 7 hours or maybe even 8 hours long. And gee the crew obviously is recovered from their motion sickness thing and are feeling well and are picking up on the working curve and you know they'll just be two days better - I really expect them to move fairly slow though, you recall the Sky - every crew has kind of got their own little characteristic about how they go about the EVA, the SL-II guys were kind of speedy and really didn't waste any time they just moved right out and did this and did that and the SL-III guys were 180 out from that, you know, they really cooled it when they got out there and from what I've seen from these folks in the tank, I'd say they were about in between. So it wouldn't surprise me if we get the whole EVA done like if we're out 7 hours, I'd say. I certainly don't think it would surprise me if we got finished in 4, that kind of thing.

QUERY Are you still considering a second EVA on Friday if they can't get through with that task on Thursday?

HUTCHINSON Yes, if we don't finish Thursday, like I explained last time, we've got a couple of points in there where we're going to stop and regroup and say to ourselves, okay are we going to press on with this or are we going to knock it off and come in. Now of course with the liquid cooling you know our chance of making it unless we run into a real show stopper are very very good. I think the impetus is to try and work slow and steady and get it done because EVA's - the preparatory work for an EVA is as hard as an EVA, even harder getting the suits on and all that stuff is a real pain in the neck and it takes a lot of time to - you know 3 or 4 hours to get ready for this to go out. And then another 2 or 3 hours to clean up afterwards. So it's a lot of you pay a lot of overhead for the time you have outside.

QUERY On the private conversation, did the CDR tell his wife where he left the car keys?

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HUTCHINSON - clean up afterwards so you pay a lot of overhead for the time you have outside.

QUERY On the private conversation, did the CDR tell his wife where we left the car keys?

HUTCHINSON (Laughter) I don't know I don't even know what - is that some kind of - I don't know.

QUPRY The DSE is full of references to having to stow things in other places than what they're supposed to be stowed, so I gather it's really a problem to fit everything in, the food packages that just won't fit in the locker it's suppose to go in and stuff. Have they finished stowing stuff?

HUTCHINSON No, the day 4 transfers are being finished right now.

QUERY A lot of improvising going - things being just stowed in odd corners?

HUTCHINSON No, I think a lot of the references to things not going where they - where they ought to was with respect to the CSM. The CSM had stuff - that coolanol tank we had yesterday was full of those candy bars, down in around the sides and underneath. As a matter of fact there was a bunch of them that got down underneath the tank that they couldn't get out that we actually weighed the two times we weighed the tank, because we didn't want them to loosen the tank in there. And I think they're referring - that CSM was packed up - there wasn't a piece of air in there that wasn't - that didn't have something in there it. I think that's mainly what they're referring to. Also, I think it takes - it's kind of like you're moving into your house and you have boxes sitting around for a month, you know. It'll be two weeks before all the little goodies that they have brought down there - even though we have a fairly rigorous map on where to put things - instructions and so on and so forth - where they've got them all in the place that they'd like to have them to use them, you know. So I think it's just a matter of time until - until that stuff all gets squared away. Plus we had more junk this time, more stuff to get across than we've ever had.

QUERY Have the crew had a chance - well I don't know if it's a matter of chance, but have there been observation by the crew either from outside while they were docking or from inside while they're moving around that would give you any preliminary indications about how any given fixes would go? And chances to observe stuff that needs fixing in a way that might tell you something about how to go? Like can you see the - see the 193 dish when you're docking in anyway that will tell you about it, et cetera?

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HUTCHINSON. No, nothing - nothing that would give us any clues on - you can see the 193 antenna of course from inside from - let's see - well I know you can see it out the 190 square window, looking backwards. I believe you can see it out one of the STS windows also. The answer to that is no, not nothing - nothing that - nothing that would change or alter or - in any way affect the plans of what we're going to do on Thursday.

QUERY This cranky ATM coolant loop, you mentioned the possibility that it may be obstructed and is - perhaps one of the reasons that it's not functioning properly. And you said that extensive study has been done about operating without pumps. Any study been done or preliminary plans made for possibly a fix on that? Have you looked into that?

HUTCHINSON Well, there's really not a whole heck of a lot we can do. That loop is a water loop. It is reservicable. However, during activation we check - verified it was full of coolant. Since you brought up the blockage thing, there is one block - blockage - that's a strong word - a restriction or an - a partial restriction of some kind. Of course when the pump went down and - in SL-III we brought home the filter. It has a filter in the loop that will preclude particles going around it. Of course that's - if there're particles loose in the loop, they all get trapped in the filter and the filter then impedes the flow of coolant - filter didn't have anything in it. We took a new filter up on SL-IV. There's no reason to believe that there's anything in the filter that's in there now. It's brand new. We just put it in when the pump went down on us in SL-III. That is an option to change that filter. There is another option that we're looking at that I'm pretty sure is going to be exercised. It's being studied in St. Louis right now. And that is where the ATM C&D loop joins the EREP part of this thing. There is a valve called a bypass valve that you can turn that will either send the coolant through the EREP gear or not through the EREP gear. And there is a pea - it has been demonstrated - they've done it on a bench model in St. Louis and they're now trying to get a lot of data on this particular thing - it has been demonstrated that the loop will exhibit the characteristics it's exhibiting if this valve is out of position. Basically, the valve acts as a res - -

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SL-IV PC23-F/1
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HUTCHINSON -been demonstrated that the loop will exhibit the characteristics that - that it's exhibiting if this valve is out of position. Basically the valve acts as a restrictor in the line and the pump will - the line - We have no pressures in the line. That's another thing you ought to know. It's not instrumented very well. All we got is a flowmeter. And the - the - when the characteristic of this thing is the thing will be flowing just fairly evenly, and all of a sudden it drops off significantly and then it will come back up. That is the characteristic of the anomaly. That has been duplicated by mispositioning this EREP valve such that - the pumps have a relief valve that goes around the pump. And if you can just imagine the pump pumping fluid against something and the something is a restricted hole. Therefore it builds up pressure - okay? And all of a sudden the - the pressure gets high enough so that the Delta-P across that pump is great enough - In other words, there is a high enough pressure on one side than on the other. This relief valve will crack and it will bypass the pump and equalize the pressure around the loop again. That would - soon as the pressure was equalized the flow rate would stabilize again. And of course the flow rate, if you were building up pressure and going - dropping down - well that's one theory. I really don't - frankly, I've looked at it and looked at the loop and looked at the circuit I - I'm not very convinced that - that could really be causing it. But the fixes are - there is a third pump. You can change the filter, you can put more coolant in the loop - more water, it's a water loop. And that's it. I mean there's just nothing else you can do.

Query You said they had day 4 transfers today after they finished this. Can we officially declare activation concluded or what?

HUTCHINSON Yes. Activation, believe it or not, was concluded before the day 4 transfers. The day 4 transfers are not a part of activation. That's actually considered stowage. And you know there are several days - there's a day 4 transfer, there's a day 8, there's a - you know, they don't get all the stuff out of the command module this time. You know there's - most of it. The biggest chunk of it is in the day 4 transfers. But yes, activation is complete.

QUERY Since you mentioned St. Louis, what different field centers, contractors, and so on have you called in data from or run sims at outside of JSC in the course of studying glitches during this mission?

HUTCHINSON During SL-IV?

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QUERY Um-hum.
HUTCHINSON Or just about all the ones that - that -
I think we probably utilized, you know, the prime contractors,
and the prime utilized their subcontractors - you know
McDonnell, Douglas, both east coast and west - McDonnell, St. Louis;
McDonnell, Huntington Beach; and North American and I'd probably
leave somebody out.

QUERY Anytime there is something with the CSM,
they look at it out there?

HUTCHINSON Well, we look at here and there, yes. And
of course then there are North American people here as there
are McDonnell Douglas people here. You know a lot of the
support people in the control center are contractor people,
not NASA folks. And of course it Mar - every time anything
even blinks an eye, Marshall is in on it. And since most of
gear was built or built under their thumb. And some of the
experiments of course are from other centers. You know there
are some experiments that are Langley - sponsored and so on and
so forth. The - we haven't really gotten into the experiment
portion of the mission other than JSC experiments because
they're all - JSC has the medical experiments so - haven't had
a lot of interface with those folks yet. But the whole repertoire
of people, whether we've talk to them directly on any particular
problem or not, they've all been involved in it just like they
are all the time. I mean they just don't come running in
when there is a problem, they are there all the time.

GREEN Neil, let me close this off by making one
announcement. And that is that tomorrow at 1 p.m. in this room,
135, there will be a EVA procedures briefing, in connection with
the Skylab EVA. And the briefer is a gentlemen identified
as Robert Cane who is a - carries a title - Skylab EVA Procedures
Technician for JSC. Thank you.

HUTCHINSON Well obvious my EVA got

END OF TAPE

**SKYLAB NEWS CENTER
Houston, Texas**

**S/L IV - Change of Shift Briefing
Johnson Space Center
November 19, 1973
7:19 pm CST**

PARTICIPANTS:

**Neil Hutchinson, Flight Director
Don Green, PAO**

SL-IV PC 24A
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PAO Okay, we're ready to start this one tonight with Neil Hutchinson, the off going Flight Director. Turning it over to you Neil.

HUTCHINSON Okay, if you've been monitoring air to ground you know that we finally finished our activation today. Again the flight plan that we had for today was fairly ambitious. We had - most of the day today, we ran behind as we have the last couple of days. Again we started the day out behind the power curve so to speak, having to - having to pick up activities from the previous day. We do have the activation complete. We've got a couple of pretty big blivets we're going to have to bite here. We did not get the CSM completely unstowed, that's the biggest one. We still have maybe, I guess 2 or 3 hours of CSM unstowing work to do. And we are going to have to find a place to do that tomorrow. The flight plan for tomorrow is already built. In fact it's already on board and I'm sure it's going to have to be modified. We finished the activation with only one anomaly, the only anomaly that I know of that turned up in the entire three days that turned the workshop on occurred in almost one of the last things we did today and that was the - and I'm not even sure you can call it a anomaly yet - we're still trying to make sure we don't have a configuration problem - but today, towards the end of the activation, we did a thing call Crew Alert, which is a little test in which the ground sends a command and it sets off a little siren in the vehicle. And another thing it's supposed to do is tie the two communications channels together, the channel A with the channel B, so that all the communications gear is hot with one another and hot with the ground. All the speaker boxes, no matter whether they're set on A or B. The warning tone went off in the vehicle but we did not get the relay closed that causes all the communications gear to be hooked together now. The same relay is the one - is a relay that has to close to talk from the CSM speaker box back to the OWS, and we're running that check tonight to see if maybe the relay is hung up or whether we had a configuration problem. We ran the test twice and were unsuccessful both times. Couple of general things - you may have heard some comments about gas in the water in the wardroom. We seem to be having a little problem with that, certainly more than we had on SL-II or SL-III. I don't think it's - I'm confident that it's not going to be a continuing problem. There are a couple of reasons why we may be having a couple of problems. One could be that when we did the reservicing procedure, you remember we did that hundred part per million flush where we loaded the iodine up a couple of days ago and then flushed it out and evacuated the

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lines. We may have not gotten a really good flush on it and may still be experiencing getting some cabin gas that was in the lines out of there. And the other thing that's a possibility is that we may have a small hole in the bladder of the water tank that we're using that's allowing the gas pressure behind the water to get into the water. Now we're going to be, we're on water tank 2, it's almost empty. In fact, we - our telemetry indicates it is empty. We expect to be switching over to a new water tank tomorrow, I expect. I don't think we'll get through the day tomorrow without going to a new tank. And I fully expect after we've gotten on a new tank and use the water system for a day or two that this apparent minor problem with the gas in the water in the wardroom will disappear. The only other abitability thing that's been going on, the OWS temperatures are up a tad. There's nothing abnormal with that. We are in a period where the geometry is such that the vehicle is in a hundred percent sunlight and will be for another, I kon't know, day or so, another 21 hours as a matter of fact. So it's never being occulted by the earth, the sun is never being occulted by the earth and the temperature have a tendency to warm up. We don't think it will get any higher than the low 80's, 82 or 83, something like that. And as soon as we start getting some -

END OF TAPE

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HUTCHINSON They have a tendency to warm. Up we don't think it'll get any higher than the low 80's, 82 or 83 something like that. And as soon as we start getting some nighttime in there it'll hit back down to the mid-range 70's. You may have also heard some talk about a liquid crystal thermometer today which we didn't deploy, we were suppose to and I just happen to have brought one with me and you can look at it when this is over. That's a liquid crystal thermometer, little gem right there. It - we have apparently discovered in some testing on the ground at Huntsville - this thing is basically a crystal solution which forms a thin film and its painted on here and it's a pretty simple device. There's different crystals in each on of these little boxes and they change colors depending on the temperature they see. You want to read the temperature on something you just paste this on and then you have a little matrix here and you can read the colors, and from the colors you can read temperatures ev - anywhere from 71 to 120 degrees within about a degree or so accuracy, a couple of degrees. And we're using these things on rate gyro six-pack, the one we installed in SL-III to monitor temperatures and it - for a failed ON heater. And as you know that's one of the mechanisms that people think may have gotten us in trouble way back in SL-I, on the original rate gyro packs, the rate gyro that were on the rack. Consequently, these things were being run in a ground test at Marshall and it has been discovered that at 5 psi there's a very very su - in some of them there's a small chance that there is some air entrapped in the - between the plastic and the - the crystal film in there. And it causes at 5 psi, of course these things were made of 14.7 and at 5 psi the air bubble has a tendency to appear and debond the - the crystal surface from the plastic and you can't read it. It turns a milky color. So would you believe the crew has got to go through about 6 or 8 of these things and punch a hole with a needle in every one of those little squares in there and take their fingernail and squeeze the air out tomorrow. I guess the biggest thing we did today was get our primary coolant loop back going and I'm just full of little goodies tonight. I brought over a saddle valve since we've been talking about this thing for so long. I thought y'all might want to take a look at one. Without going into a lot of detail, the coolant loop thing took an awful lot longer than we thought it was going to. We did have some minor problems it turns out that the basic procedure involved mounting this valve and I need to show you what the inside of this gem looks like to demonstrates this. The valve comes apart like this and the line is a quarter inch line. You put the valve around the line and put it back together with the line inside that

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little enclosure there. And then after you get the valve - you get it back together and you close these two little gems - I never could put this thing back together. Tighten them down and the valve is now on the coolant line and there's a rubber grommet in there a seal - a sealing surface. See the little black surface in there, that seals it on the - on the line. You haven't punched any holes in the line or anything yet. And then what you do is you take of the QD here and you hook on a 35 psi nitrogen source on here and leak check it. In other words, you can determine that you have a good seal on - between the valve and the coolant line before you ever punch any holes in the coolant line. And when we ran that leak check today, the leak check didn't work. It didn't pass and we ran it once and then we ran it ag - well we partially ran it. We waited almost twice as long as we had planned on waiting to see if the leak rate slowed down but the basic problem was after we put the 35 psi nitrogen on the valve the thing wouldn't hold pressure. Well, so we decided first off before we started removing the valve from the place we had it on the coolant line, we would check the leak-check equipment for leaks. Would you believe the gear we had that leak checked the valve leaked? Consequently, we had a - we had two leak checks in there basically, we had a leak check that used gas and then after it successfully pas - -

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HUTCHINSON We had a - we had 2 leak checks in there basically. We had a leak check that used gas. And then after it successfully passed that, we had another one that actually put Coolanol on the valve before you punched the hole in the line. And we used Coolanol part of the leak check to verify that the valve was seated properly before we punched the hole. And from then on the procedure went fairly smooth. We reserviced the loop. We don't yet know how much Coolanol it took to get up to pressure cause we haven't gotten the mass measurement device readings from the tanks since they finished the servicing. But the loop is up and running. We checked it with one pump and two pumps, and the control of the loop has been turned back to the ground. And when I left over there we had just turned it back on, and it will remain up now through the EVA. And it all looks great. Think it's really - we want to leave it run here before we make a final commitment to liquid-cooled EVA for about a day. So about this time tomorrow, after it's been running for about 24 hours, we'll have a very good feel whether we've got a loop that's viable. But right now it really looks good. Looks like we successfully rejuvenated it. And when you leave I got some pictures here of all the rest of the gear and some pictures of where we punched the line and of the - and I don't want to go through all that, but you can look at them at your leisure. And I need them back, so you'll have to look at them while I'm here. Let's see - let's see if - I promised you a story on EVA and we'll get to that last. I brought a couple of flight plans with me. Let me talk a little bit about the flight plan tomorrow. Tomorrow's basically another medical day, a big medical day. In fact there's nothing going on tomorrow but medical stuff. We have the first major medical runs on the crewmen. CDR will be the first M092 subject, and then we'll do the PLT tomorrow, and the SPT will be done on Wednesday - Wednesday. So that we have a major medical on all the crewmen before we go EVA. Tomorrow is basically a medical day. We have a run on the rotating chair tomorrow as the CDR as the subject. I wouldn't be surprised to see it get canceled because of the stuff that we have to do that we didn't get finished today, namely all that CSM unpacking. So there are probably going to be some changes in the flight plan. I pretty much described what the flight plan looks like for Thursday too - or for Wednesday. It's another day of a lot of medical runs. We get the 2 chair runs on the other 2 crewmen, a third M092 run which is on the SPT, and the rest of the day is devoted to preparation for the EVA, which take up a couple - 3 hours in the late afternoon

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Wednesday. The EVA on Thursday - the EVA time line - scheduled hatch-open time is about 15:00 Zulu which is about 9:00 o'clock in the morning. I really don't think we'll make that, frankly. I wouldn't be surprised if the hatch doesn't come open until 10 or 11. We never seem to get out right on the - right on the money cause it always takes us a little longer to get ready. And since this is the first one and - I really think it will take us a little longer. But I'd look for the hatch open somewhere between 10 and 11 if I had to guess. It scheduled to open at 9 oclock, I'm talking Houston time now. The EVA is - runs about - if we pull everything off and it goes nominal, about 6-1/2 hours. And if - I will run down a list of the tasks just to make sure I didn't leave any of them out from yesterday in about the order we're going to do them in. I'm trying to figure out what the easiest way is to do this - well let me just read them off - and they're pretty much the kind of things - pretty much the kind of things that I was talking about yesterday. The first thing that we are going to do is install S228. We will take TO25 out there and temporarily restrain it or mount it on a handrail outside, and there are about -

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RUTCHINSON We will take T025 out there and temporarily restrain it or mount it on - mount it on a handrail outside and there are about 25 minutes of T025 operations that start at nighttime just prior to - to about 30 minutes or 25 minutes prior to the first sunset. Well, they start in the daytime and run through - run through a sunset. The next thing we're going to do is S056 and H-alpha 1 film, that's of course the center work station stuff, those are the two films we need to replace in the center work station. We'll do S082A and B film which is the Sun end work. Then we'll pin the H-alpha 2 door, that's a lot simpler than it sounds. That's a matter of just opening the door and literally pulling a pip pin out and it leaves the door - it actually disconnects the door from the motor shaft so the motor can no longer close the door and that instrument will - door will remain open for the remainder of the program. Then we're going to install S149 the particle collection device. And that goes on - up near the Sun end right underneath the edge of the - the edge of the solar shield. And after it's installed it has to be deployed, you recall you have to crank it out it has its panels to come out with all the collection devices on them. Then we go back down to the - that's all the work up on the AIM. We go back down to - the near the EVA hatch area and we have this D024 which is another materials device with a lot of samples that gets installed - installed there. S230 gets installed after that, then we go to work on the S193 antenna. And there's a lot of prep involved in that there's probably half hour - 45 minutes of getting ready of EVA time - getting ready, getting down there, getting the foot restraints installed. The tool belt deployed and so on and so forth. And then we have about an hour and a half worth of work on the antenna itself. And if you add up of that stuff up to give you an idea of well I don't really know if you need this kind of just give you a breakdown of the kind of time we're contributing to each of these things. It takes us about 20 minutes to get all of the gear organized after we've depressed out there in - in the forward - in the fixed airlock shroud area before we start carting it out to the various locations. We'll spend about - probably about 20 minutes putting T025 out and another 25 or 30 - 25 minutes of operating it. S228 is a short task, that's about 5 minutes to install that. The S056 H-alpha film is about 25 minutes, the 82A and B film is about 35, and the H-alpha 2 door is about 5. So the whole ATM operation is an hour for everything that we have to do to the ATM including the small amount of troubleshooting. S149 is about 20 minutes, D024 is 20 minutes, S230 is 15 minutes, and then we've got about 2-1/2 hours all totaled for the 193 antenna fix - about an hour and a half work and a half hour -

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45 minutes worth prep time down there in the antenna area getting down there and getting set up, and about 20 minutes to close out. If you add up all of those numbers it comes up to be about 6 hours and 15 or 20 minutes - optimistically. And that's a long hard EVA, and we've got - of course we feel a lot more comfortable tonight with those 2 coolant loops going. It looks very favorable that we're going to be able to at least put ourselves in a posture unless we get into some problem to accomplish all of this stuff. One EVA since we are going to be able apparently to go liquid cooled. So that's the layout on the EVA. The only other thing I wanted to say there was - seem to be some interest about when we were going to start working some of these other things.

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NUTCHINSON The only other thing I wanted to say was, there seems to be some interest about when we were going to start working some of these other things. Before we start some of the ATM work, we've got some repair work to do on some of the ATM C and D console, and I kind of forgot about that last night. As a matter of fact I think I said that we were going to start ATM operations the day after the EVA is over, and that's not correct. We've got the ATM S082B timer to install and we've got that IV monitor, one of the two TV monitors the crew uses, as you recall, is inoperative. And that has to be put in. So we've got about - we also have about a three or four daylight pass checkout that has to be carried out on the ATM. So the first ATM full up manned mission operations, I don't think you can expect to see them until about mission day 10. We are looking at accomplishing EREP checkout on mission 8, after the EVA, with a possibility of the first major FREP pass on mission day 9. Corollary work, first operation that's strictly corollary is S019, working on a starfield on mission day 10. Corollary has some repair work that also has to be done before we can start on it. You recall we're flying up a new mirror for the S019-S183 operation which has to be put in. And we also have to do some work on the S183 instrument itself. A new set of - I believe it's optics on the S183 that have to be installed. So the first corollary, we've got us some repair work on the corollary systems scheduled for mission day 8. And undoubtedly the first corollary work that's pure corollary is on mission day 10. The first comet work will occur on mission day 8 and it's S233, that's hand-held comet photography. The first big whang at the comet is probably going to occur on mission day 9 and the first instrument on it will be S201 out of the anti solar SAL. So the flight plan, sort of generally shapes up medical, medical, medical, here, getting ready for the EVA. We will do the EVA, then we've got one more day of sort of fixing things to get a couple of things done in the ATM area and a couple of things done in the corollary area. Mission day 9, we start to get serious about the other science with probably an EREP pass, the first work on the comet. And Mission day 10, we ought to be in full swing on the ATM. So by the end of mission day 10 everything will be up and running. Seems like it takes longer to get things going every mission. With more time I guess, it isn't that critical. That's all I have.

QUERY I heard some reference late last night that suggested that the crew had, one of the crew had, done some work with ED63, is that so? (garble)

HUTCHINSON Yeah, not some work, well, yes, some work. We got it out of the Command module and it's - we transferred it

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down to the - down to the workshop and I'm not sure what we did - did we do anything with it? I'm not sure whether we got it in any kind of a deployed status or not. You may have heard some conversation about ED63, about it being in the window in the command module, now that was a couple of days ago. Or were you referring particular to last night?

QUERY I though I heard reference to observations in connection with it, but - but -

HUTCHINSON It was - it was transferred out of the command module last night and I don't know whether they took any observations or not, but after I left last night it was taken out of command module. I don't know whether anything was done with it.

QUERY I understand we got about 6 minutes or so of TV today on the coolant loop repair. Is there more on the VTR? And when are we going to get it?

HUTCHINSON Now I wonder if we're going to get - I guess we'll have to wait until the orbit precesses all the way around to where we're coming over this Goldstone, Texas, MILA complex again. That means we probably won't get it until early tomorrow morning. The answer to your question is yes, we have about 26 minutes on the VTR.

QUERY And what about TV during the EVA?

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HUTCHINSON - - will get it until early tomorrow morning. The answer to your question is yes, there is about 26 minutes on the VTR.

QUERY And what about TV during the EVA, are you planning any at all?

HUTCHINSON No sir. We are not even taking TV out with us. Let me tell you why the - the and it has nothing to do with anything other than the fact that the airlock is absolutely crammed full of junk, with all of the stuff we've got to fix this antenna, and the film, and so on and so forth. We just don't - it just put - adding the TV in there was just too much. So it's a matter of just ma - of tremendous amount of gear to manipulate with all of these things we're going to carry out and deploy with.

QUERY Who is going to be EVA 1 and 2 and what are their jobs going to be? Who's going to be doing what out there?

HUTCHINSON Well, the roles switch around, depending on how you look at it. The two fellows going out are - are Bill and Ed. Who's EVA 1 and who's EVA 2 that's an interesting question. I believe - I can answer that if you'd wait a second I - I wrote it down in here because I never can remember because it changes with every EVA. Stand by I'll get it for you here. Have to go to the antenna thing, because I wrote it down on there. Okay, now I'll go back here. Ed is EVA 1 and Bill is EVA 2. Now you want to know by task who's doing what?

QUERY In general - -

QUERY Primarily who's - -

HUTCHINSON It really switches to - back and forth, but all - primarily what?

QUERY Who's going to be doing the 193?

HUTCHINSON Both of them. It requires both of them and Ed is in - Ed is in the foot restraints and Bill is the guy that's sort of upside down lying along the body there doing some of the work. Now most of the work is done by Bill as far as the physical stuff. Ed is kind of like a nurse, he manages this tool pouch which is about this long and full of all of the tools that lay along the rail and he hands him tools and take stuff back. The one thing that Ed does do is he's the guy that installs the jumper box. Bill takes it apart but Ed installs it because it's very handy to him right there but all of the work on pinning the gimbals and on cleaning the gimbals and so on and so forth is done by Bill.

QUERY And did they get the gypsy moths out and hung up on the - in the house today? Did I understand right just - that they're going to be hung on the wall - -

HUTCHINSON Well, they're deployed down in the workshop, I don't know exactly where, and I don't - I think

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they were in the day four transfers. And we didn't get the day four transfers finished. So I don't they got - I don't think they're down there yet. But I'm not sure about that. But I'm - I'm fairly certain they're not.

PAO Okay, let me pass on two inquiries from other news centers. For you Neil, will any repairs made to the secondary coolant loop? Question number one take that one. You want to take that one?

HUTCHINSON Yes. And not until it - it is warranted. Our basic plan of attack for these coolant loops is we've got two of them running now and they will stay running until after the EVA. We will do the EVA on the primary loop, the EVA crewman will be on the primary loop. After the EVA, the primary loop will be shut down and we'll continue on in the secondary loop it's - it's leaking of course and when it gets down to an inlet pressure that indicates to us that the accumulator, the reservoirs, have bottomed out we will reservice the secondary loop just like we did the primary loop, new saddle valves new hole in the different line. But we'll reservice the loop while it's running as opposed to the primary which was reserviced while it was off. And then we will continue on in that manner the idea of being secondary loops leaks less than the primary loop. So - -

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HUTCHINSON - - and we'll continue on in that manner. The idea being the secondary loop leaks less than the primary loop. So we just put enough Coolanol in the primary loop to get us through the EVA and we'll see how well it holds up on down the line, but we may have to reservice the primary again. And of course to do that all we got to do is go back and connect the hose up to this valve which remains in place once you've punched the hole in the line. It's a fairly simple procedure to put more Coolanol in there now. We have three of the valves on board.

QUERY Second part of the two part question. Why did it take so long to repair the primary loop when it was estimated to be a thirty minute job?

HUTCHINSON I think I covered that but the basic reason was that the leak check that we ran didn't work and we had to figure out whether the valve was really improperly placed on the line or whether the leak check gear was not working right. And as soon as we ran into a problem, we sort of asked the crew to wait for the ground and I think they - we didn't waste time. It was inconvenient for them to wait for the ground on occasion because the site coverage by the time we got around to having a problem was fairly poor. And that delayed us as much as anything else because they would leak check and then say it was leaking, yeah, it sure is leaking, but they had to wait 15 minutes to get to tell us that it was and decide what else it was and what the next step was.

QUERY When are you planning to service the secondary coolant loop?

HUTCHINSON Well it's a function - that's a hard question, the loop - it's a function of when the pressure gets down to where we feel like all the liquid is gone out of these little reservoirs. And right now the loop is at about 20.7. It won't be in the next few days, let's put it that way. The loop came up some and is being held up some by the fact that we've increased the heat load on it here since we've manned up. I'd say probably at the end of two weeks or so from now we'll be in a posture, and it may come sooner than that. I really can't say - we haven't seen a lot of leak data on the secondary loop since we've got the crew back up in there and I haven't - other than the - heat load that we're seeing now. But it isn't going to be in the next couple - three days, that's for sure.

QUERY What comments have you had from the crew regarding the difficulty of doing a given task versus doing it in the sim on the ground with gravity.

HUTCHINSON Well you know they haven't said a lot about that, but my own personal observation is just like the other

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crews. They find it going pretty slow here in the beginning. Not because of any disorientation or anything like that. It's just the tasks take longer. And I think most everything is running half again as long as you would expect it to run with a crew that's been there awhile. And I think personally that in the last couple - as the - I've actually seen a change in the amount of work they've gotten done as we've gone through - I mean they've done more today than they did yesterday and - But they have not commented directly on that sub - at least while I've been over there - that's hey, you know we're sure having a heck of a time, or this is taking a long time, this learning curve or whatever. If you recall both the SL-II and the SL-III crews really didn't get tuned up until they'd been there about two weeks. You know about the 10th or 12th or 14th day, you really begin to see a marked improvement in the amount of work they can accomplish. And we intend to try and keep the scheduling padded. When we build one of these flight plans, we deliberately pad these activities with time over what - say the amount of time we're allowing for at the end of SL-III, to allow these guys to train and build up on this doing it in zero-g thing.

PAO

HUTCHINSON

No further questions, thank you.

You guys want to look at this junk -

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**STYLAB NEWS CENTER
Houston, Texas**

**S/L IV - Earth Observation Aircraft Program Briefing
Johnson Space Center
November 19, 1973
12:30 pm CST**

PARTICIPANTS:

**Charlie Harlan, Chief, Aircraft Applications Branch, JSC
Jerry Elliott, Aircraft Applications Branch, ERP
Charles Redmon, PAO**

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PAO What do you want to see?

QUERY I'd like to see something that's correlated with some kind of specific results like the corridors of insect infestation in Mexico.

SPEAKER I think we can probably do that after this briefing.

ELLIOTT Okay, I guess we can start it. I'm Jerry Elliott, I'm with the Aircraft Applications Branch in the Earth Resources Program. First of all, thank you very much for attending. This is going to be real brief. It's going to be over by 1:00. We have a bus right outside Building 1 here to take everyone in a group or you can drive your private car if you like to Ellington. And we're having a tour of the aircraft at Ellington Air Force Base at 1:00. It roughly lasts about an hour. And I think I've given each of you a handout press kit. The press kit has quite a lot of information, a lot more than we're going to get into today, so I hope you read it. It has the role of the aircraft in Skylab IV. And then it has a write up on the aircraft program itself. There is also an information sheet in regards to the use of the data. And we have some pictures of the aircraft. And more examples of what we do with the data than applications of the data. If you have any questions, please feel free to ask us. I'd like to introduce now Mr. Charlie Harlan who is chief of the Aircraft Applications Branch. And Mr. Harlan is going to give you a real brief overview of the aircraft program, and we'll be here to answer any questions that you have. So I'm going to turn it over to Charlie Harlan.

HARLAN Okay, thank you, Jerry. We originally set out to make the aircraft available today for a kind of a static display, a short tour so that members of the media could see the JSC aircraft that support the Earth Resources program here. And then it somehow grew into giving you a little briefing here, but our purpose is really to give you just a quick overview and show you the airplanes, and then give you kind of an invitation to talk to anybody you'd like to here on the Center that is involved in this program. If you want to do any followup in any kind of detail. We just don't have the time today, and we'd like to have made our program longer except that we're tied to the schedule of supporting the Skylab mission and Monday was the best day to have our static display because we'll have the airplanes moving in fairly soon. So the primary emphasis today is to just get a brief overview, and an idea of the scope of the aircraft program here. And then find out who it is you can go see if you want to find out more about it. At the aircraft we'll have the Pilots and some of the crew members available that can talk in detail about the aircraft per se and they can also talk in detail about the sensors, and can tell you something

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about the missions. So I guess there is another thing too, we can make some of these people from the aircraft branch available to ride out on the bus that you can chat with or you can ask questions of when you leave here and go out to Ellington Air Force Base. And I would like to introduce a couple of guys here that will be available to questions. In the back I have Dale Moore who is the head of our Project Engineering Section, and you can buttonhole him for questions. And then we have Frank Newman sitting beside him who is the Head of the Mission Management section. Frank you want to stand up again? Somebody didn't see you here. And he can talk about any of the mission-related activities and the project kind of things we get into. And Bill Molner who is head of Data Management Section, he is our resident expert here on handling the data and that kind of thing. I would like to make it clear that we're just one small organization here, the people you see today at JSC that are involved in the aircraft program. There's the Earth Resources Program Office that manages it. There's us, who are in the operations business. We're going out to Ellington and you'll get to see some of the pilots and the aircraft operation out there. They have a big role to play. And then we have something called the Earth Observations Division in the Science and Applications Directorate. And those people really have all the details and the smarts on the scientific applications of the data. So, if you want to pursue anything in detail, we can certainly route you to the right person once we leave here. We currently have four large aircraft in our inventory. We have a P-3 which is a Navy version of an Electra. We have C130B, and we have two WB-57F's, and we also have a helicopter. This program began in about in 1965 with one Convair 240 and it's grown in scope considerably over the last few years. And the reason of course, is the tremendous demand for this kind of activity. Right now, our primary support is in three basic areas. We support the ERTS program, which many of you know is a Goddard Earth Resources satellite. And that has been the major part of our activity over the past year. And the work we do for the ERTS kind of satellite activity, is much like what we're doing for Skylab here. I'll get into the Skylab support a little bit more to kind of give you a brief overview of what we're doing in Skylab. The one thing that people want to ask is why we go around flying airplanes under a satellite that's possibly doing the same thing? They're taking pictures, the spacecraft's taking pictures and we're taking pictures. They're taking electronic data and we're taking electronic data. And there are several reasons. And one is, is that the use of these kinds of sensors from a spacecraft

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standpoint, is a new field. Now the aircraft field has been around for several years. The data we get from the aircraft is by and large a known kind of quantity and can be put in many cases to known utilizations. The spacecraft is a research kind of field at this point and they are learning how to use spacecraft data for Earth Resources kinds of applications. We fly airplanes underneath the spacecraft to provide something called, "Truth data," which is to take aircraft data that is known and to be able to correlate it to a spacecraft, say image or picture that's of lesser resolution. We use it for the space - the aircraft data for the development of the interpretation or the data interpretation techniques and the same sort of thing. The aircraft data is known, the spacecraft is not known as well, and you need a baseline or a reference point or a point of departure to go from something you know to an unknown data source. We provide more - we provide data that's in a larger scale for location of spacecraft data. We provide - we have higher spatial resolution with our sensors and it enables someone to take and locate a specific area more readily by using, say an aircraft mosaic built up that's of a larger scale. And they also try to correlate signatures of specific ground events or ground activities to the spacecraft signatures. Now in EREP, our aircraft support is similar to what we've been doing in ERTS except that in many cases, it's more dynamic. As you all know, the Skylab spacecraft has a problem of accomplishing a number of scientific kinds of programs and the Earth Resources is just one of them. So we compete for time on the spacecraft with a lot of other scientific investigations. So, we never know for sure exactly what ground-track the spacecraft's going to fly. As it's based on - since they have a limited number of groundtracks they can fly due to their flight plan competition with other science that it becomes more of a real-time planning operation. I think you can see that a spacecraft can go across the country pretty fast but it takes a relatively long time to move a group of airplanes around to get them under the spacecraft. So with with the Skylab support, it becomes a Mission Control kind of thing and we in the aircraft program work very closely with the spacecraft people. We have a man in the Control Center that does this schedule coordination between the spacecraft and the airplanes.

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SPEAKER - - the spacecraft. So, with the Skylab support it becomes a Mission Control kind of thing. And, we in the aircraft program work very closely with the spacecraft people. We have a man in the Control Center that does this schedule coordination between the spacecraft and the airplanes. Could I have that first viewgraph and I'll just show a couple of pictures here that will attempt to show - Can we turn these lights down? I don't think you can see this too well from where your sitting but the point I want to make on this is that this is an ERTS image taken from the ERTS satellite and this is the given aircraft image that was taken over part of this area here. And you can see that the detail is much greater and that this data here can be used to extrapolate over this wide broad area that is taken by the ERTS spacecraft. I got another one that shows some of the same thing. I'll just hold it cause I'm gonna sit down in a minute. Okay, this red frame of data here was taken with an ERTS satellite at about 500 statute miles in altitude. This is a Skylab frame of data taken at 270 miles. This is the S190A photography. And this is one of our - it's a mosaic made up of some of our photographs taken at 60,000 feet. You can't really see much due to this poor projection here, but the point is that a very small detail in the spacecraft imagery shows up as a very large equivalent in the aircraft imagery. And so you can use this as a baseline to make determinations from the spacecraft data. Okay, you can turn the lights on now. Okay, the other part of our program, beside the spacecraft projects that we fly, is something that NASA has called Supporting Research in Technology, and these are aircraft-only kinds of investigations and we fly a number of these for government agencies, universities and so forth. And in some cases they're very complex projects and in other cases we fly data collection for other agencies that are gonna do the analysis. Okay, I'd like to have the next chart, please. Okay, this - this is just an example of how aircraft data can be used to identify damage from a natural disaster. This is Hurricane Camille and it shows the devastation of a shopping center. And we've done - or accomplished a number of flights over the years in this SRT program for damage assessment. Could I have the next chart, please? Okay, over the past year, I had this chart already made up and to show the distribution of kinds of work that we do in the aircraft program, we support the ERTS and last year we had a total of 58 projects and in EREP we had 64 and SRT is 51, so the GSC program, by and large is - the bulk of the work is towards supporting the spacecraft kinds of programs. Could we have the next chart, please? This is the same activity

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broken down on a flight basis and for ERTS we had 158 flights required. We actually flew 120. In EREP we had 80 required and we flew 58 and in the SRT program, we had 122 with 103 accomplished. So you see by the flight magnitude that again the bulk of our flight loading has been toward the spacecraft support. Although the SR in T program, it did require over a hundred flights in that year. Okay. Next chart, please. I just put this up to show the kinds of locations we fly. Geographical locations. This is - where you see the dots, including Alaska there is the test sites that we flew in fiscal year 73 just for the ERTS spacecraft program and you can see that we have some fairly diverse kinds of test sites around the country. Next chart, please. Okay. This shows the EREP test sites we flew and that was through the first of January, 1973. And again you can see the scattered test sites. Those were actual - actually test sites that we actually flew. Next chart, please. And this is the SR in T flight program. Showing again the diverse locations. We - we base our airplanes here, primarily at Ellington Field, except that to get to these widely scattered sites we have to stage the airplanes from various sites around the country. We normally use military bases or other NASA bases, wherever we can, in order to get a better break on fuel cost and that sort of thing, get maintenance that's available to government airplanes. As far as the last fiscal year, to talk about the magnitude of the program, we flew 618,594 data miles. That's an aircraft over a site somewhere taking data for a mile. That was 618,594 data miles. We took 201,000 original feet of film, which is quite a bit of film. And as far as electronic data processing goes, it required some 3500 computer processing hours back here at the site from the data that we've collected. Could I have the next chart, please? This is our P3 aircraft and you'll see that when you get out to Ellington. And, as I said before, it's the Navy version - an earlier Navy version of the Lockheed Electra; it's a little bit shorter than a standard Electra. That's the site in the background, JSC. Next chart, please. I'm not going into details on this particular chart because you can see the insides of the airplane when you get a chance to walk through it at Ellington; but this shows that we have a number of sensors installed in the airplane and number of operator stations and it's a fairly complex kind of installation. You'll get a chance to walk through. Next chart, please. This is our C130B, and again, it is full of sensors, full of consoles and - Could I have the next chart? This will show an isometric view which shows the racks of equipment in the airplane and operator positions and you'll get a chance to

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go through the airplane. Now, the P3 airplane is - is - well I'll get into the sensors in a lit - an overview of the sensors in a little bit. Could I have the next chart? This is - it just shows the two airplanes flying in formation. And, if you'll notice the way their painted, the P3 is called Earth Survey 1, and C130 is called Earth Survey 2. Those are NASA designations for the airplanes. Next slide, please. This is one of our WB57 airplanes. This particular - uh - the way the markings are on there, for the United States Air Force, we were more or less leasing or had an agreement with the Air Force to provide us the high altitude flight services the B57s. That required some funding of their own and they got out of the program so we took possession of two of the WB57F airplanes and have configured those airplanes to meet the needs of the Earth Resources Program here. These airplanes fly at 60,000 feet and are used to simulate in many cases spacecraft kind of data; we can get over about 93% of the atmosphere with these airplanes. And we also get a smaller scale photography we've - photography in the order of 120,000 to 1. Next slide, please. Okay. This shows one of our B57 airplanes and you can see in the center it has a large instrumentation pallet. And I'm hoping that you get to see that today because they had to take the pallet down from the airplane to take a sensor out and I think maybe the pallet will be available for you to look at. But you can see the whole belly of the airplane is one palletized instrumentation system and it drops down for maintenance and access to the sensors. Next chart. We chose to go a different way on our second - no this shows the pallet, right here. And this is kind of prespective view and you can see it's full of instruments. And that pallet will weigh somewhere in the order of 4,000 pounds. Next chart, please. We chose to go a different way with our second B57 and go to something we call the mini-pallet. Which we have, instead of one large pallet containing all the sensors we build - we're building several small pallets that we can hang in the belly of the airplane. Although this one's - we call it a minipallet, it's not so small, it has two RC8 cameras and it has a long focal length camera, if we ever get it installed in the S190A camera system that's on Skylab

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MARLAN - - which we have instead of one large pallet containing all the sensors we've build - we're building several small pallets that we can hang in the belly of the airplane. Although this one's - we call it a mini-pallet. It's not so small; it has 2 RCA cameras and it has a long focal length camera, if we ever get it installed, and then the S190A camera system that's on the Skylab. Next chart, please. This shows a little helicopter that we use with one particular instrumentation configuration. We don't use this instrumentation anymore on the helicopter, but this is an airplane that's been used for - or has been used in Apollo for Astronaut training, and we converted it to use for remote-sensing purposes. Next chart please. And this is a view of the same helicopter. It's rigged out somewhat differently. You see there's a pallet on either side of the airplane there, hanging out over the side, and this is the Skylab S191 system that we use. Next chart. Okay. This is just kind of an overview of the airplanes that - P3's is a turboprop airplane and we can fly it from 150 to the neighborhood of 300 knots up to close to 30,000 feet and it's very similar in performance to the 130. The B57 we fly normally around 60,000 feet. As a matter of fact, most of our flight requirements are for 60,000 feet for this airplane. The P1's are trying to get over the atmosphere and they're trying to get a wider, more synoptic view. And the time at altitude is 78 and in the case of B57 we figure, one way about 5 hours, we can be up taking data. It takes an hour to climb and an hour to let down, somewhere in that time frame - Next chart. Okay, I was going to get into the - just a little bit just a very gross overview of our sensors because I think you can get a lot more of that when you get out to Ellington and actually look at the sensors and look at the airplanes and talk to some of the people that know more about them than I do. But this shows the electromagnetic spectrum and we have sensors on the airplane that cover most of the electromagnetic spectrum, all the way from the UV through the microwave except for a couple of areas here. These airplanes - these sensors are split up on different airplanes. We have about 21 different electronic sensors and some 10 camera systems we use to cover this part of the electromagnetic spectrum. Have the next chart, please. Okay. Can you drop it down just - okay, this shows our aircraft sensor configuration and for the B50 - for the B57's - we have two B57's listed here. We have RCA metric cameras, these give a nice 9-inch film. We have a Zeiss camera with a 12-inch focal length and we have - on one of them we have a set of six Hasselblad cameras that are used for multispectral

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photography and we also have a bore-site camera that's used for this electronic sensor here. We are currently installing an RS18, which is a thermal scanner instrument, which is in the lab right now. And I had just changed this chart to try to update it and we're going to put an older sensor back on, and that's why you'll see a pallet down on RS7, which is an earlier version of that. And then we have another set of instruments we put on that aircraft which are (garble) spectrometer and radiometer. Can you raise that up just a little bit now? There you go. Okay, for the other B57, it's configured much the same except that we have the Skylab S190A camera system used as a multispectral camera for that airplane. We also are installing one of these thermal scanners on it RS18, which is a new sensor to us. For the P3 we have a full set of cameras. We have the RCA metric or mapping cameras. We have a set of four KA62 multiband cameras. We also have an S190A system on it. And we have another multiband kind of camera system we can use which is called "I squared S," and it gives four bands. And we have a set of scanners on the P3. We have the RS14 which is a thermal scanner, and we have something called a PMIS, which is Passive Microwave Imaging Scanner, and that's peculiar to that particular airplane, and it's used to fill in the microwave part of the spectrum. And we can talk a little bit more about these sensors, and I'll tell you the general purpose of this airplane. We used to have a SL7 (?) on the airplane and that was supposed to be off of this chart, and it's been put in storage. We have a multifrequency Microwave Radiometer, which is a passive device. And we have a Scatterometer, and we have something called PRT5, which is a precision radiation thermometer device. And we have some environmental sensors, and their purpose is to try to get a feel for the environment between the - or the atmosphere between the airplane and the ground so we can what that atmosphere is doing to the radiated signals coming from the ground. And we have a Laser Profiler that we could use on either one of these two airplanes. Generally, the P3 is outfitted with the cameras and some microwave systems and it does have a Thermal Scanner, and it's generally used for oceanography and soil moisture kinds of studies and that sort of thing. The C130 has the Hasselblads - 6 Hasselblads used for multispectral photography, two mapping cameras, and it also has this - it doesn't show on this chart - it also has this S190A Multispectral Camera System. And it has something we call the Multispectral Scanner, which is our 24 channel

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scanner that is similar to the S192 device that you hear talked about on the spacecraft. And we have a Rad/Scat, which is a Microwave Radiometer and Scatterometer and other similar sensors to the P3. So the general purpose of the NC130 is to provide data from the Multispectral kinds of devices, and its utilization is more towards Forestry, Agriculture, and those kinds of things versus the Oceanography and Soil Moisture kinds of study for the P3. And the helicopter we have this thing we call the Field Support Spectrometer, which is the S191 sensor used in Skylab. And it has a camera, a Vinton (?) Camera that's used to take pictures of where the electronic data is being taken. This is used to support the S191 kinds of investigations in Skylab. Okay, you want to turn that chart out please? No, just a minute let me finish this Jerry. You want to turn the light up. Somebody got the lights? Here he comes. Okay I went through all those sensors pretty fast. And in fact it was too fast to really talk about them, so if you want to really find out more about them, you're going to have to spend some time and ask some questions out at the airplane of the guys out there. That was - I was really kind of rushed for time and I went that very quickly, in fact too quickly for you to get much out of it. But for EREP - want to talk a little bit about Skylab. For Skylab we're flying with these airplanes for 69 different investigators. And this is both scientific kinds of missions and sensor performance kinds of missions. In fact most of our missions are for the scientific community. However, we do fly for some engineers here at the Johnson Space Center who are trying to determine how well the sensors are working on the Spacecraft. And they are going to use our data as part of their basis for analysis. Skylab II we flew some 8,704 data miles for 51 data flights. In Skylab III we flew 20,190 data miles with 114 flights. So you can see the scope of the program is fairly large. And for Skylab IV our plans are, for the 38 projects that we are going to support in Skylab IV, we'll fly 64 test sites around the country - there will be 111 flights - data flights - 46 of these have to simultaneous with the Spacecraft over flight coverage. In other words we have to be under - we have to over the test site at the same time the Spacecraft is, 30 of them have to be within one hour, and another 21 of them during the same day. We'll be flying for 21 different Government agencies, 15 universities, and 2 private concerns. And I can talk about some of the typical projects perhaps but we are running out of time. If somebody wants to ask some questions - I won't be able to answer all of your

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questions, but some of these guys here probably will be able to.

SPEAKER Okay, thank you very much. It's a hard subject to deal with in a very short period of time. We hope that you will come on out to Ellington with us. I have a bus standing by outside the door here, ready to take everyone, or if you have a car, and you'd like to drive, well that's fine. We will be back here, it'll last about a hour and we'll have the bus bring us back in about a hour. And I hope you will come with us on the bus cause it will give you an opportunity to ask more questions and of course out at the aircraft we can go into it. So thank you very much and for our Foreign Visitors (garble). Okay.

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**SKYLAB NEWS CENTER
Houston, Texas**

**SL-IV - Change of Shift Briefing
Johnson Space Center
November 18, 1973
6:15 p.m. CST**

Participants:

**Neil Hutchinson, Flight Director
Dave Garrett, PAO**

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TIME: 10:16 CST
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PAO

Okay, we're ready to get started with this afternoon's change of shift briefing. We have with us the outgoing Flight Director Neil Hutchinson.

HUTCHINSON Okay, we'll try and kind of make this short tonight. The - We spent the day today as you know finishing up or trying to finish up the majority of this activation sequence. We made about the same kind of progress today we made yesterday, slow and steady, maybe not quite as - a little more steady today than it was yesterday. Of course we had some stuff we had to - we started off behind the power crew this morning because we had some things we didn't get done yesterday we had to do first thing this morning. And we stayed, I'd say, just about behind maybe two hours all day long. We didn't really lose a lot more time today, although, a couple of the medical things we did this morning, these body measurements, kind of surprised us. It took a little longer than we thought it was going to. And also the blood draw this morning took a little longer than we thought it was going to. Not the drawing itself but the processing of the sample afterwards. We're probably seeing the same kind of thing we've seen in all the flight crews in terms of their initial whack at everything taking them maybe a hundred and fifty percent of the time, it probably should take them, and I'll go down here as they do it. The workshop is mechanically and electrically totally turned on now. Believe or not, and knock on wood when I say this, I guess you can say we turned the whole thing on without turning up a single anomaly, in the last two days. We've had a couple of little ditties like the pressure regulator but they really didn't amount to anything. And we are essentially all finished with the workshop being turned on. Systems are stabilizing, the temperatures are all fairly well warmed up downstairs, it's pretty comfortable, about 72 - 73. The big things we've got left in activation are storage re-configuration and they are of course the hardest. It's the filling your closets full of all this stuff you brought up. Basically the CSM is about - just really started unpacking it this afternoon. And we really have several hours of unpacking to do this afternoon, and then tomorrow we have several more hours scheduled in an item called the day 4 transfers, which pretty much cleans up the basic getting the workshop configured as far as stowage goes. We'll probably start into - we've built a regular flight plan for tomorrow. We have several things. We're gonna reservice the coolant loop tomorrow - tomorrow afternoon after lunch. Coolant loop was a bad choice of words - the primary air lock module

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coolant loop. We start the biomedical experiments in earnest tomorrow because we started today with a lot of the chemical stuff. Tomorrow we have - we're going to activate the biomedical - the rest of the biomedical system and we'll be had - I think we've got two 131 runs scheduled tomorrow. First LBNP's the next day. I guess you could say probably by noon tomorrow, we will be pretty much moving into a regular flight plan operation. We really don't get homed into the orbital operations until after the EVA, to the day in and day out ATM, EREP, etc. Because of course there's only ATM unmanned and no EREP here until we get the EVA done - finished. And that's about all I have. The crew helped the - no comments at all today on anybody feeling good, bad or indifferent. They all sounded very chipper. They worked very hard today, from the time they got up and they're still at it. All three of them rode the bicycle today, full protocol we expected. And I guess you can say our little motion sickness episode is closed, don't think we'll hear anything more about it. That's all I have.

PAO
HUTCHINSON
QUERY
QUERY

Bill, first question tonight.
You're a one man army tonight, huh?
Right.

Neil, I understand that the crew is bringing up a Far UV camera this time. Is this camera similar to the Apollo 16 camera they brought up? Could you describe the deployment process and the operational run? HUTCHINSON Well - well I don't know a whole heck of a lot about it. To answer your first question, yes, it's very similar, almost the exact same camera as we used on the lunar surface on Apollo 16 -

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HUTCHINSON First question is yes, it's very similar, almost the same - exact same camera that is used on the lunar surface on Apollo 16. The PI, in fact is the same fellow, Dr. Page from NRL. The operation of the camera - I - I just give you a quick thing. It - it basically operates two places, the anti solar SAL or EVA. It can be operated in both places and when it's operated EVA, it's mounted on a bracket of one of the big trusses - trusses that runs right there outside the hatch. And of course, it's being used for Kohoutek and it's going to be used to look at UV phenomena in the upper atmosphere, I believe, also.

QUERY What is a procedure that I gather has gone on about photographing the astronauts hands in infrared light. What's that? Never heard of that.

HUTCHINSON Okay. That's called - it's not their hands, it's their entire bodies. It's called full body IR photograph, which is exactly what you implied we're taking pictures of the body in infrared from all aspects there - the reason you heard the conversation about the hands today, we had a little mix-up on whether they ought to have their hands palms down or palms up. They're laid kind of spread eagle on the floor, in fact they're restrained with a strap across here to the floor. So they're very still - the subject is. And the photos are basically an attempt to understand the body mass redistribution that takes place early in the mission. By body mass, I mean fluids. As you know, we are also doing a significant amount of body - individual body dimension measurements which are all tied in with this photographic thing. You may have heard them referred to as anthropometric measurements which is just a fancy name for saying that they are taking a tape measure and starting at their little finger and measuring every diameter all over their entire body. Again for the purpose of un - trying to understand the redistribution of the - of body mass which goes on early in the mission - the reason you hear so much about them now and you won't hear much more about them is that where - the phenomenon is suspected - in fact, it's fairly well believed that it occurs in the first three or four days of weightlessness. So there - there was an intensity in this particular area. And it takes a long time - I mean, it's just a - you know, if you can imagine taking a tape measure at zero g and having a guy sit there and measure off, you know, you have - fingers, and your hands, your wrist, your arm, your biceps, your neck, et cetera. And the photos are in connection with that.

QUERY From SL-III, I remember something vaguely about the status of the ergometer. I don't know if it was a facetious refer - reference to them wearing it out or something, but is the ergometer - has there been any - have there

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to be any repairs on it or anything?

HUTCHINSON Yes, on SL-III. Let's see, we had - I guess we've really had two things on the ergometer, really, three things, one of which is insignificant. One is the restraint thing which you - as you know, for SL-III, we got a new restraint set up with a little aluminum bars that is real handy that's helped out - helped out their ability to ride it in all the modes. You'll also recall that - that - maybe you don't, but, refresh your memory. Early in Skylab III, Jack Louma actually overheated it one time to the point where it caused the motor to, we call, free wheel, which basically is, it gets so hot that it has a cut out circuit which removes the elec - the resistance to the pedaling. And since that time, we have had a set of, I think they call them guidelines or restrictions, or whatever about the total number of watt hours that a crewman can do on it at any given time span, which we observe as a regular protocol in using it. The other thing that happened to the ergometer is really not really of a mishap, a screw came out of one of the pedals about 2/3 of the way through SL-III. Pedals that hold the little triangle clamp on it. It wasn't out of the pedal, it was out of - There's a triangle cram - clamp that you get your sho - put your shoe in to hold your foot down on the pedal and the screw came out of there, and of course, that would be a bad scene. You couldn't put your feet down and lock them onto the pedal. So, we found another screw, in fact, I think we took the screw out of one of the - out of a used urine separator. They found some similar screws in another piece of equipment, put it back in there and torqued it down and then we've not heard any more about it. And the ergometer is not giving us any - any problems whatsoever and we don't anticipate having any problems with it.

QUERY Neil, something I'm not clear about. On the Friday EVA, which is - it is just an extension of Thursday EVA, if they don't finish everything on Thursday, or is there other things on Friday that they're going to do during the EVA, and is it going to occur whether they finish - -

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QUERY - - on Thursday or is there - are there other things on Friday that they're going to do during that EVA? And is - is it going to occur whether they've finished all the S193 work and all that on Thursday?

HUTCHINSON Well, the EVA, I can kind of answer that all together. If everything goes exactly as planned, which means, number one we get water cooling tomorrow, and we'll know that within a few hours after we re-service tomorrow. First off you got to have water cooling to do the EVA as designed now on Thursday. The EVA - the reasons are several, but there are constraints on the amount of time you can spend out and the kind of work levels you can sustain if you're on gas cooling and it's like 4 hours maximum out at work levels on the order of a thousand BTU's an hour, 1100 something maybe at the outside. Now we expect, first off we have about 6-1/2 hours of work, if you include all the stuff we're doing on the EVA including the S193 antenna work, it's a long hard EVA, there's no question about it in fact it's probably the hardest EVA we've done except for the one where we worked on the solar panel back on SL-2. Now, the flight planning technique of leaving a spare day if you will or another day labeled EVA is done deliberately to cover ourselves for one of a lot of contingencies. Number one, it covers us if we don't get the gas cooling, there will be if we don't get the water cooling, there will be two EVA's there will be no S193 antenna work done on Friday. In other words the EVA is split into two chunks arbitrarily. So we won't - we won't even attempt any antenna work the first one. The other eventuality is, you know you never know when you get out there how it's going to go and these guys may be slow, they may be fast, no telling what they may run into, we do have a lot of work to be done beside the 193 antenna in fact, there's probably about you take the 193 antenna out of there there's probably about 4 or 4-1/2 hours of work without that. So it covers you for the eventuality that the EVA turns into a longer task than you thought and we have a couple of very distinct break points in there where we'll make a GO/NO GO decision to continue on or to drop back to an EVA - another EVA on the next day.

QUERY So even if you got that water cooling, you really expect to be out again on Friday.

HUTCHINSON I do not. I said if we got the water cooling and we have a good day of it I think, we have a makeable EVA with about 6-1/2 or 7 hours of work outside, there are a lot of factors that influence that and we of course always reserve the prerogative in real time to back out wherever we are and discontinue the work, you know the

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crew may get tired. You know, there's just a lot of variables. The basic answer to your question is I don't expect to have an EVA on Saturday but who knows.

QUERY Do you have - let's see a couple of EVA questions. What are some of the - what are the other principal items scheduled on that first EVA and do you have any other exceptionally long ones that stand out as such in the course of the mission and what's the principal item for them?

HUTCHINSON Well I wish I would have brought an EVA summary over here. The - to address the first question on the - this EVA, we got - of course we've got the ATM film replacement both at the sun end and downstairs and let's see we're doing H-Alpha 1 and 2 and SO - I'm not - I can't recall from memory exactly what. But a couple of instruments down below and a couple of instruments on the sun end. You recall we had some trouble with one of the doors, towards the end of Skylab 3, the H-Alpha 2 door, it's going to be pinned opened permanently. A little piece of trouble shooting there. We've got DO24 samples to put out which is a particle of materials experiment that's deployed there by the - by the hatch and left out and then retrieved and brought home a series of samples. Got S228, which is the - that's the - I believe that's the cosmic ray thing, anyway that's another thing that has to be deployed while we're out there. We are going to run TO25, which is you know the experiment we lost when we lost the solar SAL. We'll be running that EVA on this first EVA -

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HUTCHINSON I believe that's the cosmic ray thing. Anyway it's another thing that has to be deployed while we're out there. We are going to run T025 which is, you know, is the experiment that we lost when we lost the solar SAL. We'll be running that EVA on this first EVA. That's about a 10 or 15 minute setup job and 25 or 30 minutes off - and - on operation. Let me see what else? What have I left out? T024. S149 - Particle Collection Experiment will be taken out and deployed. And then we have the 193 antenna. I probably left somebody out, 230, 23 - 232, Don Linds thing. The solar - solar wind thing. That's another thing that's got to be deployed. Another thing that's going to be deployed - that's being taken out and deployed are the - We've got some more sail samples that we're going to expose on a clipboard out there that will be retrieved later. I - Before we get to the EVA, I'll bring you a nice clear list of the order in which things are going to do and how long it's going to take and so on and so forth. Of course, the biggie is the 193 antenna. And that thing takes two men down there, of course and a pile of and a bunch of equipment and I don't know how familiar you are with what's going on with the antenna, but we have a - a procedure which goes out there and sort of does an inspection and does a minor amount of what you might call repair work in terms of these - these gimbal potentiometers which are the things that we think - they're basically a - a electromechanical device which measures the position of the antenna. That's one of the highly suspect places that we think something might be wrong and the potentiometer are open. They - they' electrical surfaces where the - where the wires come together and the wiper and the winding comes together is open to the possibility of contamination. The contamination being Mylar - free Mylar and there's a lot of Mylar in the area. Of course the whole thing is covered with the solar Mylar. So the first thing we're going to do to the antenna when we get out there is take a little brush - kind of like a tooth - like a spatula - type brush - in fact, we call it the spatula. It's about that long and it's a little tool and it has a brush about that wide with bristles about that long and we're going to clean those gimbal pots and then we're going to back off. That probably takes - that'll take a half hour to 45 minutes, because you have to go down there and you have to see the place is not designed like your workstations for people to be around the area working, so you got to put in a set of foot restraints. One crewman is in the foot restraints, and the other guy works down at the antenna sort of upside down with the guy in the foot restraints holding on to him by his shoulders. It's not exactly the most convenient place in the world to work. The EVA trails kind of interesting to get down

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there, we have to crawl out the hatch and climb onto the mol sieve vent, the old model. And I don't even know whether it's got it on there or not - it doesn't. But, of course you can - if you turn the thing around, the - the antenna we're working on is the little one right there at the back. So you have to come out the hatch and you go around this - crawl down the mol sieve vent which comes out there right to the right and it goes all the way around and forms a tee right underneath that antenna. That's how you get down there, and - One of the foot restraints are attached - attached on one of those vertical - those struts that runs along this way. One - Yes, it is the small disk down there at the bottom. Yeah, that one. And the crewman actually work in the area between the dish and the S193 box, which is that rectangular thing right behind it there. And - Anyway, we're going to clean the gimbal pots and then we're going to back off and the guy inside is going to run the antenna and see if it works - see if it'll do the right thing. And if it doesn't then we go into this long diagnostic procedure where we break all the - a lot of the electrical connections on the antenna and we put in a jumper box. And we dis - disable the electrical signals to these pots one at a time and - and put a mechanical stop on the axis so the antenna can't move and then the crewman inside tries to see if it will properly work. In the other axis the idea being that we're trying to recover either - the antenna basic scan pattern is back and forth this way as it sits there on the vehicle. Back and forth this way and the axis we call roll - -

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HUTCHINSON The antenna's basic scan pattern is back and forth this way in an axis we call roll and up and down this way. And we're trying to recover one or the other of those movements. Well, that's not clear because one of the scan patterns involves using them both and course it's very hard to - very hard to - the - the crew have looked at the antenna when it malfunctioned and so on and so forth. But we really don't know whether one or both of them has malfunctioned. So we go through a long procedure to pen one axis and try the movement in the other and then unpen that one and let it go free and pen the other one and disconnecting and connecting signals and that whole thing probably takes an hour or an hour and a half. And the end result is we hope to - of course we hope to recover both axes, but as a minimum we hope to recover one if we can't recover either one of them when we get through with this little trouble-shooting procedure we're going to be doing, then the antenna will be pinned in a permanent position and it will be pinned at 00 which is where it is sitting right now, just about. By pinned I mean we'll actually put some mechanical - we're going to take out the - the thing was pinned for launch with pyrotechnic devices. We're going to remove the pyrotechnic devices and we've built some mechanical pinning things that go in the same holes the pyrotechnic launch protection devices went in and we're going to repin it just like it was for phase faze practically. And that way we will be able to get altimeter data and some scatterometer data out of it if we want to roll the cluster out 29 degrees off to the side so we can get the RADIOMETER/SCATTEROMETER. And that's about the first EVA, and it's a long one and it's a hard one.

QUERY

HUTCHINSON Are there other long ones?
That's the longest. There are several that are fairly - fairly - have a fairly - fairly good sized about of work. Of course none of them have this big extensive troubleshooting. There're literally work - you know we're going out - see - believe we go out twice. Do we go out twice for Kohoutek? I can't remember how the plan ended up coming out. But there's one of them that almost exclusively Kohoutek work that's not too long. The ones that involve ATM film transfer and the operation of 201 and - and SO20 and TO25 end up getting to be pretty long. By long I mean as compared to a normal ATM EVA which is like 2 or 2- 1/2 hours of work that they end up being like 4 hours. But there are none anywhere near this length. I think there are 5 altogether.

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CAMPBELL What is the electric power situation?
HUTCHINSON Well, we're about to find out, Dr.
Campbell. Actually we haven't - the electric power system
has been performing well and without any - we didn't lose
any components or anything during the storage phase. We are
planning on running a test prior to starting EREP passes,
and I think that test is currently planned for day 9 or
Mission day 9 or Mission day 10 where we are going to
deliberately discharge the ATM batteries all the way down
to where we can't discharge them anymore. A test very
similar - in fact it's exactly like the test we ran towards
the end of Skylab III which gave us the first really
concrete data we have on the battery degradation. Now we
know the ATM batteries are degrading slow but sure, and so
we'll have a really good assessment of the power situation
when that's - when that's - those test are completed day 9
or day 10. And right now it's kind of hard to say
anything other than that we haven't lost anymore, and we
do know that the thing - that the ATM system is degrading
and we expect that by the end of the program here coming
up in January we'll be having to press ourselves pretty
good to be able to get the full length of EREPS out that
we want to get. But right now if the degradation proves
to hold the way - at the slope and at the rate that we have
measured during the SL-III manned period, we don't expect
to have any problems. However it remains to be seen if that
same degradation rate is continuing here during the - during
all - during the unmanned because we don't have any - see
there's no way to test it until the crew is up there.

QUERY You mentioned switching from water
cooled to air cooled EVA in the event you don't get that
loop operating. But could you give us some words on any
further impact on the mission if that loop doesn't work if
the servicing tomorrow doesn't work?

HUTCHINSON Well there isn't any impact on the
mission other than the fact that you've lost redundancy
in the coolant loops and of course it's - without airlock
module cooling it's -

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HUTCHINSON - - any impact on the mission other than the fact that you've lost redundancy in the coolant loop and of course it's without airlock module cooling it's pretty much impossible to run manned. You've got to have the cooling because you've got to have the elec - see, the big thing on the cooling is all the airlock module batteries are on cold plates, the PCG's are on cold plates and see you need the cooling to keep the electrical power going and with it - you know it's a vicious circle. However, you recall we've flown up this coolanol and you know the secondary loop is slowly leaking also, in fact it's been going down all during the unmanned phase just steady as a rock, it's down to pump inlets down to around 20.7 now. And we do have a plan, of course if we were unsuccessful in reservicing the primary, we'd immediately proceed, maybe not immediately but certainly before we got any problem on the secondary in terms of the amount of fluid in the loop, we would proceed to a reservice procedure on that loop with the loop running which we have investigated and proven we can do without any problems. And so we've got all - we've got all the tools to keep ourselves in business here and we hope we're going to be successful with the primary loop reservicing. We'll know tomorrow if we are.

QUERY Short question, how does the degradation of the ATM batteries through SL-III compare with what was projected?

HUTCHINSON Well let me answer that - I can't answer it technically exactly to the right kind of numbers, I have to say that it's more than we anticipated. As you know the ATM batteries have kind of fooled us right along here every since the beginning, you know we've had a lot of cycles on those batteries premission but we didn't think it was going to have any affect on them. It turns out it did, we actually got in orbit with less capacity, you know way back in SL-1 than we thought we had. And then they've been rather steadily going on downhill at a rate which is a little higher than we had - of course we had expected degradation, you know we had expected that they would slowly but surely go down but I think the amount of degradation data we've gotten to date is pretty meager. You know it's like you've got two points on a curve that's six months long and the two points are only three weeks apart and you're going to get a real good data point here on the mission day nine because that data point will include all the degradation that's taken place since we had - the last test we ran on SL-III which was several days before the mission was over, so we have another month and a half you know 600 cycles or more

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on the batteries and soon as that thing is over and we're testing - see we're testing two batteries 10 and 18, two that we've already got some data points on. We should have a pretty good feel for how they are going to hold up.

QUERY Can you summarize the changes in the whole package since over the interim since SL-III degradation of batteries, coolant loop leaks, I don't know have there been time for since - since SL-I for any degradation of the efficiency of the solar cells for example?

HUTCHINSON Oh yes, they're not, of course, they're no where near the constraining factor that batteries are I think the power system in the airlock module converse to the kind of thing that's going on in the ATM, it's doing remarkably well, the batteries seem to be holding up extremely well, the - we've seen some lower output in the solar cells but nothing's that anything that would bother anybody and certainly is not going to be a constraining factor in the amount of power we can get into this system. To answer your question about what happen to the vehicle over the entire unmanned period, nothing. We've watched this coolant loop go down, of course we knew it was leaking before we left, you know we've known every since early in SL-III that we had coolant loop problems. We had a couple of little minor things you know we're playing around with this lock on the ATM canister that mechanically jammed just two days before the crew took off, that thing is still an unresolved area but basically the workshop has been pretty fine, it's not - we've just not had any real problems and of course we're awful pleased this activation not running into anything when we turned all that stuff back on and everything came back on as opposed to SL-II or SL-III, when we had several anomalies during activation.

QUERY
what -

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MUTCHINSON - - and everything came back on as opposed to SL-II or SL-III when we had several anomalies during activation.

QUERY Well, it might be an obvious question, but, what - what sort of degradation would be the reason that you don't anticipate if you don't find Skylab usable along about ASTP time.

SPEAKER Oh, okay. Well, let me - let me just - that - that one's not hard to address at all. The coolant loops for one thing. I mean they're both leaking a finite rate - we took a finite amount of coolant up there. I've seen some numbers which indicate that they'll both be gone somewhere in the late spring, and I don't know exactly when. But if the leak rates continue - You see, the coolant loops are one of the - one of the theories that it - and it's a theory that hasn't been proven yet, they leak worse when the crew isn't there, because there isn't a heat load on them that there is when they're manned. When we got a lot of electrical power being used and everything. One of the theories is that we've got some joints in there that are leaking and that are sensitive to - thermally sensitive. They leak more when they are cold than when they're hot. So, even if it leaks at the same rate that it is, we've only got enough coolant - we'll be able to pretty much top off the loops when we leave in January. But they're going to head right on down. The - the ATM batteries - There's another one that is slowly but surely going down and, of course, we're going to get a good data point on that. But if the coolant loops go, there goes the airlock module power system. Then all you've got is the ATM batteries to share the whole mess. And of course, they're very weak, so, electrical power is the thing that will get us in the end.

QUERY Is there a measurable drop in the - Is there a measurable drop in the stored O2 and N2?

SPEAKER Oh, no, no, no. We're very - we're very - consumablewise water and air and that there - there's plenty of that and of course, no - no adverse usage of it or anything. You know - we've - the workshop has been continually tight, and it's just as tight now as it was when we put it up there in terms of the kind of leak rates you see and the amount of - of O2 and N2 that we're using and the water used has been just as predicted, we're about (garble) . We have - you know, we got a hundred and hundreds of gallons of water we'll have left when the last crew leaves. So that's not - not a consideration.

QUERY Well, when they leave are - are they going to leave the lights on or turn everything off?

SPEAKER No - no, we plan on deactivating it just about the way we've done it the last - last two times. I -

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I don't know of any plans in the mill right now to do anything specifically different on this deactivation. We're going to leave it in the very best posture we can to allow it to - to continue on as long as it can.

QUERY What - what do you see to be the factors and what was the thinking of limiting the mission to 85 days. What - what do you think runs out at 85 days.

SPEAKER That's - that's a easy one to answer, the food. We - we had to do something else in turn. If you'd been around here the last month, you wouldn't have believed the meetings that went on to figure out how to stow that command module. I can't believe the stuff they've got on there, as it was. If you - if you've looked at the stuff that we're taking out of there in the next three days in terms of all that junk we carried up - of course, we carried up a lot of equipment to repair things. You know, we have extra cables for this and cables for that, 80 - 40 pounds of liquid for the coolant loop and the food is a - is the constraining factor and there - it's - we're out of it. And just to get the 85 days, we had to fly up about 170 - 158 pounds of food, something like that of which some - I don't recall the numbers, but, a third of it roughly is this high concentrate candy bar type stuff which is extremely nutritional, but I don't know how psychologically nutritional it is (laughter).

SPEAKER Neal, we had some questions called in from the Cape. One of them is, would we ask you to go through the EVA again Thursday, Friday - or Friday and Saturday, or - There's some confusion down there on when the EVA and coolant loop.

SPEAKER Oh, the - well the coolant loop reservicing is tomorrow. Now that really has nothing - nothing to do directly with - -

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HUTCHINSON Well the coolant loop - coolant loop reservecing is tomorrow. Now that really has nothing to do directly with the EVA other than as soon as the reservecing is complete after we've looked at the loop for about an hour about 24 hours I'd say, probably need a day, we will be able to tell whether we're going to be able to use that coolant loop to do an EVA with. Now, one of the requirements to do the EVA the way we have it planned now on Friday, have I got my dates right, Friday is mission day 7?

QUERY Tomorrow is four, Thanksgiving is 7.

HUTCHINSON Okay, that's the day - that's the EVA day, I'm sorry, that's probably where I confuse people. Mission day 7 is EVA day whatever day calendar day that is. Okay? Now, if - to do the EVA as planned right now we have to have two coolant loops, two air lock module coolant loops because we don't want to take the chance of running the liquid cooling with secondary air lock coolant loop. The EVA will be run on the loop we're going to fix up tomorrow. So if we don't get the loop fixed we are into atwo - EVA situation on Mission day 7 and mission day 8. Which is whatever two calendar days that turns out. Thursday and Friday I guess.

QUERY Other questions from the Cape. The Bean crew urged the astronauts to eat, sleep and exercise on a regular schedule and the Carr crew said they would, in view of this why did the flight director say they have to be urged to eat and exercise and did they exercise today?

HUTCHINSON Well I think it's human nature to answer the first question, I think that we did do a little urging today, I don't think it was very dramatic, we just prodded them a little bit about lunch and we did prod them a little bit about exercising, we didn't really prod them about exercising they agreed completely with us. That they intended to get exercise today and we had - today was the first day we had - we had a full set of exercise time scheduled in the flight plan. I think there's a natural tendency when you're up there to just get this thing in a nice stable, everything organized mode and relative to the eating situation you know when you're real busy and you know you've got a lot to do and you're in the middle of a job, it takes a lot of constitutional fortitude to say okay I'm going to stop, we're all going to knock it off here and go eat. When you just keep saying to yourself I can spend 15 more minutes and get this thing done and then it's 15 more minutes and get that done. And I think we were anxious and they did stop and we ate lunch about an hour late today, not quite, about 45 minutes late, we got started and I think we're going to

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continue to emphasize in these early days in the mission until they get settled into a nice stable routine that we'd like for them to eat on time. And as far as did they exercise today, yes all three crewmen rode the bicycle full protocol we had prescribed for today which was whatever it was 45 minutes a man or something.

QUERY Okay, another question, the astronauts reported they were having difficulty in unpacking the space craft, installing items in the workshop, what kind of difficulties did they have?

HUTCHINSON I think it's a matter of finding things and they keep running - you know where - that we've run a little bit out of sequence on the activation time line and it's a very sequenced activity and I think it's a matter of a guy needing a piece of gear to do so and so and lo and behold, Joe Blow was supposed to have brought it down an hour ago and he's still doing this other thing and you've got to go up and get it yourself. It's a matter of not having everything readily available in workshop that's required to do particular tasks during the - the activation sequence. I think a typical example of that was today during the M110. It turned out that the full sheets you log the date on were up in a stowage clock room command module, they didn't know where they were and couldn't find them and they looked for awhile and they finally called us and of course we've got some storage people who know where everything is I hope.

QUERY Another one, will the delay in activation of the workshop effect the repair of the coolant system tomorrow.

HUTCHINSON No sir, and I don't think there's been a delay in the activation of the workshop, I think that we've been - after I left here last night before the crew went to bed, they ended up only about an hour or a little over down on the total activity and I think it's just been kind of slow but that's the way we like to see it in a slow and steady and that's just what's been going on and the answer to the question is no we will work on the coolant loop tomorrow.

QUERY What is the first major scientific experiment scheduled?

HUTCHINSON Well it depends on what you call major I mean we're already experimenting in the biomedical world we started that right after we got there. The first ATM operation will be on if the EVA - if we do one EVA will be on mission day 8. The first EREP pass will be probably -

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HUTCHINSON The first ATM operation will be on - if the EVA is - we do one EVA will be on mission day 8. The first ERFP pass will be on - no, I believe on mission day 9. Tomorrow, I'm going to bring a set of the flight plans. Do you guys have a set of CAL COMS yet for the first - do they have a set for the first - There's no reason why they shouldn't for the first week of the mission. A set of - yeah, a set of time line - those little computer printouts that have all the stuff on them. They ought to have because there is a fairly coherent one out that will probably hold water pretty much. Unless we get into a problem with EVA. Anyway, so mission day 8 is the first big ATM work.

QUERY

Well, what's the procedure in servicing the coolant loop? And if anything takes any longer than you expected what - what are problem areas?

HUTCHINSON

Well, the coolant loop procedure is fairly simple. We've got this tank full of liquid and got some hoses - and tanks about - it's an oh - By the way, the tank the coolanol is in is a old command module RCS tank that has been converted to - for this use. It has the same bladder in it and everything. It has a balloon type device - bladder type device inside that has the liquid in it, and it's pressurized with gas and we pressurize it with the nitrogen system on board the workshop, the 35 psi nitrogen. To get - to introduce the coolanol into the coolant system, we're going to expose the plumbing and the heat exchanger in the airlock and we have a little device that looks very much like a - it's called a saddle valve. It reminds me of a corkscrew for a - for a wine bottle. It's basically a thing that clamps on to the - on to the - it's about that big around and about that tall and has a little handle on it and you turn and it clamps on the - on the pipe and you turn the handle and the thing has a - a sharp point on it, it pierces a hole in the line. And on the other end of it, there is a fitting which you attach a hose to and the other end of the hose is attached to a tank. And you have a control valve on the tank that you can regulate the flow on and off with and you can do it - it's kind of unscientific - it's just by time, you know. For 3 minutes, you open the valve and that puts X amount of fluid at 35 psi into the coolant line. And, of course, there are some other things that you have to go through a leak check on the valve bef - bef - after you seat it on the line, before you pierce it and after you pierce the hole in the line. And that's - that's about it. We have a procedure to waive the hole mechanism on the BMMD before and after the servicing, so we get a very accurate determination of how much coolanol we introduced into the loop. Because, you see, we really don't

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knew how much we lost. We're - we're guessing on that - on how much we've lost.

QUERY How long does that take?

SPEAKER Less than an hour, if all goes well. And it's a two man operation just for a very short period of time, and then it's essentially a one man operation.

QUERY Well, do - do they leave this device on the pipe or do they have some means of plugging the hole that they - -

HUTCHINSON No, the saddle valve remains on the pipe, and we've carried two or three sets - two saddle valves, I believe.

QUERY Is there any - -

HUTCHINSON - - bad data I gave you.

QUERY Other than EVA's are there any other tasks that will require getting suited up?

HUTCHINSON Yeah, the M509 - M509, we have some suited 509 runs in the - in the - in the vehicle. Like we did on SL-III.

QUERY Do they have any Kohoutek oriented activities prior to the EVA and if so what, when, and how?

HUTCHINSON Oh, my. That's a - that's a long question. There ought - You ought to have some KOHOUTEK data around here too. There is a overall plan - Kohoutek plan of attack, which has been laid out - It is a thing you guys ought to have. It's a matrix. It's got all the instruments that are being applied against Kohoutek versus calendar date. Includes, - there's no reason why they shouldn't have that. Boy, that's been out for weeks.

QUERY (Garble).

HUTCHINSON No it's not - don't - (laughter) Anyway, be that as it may, the Kohoutek work starts long before the EVA and of course, the first Kohoutek work is done out the SAL, - -

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HUTCHINSON Be that as it may the Kohoutek work does start long before the EVA. And of course the first Kohoutek work is done out the SAL. And it includes the whole plan with observations by S019, S020, T025, S063, the handheld stuff, S201 and also it has the EVA and when they are - of course they are fixed in time because they are all associated with perihelion of the comet. I don't know the exact details of it, but there is a lot of Kohoutek work that goes on, and of course it's like this you know as you as you approach Dec. 25 or Dec. 29 it gets markedly heavier, because that's the area of intense interest when the thing gets close to the sun..

QUERY

This is available?

HUTCHINSON

That one little graph though is worth a thousand words though because it really gives you a bird's eye view of the whole plan of attack relative to Skylab on Kohoutek.

QUERY

I notice - are you talking about the experiment allocation matrix, which is Kohoutek and all the other things? Are is this different matrix?

HUTCHINSON

No, this is a particular thing which describes the nominal plan of attack for viewing Kohoutek with all the various instruments.

QUERY

The experiment allocation matrix says that the last Kohoutek experiment is day 63 as I recall - 63, 68 - works out to - works out to two or three days after Kohouteks closest approach and leaves a long time till the end of the mission if it goes 84 days. And I thought that part of (garble)

HUTCHINSON

I don't believe that's correct.

QUERY

You think it goes longer?

HUTCHINSON

Yes, I'd have to look at it as to what the stuff in the post-perihelion time frame is, but I'm sure we're going to be doing some work stretched on out through January. Sure wished I had that piece of paper here it's probably in that notebook. I'll look it up when I - and see if it's in there.

PAO

Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
November 17, 1973
8:33 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Dr. George Armstrong, Health Services Division Chief
Don Green, PAO

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PAO Okay, we're ready to start the change of shift briefing. On my immediate right is Dr. George Armstrong and on his right is - and on his right is Neil Hutchinson. We'll start with Neil. Okay.

HUTCHINSON We all set? Let me just kind of go down activation ditties we had today, I guess to sum up today before I start going into some of the details. I really think all things considered we had a fairly successful day today. We didn't get quite as far as we would have liked to, there are a couple of reasons for that which I'll talk about when I get down in here we ended up - oh, I guess probably with maybe a couple of hours or an hours worth of work, it's kind of hard to say, when I left the Control Center, we really didn't have a - have a clean look at how far the crew is going to get, of course they're still working, they were eating dinner and there were several items that we put on finishing up before the day was out. I'd say we probably ended up at the outside with a couple of hours of work that we would have like to have gotten done today, that we didn't get done. All and all I think the really important thing is that we've got the workshop all turned on and we didn't turn up any anomalies at all. We had several things that as the crew went through them we ended up having some things that turned out to be procedural. I'll kind of go down the list here. One of them was a little ditty, when we were trying to flush the water that ended up setting us back an hour or so and I'll talk a little bit about that but basically the OWS looks about like it did when we left it. And I think that's important, considering the fact that in both SL-II and SL-III, when we got in there we had several things that surprised us, in terms of things that we expected to work and that didn't and that didn't work quite right. And today we didn't have any of that. The only hang-ups we had were procedural and we pretty much got around all of those and I think tomorrow we'll probably have a better day than we had today and we'll get ourselves right back in tune on the time line as far as activation goes and frankly, I'm just real pleased with the whole operation. Let me kind of go down some of the system things and then we'll talk a little bit about Dr. Armstrong along, we'll talk a little bit about the crew's health. To sum it up tonight they're all - all three of them are really feeling great. They worked like troupers this afternoon. And we'll talk a little bit about that in a minute. Let me just go down the list of things that you may or may not have heard that didn't come off or came off today. They were a little bit out of the ordinary, you recall on SL3, when we turned on the mol sieves, one of the fans wouldn't come on, as a

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matter of fact that fan has never, we even replaced it and as it turned out the power supply was burned out, it never has worked. It had a little start this morning, one of the fans in the other mol sieve didn't come on when the crew turned it on and we recycled the starter procedure, which by the way the fans are known to take a couple of tries to get them up, to get them to run and indeed it worked all right and the fan looks fine, we certainly didn't experience any problem like we had in SL-III and we don't think there's anything wrong with it at all. We had a little problem with the VTR as you know we televised some initial work of the crew installing some things in the tunnel between the CSM and the MDA. And the crew couldn't get the VTR to come on we discovered we had a power switch that got left off. We got that turned on and then the ground couldn't dump it after they got the data recorded on it and again that was a switch position on a panel on the CSM, it wasn't in the proper position, we got that straightened around so there's nothing wrong with the VTR, it all looks great. We had one circuit breaker that opened up today unexplainedly, we feel pretty certain it was in the caution and warning system, powers only some telemetry signal conditioning that we get on the ground.

END OF TAPE

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HUTCHINSON - - today on unexplainedly we feel pretty certain that it was in the caution/warning system, powers only telemetry signal conditioning that we get on the ground here, we feel that the crew probably bumped the switch. We don't think we had a short or anything there. Let me talk a little bit about this water thing. One of the basic things we do in the workshop when we activate it is we do a thing called a hundred part per million flush. And in plain English, what that means is we get a tank of - the portable water tank and fill it up with water and shoot it full of iodine and get a very stiff concentration of iodine and then introduce that into the water system - the drinking water system down in the workshop and then let it sit there for an hour or so until it kills all the bugs, if there are any bugs. And then we dump the water overboard and dru - dump the concentrated water overboard, flush it out and the system's ready to use. Now the crew has to make this one hundred part per million solution. You take the potable water tank and you put some iodine in it and fill it up with water and then you put that tank in the water system. Today, when we did that a valve was inadvertently turned and instead of filling up the water system, let all that water - that special concentrate we had made up, go overboard into the waste tank. So we didn't get our - our soak time that was required to kill the bugs. We had to go back and rebuild ourselves a solution, if you will, and reintroduce it into the - into the water system. And you may have heard a lot of conversation about the water system today. There is nothing wrong with it. We just had - had a tough time getting that flush finished. Probably cost us about a couple of hours in the time, a couple of man hours in the time line. However, it is complete now, and the system has been flushed. The water has been drained out - the hundred part per million solution has been drained out and when I left there, they were in the process of flushing it with clean water which is one of the last steps prior to being able to use the water downstairs. Now we did get the water system turned on down stairs in time for dinner, they had to reconstitute their dinner down in the command module again tonight. But we expect that will all be squared away, so we'll have it for breakfast in the morning. We had a minor anomaly when we turned on the O2 N2. In fact, this is probably the on - and - and I hesitate to call that an anomaly. It's something we don't quite understand yet, but when we turned on the O2 N2 system in the workshop today, the thing that controls the atmosphere, it decided it wanted to regulate the cabin pressure at about 5.1 psi which is about 1/10 of a psi above where those regulators operated in SL-III. That's

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no problem. We almost turned the regulators off when they finally took control and stopped the flow of gas into the cluster at 5.1. So it looks like we probably had one of the regulators that shifted about 1/10 of a psi higher and will probably be running it 5.1 for the mission. We'll be doing some more looking at that one, but I really don't consider that to be much of a problem. There were several other minor things, but I think basically other than the fact that we didn't quite get through the time line, that kind of sums up the - some of the activation things. The things that we had - We had about an hour's worth of work to do when I - when I left there and they were mostly clean up items. We had a couple of things to do up on the command module. We were going to turn on the mol sieves on tonight so we get CO2 scrubbing. We, of course, will be sleeping in the workshop. There's nothing to preclude us. We got all the stuff done required to sleep downstairs. And I guess that's about all on that. Now let me go over - let me address this thing that's gone on with the - with the PLT's physical status or whatever you want to call it. Yesterday, as you well know, the PLT was not feeling well. In fact, he didn't eat dinner last night. And this morning, if you look at the activation time line, you see that the PLT's got a lot of work in the OWS and the work this morning was done by the CDR for the first, I guess, up to lunchtime more or less, the first couple - three hours. And the PLT and the CDR just switched jobs. Now in the basic activation time line, what goes on in the morning is the PLT and the SPT were down in the workshop and do all the work and the CDR stays in the CSM and gets that powered down effectively. And so this morning the PLT and the CDR just switched jobs, - switched rolls. By noon it became known to me and several people in the control center that there was a dump tape on the ground that indicated - of course, last night, we had a med conference with the crew. And we talked about the fact that the PLT wasn't feeling too swift, but everybody thought he was going to be all right, and you may want to ask George some things about that one, when it gets to be his turn. But the basic impetus was that the PLT was experiencing some motion sickness however nobody thought it was particularly severe and he didn't vomit yesterday. Now, sub - -

END OF TAPE

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HUTCHINSON But the basic impetus was that the PLT was experiencing some motion sickness. However nobody thought it was particularly severe and he didn't vomit yesterday. Now subsequent to that today about noon, as you know we dump a lot of tapes off both the CSM and the air lock. And the tapes are processed and transcribed and the control center doesn't get the guts of the contents until after the ladies have sat down and listened to them, and typed them out on a piece of paper. And we don't listen to them real fine or anything when they're dumped over in the control center. This afternoon it became known to us that the crew had indicated on 1 of the DSE, CSM-DSE dumps, that indeed last night - and I'm not quite sure of the timing - but basically the PLT got sick last night. He did vomit. And this kind of surprised us all because the crew indicated last night that they felt that even though Bill wasn't feeling too swift everything was gonna be super squared away this morning. And if you've been around here in the last couple of hours you probably heard the air-ground conversation we had with them. We had a private medical conference this afternoon about 2-1/2 hours ago and this subject was discussed with them in detail. And I guess if you want to sum it all up in a nutshell the crew did in this dump tape which I don't know where the transcripts are - I have not read it by the way I have not seen a transcript cause they still haven't got one - complete one over in the control center. But you'll probably see it before we will. Oh yeah I've seen it - I've seen this partial one. That's the central - central part of this conversation. I think basically when the event happened last night the crew - the crew discussed what it was they thought they ought to do about it. And the DSE happened to be running at the time. And I frankly don't think they knew the DSE was running and in retrospect course later on they realized the DSE was running. I think Al Shepard summed it up very succinctly. I think the crew made a judgment error. It's as simple as that. And they did discuss discarding the vomitus sample, which by the way they did not do. It has been processed, they did retain it. And we have talked to them on the air-ground about as candidly as we know how about being forthright in this interchange between us - between them and the ground. I think in all fairness to the crew you've got to say that maybe we were as much to contribute to this little incident as anybody else. As you know there's been a lot of talk about motion sickness. We were very surprised when the SL-III crew got in there and didn't feel well. In fact upset the activation time line in getting the

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HUTCHINSON the SL-III mission underway. Because their motion sickness persisted for so long. There has been some speculation that the volume - the initial volume had something to do with it. And as you know we tailored the activation time line of Skylab 4 to keep the crew in the command module last night. And in fact Jerry has specifically talked to us over the last week about "Hey if I'm up there and feeling good you know I really might like to open that hatch after docking and get in there and take a look around." And we had tried to discourage that because most people felt that - that would be better if we'd stay in the command module last night. Which by the way we ended up doing. You probably also know that we have a prescribed preprogramed medical intake of scop/Dex and protholomy - I pronounced that right - promethazine for the crewmen that they have been taking ever since they go into orbit to suppress any motion sickness. My point is that - that discussion and impetus of what this motion sickness means to everybody in the fact that we were trying hard to prevent it trying to get the mission off on an even keel was utmost in the crews mind. And I think they basically felt that Bill really wasn't very sick - and he wasn't. And they just felt that it wasn't - wasn't worth getting people upset about. Like Al Shepard said it probably was in retrospect was a mistake in judgment. However we've talked about it fairly candidly and I think we're all straight. Now I haven't got anymore to say about that. So I - so I think that we're off to a good start of Skylab 4. George, I don't know what you might want to add.

ARMSTRONG I - you didn't leave - -

END OF TAPE

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HUTCHINSON - - subject that I think that we're off to a good start in Skylab IV. George, I don't know what you might want to add.

ARMSTRONG You didn't leave much to add Neil, except that if you say that the - not reporting of the vomiting of emesis was a mistake in judgment or a bad judgment, I would have to add that I think that the decision made on board for the CDR and the Pilot to switch roles this morning was certainly an example of excellent judgment. Because by keeping Bill quiet, not moving around for a few extra hours this morning, I'm quite positive that they made his rapid recovery more assured, and that his performance this afternoon and how well he felt really seemed to a large part from the fact that they did reverse these roles this morning. I think you covered most of it he was - was slightly ill and he did - he did vomit. He didn't feel quite as well as the other two this morning. They all ate and this afternoon they really went to work and performed quite well.

QUERY I've got two questions one for Neil. I remember mention of the oxygen pressure, partial pressure being a little bit high. What ever happen to that?

HUTCHINSON We were looking at that in connection with - looking at that in connection with the thing I mentioned about the cabin pressure being a little high and worrying about the REG locking up at something over five. Well let me back up just a minute, you know we filled the thing based on calculation and of course those calculations are done to - we don't have any measure of the partial pressure of O2 when the crew isn't there without the - without the system up. and without the O2/NC controllers up. The way we figured out we were trying to get a partial pressure of O2 of about to about 39 in there, and of course we have to do that all manually when we fill the cluster up for pressurization prior to the crew getting there, so it's all set for them. The second thing you ought to know is that those PPO2 sensors - the three PPO2 sensors we have on board now are have been there since the mid - and they are scheduled to be changed out day after tomorrow. I think and we suspect they are not reading exactly what we want because the combination of those two things probably could be a little erroneous readings in the PPO2. We missed it on the - of course we have to do it in a few minutes and time and it's all done based on time. We had to get the pressure up. We may have missed it a little bit in the O2 repressed sequence, however, the reason it was up at that time we weren't quite sure whether the pressure regulator was demanding O2

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or N2, we later determined it was demanding N2 and not O2 and we were a little concerned that maybe we were flowing O2 into the cabin and we really shouldn't have been because the PPO2 sensor said we shouldn't have been. I think that we - the system wasn't flowing too much O2 the PPO2 is maybe a ten- a hun- five hundredth of a psi too high but nobody's bothered about that and they'll breathe it right down anyway. No malfunction in the controller and we'll get new sensors day after tomorrow.

QUERY

Second for - -

QUERY

(Garble) no problem that'll clean.

QUERY

Second for Dr. Armstrong. Do we understand

correctly that Pogue is completely recovered from the motion sickness now?

HUICHINSON

Well, the way he worked this afternoon -

ARMSTRONG

I don't know what you really would call completely recovered, he's adequately recovered that he's doing one very excellent job of work and catching up. And I don't think he could do it if he had any sensation of nausea or sickness of any kind. You'll never get a Doctor to say anything is complete.

QUERY

Well, did he say subjectively that he didn't feel any traces of it at the medical briefing this afternoon?

ARMSTRONG

I didn't - wasn't on the medical briefing Dr. Hordinsky was and Dr. Hordinsky indicated that he - he certainly had no problems left.

QUERY

If you had - couple of more things, if you had a increase in PPO2 that was say -

END OF TAPE

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QUERY If you had - a couple of more things, if you had a - a increase in PPO2 that was say, half a psi you're up to, if you want to - you say you should for 39 get up to 4 in change, 44, 45. Would that make - not necessarily a serious difference, but a perceivable difference medically speaking in- in calorie burning or euphoria or anything else?

SPEAKER You know, we flew Apollo missions at 5 psi, almost all oxygen.

SPEAKER However, in order to keep the medical - not to bias medical experiment results, we are trying to keep a constant. So in that sense of introducing ambiguity in results, we sure wouldn't like to see any operations at 45, or anywhere near it.

QUERY If - if it were to happen that the CO2 scrubbers dropped out completely for some reason, how long could you go without CO2 scrub?

SPEAKER In that volume, I don't know. Several days.

SPEAKER That's a pretty long time.

QUERY A week.

SPEAKER No, I doubt that, but I - I don't know what the number is that - -

SPEAKER - - on almost a day before - -

SPEAKER Oh, yes, certainly. Certainly a day, of course, we worked all day today with no scrubbing. You know, we haven't turned on the mol sieves yet. We're going to turn them on before we go to bed tonight, and the PPO2 is, like, way down there in 3, 4 half millimeters of mercury, or so. The fact of the matter is with that big volume, I guess you could go a couple or three days before you'd really get bugged.

QUERY There are two mol sieves with two fans each?

SPEAKER Yes.

QUERY If one of the mol sieves was not working, could you get by on the other one?

SPEAKER Yes, sir.

QUERY Was it in SL-III did you end up with all four fans?

SPEAKER No, you only used - There was one fan secondary - secondary fan in mol sieve B that's not working. We have two fan in each sieve, so we have two fans in the A sieve. One fan in the B sieve, and we have the magic jumper cable which we flew up on SL-IV which will connect the power supply on the A sieve fans to the B sieve if we ever get into that unlikely event that we have three more

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consecutive failures. And we can work on one mol sieve just great. In fact one mol sieve, of course, as far as the - It's completely passive except for passing air through the charcoal filter. You know, there's one mol sieve on line at any one time.

QUERY How many of these procedural errors which you mentioned earlier can you attribute to either Pogue's illness or to the change in roles of CDR and PLT?

SPEAKER First off, I wouldn't attribute anything to to - to - to the illness of - Bill was the guy that was involved in the - involved in the water thing. However, again in defense of the crew, the valve nomenclature make - Without being able to feel the water and not having done it a lot of times, if you turned off your hot water tap instead of your cold water tap, it's that simple.

SPEAKER It's kind of like the problem I get into when my wife leaves the shower thing turned on and I turn all the water on, and expecting it to run out the spivet and it runs out the shower - -

SPEAKER Exactly. The - As far as any of the other little - other little ditties this morning, I don't really - when you call them procedure errors, I call them procedure errors, and they were. I think they were - I wouldn't attribute any of that to the switch in the roles, really. I guess I'd attribute it that the guys being in the workshop. Most of them occurred right there in the first couple of hours, except for the water one, and I guess maybe I attributed it to a little bit of excitement about being in the workshop and the pressing on. And I don't think there were any more than - than we've seen any - any time before. The point I was making about them being procedural was that there was a lot of conversation today about several different items but, none of it was systems anomalies. It was all things we could explain. As opposed to pointing up the fact that there were a lot of procedural errors, because I really don't think there were a lot. I wouldn't categorize it that at all - at all.

QUERY Can you pin point, or even approximate in time when this conversation took place, of which we have a transcript.

SPEAKER Yeah, - -

SPEAKER - - sign, I think, GMT time there. In the margin.

QUERY Okay, I see.

SPEAKER I think it's around somewh - -

END OF TAPE

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ARMSTRONG - - you've got the time on the side, I think GMT time, there over in the margin.

HUTCHINSON Yeah, I think it's around, somewhere near the 02 hundred.

ARMSTRONG 02:20 -

HUTCHINSON Something like - in that vicinity, I know it's bracketed between 01 hundred and 0 three hundred.

QUERY Neil, this is sort of the darker side of this question, does this give you any concern that this crew might not be totally candid in any and everything.

HUTCHINSON No, I think - I think it's like, I tried - I wasn't trying to defend them in any way shape or form but I really was trying to give an explanation of why - if I put myself in that situation I might have reacted the same way. I think the ground, the events that have proceeded them in terms of this illness - illness syndrome that we seem to have getting into the workshop had triggered them to respond in the manner they responded and I don't think - I don't think that affects their overall candidness at all. I think Jerry is one of the most straight forward people I've ever dealt with and I wouldn't anticipate that this was a precursor to any general attitude that was - would be involved in the mission and I think that we took if anybody had any slight doubt that it was, we took some positive steps that indicated that we didn't condone or want such an attitude prevailing, it's not gonna and I don't have any theory at all that it will.

ARMSTRONG If I can add to Neil's comment about over-sensitizing to the comments that everybody on the ground had been making in the past few weeks, the emphasis have been placed and the description that you have there, I think that if you read it, it - it - to me it indicates that it was a very small mouthful of vomitus, if that much and I'm sure that they were weighing, you know, something like that versus and gut retching type of vomiting and their weight and decision to the - whether they thought it was significant or not significant.

QUERY Dr. Armstrong, what kind of medication did the P1F take today and did any of the other crewmen take medication to either prevent or counteract this type of motion sickness.

ARMSTRONG Today? Yeah they both, all three took medication in accordance to the plan that we had set out before and which in essence of amounted to Scopolamine and dexedrene for the CDR and the Science Pilot at meal time and Promethazine in the evening apiece and for the P1F, he took the Promethazines. Promethazine has a longer period of action -

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duration of action so you come out for a days work of two Promethazine equals three Scopolamine and Dexedrene and then the reason they take the other two selected Promethazine in the evening and take it in the evening it intends to make you drowsy as oppose to the Dexedrene and Scopolamine and Dexedrine keeping you stimulated or awakened.

QUERY Neil, in this transcript they're discussing the - whether or not they should reveal this and the SPT is quoted as saying: "You know damn well that every manager in NASA would probably under his breath want you to do that." How would you evaluate that observation by Dr. Gibson.

HUTCHINSON I think that that's a bad observation.
QUERY Could you set some light on this how this man whose been training in the astronaut corp for 8 years under your system, whose a brilliant man happen to come to this conclusion?

HUTCHINSON He's human. I don't know what else to tell you you know I mean, nobody's perfect and I - I think what we've explained all the reasons why they drew this conclusion they drew and you know they certainly had second thoughts about it since they were discussing in the transcript throwing the vomitus down the trash and then later they processed it. You know, so, you know.

QUERY I have a couple of - of EO questions, I'll just ask them together. How many - which of the crew has missed how many meals, have only one missed by Pogue last night, that's the only missed meal so far? Also PAO said today that lunch today was the first space meal to include the new high energy food -

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QUERY
today, the first space meal
was that lunch or just a supplement to lunch?
ARMSTRONG

Also, PAO said today that - at lunch
Breakfast and lunch. Two meals out of

the three - -
HUTCHINSON
ARMSTRONG

I haven't got my checklist with me.
That's all they ate for lunch, of the high

calorie foods.
HUTCHINSON
ARMSTRONG

Are you sure about that?
Pretty sure about it, yes. Two meals out of -

two meals out of three every third day was the way - -
HUTCHINSON

I usually study the menu pretty close, but
the menu did include high energy candy bars today, of course, we
got some stuff out of the freezer for dinner tonight. So they
are eating out - they are essentially on OWS food now. However, we
are going to go back and pick up some of the command module
meals here within the next couple of days.

ARMSTRONG
HUTCHINSON
ARMSTRONG

Was it pork loin?
Yes.
Which not a meal that a quezy man would approach

is it?
HUTCHINSON
QUERY

I don't - maybe not. (Laughter).
In - in the transcript that came down,
this is just a point of clarification, it says SPT in - in -

Was that Gibson and Carr discussing it? It says SPT on the
thing rather than PLT.
HUTCHINSON

You know, I really don't know. I think
you have to wait until you get that whole thing not out of
context to see who - I have not heard it, nor have I read
it. The - the big long thing. Except I have gone over this
thing. I don't know how - how - - Say again?
Sounds like Bill talking, but I just

QUERY
want to make sure.
HUTCHINSON

Yes. You know, you have to understand
that these things are done by - by gals listening to tapes
and interpreting peoples voices and it's easy to get them
mixed up and I - I'm sure that this particular set of trans-
cripts will be validated reasonably well.
I haven't listened to the voices either,

so it's - it's - -
HUTCHINSON
ARMSTRONG

I can't answer your question.
What you're really doing is accepting
the transcribers intprepretation of who's voice it is.
Was Pogue scheduled to do any principal
their - their exercise program. And if so,

exercises today in
did he perform it?
HUTCHINSON

All three were scheduled to do exercise
today, and none of them did it because they didn't have time.

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They were all working their tails off all day long to stay up with the activation time line.

QUERY Bill made a reference - I think it was early in your shift to - He was discussing rocky crew making a nice docking. He said that RCS propellant used for perfect docking is said to be 450 pounds. I missed the number of how many pounds they used. I think they said 455.

SPEAKER They used about 4 - 485 and the description of a perfect docking, I guess, as far as the whole rendezvous goes, of course, this crew has done better with the propellants than the last two crews and that was the context in which the rookie crew doing such a super job on the rendezvous was discussed. The RCS situation - I don't know what you - a perfect rendezvous would be described as the very absolute minimum theoretical number that we could compute on the ground that you could get by with and complete a rendezvous and dock. You know, I really don't think that number means much. I was absolutely overwhelmed they did it considering they went in twice on the docking - or twice, I guess, or three times - or how many ever it was that they got by with the number that they got by with. We have an over abundance of RCS propellants. As opposed to SL-III when at this stage in our lives we were scrimping for every pound. Of course, we had an anomaly in SL-III along with a little heavier usage for the rendezvous.

PAO

Okay, gentlemen, thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
November 16, 1973
5:28 p.m. CST

Participants:

Phil Shaffer, Flight Director, Command Service
Don Puddy, Flight Director, Orbital Workshop
Dave Garrett, Pao

SL-IV PC20A/1
Time: 17:28 CST
11/16/73

PAO

We're ready to get started this afternoon with our first change-of-shift-briefing for the last Skylab mission. We have with us to my immediate right Philip Shaffer the Flight Director for the command service module today and Don Puddy who is Flight Director for the orbital workshop. Phil.

SHAFFER

Okay, the - I'm sure if you all were listening you know that the countdown was flawless. The vehicles - both the launch vehicles and the spacecraft stayed ahead of the count all the way down and we just had no anomalies of course we deserved that after the problems we've had with the fins and the longerons in - in the inner stage. But it really was a very straight forward thing we counted it down and into the - air we went. Launch phase was track to nominals no problems none whatsoever. We had a nominal rendezvous for all practical purposes all of the maneuvers came out almost like they were in the crew's checklist, the preflight numbers. We had no problems with the execution of those maneuvers but we did have some minor problems on the way. One of the problems was in the secondary coolant loop in that when we turned on that loop to check out the evaporator you know the loop has two methods of cooling, one radiating heat through a radiator and the other by boiling water. And we were not able to put water into the boiler to produce any cooling. And since that thing is - is a double backup, the secondary loop is a backup and the evaporator is a backup to the radiator - we did not troubleshoot that at all. And there are two potential causes for the anomaly one is a problem with the switch, that opens the water valves to the evaporator or we had lost the servicing of the evaporator itself. We have to pump enough water into some wicking material to start it evaporating or boiling. During the first rev we had what at this point I'll have to call it glitch. And in the truest definition of a glitch, whatever that is, the - I did that once I never recovered from it once by the way. That defined a glitch um. (Laughter). We have a device in the guidance and navigation system called an OCDU or an optical coupling display unit, and what that does is interface the optics with the computer and the glitch was that the optics failure detection logic detected a failure. And the blooming thing never lasted long enough to see whether we had an OCDU failure or whether we had a failure of the failure detection logic so it went away and it never came back. They - - weren't completely nominal. The rest of the rendezvous was textbook until we tried to dock and between Guam and the States the crew made two dockings.

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attempts, neither of which was successful. And we tried one more time so that we could watch essentially doing the nominal again but taking the precaution of being sure that we had reset all of the logic into the docking system and it was a nominal docking. When we left the Control Center the crew was charging batteries and getting themselves squared away and determining what the mechanical misalignment between the CSM and the workshop was and the very normal very sorts of things that we do after we get docked. Don took care of the SWS for us today and in addition to that he monitored the S-IVB during it's demise. Don.

PUDDY Well, I guess the first comment I'd have is that we're happy to be back in manned operations it's quite different from the unmanned and - -

SHAFFER Here, here.

PUDDY We enjoy it a lot more. Really not much to add to what Phil said. We sent the commands for D for the S-IVB up over Hawaii rev 3 and we impacted the - the next rev in the Pacific at about 6 hours elapse time. And other than that it was a nominal day for the SWS.

END OF TAPE

SL-IV PC208/1
Time: 17:28 CST
11/16/73

PUDDY Rev in the Pacific at about 6 hours
elapsed time. And other than that it was a nominal day for
the SWS.

PAO

Okay, ready for questions. Bruce?

QUERY

Yeah, a couple of quick ones. Don,

what's the conditional of the secondary coolant loop in the SWS?
Have you gotten any low level warning lights yet?

PUDDY

No, we haven't we're running about 20.3

psi we expect to get a low level pressure not much lower
than where we are right now. But as you're probably well
aware we are at a high beta right now and as a result of
that the additional heat into the load has increased the
pressure and we have not received a low level.

QUERY

At what point on the flight plan does

the servicing come?

PUDDY

Yeah, also another fact I might add that

Phil pointed out here is that in preparation for the manned
phase we also turned on the MDA wall heaters, which had
been off during the unmanned phase, which again put in
additional heat load in there. And we think that the loop
does leak considerable less when it has a heat load on it
for instance we run right around 7,000 B.T.U.S. during the
manned phase and during the unmanned we dropped down to
around 2,500. I think right now in the preliminary flight
planning we've done which is subject to change, it's either mission
day 4 or mission day 5, is that changed.

SHAFFER

Reservice.

PUDDY

Four last time I left.

SHAFFER

Yeah, but I'm sure it's day 5 now, it'll

be going on the same time the - -

PUDDY

We've had a little bit of oscillation

because of the - the increase of the time line on activation
it's either day 4 or - or 4 or 5 and I have a hunch it's
5. No, I take it back it's day 4.

SHAFFER

Yeah.

PUDDY

Day 4.

QUERY

You - you could do it earlier couldn't

you if you ran into a low level warning or - the low level
warning doesn't really tell you you need to shut it - -

PUDDY

No, no, low level warning occurs somewhere

in the order of 18-1/2 to 19-1/2 psi somewhere in that
region it's not completely defined. Sometimes it can be as
high as 20-1/2.

SHAFFER

And we got low level on the primary at

18.6.

PUDDY

Right.

SHAFFER

Right.

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PUDDY But the key thing to keep in mind is that if I remember my figures correctly we ran either 18 or 20 days after we got low level on the primary loop before we shut it down and of course our criteria for shut down is when we reach a pump inlet pressure of around 5 psi.

SHAFFER And the problem is pump cavitation at that kind of pressure and that's really all you've got to worry about. So the fact that you get a low level doesn't mean all that much to you.

QUERY One for Philip that I have. Other than I think the one time when Bill Pogue lost his place on copying some figures down in one of the early maneuvers, how would you assess this crew and all rookie crews performance opposed to the others? Was there anything foreign to worry about today anything that they had to really show their strength on or was it just so nominal that anybody could have walked through it?

SHAFFER No, the optical CDU problem had all of the potential of being not an exceptionally hard but a rather clumsy in a rendezvous because in a process of doing the navigation onboard instead of moving the optics they would have to move the spacecraft and leave the optics frozen in order to do that. And Jerry accepted that with all good grace with a, "Roger, understand," - and went and looked at the checklist. The docking exercise is frustrating. By no means - and he had absolutely no indications of any kind of losing his cool or anything like that. Like these guys are a bunch of pros they felt to me just like Al and Pete did.

PAO Arthur?

QUERY Phil, you got any guesses on the - why the docking didn't work the first two times?

SHAFFER I think he was being gentle. He thinks he was being gentle. The first time - I want to say sets or resets but I don't know which to say, the capture latches and he did not do the opposing part of whatever he did the first part, so the second time he really couldn't dock. And he just - and he told us when we asked him about it that he had not done that and he was going to try it again. And then if it didn't work stand off until AOS so we could help him. And all we really did was make very sure that he reset, recock, that's the word, recocked the capture latch -

END OF TAPE

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SHAFFER - - really did was make very sure that he re-set - re-cock, that the word, re-cock the capture latches before he tried again and he - he went in with a bit more vigor that over the States on the third attempt and it appeared to be a nominal docking.

QUERY But it was still very soft.

SHAFFER Yea, it really was.

QUERY Yeah, I understand

SPEAKER Okay, I tell you for sure, it wasn't like

Pete Conrad on his second time.

QUERY (laughter)

QUERY Okay, let me be sure I got this sequence

right, then, the first time you think he was and he thinks he was too gentle, the sec - when he went back for the second time he had forgotten to -

SHAFFER No, he just didn't do it, he did it by choice. And the first time he did it, he uncocked the capture latches. But didn't think he had, so he didn't re-cock. Okay the third time, we made sure they were re-cocked. And went on in with a bit more vigor.

QUERY Now, I need to get some idea of what you mean relative to being too gentle and then going in with more vigor.

SHAFFER Well I would guess he went in maybe with two or three-tenths of a foot per second, the first time and with a foot per second the third time, and I don't have any idea what he did the second time, I'm sorry. The first time very gentle, probably on the order of two or three tenths of a foot per second, the second time, he went out and stuck the nose in and pushed on it for awhile with the RCS, which doesn't do any good if the capture is not cocked. And the third time, when he was successful, probably in the order of a foot per second, we have indication from the PIPA's, the little accelerometer in the CSM, that's the kind of acceleration it got, stopping against the workshop.

QUERY Is there any way - where something that might be familiar to some feet per second is very hard concept to try to get across and I'm just trying to think of striking something or -

SHAFFER One-ninetieth of a mile per hour. One foot per second.

SHAFFER That's two thirds of a mile per hour was how fast he was going, probably the third time.

QUERY My question has been answered.

PAO His question's been answered, let's

move over here to Dick.

QUERY Don, I understand that there are a few pointing problems that have developed with the AIM? Could you - No?

SKey Lab IV

Vol. I.

II

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
January 29, 1974
4:49 pm CDT

Participants:

Don Puddy, Flight Director
Dave Garrett, PAO

SL-IV PC-116A/1
Time: 16:49 CDT
1/29/74

PAO Okay, we're ready to get started with this afternoon's change-of-shift briefing. We have with us the offgoing Flight Director Don Puddy. Don.

PUDDY Okay. I guess I'll open up by saying I won't say I'll be brief tonight, because - although I'm going to try to be after last night's discussion when I started out that way. As far as today is concern all of our operations have been fairly normal. CMG 2 did show some stress last night. However, today, during our SI operations, it was back to the previous plateau - new plateau for the CMG. It did show a little stress again or distress again during the EREP operations, but when I left it did return to its new plateau. So, really can't draw any conclusions from that. We're continuing on with normal operations. I don't think anyone's said anything to you in the last 2 days about our cabin temperature. We are in general running about 72 degrees in the cabin in the morning, increasing a couple of degrees during the day. And expect to maintain that essentially for the rest of the mission. On our EREP pass today, we had five mandatory sites. One of them was in the Great Salt Lake area, where we were primarily trying to gather some sensor performance data, using the new X5 detector on S192. We had another site in the Colorado/Guadalupe River basin extending on down through the coastal wetlands just off of Freeport, also tried to pick up a couple of sites there of Eagle Lake and Rosenberg. Third site was the - again the ITCZ over land in South America. And a fourth one was - as I briefed you the other night, one of the two track intersection points for geothermal studies. And this was the intersection of track 34 that we ran today and track 2 that we ran a couple of days ago. I think based on the weather and the - a couple of anomalies that I'll mention here in a minute, I think we were able to obtain coverage on all of these mandatory sites with the exception of the ITCZ. And the anomalies that I'm referring to was that we did as you may have monitored on air-to-ground - The commander reported that he had MALF lights on all 6 of the S190A cameras. We have ran a malfunction analysis on that; feel like we have some sort of a shutter drive circuit failure. We're looking into the malfunction procedures at this particular point in time to determine whether or not we are going to be able to bring that facility back on line. It was one of the most beautiful days over Texas as far as the HATS area is concerned that we have seen to the best to my knowledge in Skylab. And when he reported this, we had just cleared the coast of Texas and we weren't sure how long it had gone on. But we went back and clarified that. And to best of our knowledge, I think the last frame when we know the cameras were working

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was just as we cleared the coast. So we think we got all of the 190A camera data over NATS. We also had some problems with the antenna on the S193 RADIOMETER/SCATTEROMETER. It appeared like the antenna was working properly, although we never did get a - a good firm lock indication. Exactly what we - what type of data we've lost here and how much of it we're not certain and we're looking into that one. The EREP pass today used approximately 35 pound-seconds of TACS, more or less what we predicted. This afternoon we are - are running a - in the ATM area we are running a JOP 13, taking some data with a couple of the instruments on a UV source Gamma Valorum. This particular study is very interesting to us because we feel like the data will give us some feel for the - -

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PUDY Ah - This particular study is very interesting to us because we feel like the data will give us some feel for the frequency band that we need to be able to design future large space telescopes for. Right now, we think that there's probably not too much radiation below the Lyman continuum line, which is running around 1000 angstroms, although there have been a couple of reports where they think they may have picked up some radiation at this level. So, we're looking at that as a primary source of data from that standpoint. It is a fairly expensive run, so if you hear some increased TACS costs on that, don't be surprised. We're estimating somewhere in the order of about 320 - 350 pound-seconds. Had a couple of laser operations today. We picked it up the first time when we had it at a watt level. The crew was able to observe it for quite a period of time. And a little bit later today, we picked it up where they had switched down to a different color and also the half-watt. We were not able to see it the second time. We think this is primarily due to cloud cover and not due to the color change, because the color we were using at the hot - half-watt level, the crew had observed a couple days ago, at the 1-watt level on out to about 1000 miles. So we feel fairly certain that they can see that for a long distance. We have, as of this morning, when we picked up, about 15,000 over 15,000 pound-seconds of TACS. We're continuing to stay well above our Flight Planning line. The allowable TACS that we can use per day is in the order of 840 pound-seconds per day. Thought you might be interested in having a feel as far as where we stand in the way of consumables remaining on Skylab. And there's, of course, some degree of prediction in here, but it's a fairly firm prediction. So let me give you an idea of how long Skylab could go after day 85. In the O2 area, we have enough where we could, at our present usage rate of around 13 pounds a day, we could go another 154 days. In the N2 area, using around 1.7 pounds per day, we could go, approximately, another 248 days. Our most constraining consumable, as far as life support consumables are concerned, is the potable water. Here we use somewhere in the order of around 19 pounds a day. And we have approximately 43 days worth of water left. As far as tomorrow's Flight Plan is concerned, we have a M092/93 on the commander, M131 run on the science pilot. We have another EREP pass scheduled, which is one that comes down through Washington, central United States, crosses Louisiana coast and goes on down through Columbia and Brazil and South America. Looking primarily at two mandatory sites, the Colorado River Basin and one in Columbia, South America. There are also, of course, many other desirable sites, as there were today. Have an S019 comet observation, about

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3 hours of ATM viewing. And we're going to do some TV of the human momentum attitude control type thing that - similar to what Joe Kerwin did on Skylab II. I don't know whether it's been mentioned to you or not, I do recommend that if you want to have a fairly decent feel for the end of mission time line, there is a general message out, which I'm sure the people here will be able to provide you a copy of. I did want to mention one thing on it. As you probably are well aware, we are doing a trim-burn on mission day 83. At our present ephemeris, which is 239 by 233, we've got somewhere in the order of a 4- to 6-year lifetime. And this is - these figures are somewhat estimates strictly because you've got to say whose atmospheric model are - they're based on. But these are more or less extrapolated from what we think today is the model that we've been seeing throughout the Skylab time frame. We are going to be doing a SM RCS trim-burn on mission day 83, which will put the vehicle in a 246-by-235 orbit, probably increase - -

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PUDDY - - put the vehicle in a 246 by 235 orbit probably increased the lifetime between 1 and 2 years. As far as the complete end-of-mission time line: a couple of times if you don't get a copy of the thing that you might be interested in, we do plan to undock on mission day 84 at 10:30 Z; shaping burn will occur at 11:33; the orbit 14:36; with splash at 15:17. That's an the adjjustice time. You all probably, I think, have been looking at a previous time around 15:15, so it's a couple of minutes later than that based on the latest prediction. That's about all I have gentlemen. Why don't we open it up for questions?

QUERY Do we have an around the world EREP coming up and can you give us some details on that, fair amount of degree?

PUDDY That's - that's still being looked at so - and I think we're probably going to finalize that tomorrow, so let me give you that tomorrow night. We are talking about a 360 degree pass. Right now we're looking at that on day 78, which is essentially the last day we're going to do EREP passes. A couple of details still to be ironed out on that one so let me - let me tag with you on that one tomorrow night, if it's all right.

QUERY Is time of day one of those details?

PUDDY Yes.

QUERY Time of day is?

PUDDY Time of day is one of those details.

QUERY And now on the HATS, was this the first time in any of the Skylab flights that we've gotten HATS data?

PUDDY No, we have obtained, I think there's either two or three other occasions where we have obtained some spotty coverage in the HATS area. To the best of my knowledge, however, this is the first time where we have had this particular track over these sites with essentially a clear shot at it all the way. It was extremely clear today and best of my knowledge it's the best coverage that we've ever had of the HATS area in the Skylab.

QUERY Okay, would that include some of Houston itself, the city of Houston itself or just the area around it or what?

PUDDY Just the area around it. We were actually slightly to the west of Houston itself.

QUERY And the PAO seemed to indicate that some of those frames may be in danger of being exposed -

PUDDY Okay.

QUERY - that you can't recover it?

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PUDDY We're looking at that right now. Of course, the malfunction we had was that the frames just quit advancing. So one of the things that you got to concern yourself with is, how do I get those frames out of there and on to the takeup stool that I've already exposed? There are - I'm certain, if we really got into a pinch and couldn't do anything other way, I'm sure we can actually get in there and manually move those frames forward. It is kind of a arduous crew task, we're not going that route yet. Right now our primary intent is to see if we can get that facility back into operation. And we have had one other occasion, I think it was back on mission day 19, where we had some problems with the - in the forward motion compensation circuitry where we had a camera stoppage. We are looking at that now to see whether or not there is any similarity there, working on other areas where we think there could be something that we can investigate. So I can't give you a definitive answer, but I can assure that some way or the other we will get those frames out, without running the risk of exposing.

QUERY Phil, you said that - that the trim burn will increase life of Skylab left two years -

PUDDY 1 to 2 years.

QUERY - 1 to 2 years. What's the total length of time the Skylab's suppose to last?

PUDDY Well, like I say, in its present orbit right now, according to whose atmospheric model you want to believe, we're talking somewhere in the order of 4 to 6 years orbital lifetime right now. The trim burn will increase it about 1 to 2 years, so you're talking anywhere between 5 to 8 somewhere in that vicinity 5 to 8 years.

PAO Paul.

QUERY Okay. Don, on that 5 to 8 years, when we -

END OF TAPE

SL-IV PC116D/1
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1/29/74

PUDDY - 5 to 8 - somewhere in that vicinity -
5 to 8 years.

PAO

QUERY Paul?
Don, at 5 to 8 years, we were told by a number that it would be 10 to 11 years and there's a change in that. Also, we - we were told in earlier discussion that - that the thing would probably be tumbling - or start tumbling after they leave the thing and - as a result a docking would be unlikely by - for revisit. Can you go into that and - he assessed the thing and got new data on it or - or how do we stand on our -

PUDDY No, like I say, that - you have to - the data, the duration is strictly dependent on whose atmospheric model you want to believe. We have seen in Skylab considerably less degradation based on actual tracking data in the orbit than any of us previously predicted. If you went back to the standard atmospheric models, you'll get one figure, if you use what we're seeing, you'll get another figure. And I have heard figures anywhere from 5 to 11 years. The figures I'm giving you are ones that - basically our trajectory people are estimating based on what they have seen through daily observations on the tracking.

QUERY Well, do you expect to be able to establish gravity gradient stability to a point where docking - ASTP or later - and Shuttle would be possible?

PUDDY We expect to be able to put the vehicle into a gravity gradient attitude. How long it is going to stay in that attitude is anyone's guess. And I'll stick my neck out on a limb and say that it would seem to me very unlikely that we would be able to take an attitude where we can assure ourselves that over a period of time, it is not going to pick up a ever-increasing pendulum-type motion. Just due to the fact that we do not now know the center of gravity, the moments of inertia, et cetera, that well. We've been throwing things down the trash airlock. We had some damage there at first, we lost a wing. All of these things have degraded our knowledge of the parameters that would be necessary to put it into a perfect gravity gradient attitude. In addition to this - as I'm sure most of you are familiar who covered Apollo-type missions, mascons, as far as lunar trajectories are concerned had a tremendous influence on the trajectory. I feel certain, when you essentially take CMG power, TACS power, all that type of thing away from Skylab, that we're going to see some of the Earth magnetic concentrations having a similar type of effect. And if they have enough of an effect, and they get it started, I don't see that there's going to be anything to stop it. So, essentially, I think it will tumble.

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That is not to say, however, that it will pick up enough motion and enough rate that it will be impossible to dock with. That's just something that we'll have to wait and see. But I don't think it will sit there in a perfectly stationary gravity gradient attitude, and that's a personal opinion.

QUERY What's so special about a gravity gradient attitude, and why is that attitude selected?

PUDDY Well, basically, if you left it in any other attitude, you're assured that it's going to tumble. And all gravity gradient is trying to do is - it's just an attitude that supposedly you've got everything optimized so that the effect of gravity on the vehicle itself is constant throughout the orbit. Any other attitude that you would select would cause the vehicle to want to move along one axis or another as you progressed around the orbital path. And since you're constantly changing the area of Earth that you're going over, et cetera, gradually that would tend to amplify the vehicle motion and you would certainly get into a tumbling situation. And all I'm really saying about the gravity gradient is I'm not positive that even - we have got to try and calculate what is gravity gradient based on the knowledge of center of gravity, mass, moments of inertia, et cetera. And there is some uncertainty in those figures for this vehicle.

PAO

Tom?

END OF TAPE

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PUDDY - - uncertainty in those figures for
this vehicle.

PAO Tom?

QUERY You got something else on this Paul? Go
ahead.

QUERY Well, do you have a gut hunch on whether
or not it's going to be stable enough for 18 months to - to
permit a revisit in July of 1975, for ASPT?

PUDDY I would hate to speculate whether or
not it would be stable enough to dock or not. It - It's -
I just don't know.

QUERY On tomorrow's Flight Plan, Don, do you
know what that mandatory site on the Colorado River is on
the EREP pass?

PUDDY It's the - it's the same one -
essentially the same one that in the same area that we
covered today. It's the Colorado River basin itself, the
whole basin area. And, as I mentioned to you last night,
this is the one that we had hoped today that we could cover.
And that more or less completes those sites that we missed
do to 190A filter anomaly earlier in the mission.

QUERY And - maybe I should know this. But
what is IV-87 hum - human body momentum?

PUDDY Well, that's the one I was mentioning
to you a minute ago. That - it's - you remember the TV that,
I believe it was, Joe Kerwin did on Skylab-II, where he
essentially suspended himself and by moving his arms he
demonstrated human attitude control in space in zero g?
It's - it's the same type of thing. Just exactly what the
crew is going to do here, what motions they are going to go
through, and what they're going to show, I'm not certain and
I don't think anyone is. But it's that type of demonstration
that we're looking for.

QUERY And on the comet ops, has the crew said
anything about what the comet looks like to them now? Are
they - they still really taking anything on it?

PUDDY No - well as far as visual observations?
No. They have not - at least during any of the shifts I've
been on, and the transcripts I've read, they have not
made any visual observations on the comet for quite some
period of time.

QUERY On this CMG distress signal that we've
had, can you kind of give us the parameters of it? I mean -
of the wheel speed how much it reduced and everything or is it
involved?

PUDDY Okay. Basically, what we're talking
about here is the wheel speed dropping down to let's say
approximately the 8800 rpm region. Normally, we're running
somewhere around 8829 to 8850, now our currents are normally

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running somewhere in the 1.04 to 1.05 area. Both during the
EREP and last night, we were seeing the wheel speed down to
8800 in one case slightly less than that. Currents were
ranging from 1055 on up to as great as 107. It's - it's
still not near our - our limitations by any sense. We're
tal - you know, our limits we're looking at are 8500 rpm and
about 1.5 amps. So, we're - we're a long ways from there,
and there's - there's no way to predicte but I still hold
my personal confidence going to be in there when we splash.
PAO
QUERY
PAO
No.
No? Okay. Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 28, 1974
5:08 pm CDT

Participants:

Don Puddy, Flight Director
Bill O'Donnell, PAO

NL-IV PC-113A/1
Time: 17:08 CDT
1/28/74

PAO Okay gentlemen, we have with us tonight
Don Puddy off-going flight director. Don.

PUDDY Okay, it's fairly brief tonight. First
off y'all had a question last night on which of the EREP
sites we hadn't - that we missed due the 190A filters that
we hadn't covered. There are two of those, one of them is
the Colorado River Basin in Texas. We do have a pass
scheduled tomorrow where we hope to accomplish that. The
other one is one off of Costa Rica. We don't have any more
opportunities at that particular site, however, we did cover
that particular site one time subsequent to that original
pass where we covered it without the filters where we did
get the 190A data, we did not however get good resolution in
the 192 data. That particular site happens to require data
from both of those sensors in order to meet its mandatory
objectives. However we feel like that we can combine the
190A from the 1 pass and the 192 from the other and
essentially say we have met those objectives. So in summary
I guess what I'm saying there is that in our opinion it
looks like we are going to recover all of the data that was
required to meet the objectives that we originally lost by
the fact that the filters were not installed on the 190A
camera. You also asked a question last night concerning how
many sites of those that we originally had planned to try to
obtain coverage on where we had not to this point in the
Skylab program obtained any data. And to the best of my
knowledge there are three sites that fall into that category.
One is in Iran, one is in Central Africa in the Tibesti
Mountains and one is in the Orizaba, Veracruz, Mexico area.
There are several other sites, and I don't have an exact
number, but let's say somewhere in the 15 to 20 site area,
where there is repetition of coverage required. We have met
some of the data requirements on those particular sites but
we have not as yet obtained all the necessary repetitions
to say we have completed all of the mandatory objectives.
You also indicated some - some interest as far as - as where
we stood in the overall man hour expenditure where we were
falling shy, so on and so forth. Let me - let me kick off
that discussion a minute with some of the things that we
feel have been fairly significant from the standpoint of -
of more or less firsts on - on Skylab IV. Probably, and I
know this has been highly publicized in the - maybe down-
rated a little bit but this is - has to be mentioned that it
was the first time from space that we have been able to train
the number of instruments, and over the duration that we did
on a comet. And it's certainly the first time that we had
an opportunity to collect data on comet - on a comet as close

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to the Sun as we did in Skylab. We've been able to note coronal and disk transients on the Sun of a larger magnitude and more frequency than ever before. We finally got an opportunity on this mission, and I think this - you remember this being reported to you not too long ago where we got significant data all the way through a flare rise period and were able to follow it all the way down until the flare died. There's been a lot of concentration on the geothermal passes in the EREP area. On Skylab III we did quite a bit of investigation to develop some of the techniques that we might be able to use in the visual observations. The Skylab-IV crew has done an outstanding job in our opinion of working these into their Flight Plan. I don't have an exact knowledge of the number of photographs that have taken, although it by far exceeds any of our fondest expectations prior to the mission as to the number of photographs. In fact here just recently we've actually had to go to a separate pad to list all of the optionals because the crew is - it's just taking more than we feel are realistic to list on their detail pads. I think if there was any one er -

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PUDDY

- - to go to a separate pad to list all of the optionals because the crew is just taking more than we feel are realistic to list on their detail pads. I think if there was any one area that you might point out where we have not come up to what we had planned pre-mission, it would have to be in the EREP area. However, let me emphasize in this area, it is not due to the fact as some people may have thought to crew inefficiency or crew problem or anything of this nature. It's been forced on to us primarily because of the fact that we did lose the CMG, therefore were forced to not be able to take advantage of the back-to-back EREP opportunities that presented themselves and some very lucrative tracks early in the mission. Also, as you probably caught from our briefing day-by-day basis, weather hasn't exactly played in our favor. And, of course, as has been true in the pass, we're always faced with the fact that you have the circadian shift aspect that you got to consider. In other words, there are a lot of passes that have some very nice targets, the only thing that they require is the crew being up 24 hours a day for 84 days and of course, that's not practical. So there are a lot of passes that we have elected to go ahead and not cover strictly because it would require something like a two or three hour early wakeup for the crew or two or three hour period where of putting to bed - or the crew to bed. We do expect pre-mission, we had talked about 50 p - 50 passes. When we scaled that down because of the crew's request, we said we would hope to get 42 passes. We now project by the end of the mission that we will have accomplished 39 passes and I think it's noteworthy to say that with these 39 passes, we will have exceeded the total number of man hours that we originally allotted to EREP and I think you'll be able to figure that this is - easily came about because of the failure of the CMG and therefore we had to devote more time to each EREP pass because in - in most cases we were using the noon-to-noon; where with the three CMGs, we've been able to go immediately into attitude, take the data and come out. Now we have to, essentially schedule the crew for longer period of time to gain the same amount data. In the ATM area, we'll probably fall shy approximately some 10 percent of where we had really hoped to be from a total number of hours, but from the standpoint of scientific accomplishments we feel like we're further ahead than we had originally planned. The comet observations, actually they used less time than was actually projected by some 26 man-hours but in turn we actually accomplished a little more in the data take area than we originally predicted. Same thing in the medical area, we're not going to quite make

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the original projection of man hours. In fact, we'll project it will probably be some 45 hours shy in this area. But at the same time we have not eliminated any of the experiments. In fact, we have added some experiments over and above what was originally projected in the mission. And this delta is primarily due to the fact, as you'll probably remember in some of the discussions we had with crew. They have reduced the amount of time necessary to accomplish certain protocols over what we've predicted. And therefore, we've been able to get more done in less time. In the corollary area, we're essentially going to come out on the balance. And in the miscellaneous area, we've picked up a lot of additional experiments in the way of science demos and things of this nature which I hope you all have had an opportunity to view the TV -

END OF TAPE

SL-IV PC-115C/1
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PUDDY And in the miscellaneous area we picked up a lot of additional experiments in the way of science demos and things of this nature which I hope you all have had an opportunity to view the TV from these. I think you'll find it very interesting. We're going to come out on the balance and again we had more in there than we had actually hoped to get originally. Hitting a little bit as far as today's Flight Plan, of course there were a couple of things that were very interesting today. One was we decided to take a one shot at the - at the old light flash phenomenon, I haven't been able to gain a detailed analysis of just exactly what the PI has been able to gather from the information that the pilot downlinked. He did accomplish this from 14:57 to 16:07 Z. I do know that he has reported 26 flashes as far as where these were concentrated, whether or not they were in the South Atlantic anomaly, I do not know. However, the PI had relayed the information in that he was very very happy with the data. So, we feel like that was very successful. Also one of the items that we accomplished today was the S055, what we call - what I referred to yesterday as the super RASTER. Basically, what we're doing is studying in 6 wavelengths simultaneously from 300 angstroms up through 1335 angstroms, the ultraviolet radiation from the sun, this was being conducted simultaneously with some satellite observations being made by a satellite that the Air Force Cambridge Research Laboratory is flying. They were measuring essentially the total flux from the Sun. And scientifically this is considered important from the standpoint of the XUV's influence on our upper atmosphere and therefore weather and the effect on radio reception quality. One other item that it enable the S055 instrument to do, which we haven't had a chance to do on a concentrated basis is to study the connection patterns of large-scale solar features, especially in the corona. From some of the other instruments we have noticed interconnecting characteristics of solar features located as much as a solar diameter apart. So, of course, the ATM PIs were fairly excited and they haven't had a chance of course to reduce the - all of their data and draw any conclusions from it. But they were very excited as - as the day progressed. As far as the EREP today, we felt like it was a good pass. We did have one of the p1abals get hung on STOP again. It did - it was corrected by the software, outer gimbal drive logic, that I briefed you on last night. We did not have to go into the zero maneuver. We did have some small attitude errors in both X and Y, something in the order of 2 to 3 degrees. We do not feel that this degraded the data significantly at all. As far as we can tell right now, on the mandatory sites that we were trying to cover, one of which

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was in Weelaco, Texas. Another in the Isthmus of Panama
one in the Central Andes in the Amazon Basin, one in Paraguay,
and one in trying to get some coverage of the intertropical
convergence zone over land. We probably were able to get all
of those with the exception of Paraguay and that's questionable.
The weather improved significantly over what we predicted just
before the pass. In fact the pilot picked up several bonus
sites for us, using the VTS. And let me just add one side
comment here, which I should have mentioned to you yesterday.
I think it was fairly significant considering the problem we
had yesterday where we did drift out of attitude 38 deg - -

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PUDDY - here which I should have mentioned to you yesterday. I think it was fairly significant concerning the problem we had yesterday where we did drift out of attitude 38 degrees. And today, again, where we did have some small attitude deviations that the - the crew kept their cool. And yesterday, the pilot, and today, the commander, both continued on taking data and as far as I know, there wasn't a single switch moved in either one of these occasions where we had the attitude excursions. And - and particularly in light of yesterday's problem, I think that certainly shows a high degree of experience as far as their performance in space. We did have, during the EREP pass, as you probably might have heard on air-to-ground, some malfunctions associated with the 190A camera system. It happened when we went up to the fast exposure rate on the particular cameras. We got malfunction lights on three of them. In checking the frame counts that were downlinked, both at the beginning of the pass and at the end of the pass, plus running a special test at the end of the pass to see whether or not we could get the anomaly to reoccur. We essentially do not feel like we have a problem with that spec - that multispectral facility. And as far as today's pass, the best we can determine right now, we might have lost a - a maximum of a couple of frames of data. So this should not be of any significance as far as loss of data. Give you a little summary of tomorrow. We have again a EREP pass. It's going to be one of our last chances at the HATS area. Right now, the weather is predicted to be clear, and I don't want to go any further than that. It is, of course, a CONUS - just barely touches on Central America and down through South America again. We also are running the S183, I mentioned to you, as we are doing today. As I mentioned to you last night, we - after I go - gave the briefing, we had an S183 malfunction scheduled - malfunction procedure scheduled. We did accomplish that. We were able to wire around a blown fuse, have operated that instrument today, and will operate it again tomorrow. We also have a major medical run M092/93 on the science pilot. We'll be doing a JOP 13 towards the end of the day and - coming up to a total of little over 4 hours of ATM work. And I think that's probably enough for the highlights as far as tomorrow's activity. Guess I should have mentioned on today's EREP, we did use a total of 57 mibs, or somewhere just a little under 300 pound-seconds of TACS. We still have in excess of 15 - 15,000 pound-seconds of - of TACS left. Still have sufficient TACS to enable us to use just under 800 pound-seconds a day through the end of the mission, and - and still have - have no problems. Also mentioned to you last night that I would cover with you briefly - a little bit as far as what we planned to do end of mission in the way

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of engineering tests. I think Neil Hutchinson kind of gave you a real sketchy idea of what our plans are. We also did a little work today and, if you want some additional details, as far as the overall plan, I think that there is a good briefing on air-to-ground that we gave to the crew today. Let me just kind of briefly run through the tests that we've planned to accomplish and the time frame in which we plan to do that, and you can gather the other details from there and maybe you might have some questions on these sequences. Basically, wh - ..

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PUDDY - - plan to do that and you can gather the other details from there and maybe you might have some questions on the sequences. Basically, what we're - our overall intent is to set the Skylab vehicle up in more or less a dormant fashion at the end of the engineering testing where it could possibly be revisited in the future. At the same time, we're not taking any special precautions other than putting the vehicle in an attitude that we hope it will remain stable, and our primary intent is, of course, at this point in time is to gather some engineering data. This is more or less an engineer's dream is to have a vehicle at this time where you still have the capability of commanding it and gathering information on systems performance. Something that we hesitate on doing during the actually - actual man portion of the mission. Primarily, in some cases, because of - of the risk associated with it and in other cases just because crew time and space time is valuable and you just don't wish to conduct this type of testing per se during that time frame. We hope to run our last set of battery capacity test shortly after the EVA. This is on two of the CBRM's and one of the PCG or AM batteries. Our only crew monitoring task here will be to get a verification of the discharge or the delta in capacity between the talkback and the auto-disconnect in the case of the CBRM's and between the 33 volt level that we have previously used in capacity checking and the 30 volt level as far as the airlock module batteries are concerned. Assuming that we have no problems up until that particular point in time, we will be going ahead and between the point of these test and essentially powering up the command module in preparation for entry, we will be conducting primarily during the night frame - night time frame or crew asleep period, test of all the remaining CBRM'S. If we should have any problems, in other words if the - if a CBRM should auto-disconnect and we should subsequently not be able to bring it back on line we would terminate that testing and wait until after the shaping burn. We really don't expect any problems in this area but it's a possibility. We have plenty of pad powerwise as far as solar inertial operations are concerned. We can loose up to 1200 watts power capability and still not experience any significant power management problems and this is a roughly equivalent to about 5 CBRM's or around 3 PCGs. Subsequent too shape being we - the primary we thing we plan to do is to go ahead and accomplish the capacity test on all of the airlock module batteries and we estimate this take to be somewhere around 22 hours. We are going to run some

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simul loop test on the refrigeration system. Try a little bit of the flushing procedure that we did try early in the mission with only a few cycles but didn't have any joy with it there. We'd like to give that one another chance and see if we can free-up the bypass valve. We're going to try a pump inverter combination that originally had popped a circuit breaker on us as far as the secondary coolant loop is concerned. We plan to turn on all of the rate gyros again, just to take a look at them; plan to run the, I think I mentioned this though, we plan - we do plan also to run the secondary and the primary RSS systems simultaneously. We will be spanning up CMC 1 again just to see what it looks like after being off line for quite some period of time. Primarily, I think those are the significant test that we'll be looking at. At the end of this testing period, what we will be doing is placing the vehicle in a - oh, I should mention one other. We're also going to try to load the primary computers. As you know we're now operating on the secondary computer. We're going to try to load the primary computer a 16K memory, both from a ground RF uplink standpoint and also from what we call a memory load computer which is -

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PUDDY - computer, as you know we are now operating on the secondary computer. We are going to try to load the primary computer, 16K memory, both from a ground RF uplink standpoint and also from what we call the memory load computer which is - memory load unit, which is essentially a tape recorder with the program load onboard. At the end of this particular period of time, we will be placing the vehicle in a gravity gradient attitude. This is after the CMGs are powered down, TACS is essentially disabled and turn off the power and we're essentially finished with Skylab. We do not plan to bring up any of the STDN sites subsequent to this period of time to monitor the vehicle and we have no firm plans at this point in time for revisit. However, there are - are - we have made preparations in what we call the revisit bag with various samples of materials which we would like, if we should subsequently revisit and redock, to bring back and to evaluate the even longer term effects than we have seen on Skylab itself as far as degradation or effects of space on these various objects. I can't think of anything else so let me open it up at this particular point in time for questions.

QUERY Why are you waiting for some of these test until after the shaping burn? Is that because they might have to come back up and rejoin the - the spacecraft if something goes wrong?

PUDDY That's correct. Basically, we still keep ourselves in a rescue posture until subsequent to the shaping burn. So we would not be venting or running any risks to any of the vehicle systems until after that particular milestone had been met.

QUERY Like to ask you a - going back to a number of hour and so on. You know how many ATM hours had been planned pre-mission and how many - let's see it was ATM and - oh, medical - medical and ATM, and how many you expect to get now.

PUDDY Okay. You have to do a little mathematical gymnastics on all of this because our original 84-day plan was laid out assuming that we would have an hour allotted to the PTA - PT-PH period. And as you're well aware, once we got there and all was said and done, we elected to go with an hour and a half for this. So these figures - and - and you have - it never has gone - been gone through again to decide exactly where you would take the hours off. Generally, you would assume that what we usually do is to meet the minimum requirements in each of the experiment areas and then probably take those hour from the ATM. But in the - in the medical area - Oh, let me say one other thing before I get into that

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too. The original plan was based on the crew expending approximately 22 man-hours per day for the first 14 days and subsequent to that, moving up to a level of about 28 hours per day. As you're well aware, we didn't quite get up to that 28 hour figure that early in the mission. I'd say we averaged somewhere around 23 to 24 man-hour per day dedicated to science now, up through about day 50 and subsequent to that, we've moved up to a figure of somewhere around 27 hours. Some of the flight plans that we're working on right now are - are running in the 28 and 29 plus hour region. And I should say the ones we're planning because the crew is actually accomplishing more than that. There's a lot of this work on science demos and things like this that we're not scheduling which they're pulling off the shopping lists and accomplishing. But, with those few preliminary remarks let's say that in the medical area -

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PUDDY - but with those few preliminary remarks, let's say that in the medical area for an 84-day mission, we had looked at 431 man hours. Adjusted, that came down to about 422 hours we have accomplished - we will have accomplished projected at the end of the mission 400 - let's see, here, 285 plus 38 plus 45. You're getting me into the mathematics game. Right, 368. That's essentially as I indicated a minute ago about 45 hours less than what was originally predicted. At the same time, let me emphasize again, that with that reduced man hour figure, we have met every MRD - medical objective that we planned premission, and that that delta is primarily due to the increased efficiency in the crew as far as accomplishing their protocols in a - in a less period of time - shorter period of time, I should say. In which other area where you specifically interested? In the ATM, we were looking originally at - somewhere in the order of 480 hours total of which there was a split between the Kohoutek observations and - and actually the solar observations themselves. To date, we have accomplished 200 - let me give you the revised figure. After the adjustment on that, we had 284 hours of - of solar planned - or 417 hours of solar planned. We accomplished 284 of that. We project we're going to accomplish about 40 more. So basically, in the ATM solar observations themselves, we feel that we will probably be down approximately 10 percent over the original non-adjusted values. And if you want to, you're perfectly welcome to go through all the - the exact detailed numbers and we can pull out what you want to after the briefing.

PAO

Jim?

QUERY

Don, do you have one of the Summary Flight

Plans like this with you?

PUDDY

For which day, Jim?

QUERY

Tomorrow.

PUDDY

Sure do.

QUERY

What is this stuff up in the right-hand

corner as you look at it?

PUDDY

(Chuckle) Jim, I asked that same question.

I think that's somebody's attempt at preparing the flight controllers for ASTP. However, in the words of people who should be able to read that, it means, to the best of my knowledge, nothing. It - it's - it's not decipherable as far as the language, per se, is concerned. It - it is rushing, yes. But it - it's - it is not put together in a fashion where it can be interpreted. And I don't know exactly, to be honest with you, how it got on the forms. But it has no - no meaning to us at this particular point in time.

QUERY

Make sure that on, I understand correctly, on the EREP, now you got 39 - you're going to be doing 39

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passes in all out of the original 50 planned. What percentage of - of all the scientific objectives is that, and did you go over that and I missed it? All right. On - on - EREP -

PUDDY Well, I - I think so. Basically, as I indicated to you, and I'm more or less taking into consideration, as I must I think, on this, EREP' coverage across the entire series of Skylab missions, there are those three sites where basically, the - -

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PUDDY - - Skylab missions, there are those three sites where basically we had hoped to gather - three mandatory sites where we had hoped to gather some data that right now there is absolutely no data and no possibility of getting that data. There are some 15 to 20 sites and those are the gross numbers where we have obtained some data, but not all of the data that we would have like to have had to meet the MRD sp - mission requirements document special for - specified mandatory requirements. So, I think that kind of puts it in perspective as far as the overall -

QUERY Would you say 80 percent, 90 percent or 98 percent or what? Of all of the scientific objectives that were set out at the beginning of the mission - of the program?

PUDDY I'd hate to quote you an exact percentage but I would say, based on the fact that we had in the very high hundreds the number of sites and tasks that we hoped to accomplish, this would certainly have to be in the - in the 90 and above percent area as far as overall accomplishments. And EREP also takes care of the visual observations and I would say that would have to be well in excess of 100 percent what we predicted premission.

QUERY When you run these CBRM test on the PCGs I assume you run them down 1 at a time, so you won't be running them all out at once in case they all decide to fail?

PUDDY There's - there's really no way we can run them all simultaneously because of course, one of the things you want to do on a battery capacity test is to maintain more less a constant level. And if you did that you would constantly be decreasing the amount. Each one of them would be assuming as far as a load. So, you would degrade your data result. Our intent right now is either to run them one at a time or to run them slightly staggered. So, if we do run into a problem - you know, stagger say a rev apart, so if we do run into a problem we can stop the other one before it reaches the point where we would expect to have the problem. And this is true both while we're manned and while we're unmanned.

PAO Any more questions. Thank you very much, Don.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 25, 1974
17:03 p.m. CDT

Participants:

Milt Windler, Flight Director
Terry White, PAO

SL IV PC-112A/1
Time: 17:03 CDT
1/25/74

PAO This is Skylab Control at 22:03 Greenwich mean time. We have 19 minutes until the station at tracking ship Vanguard. Meanwhile the current flight director, Milt Windler, is here, standing by on the broadcast line for a review of the day's activities, and the outlook for tomorrow. Milt.

WINDLER Okay. Well, this Friday turns out to be a - what's come to be a fairly normal day in the Skylab flight. And we did set a record today. It's already been announced, I'm sure, the crew spending the most time in orbit of any spacecraft. The EREP track today went fairly well. The weather was - was good. The control system responded well. It - it continues to - the control moment gyro continues to be somewhat higher in bearing temperatures, a little bit higher in current and lower in rpm, as it has been now for a couple of days. But, there's been no change, and so we're proceeding on with the plans to continue to do the maneuvers. Later on today, we do have another comet maneuver. It has about a 40 degree roll with it, and we'll be using the S201 instrument on the comet. Also today we did the medical run on the SPT, the MO92/171 and that went well. The crew at the present time, or the SPT is involved in trying to get some telescope film, ATM film, of a small eruptive prominence on the west limb on the Sun. So far he has really not seen anything on his onboard instrumentation. The information came from the NOAA network on the ground. And we will spend a relatively short amount of time, it looks like, looking at this event. And if it subsides, if it looks like it's doing, then we'll proceed on with our normal Flight Plan. Tomorrow's Flight Plan is supposedly a day off. However, it's a - it's kind of complicated in that the crew to start off with gets to go to bed an hour early tonight, and they get up an hour - an hour later tomorrow instead of two hours. So that's makes the wakeup time, then, around 12:00 Greenwich mean time, which is about 7:00. We normally try to let them sleep in until 8 on local Houston time. The Flight Plans have a couple of alternates involved. Our primary Flight Plan for tomorrow, we'll do a data take with the S201 instrument of a VOD rocket launch; and then later on in the day we'll have an overall science conference with all the crewmen spending three or four passes with the corollary's and the medical PI represented by Dr. Musgrave. And then we'll talk a little bit about the comet. And then spend - most of the day however, as far as the ATM is concerned in letting the SPT do freelance experimenting planning and executing. We're sending him up a message tonight which will give him some of the things that the PIs are interested in, but the intention is to let him devise his own ATM schedule for his

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day off. And run as many day cycles as he sees fit. We do have an EREP pass scheduled in the afternoon. It's at 19:40 Greenwich time. It will be over the western United States coming from north to south down California and on into Mexico. One of the prime areas of interest here is the geothermal regions that are in California, and particularly on down into Mexico. If the weather is bad for this pass, and if the S201 rocket is not launched, then we have another opportunity at a early-morning EREP pass. In which case, we'll awaken the crew an hour early, which will be their normal time and let them do a - -

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WINDLER - - opportunity of an early-morning EREP pass in which case, we'll awaken the crew an hour early, which will be their normal time and let them do a pass at - that will come across the United States across roughly the Yellowstone Park area, getting some additional geothermal areas, continuing along the Saint Lawrence Seaway and on out into the Atlantic. We also have an opportunity tomorrow to try to have the crew look some at - to see if they can evaluate the presence of the Apollo light flashes and also Gemini light flashes, I guess you could say. But the one that we're evaluating quite a bit in Apollo to try to see if we can relate those to any particular orbital position. And other than that we think, it's just going to be a normal day off. Only 10 hours of work. The weather outlook for the afternoon EREP is very good. The weather outlook for the morning EREP is not quite as good as that but of course we expect to plan - to do the primary EREP which will be in the afternoon.

PAO That completes the change-of-shift briefing with Flight Director Milt Windler. Thank you, Milt. Next station in 12 minutes will be tracking ship Vanguard. We'll return then and at 22:10 Greenwich mean time, Skylab Control.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 24, 1974
4:13 p.m. CDT

Participants:

Neil B. Hutchinson, Flight Director
Bob Circosta, PAO

SL-IV PC111A/1
Time: 16:13 CDT
1/24/74

PAO We're ready here - we're ready for our change-of-shift briefing today with Flight Director, Neil Hutchinson, Neil.

HUTCHINSON Okay, this hate to start this off with this kind of nostalgic briefing for me, this is it. This is the last time I'll be seeing you guys. I'm off executes here for the last time, and the next time I come on we'll be getting ready for deactivation and entry. And they're in the last couple three days and I don't know I have some executes then. But I don't know whether we'll be having these things in the middle of the night since we're flopping everything around early in the morning. However it may end up - I guess it ends up being early in the morning. Anyway, it's been a pleasure for the last almost year since I was doing this on Apollo 17 too, or over a year I guess. Far as the mission work today, we did an EREP with old CMG 2. And I guess it kind of surprised us a little bit when we ran the EREP. I'm not sure why it surprised us in retrospect. It turns out that the torques on a - for the CMG has to exert on the vehicle. Or it may be a better way to put it would the the torques that gravity external forces exert on the vehicle when you're in Z-LV attitude, or actually less than they are when you are in solar inertial attitude. So consequently when you're in Z-LV attitude, the CMG doesn't have to work quite as hard. Conversely of course it takes a pretty good - the transition to get from solar inertial to Z-LV and then to get from L-LV back out to solar inertial is - has to work considerably harder than it normally has to work. Today we did do an EREP. It was a successful run from both an EREP standpoint and from a CMG standpoint. CMG over the last 24 hours has gotten slightly worse, but it has not continued to degrade at the rate it was at this time yesterday. And we're now running about - I'd say about 1.045 maybe average on the currents. About a 3 degree bearing differential, and an average slightly below 8850 on the wheel speed. And that's not much worse than we were 24 hours ago. That's probably a half degree higher on the temp and not much slower on the wheel speed nor much higher on the currents. It's not clear yet whether maybe this CMG has found a new place it likes to run. But I'd have to say after the last - this last shift in the control center I was - I'm certainly more optimistic than I was yesterday about its ability to press on. Because it doesn't seem to be involved in a linear decay curve or worsening of the situation. Now it's all maybe kind of premature, you know, it may have just - the EREP may have done something strange to it, it may have just stop for a little while and it's going to press right on. But from what I saw today, I have to say I'm more

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encouraged than I was yesterday. And we plan on pressing right on. We have an EREP scheduled tomorrow. And as a matter of fact while I'm talking about it I might as well talk about tomorrow's Flight Plan. It's a full day EREP 41 tomorrow. ATM a major medical on the SPT it's very - very ordinary day full up with everything. S063 twice, S019 once and a S201 on the comet tomorrow. They are resuming comet operations tomorrow - S201 out the SAL on the comet. We had a very uneventful day today - it - everything went very smooth. The vehicle, no new systems problems. The only thing that I heard all day that could even be construed as something - a new problem that we didn't know about. The PLT commented that the little minimonitor on the television that he. You know they have the camera and then they have a monitor that they can use to check the scene that they're looking at. Said it was severely degrading was getting so bad that they - -

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HUTCHINSON - the PLT commented that the little mini monitor on the television that he, you know they have their camera and then they have a monitor that they can use to check the scene they're looking at - said it was severely degraded and was getting so bad that they couldn't tell whether they were looking at good scenes or bad scenes, and that's the first we'd heard that there was anything wrong with either one of the mini monitors, we have two on board. And we use them pretty much interchangeable, in fact we assumed the crew was using them at will, they probably left one up in the front end of the vehicle and one down - downstairs in - in the OWS. Let me tell you a little bit about the end-of-mission sequence before I get off here. I'm not sure how to go about this - probably the best way is to kind of give you a little philosophy about how we're going to leave the Skylab and then kind of tell you how it fits into our normal way of - way of getting out. Basically we are going to leave the vehicle in a posture where it could be revisited but not reactivated, if you will. That's a nice way of saying that we're - we're not leaving it in a - in a position where somebody could go in shirt sleeve and have at it in there. However, we are leaving it in a posture where we could go up to it and certainly investigate it from the outside and possibly dock with it providing it was in a stable attitude and if things - if it happened to be the desire you could go in there hard-suited. Now, in order to do that - well let me tell you one other thing we going to do, we have some testing we are going to do after the crew leaves, not a lot of testing, it's a series of fairly straightforward engineering tests that we think will take no longer than about 48 hours from the time the crew leaves. And then the vehicle will be effectively put to sleep by powering it down completely after we have put it in a gravity gradient attitude, essentially perpendicular to the Earth, and we will turn everything off including discharging all the batteries down to zero capacity, and then off comes the telemetry transmitters and of course, as you know it's impossible to unhook the command receiver. So the possibility always exists even though the thing will have no way to recharge the batteries because it won't be pointed at the Sun that you would have enough residual energy there to turn it back on - get a command back in, I'll put it that way, we have no plans whatsoever to do that. The last we are - during the time from crew unhabitation, which is Friday through probably Sunday, through the weekend we'll be working with the vehicle 24 hours a day regular mission operations running this series of tests. And I'll go over some of them just so you get a - you don't need to know - they'll be well publicized.

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I'm sure before we get there, you don't need to know exactly but give you an idea of the kinds of things we're going to do - all the things we wanted to do, you know it's an engineer's dream to have it up there and be able to find out what works and what doesn't. Anyway, so, that plan coupled with the basic - you recall the crew has a circadian shift to accomplish at the end of the mission - puts our de-activation into a time frame that kind of strings out over a couple of three days at the end, mainly because the day before entry and entry day are short crew days as far as the OWS goes. EVA is still scheduled as it has been for quite some time on mission day 80 and then as the days go on there, and I'm sorry that I didn't bring a set of Flight Plans with me because I've got a preliminary set of Flight Plans up through the end but I didn't bring them, but from memory I'll kind of tell you how that end goes. The EVA is on day 80, we continue running major medicals right up to the end, the last one's on day 83, I believe, day -

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HUTCHINSON - - I'll tell you how that end goes. The EVA's on day 80. We continue running major medicals right up to the end. The last one's on day 83, I believe. Day - the circadian shift will take place in one chunk on - between day 83 and day 84. Day 84 is a short crew work day, 9 hours, and it's all deactivation. And, of course, day 85 is splash day and we splash about 10:00 in the morning here, getting the crew up - roughly midnight, something like that, Houston time, I believe. So - and as - the deactivation, basically takes place over about 3 days. There will be deactivation on day 83, not all day, but a good part of the day, piecemealed in various places. Day 83 is primarily a stow-the-CSM day. Day 84, the hard core, the 9 hour day on day 84 is the hard core deactivation of the workshop. And day 85, there's only - we spend about 5 hours in the workshop, and most of that is suit donning. Getting up and getting breakfast and getting suit donning. There's maybe only an hour and a half's worth of work. The final switch closeouts and so on, and so forth. We are not going to do anything special in deactivation in particular, we will not be doing anything, any microbiological control like we normally do, you know, we always go around and swab everything down and spiffy everything up and try and get it in a leave it like you found it state, so to speak. This time, we won't be doing any of that, for example, we just leave the urine separators in place. We don't change out any of the filters in the - in the - or the solids traps in the sieves. We are going to deactivate the water system, to preclude a water line freezeup and rupture inside the vehicle. We won't be dumping any of the gaseous systems. All the water that remains in the water tanks will be left there. Whatever TACS we end up with when it's all over will be left there. Not going to throw any food away, whatever food, of course, it'll - soon as we - we are going to turn the refrigeration system off after the crew leaves as part of this deactivation, so - I don't know, it'll get hot or cold or whatever it'll get with the vehicle orientation as it ends up. We're not going to do anything more with the coolant loops that we know of, unless, of course we had some kind of a big leak spring up. The coolant servicing kit, there was a lot of talk during this - how we're going to fix it up, putting it to sleep, about reservicing the coolant loops, and we're not planning on doing any of that now. We're not going to hook the reserve kit up. Just leave it status quo, both coolant loops in the airlock module look good. We will vent the cabin down to 2 after the crew is committed to entry, down to 2 psi via ground command. And subsequent to that we will dump it to cabin - dump it to vacuum. And then we'll close the vents off and

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of course the O2 system will be shut down so it will remain at vacuum. And after the tests are performed, the vehicle will be maneuvered to this gravity gradient attitude and the APCS will be shut off. The CMGs will be shut down, the batteries will all be run to depletion, and then we'll turn off the telemetry transmitters and the command system. You can't turn the command system off. The EPS BUS - EPS CONTROL BUS is a hard-wired BUS. It's up as long as there's an ounce of energy in anything. And that's kind of a synopsis of how we're going to end this thing up. And I guess that's about all I have to say.

PAO

Any questions? Howard.

QUERY

On this deactivation, wouldn't it be of some value to leave some telemetry on for some time to see how long some of these systems might last, like say the CMG, for instance?

HUTCHINSON

Yeah. Howard, that was discussed at great length, and it turns out that that's a very expensive proposition and I guess people feel - the decision was made that the proper approach to this thing was to accomplish a discreet amount of testing, for example, I have my list - -

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HUTCHINSON - - and I guess people feel - the decision was made that the proper approach to this thing was to accomplish a discrete amount of testing. For example, I - I have my list of tests here. The example I was going to give you and I can't - Yes, we are going to try and fire up the CMG 1, for an example. And I guess that we thought we could maximize the amount that we - of engineering data we could get out of the vehicle with a minimum amount of cost by doing a concentrated, full-up testing effort over a short period of time. We'll turn on everything we haven't seen, we'll be trying to run both refrigeration loops at once, which is something that we been wondering whether we could do or not: running multiple pumps in both airlock loops, powering up CMG 1. We're going to try and reload the ATMDC from the - from the tape unit we have on board, which, of course, has never been done. I think we're going to do a computer switchover, I'm not sure, after we've got it in gravity gradient in the attitude so we don't need the computer anymore, and so on. But that's the main reason, I'd say, economics.

PAO Tom.

QUERY Was there much discussion or argument for leaving it so they could be revisited in a - or reactivated, rather than just revisited? Was it - was there much -

HUTCHINSON Well, I guess - -

QUERY How much policy in that?

HUTCHINSON I didn't personally participate in a lot, Tom. I think that the thought process that you'd have to go through when you think about something like that is you have to look at the usefulness of some of the critical systems on board, like the power in the CMGs that are - By the time we would get ourselves into a posture where we would be able to conduct the revisit for whatever or under whatever circumstances, you'd have to say it's a year or more on down the line; and you just wouldn't expect that the thing would be in a posture where it could support that kind of thing. I don't know if you could say serious consideration was ever given to it. I really don't know that answer, how much that was debated in the management circles around. But, I - I'm sure it was - I'm sure it was looked at. One time, you know, we were considering leaving the workshop in a posture where it - we could keep going as long as we possibly could. Of course, you know, you have think that as soon as we quit managing this heater on CMG 1, it'll probably - correct CMG 2, it'll probably blah, you know. I would expect that, anyway. Maybe not. But the cost to do something like that, I mean you could imagine having a network up and people over in the control center as the thing goes around month after month, just gathering data, would be prohibitive.

PAO Howard.

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QUERY On your end-of-mission schedule there,
when is the last ATM day, and when is the last EREP day, and
how - how many days will you be looking at the comet, starting
tomorrow - how many more days will you be looking?

HUTCHINSON We look at the comet pretty much - it's
scattered here. Well, why don't I not guess and look at my
7-day forecast and tell you. I can answer a couple of them
right off. The - we'll be looking at the - -

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HUTCHINSON I can answer a couple of them right off. The - We'll be looking at - We'll be - the last EREP day is mission day 79. The last ATM day is mission day 79, mainly because mission day 80 is the EVA. Now when I say ATM day, I'm classifying manned ATM. I suspect we'll run SO55 up through deactivation. Looking at this thing - let me correct myself, Howard. The last planned EREP is on day 78. Day 79 is closeout day for EREP, where we'll do the EREP deactivation. Let me answer your other question about the comet. It's around here. You know, I'm chagrined to say that I don't know whether we're going to look at the comet in EVA or not. I suspect we are with TO25, so I'd have to guess that day 80 would be the last comet. There are - a rule of the thumb you can go by - there are no experiment operations post-EVA except medical. And the medical continues right on to the bitter end. The last medical - there are two major medicals on day 83, and you recall that day 84 is the short 9-h crew awake day.

PAO

QUERY

Howard.

Neil, since this is the last time we may have a chance to talk to you, how do you as a flight director evaluate the whole Skylab program?

HUTCHINSON

I think it was super. Just stupendous what we managed to accomplish considering where we started. I wouldn't have given you a - two cents for being here talking about it today last May. And I really think - well, if you look over the fact that we've - of course we aren't there yet, but we're headed for pulling off an 85-day mission here, which wasn't even in the original plans. And look at all the things we're overcome on the way. The CMGs breaking and all the gyros that fell apart and we replaced, and the solar panel problems and everything. I don't know, you about have to consider we got 150 percent out of something that we could have gotten a 150 percent loss out of. So, I guess I'm pretty pleased to have been associated with it.

PAO

QUERY

Jim.

Well, Neil, how does it make you feel to know that you won't be doing this for a decade or more?

HUTCHINSON

Oh, I don't think I won't be doing it for a decade. I hope I'm not - we're not out of the operations business for that long, Jim, but, you know, you're a little nostalgic and you're a little relieved. You know, we've been grinding away for so long, I probably don't feel very bad right now. I kind of - just kind of glad to take it easy for a little while. But I'm sure I will be, nostalgic and -

PAO

QUERY

Jim.

Yeah. Let me amplify that a little bit. I wasn't speaking just of the operations business. I mean I

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know you've got ASTP and the Congress willing, the shuttle. But, having gained all this knowledge and experience in space station operation, to let that slide for, we know, more than a decade. We don't know how much beyond that. How does that make you feel?

HUTCHINSON Well, I - I don't know whether the next generation of this kind of a thing would be conducted or will be conducted with a relationship between the airborne crew and the ground crew that we have in terms of all the help that the guys get from the ground. Not help, but the monit - the way the system is designed to work, the ground is built in as an integral part of it. I guess I kind of hope that by the time we got ready to do this again, we'd be in a posture where maybe we wouldn't need the extent of ground participation in the operation that we need now. Maybe we're never going to get away with it. I don't know. I think that - that certainly we've built - we've established a base of data to press on from, but I'm not totally convinced that considering the advances that people hope to make in hardware and in putting together one of these things, and so on and so forth, that the concept of the relationship of myself and the other ground controllers and everything to the Skylab is the way the next one will end up being done. I'm - you know, you can't help but think that a lot of the things we've done and a lot of things the - -

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HUTCHINSON - concept to the relationship of myself and the other ground controllers and everything to the Skylab is the way the next one will end up being done. I'm - you know you help but think that all - a lot of the things we've done and a lot of things the people that built the hardware, particularly the airborne hardware have done, will apply in the future. But I - I don't know whether - in fact I'm sure we haven't come to the ultimate way to run a space station, or to build one and design one. To answer your question about wouldn't I like to be next week starting off on building one that would stay up for 5 years, of course I have to answer that yes, because you know this is I do and I like to do it. And I wish somebody would give some money to do it, we'd leap into the breach I guarantee it.

QUERY We have one question, Neil, from ABC News and they're asking do we plan to televise the EVA on the 80th day.

HUTCHINSON I would guess not, but that - I can't answer it directly yes or no but it could be answered with a telephone call over there.

PAO Okay, then we'll try to get that.

HUTCHINSON In fact the guys that are going to do the EVA are on over there now, the teams that's going to do it.

PAO Fine, well we'll get that for them.

HUTCHINSON I suspect not, although I don't know why not.

PAO Any other questions? Fine, thank you Neil.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 23, 1974
4:19 p.m. CDT

Participants:

Neil B. Hutchinson, Flight Director
Bob Circosta, PAO

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Time: 16:19 CDT
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PAO We're ready for our change-of-shift briefing today with Flight Director, Neil Hutchinson, Neil.

HUTCHINSON Well, I'm sure you all have been following what's been going on with CMG 2. To kind of bring you up to speed on - on where we are, the CMG over the last 24 hours since I talked to you last night has been in not quite in almost continuous distress, but pretty much so. We are on our 33rd occurrence of distress on CMG 2. We have been in it since 05:35 Zulu this morning so we have been in continuous distress for about 15 - 16 hours now. The magnitude of the distress is - is more than it's been. The bearing temperatures - the differential between the two bearings, which of course is one of the things we watch and of course the bearing we're watching particularly is bearing 2 - is larger than it's been. It's very very slowly getting larger. By slowly I would characterize today as being between 1/2 degree and 1 degree hotter than it was yesterday, Fahrheit, at this time. We cancelled the first EREP this morning because of weather, not because of the CMG. We cancelled the second EREP today because of the CMG. We've been in several caucuses today with the bearing experts and other folks at Marshall Space Flight Center at Huntsville. There is another one of those going to go on as soon as I leave here, or shortly thereafter or around 5 o'clock. We have not yet decided how we're going to plan the flight plan tomorrow. We do have an EREP scheduled on the flight plan tomorrow. We have some options open to us. One of the options of course that has always been open to us is to do the EREP in TACS only. That's a little expensive TACSwise. However, we as you know have been doing very well on TACS here over the last 2 weeks, and the TACS situation is very favorable at the moment. I told you last night that we were looking at various and sundry other things we might do to the CMG's, and we have not progressed any further in our deliberations on those subjects. We've mainly been trying to attack the immediate problem, and that is whether or not we should do maneuvers. There are two schools of thought. One that says that we aren't materially affecting the speed with which CMG 2 is deteriorating by doing maneuvers. And there is another school of thought that says no matter what you do every little extra amount of stress that you put on a CMG has got to affect it's end lifetime, when it's in this kind of configuration that this one is in. And I'm sure we'll have a long and heated discussion tonight when I get back there about exactly how we're going to do tomorrow. We do want to get the EREP tomorrow. We called off, as you know - we've called Off three EREPS recently in the last 2 or 3 days

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because of weather, and two now because of the CMG. And so our EREP science has not been particular overwhelming here in the last few days. And we're - fortunately, the track we cancelled this morning because of the CMG, we do have another crack at it. The one that we cancelled because of weather, we probably won't have another crack at it, mainly because it was a geothermal pass early morning wakeup in South America. And the next time it comes around, it will be 2 hours earlier than it was this time. So that's about where we stand. I - let me say a couple more things about S183. We ran a malfunction procedure on S183 today. And we indeed do have something wrong with the instrument. And we're kicking around some plans about an alternate way to power it, and I don't know whether that's going to materialize or not. The only other system problem we had was a little glitch on ATM C&D, which we haven't seen in quite a while. It - the flow dropped to zero early this morning and it was down there for about 3 or 4 minutes and then came back up. And it has been operating normally during the day -

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HUTCHINSON - glitch on ATM C&D which we haven't seen in quite a while. It - flow dropped to zero early this morning, and it was down there for about 3 or 4 minutes and then it came back up, and has been operating normally during the day today. Say a quick word about tomorrow's Flight Plan. Excuse me if I'm not very well organized today. I said we had a EREP tomorrow, we also have another TO20 run with the commander as the test pilot. EREP is track 33, it's a track across the U.S., coming in up across the Pacific Northwest and down across - pretty much dissecting the United States. It's a fairly good track, there are several mandatories and several desirable passes. It's like I said we'll be opting to get it tomorrow. Rest of the Flight Plan is filled in with ATM and some SO19 work. I guess that's about all, I'll throw it open to questions.

PAO Tom?

QUERY Neil, with this distress all day today, does it really look like that the CMG is not going to recover this time, that it's slowly but surely going?

HUTCHINSON Well, if your definition of recovery is to return to a non-distress situation, I'd have to say now that I don't think it will. But, it's done some things we don't expect - you know, I mean, that's a personal opinion or an engineering judgment or whatever you want to call it. It - it doesn't look like it's going to undistress itself. Now as to whether it can sit here and run for 6 months at this state, who knows. That remains to be seen, of course, and we're trying to understand what it is we might be able to do to aid and abet it - keep it running.

QUERY Descriptions of plans in the event the thing fails in the past have been couched in uncertainties. The PAO seemed to indicate in words he put out just before this briefing, that it's more or less definitely been decided that you will continue for the 84 in the event CMG 2 fails. Is - is - is this a positive decision that you will go for the 84, or - or -?

HUTCHINSON No, Paul, they're hadn't been any specific discussions that I know of in the last 24 hours that - that would put us into a posture where we're committed to - to - to make a crack at the 84. The - I wouldn't characterize that the - our posture if CMG fails as uncertain. We know very clearly how we want we have, and we know very clearly that we want to have a high probability in the combined TACS and CSM propellants to keep us in the air with comfortable margins to complete the mission. Now the question - you know, about uncertainty, the question is, when that we have to sit down and understand very clearly how much confidence we're going to be

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able to get. I mean, it's a programmatic decision. It's certainly over my head in terms of being able to make an assessment on an overall situation as to whether we want to continue for the 84 days or 85 days. The capability exists to do that. Now, the CMG hasn't failed yet, so, you know, I - we haven't changed our posture at all. When it does, we're in a non hurry-up mode, as you well know. We've explained that several times. And I'm sure that when we get - when and if we get into that posture that it won't be long until we have a very orderly plan of attack. I do suspect one thing you could expect is a fairly early EVA after the event, if it happens. That - for several reasons, obviously, without the CMG, we're not going to be doing any ATM work because the quasi-inertial patch in either the ATM or running it with the CSM doesn't allow finding enough pointing to operate the ATM. Plus the fact we have a lot of valuable film out there, and to preclude any other failure getting us into a posture where - any subsequent failure where we couldn't go out and get it, I'm sure we'd go out as soon as we got our attitude control situation stabilized and understood well. So that's the only immediate flight planning thing that - that I think you can expect. And other than that, I suspect we'd go right on running medicals and doing what corollaries we could, and decide how long it is we want to go, and whether we want to try for any - spend gas to go for any more EREPs, and so on and so forth.

PAO

Lou - Lou.

QUERY

Would you give us a few round numbers about the fuel situation, how much you have left, what you would probably spend on an EVA if the CMG went out, and what you'd expend if it didn't, and what it would take for - to do an EREP with TACS fuel alone?

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QUERY

- - expend on an EVA if the CMG went out, and what you would expend if it didn't, and what it would take to do an EREP with TACS fuel alone.

HUTCHINSON Round numbers. Round numbers for the TACS, at the moment we've got - these are round numbers, and they are all based on only using the CMG - I'm sorry, the TACS down to a 10-pound thrust capability. And as you know we have a - the prerogative to go on down below that to a 5-pound thrust capability which roughly adds - oh, it adds - I'll have to figure it out here, but it adds quite a bit of capability. It adds about - about 4000 pound-seconds of impulse, roughly. The TACS situation, as it stands right now we've got based on a - quitting at a 10 pound-thrust level, 6 - roughly 16,000 pound-seconds. Now that equates worth of attitude hold attitude hold in orbit about 6 days worth of attitude hold capability. Now if you were to use the TACS down to 5-pounds of thrust, we've got about 8-1/2 days worth of capability in the TACS. Now those numbers already have in them the amount of TACS necessary to do an EVA and we are saying or reserving 2000 pound-seconds for an EVA. Now if we did an EVA - if we did an EVA and we were already in TACS only I wouldn't expect it to cost us more than our normal TACS cost, which would probably be less than that. That's an EVA on CMG control with resets and so forth. So a round number for an EVA - a round conservative number for an EVA is 2000 pound-seconds TACS. For an EREP - We are looking at this EREP tomorrow very closely and we are - I'm not sure exactly how - how it's - the maneuvers are going to be designed yet, but a middle-of-the-road number for a EREP would be 1000 pound-seconds, for an EREP TACS only. And that number goes up and down considerably if the EREP datatake is fairly short, that number could be down around 500. If it's nice long pass like one of the 90 degree jobs, it could be up around - around 1500. Now if you want to - want to add and subtract numbers, you'll realize that to do one EREP with TACS will cost you about 1 day worth of orbit stay time, it's about an even stephen trade. Now as far as the CSM goes, with CSM quasi-inertial patch in it, and of course as you know we don't have it in it. We have load it so we'll be in CSM Y deadband for awhile which is more expensive. But we have to modes of operation of that Y deadband with that quasi-inertial patch in there. One that does not contaminate anything down in the OWS area, doesn't use forward firing thrusters and another that does. Without using forward firing thrusters, in other words keeping the contamination of the workshop completely clean which is highly questionable considering you probably close down the ATM operation anyway. And we've

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got about 15 days above the CSM RCS hybrid redline, in other words preserving a capability to get down with - should the SPS fail with the CSM. We've got about 15 days, if you enable those two forward firing jets it makes the autopilot much more efficient, we've got about 24 days. Now - well, there's some round numbers.

QUERY How does this moribund gyroscope curtail the mission, and would it be better to kind fish and cut that. In other words, just say okay the gyroscope - this in other words is the moribund gyroscope worse than say going into these other modes of operation?

HUTCHINSON Well, the - really Abbie when you look at that whole thing, the thing you're -

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HUTCHINSON - the re - really, Abby, when you look at that whole thing, the thing you're trying to do is hang onto it as long as you possibly can because it's the thing that's keeping us in business looking at the Sun. And, of course, that's one of the prime things we're up there for. The reason that we would be - for example, examining an EREP tomorrow in a TACS-only situation is to not put any more stress on this thing than we absolutely have to and still try and accomplish some other science besides just sitting there in solar inertial looking at the Sun and doing medical. And I said before our TACS situation is - over the last 2 weeks - 2 to 3 weeks, in fact ever since the last EVA, shortly after the last EVA, it's been getting more and more favorable every day.

PAO Lou?

QUERY Forgot my question.

PAO Okay, let's get on here.

QUERY We were given the 5 degree crossover parameter for shutting down the CMG in temperature - -

HUTCHINSON Yes, sir.

QUERY - - but at what point in rpm does it become so ineffective that you would shut it down and also at - at what point in - in electricity drain would you shut it down?

HUTCHINSON The - the constraints on the other two, Paul, are not directed toward inefficiency in terms of drawing too much current or inefficiency in terms of not providing enough momentum. The wheel, obviously, as the speed - if the speed were to go down, efficiency - well, the capability of the - of the system to absorb energy from the vehicle goes down in a linear fashion. The the wheel speed would have to go down to a point that was well beyond a catastrophic bearing failure before you would have that criteria to shut it down because it was no longer worth anything to you. Do you see what I mean? I mean, it'd be down half or a fourth or something like that, couple thousand rpm or 5000 rpm. The criteria that we are using on wheel speed to shut the wheel down, which is a function based on that wheel speed indicating a severe bearing anomaly, is 2000 rpm - not 8000, that's wrong, 8800. Okay? 8800. That's the - the function that we're using on currents is - all three currents over 1.07 amps - that's all three phases - or any one current over 1.01 amp.

PAO Lou.

HUTCHINSON Now these currents are, you know - you know, the range we're running in now. And of course, you've already mentioned the bearing crossover limit.

PAO Lou.

QUERY Neil, a while back, somebody said that they were working on a one-gyro logic problem. And then I believe they

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said they gave up and decided not to. And now you're facing a one-gyro situation. What's the situation as far as computer logic?

HUTCHINSON We do not have a program that operates the system with a single CMG. And if we get faced with a single-CMG situation, we are into a TACS-only and a CSM control mode. In other words, the other CMG - the good one, will be - I'm not sure whether we're going to power it. We'll probably - we would probably power it down after we'd finally given up on the one that - the next one that craters if it does.

PAO

Tom?

QUERY If the CMG goes, Neil, what other - what are the corollary experiments that you will be picking up on? What are you behind on there that you would be emphasizing?

HUTCHINSON Well, I'm not sure, Tom, how many of those ones - I haven't really taken a detailed look at it myself. I know the guys have. There are some of the corollaries that go out the SAL who's attitude requirements are stringent, but who could get some data. For example, some of the photometry and stuff can be gotten even though you get film smear and so on and so forth with lousy pointing. The maneuvering experiments inside, of course - there are some of the things like some of the detail work like M487 and - let's see do we have - We don't have any of the furnace work left to do. That's all finished. So there wasn't - there wouldn't be a lot of -

END OF TAPE

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HUTCHINSON - the maneuvering experiments inside - of course there are some of the things like some of the detail work like M487 and - let's see, do we have - we don't have any of the furnace work left to do. That's all finished. So there wouldn't be a lot of them, but there are some of them that - that still have work remaining to be done that are not attitude dependent, and some that even are attitude dependent that we'd press on. Now I suspect some, like SO19, would be - be finished, for example. It requires precise pointing and blurring the fields would smear the spectrum and it - you wouldn't be doing SO19, for example.

QUERY On the quasi inertial mode, you know, where you're wandering back and forth, do you just sort of wander back and forth like this rhythmically, or wh -

HUTCHINSON -Oh yes, it's very rhythmically. It's four times in orbit. It's a sinusoidal function that's very regular and very predictable. And basically, what the control mode does, it allows gravity to affect the vehicle up to a point and of course the - pulls the vehicle out to one side of the deadband and then you get some firings. And it allows it to wander in a controlled fashion, if you will. If the vehicle didn't have an attitude control system, of course, the Skylab would stabilize itself - you know, longitude and lat - one or the other of the axes pointed radially away from the Earth - type of thing.

QUERY

How fast does it go back and forth?

HUTCHINSON

Four times - well -

QUERY

Or was this at a rate of speed, you

know?

HUTCHINSON Oh you mean in terms of degrees per second or something. Well, we'd have to figure that out. The deadbands are about - Let's see, it hits one side, then the other side, so it would go back and forth twice. And it would traverse a 17 degree path, and it would do that in a - or let's just call it a 20 degree path - and it would do that in about - 40 degrees in 9 minutes - so half a degree a minute, it's very slow. Certainly almost imperceptible.

QUERY

I'm still searching for certainties. But I'm wondering if - if the CMG goes out and you have no other - other major problems, can we say at this point that you - you would wait and - and - but you do have an early splashdown. Can we say at this point that you would come down on the best days which we've been told is Tuesday on February 3, and not any of the other days?

HUTCHINSON

I'm not - fill me in on why Tuesday, February 3, is good, because of the fence position, the vehicle position on the fence?

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HUTCHINSON - - started becoming more frequent and finally has gone into a distress that is continuous. The fact that the bearings have crossed over and they are at a higher temperature than we've ever seen them has got to say that the CMG is doing something different than it has been doing over the last three months, ever since it started acting up. And the question that's foremost in everybody's mind, and that nobody can answer, is how long is the thing going to hold up. You know it could go at this slower speed and elevated temperature and run right on down through splash-down. And months from now or tomorrow morning we may come in here and it may be gone. And I don't think anybody can say. But my gut feeling is, if I have one, is that I'm a little bit chagrined. And I think we're closer to a cratering than we were this time yesterday. (Laughter)

QUERY If it goes like this, say, for the rest of the mission though - how will you - will that curtail any of the activities on the flight? In other words what do you lose by having this?

HUTCHINSON Well, if we can nurse it along, Abby, the obvious thing that we're having trouble with is these EREP passes. And if we decide that, tonight, that TACS is the way to do EREPS then you are in a consumable situation on the TACS. And I would imagine - of course EREPS - you know, we're getting down there, this is day - what day 69. We've got - got - what - 9 days left of EREPS. So there aren't - you know, were not - We're talking about 9 or 10 more passes, and if you could get by for less than a thousand pound seconds a pass, it's certainly in the cards to say that you could - you might be able to pull off the rest of the EREPS you wanted to do. And if that were the case and the CMG held up, then we wouldn't - it didn't cost us anything but a lot of headaches.

QUERY What was it that - when the first one died, how did you know it died? In other words what -

HUTCHINSON It got very hot. Yes ma'm. The bearing - bearing in a matter of - well, it was okay at one LOS, and the next LOS the thing was - I don't remember what the temperature was but it was a hundred - hundred and some odd degrees. It's very obvious when - when it's - and the currents were way up and the speed was almost nothing.

PAO Neil doesn't have a re - replacement today, so there aren't any more meaningful questions, can he cut it off, say, thanks.

END OF TAPE

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QUERY (garble) splashdown point nearest San Diego for medical reasons.

HUTCHINSON That's probably a reasonable assumption, Paul, I'd say. That's a mighty big "if" you've put there in front of your attempt to elicit a certainty out of me.

QUERY The - the - I don't know whether the PAO was - was guessing your mood or - or quoting you this afternoon. But he said that - that you said it appears CMG number 2 is slowly but surely caving in. Is that - is that your - your - I've been trying to get gut feelings for several months now on this. Is that - is that how you feel really today?

HUTCHINSON Well I probably, after - after watching it the last couple of days, I'm a little bit disappointed - more disappointed than I usually am about these kind of things because there's no question that it has worsened. And it's like - it's like a bearing in your car, you know. When you first hear it making a noise, you say, hmm, wonder what that is and then it makes more noise and you finally discover it's a bearing in the right rear wheel and pretty soon it's going pretty loud and you say well I better not drive it anymore or - you know, it's that kind of thing. And we're down to the stage where we're questioning whether we ought to drive it anymore, you know. Now, this thing is so - has so many unknowns in it - you know, if we just had some better instrumentation on the wheel so we'd understand a little more about what's going on - you know, everybody talks about poor lubrication and bearing instability and the fact that the bearings are loosening a little in the race and so on and so forth. The indications that I see over the last couple of days - the fact that the stress starting becoming more frequent and finally has gone into a distress that it's continuous the fact that the bearings have crossed over and they are at a higher temperature than we've ever seen them, has got -

END OF TAPE

SL-IV - CHANGE OF SHIFT BRIEFING
Johnson Space Center
January 22, 1974
4:10 pm C.D.T.

PARTICIPANTS:

Neil B. Hutchinson, Flight Director
Dennis Williams, PAO

SL-IV PC109A/1
TIME: 16:10 CDT
1/22/74

FAO Start change-of-shift briefing.
Neil Hutchinson is here in Mission Control to briefly summarize today's activities. We'll turn it over here to Neil.

HUTCHINSON Okay. In case you hadn't heard, we've been babysitting our friend CMG 2 again today. Since I talked to you last the - we have had - let me count them here - 6 occurrences of - our anomaly on CMG 2, lasting anywhere from about an hour and a half up to about 4-1/2 hours. The CMG at the moment is just coming out of a distress period that's lasted some 4 hours almost. It will have lasted 4 hours, I'm sure, before the bearings end up back at their normal delta. This morning when we started the day off, shortly after the crew woke up, we got into a distress situation apparently brought on during the regular gravity gradient dump. We were in a distress situation when it came time to do the maneuver for the first EREP pass. We had 2 EREPs scheduled for today as you recall, and so we called off the EREP, we also called off scheduled momentum dumping inhibit for the following rev that would have - it was used to keep the vehicle from maneuvering for an S073 data take. And it turned out that we got some - some data on the S073 anyway, because we were looking for some photometry data besides the actual visible stuff. So we ended up doing the S073 pass, but we didn't do the momentum dump inhibit, which of course in turn - what that really does is when you inhibit a momentum dump, I rec later when you finally do one, you have more momentum to dispose of. That ends up putting more stress on the CMGs. We have been - we had a conference today with CMG experts at Huntsville, Marshall Space Flight Center. And we are continuing discussions of what are we going to do if, for example, the CMG goes into a continuous distress mode where it's in distress all the time. Right now we're seeing a situation where, of course, it appears that the thing is getting worse. However, the magnitude of the symptoms is not increasing, only in the length of the occurrence and frequency of the occurrence. We discussed a lot of things, like whether we'd attempt to do maneuvers with the CMG in distress, presuming that the thing would go into distress and stay there. And we didn't come to any conclusions on that. We did, however, decide for the next day or so to see if we can still play it a little conservative and not maneuver when it's in distress and not do momentum inhibits while it's in distress and wait until - to see if the thing gets to the point where it's affecting the Flight Plan significantly. And if that happens - to where we aren't able to do any EREPs or anything, I'm sure we're going to regroup. We did discuss a couple of other possibilities, neither one of which I think are very attractive. They're

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both fairly risky. We've known about them for quite some time. However, they've not really been candidates and aren't really candidates now for a possible fix. But we did discuss them again today merely because the situation does seem to be getting a little worse. One of those - one of those is lower in the speed of the wheel. And the way you do this - if you turn the wheel off and on continuously and we would modulate the wheel power very similarly to the way we're modulating the heaters now. In other words, we turn the wheel power off and let the wheel spin down on its own, unpowered, down to about - oh, say, 7,000 rpm. And then we turn it back on again and let it spin back up, say 7,500, and then turn it off again and let it spin down, and in that way lower the overall wheel speed, which of course if the wheel is not spinning as fast, it's not putting as much stress on the bearings. Obviously there are problems with that approach. You could turn the wheel off and have a relay fail on you and not be able to turn it back on. Also it requires a lot of commanding from the ground on it almost at a continuous basis -

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HUTCHINSON - from the ground on almost a continuous basis that again loads up the amount of commanding we have to do is over and above the commanding we're currently doing to manage the heater switches, which is almost every site. The other alternative that was discussed is called, aptly, shorting the heater. Basically what that means is - is putting a wire fix in. We do have a cable on board that we could use to short the heater. It requires an EVA to do it. It would short the heater on so the bearing heaters would be continuously. I don't think anybody is considering that one very seriously either with only 17 days to go on the mission. It doesn't make a lot of sense to do an EVA to - just to get the heaters on permanently when we're not even sure that will help the situation significantly, or at all for that matter. I think we've kind of adopted a kind of a wait and see attitude. We - we have - we did cancel an EREP today. I think we'll be more hesitant to cancel it tomorrow unless we're in a - if we're still in this continuous distress situation, which I don't really expect to be, but if we were I think we'd have ourselves a pretty good caucus in the morning before we cancelled another EREP. Just to make absolutely certain that that's the approach we want to take here as apposed to pressing on. Now today when we did the second EREP, the CMG did come out of distress in the middle of the day, after we sort of babied it all morning by not doing any maneuvers other than the dump maneuvers. And by the way the characteristic of it this morning and during the late evening and early morning and most of the morning was the distress would start to disappear as the vehicle went around the rev. And then when we did a dump maneuver at night the - that would bring on the distress, and the distress would exist for about an hour and an hour and a half, and it would never really go away. But it would appear like it was starting to shape up. And just about the time you thought you were about to get a handle on it, we'd go through another momentum dump and it would flare up again. Tomorrow - this afternoon when we got to the second EREP maneuver, we were in fairly good shape. The CMG had quieted down and we were not in a distress situation, so we went ahead with the EREP maneuver. Immediately upon initiating the maneuver, the CMG began to show signs of distress. The bearings heated up, and within about 3 or 4 minutes after we started the maneuver, the currents were up and the speed was down and the bearing temps were converging. Which as we have told you numerous times the onset of this thing is caused by rapid motion of the gimbals and side loading on the bearings, and that appears to bring on the distress signs. So tomorrow I guess we will be thinking

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through the night here and into the morning early about how we're going to go about the EREP's tomorrow. We do have - as far as tomorrow's flight plan goes, there are two EREPs scheduled, track 14 and I'm sorry I didn't bring with me a listing of what the data tapes are. But we've got track 14 and are early morning EREP which I suspect is a geothermal run. And we've got track 19 late in the afternoon, or in the middle of the day I'd guess you'd say. So we do have two EREPs planned for tomorrow. And we fully intend to execute them as long as the CMG has not gotten any worse. Again - again tomorrow we're going to bed early. We go to bed at 01:00 tomorrow. And we'll be getting up early for another early - morning EREP on day 70. However, we do get 8 hours sleep tomorrow because we went to bed early tonight. And we are terminating the day early tomorrow again. The only other systems problems we had today wasn't - is not a new problem it's the old brand, the six cycle tone. And we decided the way we are going to play that one is the crew has the ability to cut the tone off. And it is on in the vehicle all the time. They have the ability to cut it off whenever they so choose by pulling a circuit breaker, and we have verified we could pull that breaker anytime we want. The only problem is after we pull the breaker they can not do any recording on board, because that breaker power is there the only ability they have to use the tape recorders. So they're running most of the time with the - with the breaker - with the breaker pulled.

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BUTCHINGON - with the breaker - with the breaker pulled - correction, they're running most of the time with the breaker in and I believe they're going to pull it to sleep at night. That doesn't effect our ability to manipulate the tape recorders. Couple of science items for today. We're having an exceptional time with the Sun. Let's see, since I've talked to you late last night before they went to bed the SPT got a Charlie 9 flare. This morning he got a class C3 and the CDR today also got a class C3. And we've been looking at active region 31 and active region 33, those last two were both out of 31, I believe. And the Sun seems to be cooperating extremely well. It's interesting to note that we got the - the last C3 this morning by flying the Alternate Flight Plan. That is we got it during the time we normally would have flying EREP pass and when we cancelled the EREP, of course we have Alternate Flight Plans onboard for just that case. The Alternate Flight Plan involved operating the ATM for an extra pass and we caught a flare. So we certainly made productive work out of the cancellation of the EREP today. And the Sun continues to act up. As a matter of fact just before I was getting off the CDR was talking about the fact that he was having high X-ray activity out of active region 31 again, so I wouldn't be surprised if we get another couple today, later on today. One new thing we did on EREP this afternoon, which we've been thinking about doing for quite awhile and finally decided to try, and I haven't got the results yet of how it worked out, but we assume it worked well, had to do with operating the ETC which you know is the - the 190B the Earth terrain camera that sets in the - in - in the OWS in the antisolar SAL during EREP pass and it's operated by one - one man. We decided to let him within the guidelines of the pads we sent to let him decide when to turn - we gave him the times to turn the camera on and off and each time he makes a GO, NO/GO as to whether he feels the - the weather is appropriate for him to be able to take data. Of course that's a visible camera and with cloud cover it, unless you're shooting clouds for a particular reason, cloud cover pretty much obscures the data and provides you with no data. So we've modified our camera operating plans to take advantage of the man being on the scene. And he just looks out the window in the wardroom and then runs up and depending on what he sees decides whether he's going to operate the camera through the various segments of the pass as called out. And we're kind of curious to find out how that worked out. That was really done at the SPT's suggestion, he decided that he could - he could adequately look out the window on numerous occasions as he went through the pass and

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decide how the weather was going and decide whether he ought to shoot or not. And so we took advantage of that today. One little problem we had here in the Control Center right when we were getting ready for handover, we had a major power interruption all over the center here. We do have auxiliary power in the Control Center. However the power interruption did glitch some of our systems and we lost all our displays and lost the computing system downstairs, however it's all back up on the air and running now and everything seems to be going smoothly. The Flight Plan for tomorrow, I've all ready talked about, has two EREPs, S073, a couple of them, major medical on the commander tomorrow, and going to bed early in preparation for getting up early once again day 70 for another early morning EREP. And I think that's about all.

PAO Thank you Neil. That's concludes the
Ct e-of-Shift briefing.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Press Briefing
Johnson Space Center
January 22, 1974
3:30 pm CDT

Participants:

William C. Schneider, Skylab Program Director
Bill O'Donnell, PAO

SL-IV PC108A/1
Time: 15:30 CDT
1/22/74

PAO Okay, we have with us here again Mr. William C. Schneider, Skylab Program Director. Bill?

SCHNEIDER Okay, you have been following the mission and I'm sure you're aware that the control moment gyros have been acting up a little more frequently than they had in the previous week. And we've been watching the - the little hiccups come about from - about once every third day to about once a day, until finally in the last couple days, we've been getting several a day. Then today, the CMG acted up and held itself in the distress position for something on the order of 6 hours. As a result of this, we have ordered the recovery force back into port in San Diego 3 days early, I believe it is - yeah, about 3 days early. This is to give ourselves a little more flexibility to insure ourselves that we're not constrained by the availability of the recovery ship in the event that something further happens. Do not construe that as meaning that we're coming down early, we - we just making sure we have not blocked ourselves out of the opportunity to come down early. So the ship - the task force has been notified, I'm not sure whether the ship has heard yet, but they will, I'm sure, shortly. And they would be expected in San Diego tomorrow afternoon, I guess, and would be expected that they would sail for the recovery area B about the 26th. And the net effect of that is that we do not have recovery on the 20 - today and tomorrow - until the 27th really, which is no big sweat. We had planned on having a - a period when we would not have ships in the recovery area anyway. We just moved that period closer to today. That's all I wanted to say. I wanted to reassure everybody that we were not planning on an early - an early recovery, we're just making sure we have that capability, if something further happens.

PAO Questions? Tom?

QUERY Have you been able to determine what is - is caused the more severe distress and more constant distress on the CMG number 2?

SCHNEIDER No, we have no firm idea as to what has caused the distress at all. It looks as if it probably has something to do with the lubrication system, and it might have a secondary effect - have to do with the stability of the retainer ring in the ball bearings. But to say anything more than those are two probable causes, that's all we can say. We haven't - we haven't duplicated anything like this on the ground. As you may know, our control moment gyros in one g have gone for years and years and years. We've never had any problem with them.

PAO Howard?

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QUERY Phil, last time we talked to you, you were talking in terms to say, that if it went out, you might have to come home as early as 5 or 6 days. Now what's - what's the latest? We've heard several different versions, now 10 days now 22 days, what is the right thing now?

SCHNEIDER Well, let me - let me go through in a little detail for you, so you can understand our uncertainty. There are two attitude control systems - if the CMGs went out, we would have two attitude control systems left. The TACS system, which is on the workshop, and the command module RCS system. These systems can operate in a variety of what we call deadbands, which of course, is the degree with which to try to keep the system lined up with - with a given point. And most of them have a wide deadband and a narrow deadband. If CMG - if a CMG went out, we would shift immediately to TACS control. TACS control, as it would - as it - as it would occur, uses about 700 pound-seconds per revolution. We would shift as soon as we could then to RCS wide-band control. We think - we think in wide-band control, we'd have about 8 days of attitude control capability with the RCS before we got down to any redlines.

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SCHNEIDER - - about 8 days of attitude control capability with the RCS before we get down to any red lines.
SCHNEIDER We would use that - we would use the sum time on RCS control to examine the CMG's to see if there is any - see if we're real sure that there is a problem and there's nothing we can do to fix it. Assuming we conclude that, we would power down the last CMG, the operable CMG, and we would insert into the command module RCS system what's called the quasi inertial deadband. Now we've never done this before, we've never used this. We think our calculations say that it might last as long as 15 - 17 days, on that order. But we do not know, we just plain don't know how much that would give us. So if we stand on RCS, we have as a narrow band about 4 days, a wide band about 8 days, and, if this quasi inertial works, about 15 days. In the meantime we would be patching into the other control system, the TACS system, which is controlled by the ATM visual control, another quasi inertial mode. Now we've never operated on this before, either. So we really don't know how long that would last. So the first thing we would do as soon as we got in there - got that into the system would be to turn that on and see what our TACS usage was. We then have TACS usage in a TACS mode and we would have RCS propellant usage in the RCS mode. And we would at that time decide, you know, how long we could stay. And we would decide what we had to do, what we wanted to do, with that propellant that we had on board. We think - we think we would do an EVA, reasonably quickly. And we would then make a decision as to what - how long we were going to stay up there, what we were going to do. You can maneuver in these modes. Basically, a maneuver takes about a day, a day's worth of RCS. So you can elect to trade off some maneuvers versus time in orbit. So that's where the uncertainty comes in. We say a minimum of 5 days, just to say, well, okay, we probably wouldn't come in in any rush. We'd go to a good recovery zone, and we'd probably do an EVA. So that's like 5 days, where we could go the whole 84 if things were, if the gods smiled on us a little. Did that explain that, Howard?

PAC Abby.
QUERY One think I did not understand -
number of days from the RCS. Did - do you have 4 days in the narrow band, plus 8 days, no -
SCHNEIDER Either/or -
QUERY Either/or.
SCHNEIDER If there - being one or the other with a given amount of propellant on board -
QUERY Oh, yes, I see -

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SCHNEIDER - - and depending upon which mode you are running. Again, these are calculations and not actuals.
QUERY That's in addition to the 15 days, perhaps, of your quasi inertial?

SCHNEIDER Yeah.

QUERY You don't know if it's 8 plus 15 or 4 plus 15 or if the 15 is going to hold?

SCHNEIDER I'm not sure what we get out of the TACS and the quasi inertial these days. I think 15 is overly generous. We used up a lot in those last two EVA's. I would suspect it's probably - our estimate is probably - I think we said 100 pounds per revolution is our best guess and that's - that's my recollection and I have to look that up. And we have - we have 16 - we have about a thousand - 10,000 pounds that we could use today. We use about a hundred pounds per rev, I think. I think that's what the (garble). I'll get you that number.

QUERY How many days (garble) be on TACS then?

SCHNEIDER 1600 - about something on the order of 8, I think. I'd have to calculate it out for you. A thousand pounds - 10,000 pounds, 100 pounds per rev, 16 revs per day. That's 100 revs and 16 a day, okay.

QUERY What do you give as far as the chances for this gyroscope holding out for the rest of the mission, given this performance today?

SCHNEIDER The best I can tell from the experts - we may have reached a new plateau in gyro performance and then again we may not have. I'm afraid we're in the dark. You can get an estimate, you know, that it'll last a long time or you can get an estimate that says hey it might go out real -

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SCHNEIDER You can get an estimate - oh, that - it will last a long time or you can get an estimate that says, hey, it might go out real quickly. I guess I feel that we should be prepared for it to go out at any time, and we're hopeful that it won't go out at all.

QUERY What does your gut feeling say about it, just personally? Do you give it 90 percent chance of going out in the next couple of days?

SCHNEIDER Before or after I take the Rolaid? I - I - I have no gut feeling on it at all. I'm just watching it from day to day. I have a - I'll say a good feeling that we're going to go the 84 days.

QUERY Let's go back to this recovery force shift. Would the first time that you could recover be on the 27th. Is that what you were saying?

SCHNEIDER Yes, yes.

QUERY Will then the next time be 5 days later?

SCHNEIDER No - no we have a recovery every day. We have a recovery every day you know - we have recoveries on every day.

SCHNEIDER What this does - if you recall, we would like to recover close to San Diego for medical reasons. And that track is on the 29th - goes over - goes over that recovery zone on the 29th, the 3rd and the 8th. With our previous plan, why we would not have been able to support the 29th. With this plan we can support the 29th as a good recovery zone, and that's the primary reason for doing it. We just felt that we had everything to gain and nothing to lose by - by making this shift.

QUERY Are all the recovery zones - will be off San Diego, or do you go back to that Hawaii net out there for - -

SCHNEIDER - No.

QUERY - - rescue?

SCHNEIDER No, we have 5 separate tracks that - I guess the furthest west track is about I'd say about two-fifths the way to Hawaii. And, you know, a ship keeps moving to the days - the primary recovery zone each day.

QUERY No matter what day it is, the New Orleans will still be primary recovery ship?

SCHNEIDER Yes, yes -

QUERY Starting with the 26th.

SCHNEIDER We have no other ship.

QUERY Could - could you address yourself as to the philosophy on your priorities. I mean - is staying up and completing the 84 days - have a very high priority

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or - obviously doing a space walk would have a priority so you can recovery all the - the data. But - can you kind of fill us in on - on these priorities verses - acquiring additional data?

SCHNEIDER The top priority of Skylab always has been and always will be the gathering in of scientific data. Now the medical data we also classify as scientific data. I'm not trying to set any records. We've already set records. So we would not - you know that's - it's - setting the record is not - is not a fact of what we - What we will do is we'll continue to look at the various tradeoffs with the various sciences. And we have earth resources, we have the solar science, we have the comet science, we have the corollary science, and we have the medical science. And we'll try and factor them all in, one on top of the other. If the CMG fails we probably won't get any more EREP. So you end up saying that if the CMG fails, you will not probably maneuver for any EREP. You might conceivably do one, but certainly not much more than that. The ATM is kind of out of business because in either the quasi-inertial modes why you're oscillating back and forth and therefore you can't look at fine points on the Sun. So you're left then with medical and corollary experiments as what you would do.

QUERY On the - something that was said this afternoon when they went ahead with the EREP. That there is apparently less apprehension now about doing a maneuver for an EREP even with the - even with the stress that the CMG has been showing. Does this mean that you will go ahead and - and do as many EREP's as normal?

SPEAKER I can't answer that until we look at the data that they get out of it today. The Marshall people are looking at that data, and we hope we will come up with some better definition. Right now, I presume our ground rules are going to be the same. Until I hear differently, why they will be that we will continue the maneuvers unless that -

END OF TAPE

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SCHNEIDER I presume our ground rules are going to be the same. Until I hear differently they will be that we will continue the maneuvers unless the gyros are in a distress state at which time we'll inhibit the maneuvers. That might change in tomorrow's flight management team meeting.

PAO Debbie.

QUERY How long do these distress signals usually last, in other words when they're not so - 10 minutes an hour?

SCHNEIDER Up until today they have been lasting you know like a rev, a couple of hours something like that. This one lasted 6 hours, and that's a long time.

QUERY Was this one signal or was it two signals together this morning?

SCHNEIDER The CMGs had two - had two period of distress today. The first one lasted about 6 hours and then another one started about noon - about 1:00 o'clock and is still in progress, or it was the last - last I heard.

PAO Howard.

QUERY What happens if say the gyro goes out when you're not near a station and the astronauts are sound asleep do the TACS automatically take over?

SCHNEIDER Yes, automatic TACS control. We are assuming that we would be in at least 1 rev of TACS only control.

PAO Bill, I have a question phoned in here. Do you contemplate restart procedures on CMG number 1 that is already out and restart on number 2 if it goes out?

SCHNEIDER I said one of the things we will do will be look at the CMG - CMG history to see what we should do. We are planning on - or - yeah - we are planning on trying to start CMG number 1 after the mission is over. And I guess that's one of the things that I'm sure we'll debate if - if another one goes out. Whether or not it's worthwhile to try it out or whether or not there's a hazard involved.

PAO Howard.

QUERY At what - under what ground rules would you suddenly just turn off CMG number 2 or will you - or will you just let it die?

SCHNEIDER As long as it's operating why - we may do something - turn it off and on, there's some technical debate going on as to whether or not we should reduce the wheel speed which involves turning the wheel off and turning it on and - Somebody shooting at me? There's is some - some technical opinion that says that might be beneficial to do. And that too is one of the things that's under debate today.

QUERY You said you - you - talking about an EVA, fairly quickly. If it - the CMG were to go, how quickly, 24 hours or 48 hours?

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SCHNEIDER No, I reserve judgement on that to see what really happens and what posture we're in and when it happens. We want to get that EVA - ATM film back. You can not - if you go into quas - the quasse inertial mode you can't get any more ATM data. So whether or not we did it in 2 days or 3 days or 4 days, I think we'd look at what - what other things we had to do and make that decision. I'd guess like in, you know 2 or 3 days but that's no - that's not a firm decision as yet.

PAO Paul.

QUERY Have you accelerated preparation in any form of the rescue rocket at the Cape?

SCHNEIDER Not in the least.

QUERY If they perform - the the CMG goes out totally, and they perform a EVA, what will be the stablizing thruster, the TACS or the RCS?

SCHNEIDER We'll probably use the RCS during EVA.

PAO Howard.

QUERY Bill, you mentioned the command module RCS and the document we had said the service module RCS would be used, do you know which is -

SCHNEIDER I'm sorry, I meant service module, you're absolutely correct.

QUERY Okay.

PAO There any more questions? Thank you very much Bill.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 21, 1974
5:41 pm CDT

Participants:

Neil B. Hutchinson, Flight Director
Dennis Williams, PAO

SL-IV PC107A/1
TIME: 17:41 CDT
1/21/74

PAO We're prepared now for the change-of-shift briefing with Flight Director Neil Hutchinson who's now coming off duty and he'll give you a brief status report. This is the change-of-shift briefing with Neil Hutchinson.

HUTCHINSON Okay, we had a fairly quiet day today at least as far as CMGs go. Let's see, since we had a - since we've talked to you folks last, we have had two glitches on CMG 2. Both of them occurred early in day 21. One of them at right after midnight Zulu at 00:25 and another one about 1 hour later, at 08:55. Both of them were characteristic normal glitches, if there is such a thing, with bearing tempo coming up equal, wheel speed dropping 40 to 50 R.P.M. and phase A, B and C currents going up to about 1.04 or so. We have had no occurrences of any anomalous operation on CMG 2 since 08:55 this morning which is about oh, 14 hours ago roughly. So all during my shift today, in the activities we carried on today, there were no glitches in CMG 2. The, let's see, we've got two or three other systems things that want on today. One is a - as you know the crew is - has been plagued with this 6-cycle per second or 6-hertz tone on the - on the channel B recording that we do in the vehicle. And we have investigated several things in connection with that and we think we know where the problem is and we have a couple of alternatives on how to fix it. One involves stopping the use of channel B for the rest of the flight, which would mean we would have to do our recording and our air-to-ground on channel A which obviously means that anytime we're over site, the crew can't be putting anything on the recorder. That's kind of an inconvenient way to operate. There is another fix that involves installation of a jumper cables which we flew up to wire around a failure that we already had in part of the audio gear that's caused us to have to go to recording on channel B and downlink on channel A. The problem with this is after we install the jumper cables we lose our ability to - to designate which recorders is used for which function on the ground, which is one of the little tricks of the trade we use to manage the tape recorders by a command from the ground. We have one more troubleshooting procedure we're going to do on this 6 hush tone and we're going to do it tonight. And that is to unpower the system that's - we think the tone is coming from for the entire sleep period tonight and bring it back on in the morning and see if that doesn't get the - rid of the tone. Now we have experienced this tone once before early in SL-III, not SL-IV now, SL-III, the last manned mission and we were able to get rid of it by unpowering the system and powering it back up again and nobody is quite

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sure where - the exact nature of the thing but we're going to try it again - try this thing tonight and see if we can't get rid of it. If we can't, tomorrow we will probably pick one or the other of the solutions since the thing is obviously bothering the crew. Today we changed out one of the airlock module recorders, tape recorder number 3 or recorder number 3 and we changed it out, not because it failed but because it had a lot of hours on it and we had a brand new one up there that hadn't been used yet and we didn't want to take any chances of having to repeat a medical run here late in the mission because we had a recorder that wasn't working right. So just maximize our recording between now and the end of the mission and the small amount of testing we're going to be doing post flight, we chose to change out the recorder today. We had a malfunction in an experiment today. Our old friend S183 which seems to give us troubles quite often, got us again today. Prior to the first pass this morning, the CDR was setting up the experiment and had loaded the DAC camera on there and the DAC camera receives it's electrical power and it's turn-on signal from synchronous from 183; in fact, the DAC camera power cable just plugs into the 183 instrument -

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NUTCHINSON - - camera receives - or - and is
turn on signal from - synchronous from the 183. In fact, the
DAC camera power cable just plugs into the 183 instrument. We
aren't sure yet, still, what happened. We have a trouble-
shooting procedure we're going to work on tomorrow, but
basically the DAC camera jammed, and in the process of jamming,
apparently, it appears to have overloaded the S183 instrument
from a power standpoint and to have blown a fuse inside the
instrument which could well have - have ruined the instrument
for the rest of the mission. However, we do have a couple
of troubleshooting procedures we're going to try to see if
it's maybe not the fuse, and maybe some diodes in an electrical
circuit in S183, but for today, we were unable to get
183 running. We had to cancel both 183 operations out of
the Flight Plan. The one this morning, since the malfunction
occurred so close to the data take, we were unable to fit
anything else in the Flight Plan. We had another 183 in the
Flight Plan for tonight, and we have - these are UV starfield
observations - we have pulled that one out and substituted
an S073 for it. We were also able to fill in the S073 to-
morrow. And so I think we recovered some of the time that
we lost by substituting another instrument in there - and
tomorrow or the next day we'll be troubleshooting 183 to see
if we can regain the use of that instrument. As far as the DAC
goes, it malfunctioned. It was 140-foot magazine of UV film.
It was the only magazine we have left of good UV film, and
if we can't get that running, of course, we can run 183
without the data acquisition camera. You don't have to use that.
It has its own film supply in a carousel or cassette type
of operation in addition to the DAC camera, so you can run
without the camera, if we can't get the magazine unjammed.
And that is a separate troubleshooting procedure that's
going to be gone into tomorrow. Let's see. Panel 191
relief valve. We discovered today that we had a relief
valve open that we didn't think was open. And you may have
been hearing some conversation on the air-ground about the
last couple of days we've had some minor troubles with
momentum and the fact that over the weekend, it didn't behave
quite the way we expected it to. We also have had some
corona or arcing what we believe to be corona or arcing in
one of the airlock module transmitters. Transmitter B, which
has caused it to kick offline several times on various occasions
over the last few days. The relief valve that was open was
the cabin relief valve that relieves overboard at about
5-1/2 PSIA cabin pressure. These relief valves are deliberately
closed. There's three of them. One in the aft compartment,
the lock compartment and the forward compartment in the airlock
module. They're deliberately closed prior to the M509 runs since

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we, in the process of running M509, particularly when we run M509, you recall is the maneuvering unit, which we've run twice in the last few days. When we MS - When we run an M509 run, we close these relief valves because M509 does two things to jack up the cabin pressure. If it's a suited run, it dumps oxygen into the atmosphere from the suit - from the purge flow through the suit. If it's an unsuited run - whether it's suited or unsuited, it dumps nitrogen into the atmosphere because that's what M509 uses to control its attitude, when it's using its little jet control system. So, we expected, of course, the cabin atmosphere to get up above relief pressure and that's why we closed the valves. Apparently the crew missed one. When we closed them back along about day 63, I believe, and therefore we've had some occasional relieving overboard and we think this might account for some of our slightly off-nominal momentum and this arcing that we saw in the airlock module transmitters. Transmitter. Transmitter B. We've closed the valve this afternoon. Tomorrow's Flight Plan is a toughie. That's one of the reasons I'm late tonight. We've got two EREP passes, really three EREP passes tomorrow. One of them is the front end of one track and the back end of another track all done in one single Z-LV pass. It's a fairly long pass. One's in the morning and one's in the afternoon. The two passes are let's see, track - -

END OF TAPE

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NUTCHINSON - one's in the morning and one's in the afternoon. The two passes are c track. The first - the first pass is - we're calling it track 2 and track 3. The track 2 portion comes up across the U.S. north of point Hague, California and goes over and into Nevada and Wyoming and ends up over New Foundland - New Foundland after crossing the Gulf of Saint Lawrence. The western portion of the pass is going to get us some thermal stuff, predawn. It'll, of course, be before the Sun comes up along the west coast and it goes right across the San Andreas fault. We're also going to get some geo - predawn geothermal data on Hot Springs - on a hot - on the Hot Springs area up in Wyoming. And the second segment of this pass, the so called backend of it, is a foreign pass; it's over Africa. It's track 3 and it comes down across the Sahara and the drought region in Niger. The second or third, if you want to look at it that way, EREP of the day is track 5 and it comes down. Its descending track comes down across Vancouver Island up across in the north western U.S. and it - all the way across the U.S. and leaves the mainland down across the Cape, and this is the one we've been having some trouble with trying to plan this afternoon, and the fact that we had to cut some of it - some of the - the tail end of it off, the part that goes into Brazil and South America. And this is a pretty - going to be a pretty normal pass. We're going to be getting data just about all the way across that ground track for the standard EREP purposes. I don't think I need to say anything more. There's nothing really unique about that - about that pass except it's a very good one. Otherwise, the Flight Plan for tomorrow is fairly normal. Three EREO passes, if you will or two and a half. We've got a M092 scheduled on the SPT and a lot of ATM time. One thing that is different about the flight plan tomorrow, and I guess I ought to say something about the flight plan for the next ensuing days - for the next two days, mission day 69 and mission day 70, which are days - lets see, today is 67:21, so that's 23 and 24, day of the year 23 and 24. The crew will be getting up early both mornings to do early morning EREPs. And so this flight plan that we're discussing right here which is tomorrow, they'll be going to bed an hour early, and we'll run a sleep cycle where we short them an hour. They'll only get 7 hours of sleep tomorrow night, then the next night they'll get their normal 8 and then they get an extra hour the day after that. So we'll be getting up early both tomorrow morning - not tomorrow morning - morning after tomorrow morning, we're going to go to bed early and get up early, an hour early, for an early morning EREP and that first one - let we see here, I got a piece of

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paper - that first early morning EREP is track 14 and it's geothermal again, and it's volcano in Guatemala are the big objective on that one. The second early get up is on track - is track 29, and it again is geothermal innature, and it's acid drainage fields from strip mines in West Virginia. Both of those are a couple of super hot objectives we want to get - geothermal objectives that we want to get early in the morning before the Sun comes up and so that's the reason for the early get up for two days in a row here. I don't believe I have anything else as far as status, and let me read off some questions that folks have written down here. Question 1. How do you explain the lower frequency of CMG glitches today after the large number over the weekend? Well, if I knew how to explain it I'd probably be the sooth of the century. I'm not sure that you could characterize this as a lower number. Just to go back and recap on mission day 19 which was Saturday, we had three on Sunday we had three - I guess you can explain it as lower - and today or day 21 we had two, and we haven't had one for 14 hours.

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HUTCHINSON - - and we had three, I guess you can't explain it as lower, and today or Day 21, we had 2. And we haven't had one for 14 hours. Since we've been doing dumps just as normal and we had an EREP today which, by the way, I forgot to mention went very, very well, I don't know whether you saw any television from it but it was really spectacular. We had a TV out the window for the entire pass. Out the wardroom window and it was really - after the whether cleared up over across southeast of the United States, it was fairly spectacular. We - we've been doing everything just exactly the same and the CMG has not decided it wants to cough today. So I don't have any explanation for it at all. In work, we have not done anything different. We're continuing to manage the heaters to keep them up to as warm as we can. Question 2, view due of recent CMG behavior, what are expectations for it's survival to the end of the Mission? Probably - I'll probably get asked that question every day from now on and every day the answer is just the same. We have every hope that it's going to make it to the end of the mission and no particular reason to believe it won't. I guess it makes me feel uncomfortable when I see a glitching three and four and five times or three times in a today I guess is the most we've seen. You know it was glitching fairly regularly around the turn of the year over the second, third and fourth of January and then it didn't - it stayed clean for 7 days in a row without a single even so much as a sniff and then it started again up on the 14 of January and has been acting up 14, the 17, 18, 19, 20, 21 fairly repetitiously here recently. I don't have any reason to believe that it isn't going to all of a sudden now. We haven't had one for 12 or 14 hours, it might go 7 days. I just think that the answer to this question is that we're doing all we can within reason to preserve the - to preserve the CMGS life so we'll make it the full 85 days, and of course, people have asked over and over again, how come we don't quit maneuvering and so on and so forth. It - it isn't much, you lose an incredible amount of science if you stop maneuvering plus the fact that basically the CMG is stressed harder and longer in a normal gravity gradient dump than it is on a typical one of these maneuvers. Particular these ones where we're sneaking in at noon and coming out at midnight, or coming out at noon, which is the way we've been doing most of these EREPS. Basically, I think we're doing a very judicious break between making sure that when we do do the maneuvers we're really accomplishing something and not doing any maneuvers at all which puts somewhat less strain on the CMG but certainly no - not very much since most of the strain that's put is the normal

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normal everyday orbit to orbit gravity gradient dump dumps that we have to have to keep us in the air. Next question, if CMG 2 fails, will crew - the crew come back earlier or will they complete the 84 days with reduced activities? Well that question's pretty hard to answer because it depends on when it fails and how it fails and under what - how close we are to the end of the mission and so on and so forth. Right now we have roughly 9 days worth of attitude hold capability with the TACS and we have certainly that and more with the CSM. However, I think at the time we would have to see how much the CSM we're willing to delve into and how close we're willing to run the TACS down to using the full capability. I think it's comfortable to say that we certainly have 10 days or so before we'd be - after the failure, before we'd be thinking about coming home. And the reduced activities, of course, goes without saying since the attitude hold capability isn't particular good with - as far as accurate. It is certainly adequate as far as electrical power is on as far as accurately pointing at the Sun or anything, it's not very good. Last question is what's on tomorrow's Flight Plan? I think I've already talked about what's on tomorrow's Flight Plan so I don't think - I think we've answered that one.

PAO Thank you, Neil. That concludes the change-of-shift briefing for Mission Control. This is Skylab Control at 17 minutes before our next acquisition.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV Change of Shift Briefing
Johnson Space Center
January 20, 1974
4:30 pm CDT

Participants:

Milton Windler, Flight Director
Gatha Cottee, PAO

SL-IV PC-106A/1
Time: 16:26 CDT
1/20/74

PAO - - shift briefing with Milt Windler.
We're in a little locker room here. Milt, you want to give us a rundown?

WINDLER Well, we gave them a good fight today. The - I guess it was a semi-normal day, you might say. The big thing is we did the EREP pass. And I guess people are interested in the results of that. And basically, it was across the northern United States where we were primarily looking for snow cover and - on the ground - which, of course is hard to come by in the winter time without clouds and we were looking through the holes, which we did. At one point about over the north central United States, I guess, in the way to say it. Somewhere up after going over Minneapolis, the pilot was supposed to turn off the 190A - I mean off the 192, rather, and he turned the 190A off instead, by mistake and just a thing similar you might say, to - when you want to turn your automobile heater on and you turn the defroster instead because of the proximity of the buttons, and he didn't even realize he had done this until later on when he went to turn the 190A off and it was already off and then he realized that he had - that there had been some mistake made, but he wasn't sure what it was because he knew he had turned it on earlier. Anyway, that resulted in us getting some extra 192 data, part of which I'm sure we can use. It was over the - an area of some clouds. It was over an area that - where the mountains were exposed above the clouds apparently in the Appalachians and it did show us the Cape Hatteras area, part of which was clear. And we lost some of the data in the vicinity of Minneapolis and part of the - that we would have gotten early in the pass, I'm sorry, early in the east coast part of it. Now, later on he turned the 190A on, at another point in the Flight Plan where it was supposed to be in that same pass. The CMGs are getting kind of exciting. We're up now to two or three a day. One's going on right now, in fact. I believe that's five in 2 days now, depending on how you count your days. A little over a day ago there was a minor one and then there were two that - later on that day, and there was one last night and one now. So, they're getting more frequent. And we still don't know a lot more about them than we did before, other than this relationship - potential relationship with the peaks in the beta angle which make the dump maneuvers come out a little bit different, make them a little bit larger angles. Yesterday, we had problems with the purge vent, and we wound up having high dump angles all day long, and that may or may not have had something to do with the fact that we've had several of these in one day. By high

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dump angles I mean, maybe, 10- 15- 20-degree maneuvers where you normally get a 3- or 4-degree dump maneuver, so it's - there's a lot we don't understand about 2MG - CMG operation. There's also things we don't understand about operating at the real high beta angles, which is - both of which are happening to us right now. Right now they're doing the M509. Should be pretty straightforward. The - Tomorrow's Flight Plan includes a kind of an elaborate set of EREF choices. There is one pass that goes - starts roughly over the central part of Africa, gets Chad and a set of mountains over there that I - Tibesti or something like that. It comes in on across - we turn the instruments off after passing over Africa and then it comes across the United States roughly around the San Francisco area, goes up in the hot areas around Yellowstone, more or less, those, you know, warm, geothermal areas, and then crosses the St. Lawrence Seaway. And it gets us some of the task sites that we have no data on yet. And then the other pass comes through the - -

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WINDLER - - was in a warm geothermal areas and then it crosses the Saint Lawrence seaway and it gets us some pass sites that we had no data on yet. And then the other pass comes through the Mississippi area later on in the day. And we'll be looking at that and see if we can do all that with the weather and of course a knowledge of the weather in Africa's not real good. And that's about - other than that, the 's medical runs and things like that tomorrow.

PAO Okay, ready for questions?

QUERY The problem with the CMG number 2 is ' having no influence on your planning as many EREPs as you can get?

WINDLER No, it has not had any effect on it. But I don't know how to answer your question. The answer is, yes, it's having no effect.

QUERY And you don't foresee it having effects?
Do you foresee - not going on -

WINDLER Not until we can relate it to something that we're doing because we didn't even do an EREP yesterday as you'll recall and we - we still had the activity. So if we're going to have it, you know, during normal dumps, you know we might as well have it while we're taking data, is about the way I look at it. Certainly, we have no indication now, you know, that not doing the EREP maneuvers. I think I have already pointed out to you that the rates involved in establishing, because the EREPs, we either go into them at noon, which means we're already in the attitude and we have to just set up an Earth orbit rate, or we take a long time to get into the right attitude. And both of those things result in the rates - the maneuver rates being low. And they're below what we have in a dump, which we have virtually no control over. So that is the dump, you know. In fact, it's hard for us right now to even tell with the high betas what the dump angle is going to be before it occurs, since the computer takes all this and runs it through a real complicated set of equations that we have trouble duplicating. We - we can, if given enough time and the exact initial input, of course. But we don't have the time to do that in real time, and they never are quite what we expect them to be. So that's the reason why the EREPs are not necessarily - they sound bad because they are large angles but the rates are slow. So they're not as a big an influence on them as perhaps you might think at first.

PAO Paul.

QUERY In view of the fact that you're having these frequent normal anom - abnormalities I'm wondering, is this change the basic philosophy toward the survival of this CMG for the balance of the mission over there in Mission Control? Are there any attitude changes toward this instrument?

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WINDLER No, I don't think so. I can't - there's no change in the operating philosophy as I've just indicated. Now, the concern that individuals have for it is hard for me personally to say for anybody besides myself. I still think that we're doing all we can do and if it breaks, it's going to break. We can't do much about it. If it's not going to break, we will have gotten some good data and so we're pressing on.

QUERY Well, because of these frequent seizures it's now having, you think the patient is getting in worse and worse condition or does this change your idea about that in the least?

WINDLER Well, I - I guess the way to answer that is obviously I would like it better if it didn't happen so often. You got to think that - that something is going on there that's causing these things to happen more frequently. And certainly it's - the potential for failure must be - the probability, I guess is the way to say, must be somewhat higher than when it's not doing these things.

QUERY That something's that's going on, do you think that it's getting in worse and worse shape; it's degrading?

WINDLER I don't - the easy thing to say would be to say yes, but I don't really know that that's the case. I don't know - we don't know whether something is changing or whether the conditions that it's - that it's undergoing, as I mentioned, the dump angles are different because of the high betas and also we had this stress yesterday due to the vent, so the initial conditions maybe the thing that's changing. The mechanics of the CMG may not have changed at all. I just don't - we just don't know that. That's not a very clear explanation.

QUERY Well c - did CMG 1 go through this much activity before it failed?

WINDLER No, it did not, as best as we can tell. Now, we're looking at this one certainly closer than we did the other one.

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Time: 16:26 CDT
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WINDLER - - doesn't - we just don't know that.
But seeing is not a very clear explanation, but -
QUERY Did CMG 1 go through this much - -
WINDLER No, it did not.
QUERY - - activity before it failed?
WINDLER No, it just, as best we could tell, now
we're looking at this one certainly closer than we did the
other one, and we're still talking about relatively - compared
to where it - we think it might fail or cause us serious prob-
lems, that we would want to take action. We're still talking
about a level of activity that's less than that. We're talking
about current, for example, of 104 instead of as compared to
107 and a nominal of maybe 101 or something like that. So
we're down in the - in the low currents and small rpm changes
and relatively small temperature changes.
QUERY Okay, well, if the - the CMG fails totally,
completely and without reprieve, at this point in time, less
than 3 weeks before the mission is over, could we comfortably
complete 84 days in space - I realize you'd lose some science,
but at this point in time, do you believe we could comfortably
complete those 84 days?
WINDLER The word comfortable - comfortably bothers
me. I don't know how comforting it would be, but I think we
could, yes, we could design procedures that would allow us to
get to the 84 days from where we are now, in the consumables
we have.
QUERY But would you expect this would be the
route to take, or in order to get to examine - -
WINDLER Yes, we'd have to look at all of that
and - and see how much margin we had, but yes, I'd think
there'd be certainly merit. We're already there now and as
long as the CSM is okay, we can certainly get a lot of benefit
from the medical observations plus some limited amount of
other science that we can do.
QUERY Okay. Now, in view of that fact that you
would in fact be able probably to complete the 84 days, is
has this lowered the concern toward the apparently degrading
health of the CMG 2? You see my point?
WINDLER No I guess I really don't.
QUERY Well the CMG 2 -
WINDLER It doesn't change my - I've already told
you, it's just like anything else, I get into my car and I
run down the freeway and I try to have good tires and good
steering and I figure I'm doing the best I can, if I wanted
to be absolutely safe, I would stay at home and be a
vegetable. So I - we have decided that there are certain
things you want to do and we - you know we're doing what

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we think is the best. Yesterday we looked back at some things we could have done to make that momentum better, we should have taken another sextant check. And we kept thinking it was none of the momentum. The dump scheme was going to restore its momentum state and it had never quite got there. And that was something that we could have done better that we didn't do yesterday. And in retrospect, it's more clear that we should have - we should have done that. But I guess the only thing I can say is that we're doing what we think is the American thing in trying to minimize the effect on it without going to absolute zero and we're going to press on.

QUERY This - the problems that CMG 2 have had, I want to make sure that I understand this - don't look at all like anything that CMG 1 did before it went out. It didn't show you anything before it went did it?

WINDLER No, I didn't mean to say that because some of the characteristics are, yes, are the same. This - the idea of the current increasing, the wheel speed dropping off, the temperature characteristics changing, yes, CMG number 1 did this a few times as best we can tell. Now we have not gone back and researched the whole Skylab II and Skylab III Missions for example and tried to find all these little current changes. Some of these things clearly, I'm sure would have happened and we wouldn't have paid much attention to them because they are relatively small. But now because we're conditioned to seeing it, that's an evidence that the CMG is taking a little greater strain. We're paying a lot more attention to it than we did before. And hence, we're seeing perhaps we're seeing more of them, but I think there's no question about what - they're happening much more frequently on 2 than they did on 1. One as far as we know went through probably just a few of these and failed. Now -

PAO Any more questions? Can we go back to the golf course now?

WINDLER Why not?

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 19, 1974
16:21 p.m. CDT

Participants:

Milton Windler, Flight Director
Dennis Williams, PAO

SL-IV PC105A/1
Time: 16:21 CDT
1/19/74

PAO We're ready for the change-of-shift briefing now with Milton Windler from Mission Control and we'll proceed with that change-of-shift right now. Here's Milton.

WINDLER Okay, let me go over today's flight plan activities. We got off to - what might be said as a - as a slightly bad start because when the first experiment was set up in the - in the airlock, a purge fitting was - was left connected inadvertently. And it turned out that a small amount of gas was being vented overboard from the cabin, and this very small amount though was enough to get our momentum confused, you might say. It - it - pushed the spacecraft slightly out of attitude in the Z direction, and - we wound up in having to make a continuing series of corrections in our dump maneuvers. And it's just been recently that - in the last dump maneuver that it appears that the spacecraft was - was getting back on top of its orientation. Now, earlier today, we - we did do a sextant update and we put this in at about the same time the computer was trying to solve the vent problem. So, these two things going at the same time have - have taken awhile to settle down as probably everybody knows. And because of - of the fact that the momentum was - was not in real good condition, and because the weather today - the forecast for the EREP pass and the prime sights which were in the - in the Houston area, as we all know by looking outside is not - weather's not very good. It was decided that the pass would be scrubbed. Another factor in that was the fact that the ATM PIs are working on a survey of active regions. And it would fit in very nicely to allow them another orbit to continue their - their observation, and that's what - what the SPT is doing as you perhaps heard discussed with Bill Lenoir over the air-to-ground. I would also mention that we've experienced two anomalies with the CMG and maybe even three if you count a real minor one early today or late last night. So there's perhaps some indication here that the - that those CMG stress points are coming with a greater frequency. However, it's not much we can tell about that now as you know. Tomorrow's flight plan is pretty much like the - they have been all along. We've got a major medical run as we usually do, several hours of ATM. We do have one EREP pass scheduled and I don't have any idea - that's a more northerly type pass, and I don't have yet a good feel for - for the weather on that. The - there will be a run on the M509 tomorrow afternoon. And the temperature conditions in the spacecraft we - we appear probably - maybe a day ago to have passed the peak of the temperature point. Probably 2 days ago, in fact, we probably actually experienced our - our - our

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actual peak temperature. Since - since that time, it's been a degree or so less than that. Although, it's just now starting to - the trend is dropping off. And certainly today cancelling the EREP pass would have a help on that - good effect on that. I have two or three questions here, one concerns when are we going to start doing Kohoutek sightings. The plan right now is in the order of mission day 70 and 75, and - as everything else, it would be Kohoutek requirement will be put into the science planning conference and discussed among all the other science priorities whatever's going on. The - the EREP requirements, the ATM requirements, and so forth. And from that it may or may be decided to start that Kohoutek sightings again, and of course, the inputs from the ground observing programs that are being run on the comet will have some effect, obviously. And there's a question here, why there was a gap in the observations during the past few days, and I think we said all along that we can only devote so much time to any given discipline, and it was decided in conjunction with the Kohoutek principal investigators that - that we would -

END OF TAPE

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WINDLER - - we can only devote so much time to any given discipline and it was decided in conjunction with the Kohoutek principal investigators that we would concentrate on observations at a certain time frame which were reflections of what the comet was expected to do as it approached the Sun, passed around the Sun, how the spacecraft could observe it at certain periods of time when the ground could not and some characteristics that were unique to the ATM instrument capabilities and that sort of thing. So we have been following this overall plan. We're not able to - you know to drop everything and devote our time entirely to the comet and we - because the lighting is getting better now for the Earth resources why we have to start spending time on both the ATM and the Earth resources. In the ATM area the more active region of the Sun is presently in view so we're devoting some time to that. And I think that takes care of the questions, do we have (garble)

PAO (garble)
WINDLER Okay, thank you.
PAO That concludes the change-of-shift

briefing this afternoon with Milton Windler. Charles Lewis has taken over here in Mission Control. Thank you Milton.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 18, 1974
4:31 p.m. CDT

Participants:

Milton Windler, Flight Director
Gatha Cottee, PAO

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PAO You got some question from (garble)?
None today.
PAO Okay, we'll start the change-of-shift briefing, Milt Windler. Milt you want -
WINDLER Well, today was a crew day off of course. and which means they only do 10 hours of work. And they've been running the ATM all day or Ed has mostle. And I guess you're probably aware that they had a disc transient - you got a problem here? Okay which is the first one that we've had during the Skylab Mission and in this case what the event was that a filament lifted off and in something like 4 minutes we were able to get Ed over there on it and he started taking data. Took data for really just part of one orbit which was all that was desired and the NOAA people felt like this also enhanced the possibility of a flare occurring in one of the active regions number 21 so that may occur later on today. Just completed an EREP pass which was fairly ordinary. The crew came down over the northern United States, roughly over South Dakota or Montana and on down across the southeast coast of the United States and then on close to South America and made some comments as they went along. We did do some work at trying to readjust the thermal channel in the S192 instrument and they did readjust that and it seems to be working okay and we're still expecting to get some data back. We did get data on the ground, we'll get that back in the control soon. A few hours and be able to analyze it. The temperature is somewhat lower than we had expected, it was in the - at 30 and few tenths going into the EREP pass it was expected to rise a couple of degrees but go back down shortly. And tomorrow morning we think it will only be around 81 degrees which is somewhat less than we had thought like a day ago. I predicted a day ago. So we may in fact be over the temperature peak although we hadn't really expected to be until tomorrow. And I guess it's unfortunate that Paul isn't here, he asked what we were going to do about the CMGs and I said we ran out of tricks but we think we may be on to one more trick. And that is we're going to keep the beta from getting too high. We have been looking at the occurrences and they seem to be related to the beta peaks. In fact I have a little draft here that you probably all can't read and certainly the ones listening can't but if you want to - since there's just two of y'all hardy people out here in the rain, why y'all can look at this. But if - the occurrences seem to be - if you would pass that around. They seem to be associated with the beta peaks, you'll see there the CMG number 1 failed right after a peak and the CMG 2 anomalies have

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primarily occurred centered around the two peaks that we've had and since we are now back on the upswing again and will be landing before - before we get to the next peak, why I guess that's our last - last trick that we've got going for us. We did have another CMG stress this morning. So they're continuing to occur but we'll - I guess if this is - beta effect is true and certainly that's not a - it's now a gross hypothesis I guess is the way to say it - there's no - we haven't validated that and perhaps never will but in any event we can at least have some additional optimism that since we're getting away from this peak now that the events will decrease in the rate of occurrences instead of continuing to plague us everyday.

PAO Howard.
QUERY Just, just on that subject Milt, you said you keep the beta from getting too high, how can you do that?
WINDLER Well it just - just like we make the Sun give us flare you know and things like that, you just have to have a great control over the -
QUERY You just (garble) going away?
WINDLER Yeah, that's just the way it is.
QUERY And while we're looking at this chart -
WINDLER Don't ask me to explain that because I can't. Go ahead, though.
QUERY Okay -
WINDLER You're pointing at 20 degrees there.
QUERY Where's your high beta, here or here?
WINDLER Both. Well the highest is to the right side but both of them are fairly they're - they're -
QUERY Okay.
WINDLER High negative angles down at the bottom. It's around 70 degrees, both of them are.
QUERY Okay, this one - the CMG 1 failed here
WINDLER Yes.
QUERY And then you got - it looks like 5 glitches marked here but all the way in between and including -
WINDLER That's another peak there.
QUERY Oh, that's another peak.

END OF TAPE

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QUERY One failed here.
WINDLER Yes.
QUERY And then you got it looks like 5 glitches
WINDLER Yes, I know.
QUERY - - marked here, but all the way in between
and including the bet -
WINDLER That's another peak there.
QUERY Oh, that's another peak?
WINDLER Yeah, that's a positive peak up there.
QUERY Oh, I see, okay that - -
WINDLER See you take your black - take your pencil
there and draw a line across the zero and you can see that. Now
I can't really explain why, you know the other peak it only
occurred at 20 degrees so. But there - there may be something
about the way, the ATM DC handles the - the dump as you know -
it takes the momentum state and compensates for the Z-angle
rotation and jockeys that around. And there's a more of
a angle involved in the dump maneuver during this peak
data periods so as I think I mentioned yesterday. The angles
have been fairly high.
QUERY I hate to - you know I don't mean to
throw any shadows on your figures here but I see
WINDLER You know they're shadowy figures.
QUERY I see the peaks here and there's - like 5 -
there's two nice groups of 5's but still spread out all the way
along this curve starting here. There's a fairly even distribution -
they group up at the beta peaks, I see that. There's a nice
even distribution there.
WINDLER I told you I couldn't explain all of it
and I don't think we ever will. Of course you'll remember
right in that period also we're having EVAs and the maneuvers
and I haven't had a chance, we had plotted the whole thing
on there but that - it turns out that I've got enough really.
I've got some more of that data on another curve. But during
that period around there, from you know down around day 360 or
so that was during the EVAs during all the Kohoutek maneuvers so
that might account for some of those being scattered around.
And certainly this is not the complete effect. We did a lot of
EREP from on day 331 on up to 350 or so almost everyday an EREP
and some of those of course didn't have maneuvers involved and
most of them did. And then we started doing the comet maneuvers
so that may account for the wider spread. But you'll notice that
they do tend to bunch up that little place where it says just
before we started the heater management where 5 or 6 of them
bunched up right there together at that one peak. And then we're
getting into this period that y'all been asking me questions about
here right now where we peaked again and lo and behold they

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are coming more frequently. If you got an explanation, it's just like the bubble in the ATM C&D loop appears that every-time we shut it down, it get some bubble and it takes it awhile to mix up or something and we don't understand that either.

QUERY Have we ever had two in one day.

WINDLER Oh, it depends upon how you're count days if you use Zulu times from midnight - I don't know really. It possible could be - in fact I think down along about day 356 they were very close to being less than 24 hours apart. That's really probably what you mean isn't it, less than a 24 hour interval?

QUERY Well, basically.

WINDLER Yeah, I think that -

QUERY Two on Wednesday or two on Thursday, that kind of thing.

WINDLER Yeah it I think we probably have. Without looking at the exact time but it looks like day 356 there's one and I'm now real sure what's been less than 24 hours between yesterday's and today's they both occur in the morning so.

QUERY I think there's a little less time but not much, a couple of hours difference from what I remember the GMT times. The other thing we do not hit anymore high beta angles positive or negative before the end of the flight. Is that - ?

WINDLER If we land on the 85 day mark.

QUERY It will just be kind of nice in the middle there.

WINDLER We're increasing of course from now but we'll be passing just a little bit above zero, 10 15 something like that, really didn't look up that final angle. But it won't be you know - there may be something to the fact that the curve changes, you know the rate of changing the beta angle, so when it starts up off a steady slope and starts rounding off may have something to do with it, I don't know.

QUERY You said that if we land on the 8th, is there some consideration being given to going on beyond that?

WINDLER No there isn't.

QUERY Okay.

QUERY But now that you - you hope that this chart is really telling you something so you say you now got the optimism is that -

WINDLER I had the optimism before.

QUERY Well the optimism that they will kind of stop happening with very much frequency?

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WINDLER Is that - I had the optimism before.
QUERY Do you have the optimism that they
will kind of stop happening with very much frequency?
WINDLER I think that the frequency will
diminish yes.
QUERY How many mibs did you get through
on the EREP today?
WINDLER Well, of course we haven't seen the end of
it yet.
QUERY Oh, I see.
WINDLER Or we hadn't when I left.
QUERY Oh I see.
WINDLER We were up to 5 I think just in starting
the maneuver back up, and expected to have some more. The
total is still around 10 as expected.
QUERY What's tomorrow look like, Milt?
WINDLER In terms of mi - it's - there's a
medical run in the morning, and an EREP in the afternoon.
that comes across the HATS area. I don't remember the
prediction for the mib count. The temperature is expected
to go - right now anyway we're saying it might go as high
as 83 degrees. And then, of course cool off shortly after that,
down to like 81 or so. However, I think I already mentioned
that in general the predictions right now seem to be that
we're a little bit below what - what we've been estimating
by a degree or so. So we're optimistic there too that it
won't be quite that high.
PAO Bruce.
QUERY Does anybody mind Ed Gibson sleeping
up in the MDA? Is it any hassle for any - any of the
medics or anything like that? Is he on crew duty or are
they just going to shuffle that around -
WINDLER No, no, there's no -
QUERY - - to somebody else?
WINDLER No there's no problem with that. In
fact there - there was talk about getting the M133 experiment
set up so that they could get the data from that. But
they decided not to do that tomorrow when the next schedule
was and just delay that. It looks like in a couple of days
he'll probably be back in there anyway. But if they wanted
to looks like it wouldn't be too much trouble to - to just
plug that instrument back into SI up in the MDA, so nobody is
worried about him sleeping up there.
PAO Howard.
QUERY Why did Ed - why is Ed the only one
that decided to go up there, does he have a little more
trouble - -
WINDLER He - -

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QUERY - - sleeping?
WINDLER He's in the hottest room. And I guess
he - he does - also he seems to have little trouble sleeping
too.

QUERY Didn't Kerwin do that on mission 1?
WINDLER I think Kerwin, and I believe Waitz
did some too. In fact, I think he sleep up there for
several days - -

QUERY Conrad made the remark that he disappeared
at night and went - -
WINDLER - - before we even realized he was
doing it.

QUERY - - floating down into the - -
WINDLER Yes, that was earlier in the mission I think
the overall temperature was high. But I think after that
that Kerwin perhaps was the only one. I don't really remember
for sure, but it's no big problem.

PAO That's it, thank you gentlemen for
coming out in the rain.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Solar Prominence Briefing
Johnson Space Center
January 18, 1974
13:32 GMT

PARTICIPANTS:

Dr. Robert MacQueen, PI 5052
Dr. J. Gosling, Co-PI 5052
Joseph Hirman, NOAA
Bill Pomeroy, PAO

SL-IV PC103A/1
Time: 13:32 CDT
1/18/74

PAO Okay, at this time, ladies and gentlemen, we're going to have a briefing based on the unusual solar prominence that was seen yesterday. And with us at the panel to my immediate right is Dr. Robert MacQueen of the High Altitude Observatory and principal investigator on S052. Next to him is Joseph Hirman of NOAA in the ATM support room, and beyond him Dr. Jack Gosling, co-investigator on S052, also from the High Altitude Observatory. We'll have some remarks from Dr. MacQueen and Joe Hirman and from Jack. And then Dr. MacQueen will show us from down in front here the - some pictures and show us just what we are talking about. We'll start off with Dr. MacQueen.

MACQUEEN I want to make just a couple of points in prefatory to Joe Hirman and Jack Gosling telling you more about the specific events that went on yesterday. The first, the point I want to make is that this of course is not the first coronal transient that we've observed on Skylab. It is a unique event in the sense that it is probably the best observed coronal transient that we have on any of the Skylab III missions, due to several fortuitous circumstances and several circumstances that were the result of good planning both by the people on the ground and Ed Gibson on the panel. The event is of some interest to us as all the coronal transients are because of their implications with regards the coronal structure and inter-planetary events. But this particular event yesterday came at a very nice time. Those of you may be - you may be aware that Ed Gibson has several times during the course of SL-IV queried the ground as to what was the reason that he had not seen any of the white light coronal transients that for example the SL-III crew, the so called solar bubbles that Al Bean, Owen Garriot, and Jack Lousma all saw on SL-III as a result of activity on the Sun. And in response to this NOAA and the HAO people made a survey of the activity that had gone on and came to the basic conclusion that the Sun was just not that active during SL-IV and therefore the frequency of events was much less. Well, this clearly I think, in my opinion, this clearly worried Ed Gibson that he hadn't been able to make any observations of these phenomena especially since his premission training considerable emphasis had been placed on this after we had seen this spectacular events of both SL-II and III. So I think quite frankly the happiest person to observe this event is Ed Gibson. Not to say that we are not completely happy with it too. We have by far the most complete and thorough observations with the coronagraph of this transient in the corona

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than any of the others on Skylab. It works out that because we're at extremely high beta angle the inclination of the orbit is so high that the amount of sunlight per orbit, that is the amount of time you spend above the grazing height of the atmosphere is very long. In fact this means that you have more sunlight time to observe the Sun per cycle. And that was the circumstance that permitted him to only to miss only the night time part of the orbit for something like 20 minutes or so. I think without any further comment along those lines why don't I turn this over to Joe Hirman of NOAA. Let him tell you a little bit about some of the ground event - ground recorded events and then Jack Gosling will describe to you the events that were seen both by the S052 coronagraph and in the XUV monitor of the Naval Research Lab. And I guess since Neil Sheeley of the Naval Research Laboratory could not attend I should point out that this is by far their best observed eruptive pictures of erupted material and that Ed was ab -

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SPEAKER - - of the orbit for something like 20 minutes or so. I think without any further comments along those lines, why don't I turn this over to Joe Hirman of NOAA and let him tell you a little bit about some of the ground events of the ground recorded events and then Jack Gosling will describe to you the events that were seen both by the S052 coronagraph and in the XUV monitor of the Naval Research Lab. And I guess since Neil Sheely of the Naval Research Laboratory could not attend, I should point out that this is by far their best observed eruptive pictures of eruptive material and that Ed was able to get a number of good exposures for the Naval Research Lab - spectroheligraph on the event.

HIRMAN Okay, the first indication we have of any significant activity was the alarm that came over our teletype network which was an automatic response from some of the classified Air Force monitoring satellites. We do not know exactly what this means as far as what monitor it was or what triggered the alarm however that was the first indication we had in the sign that something was going on about it. About 2 or 3 minutes later we begin to receive calls on our telephone system that connects to several observatories, one of which was Ramey in Puerto Rico. They at 1925 saw a piece of material off the west limb of the Sun around north 07, which was bright and apparently moving out from the surface of the Sun. And at that time it around 1926 or so, it was out to about 0.22 solar radii. This was from an area that did not expect any activity, and - and it was at this time we also received reports from Boulder indicating that there was a radio event occurring at the same time in - in addition to this was also notification from Mauna Loa Observatory that they were also seeing in this event on the limb of the Sun. All this together was, I think, sufficient enough to warrant some rapid response in the science room in the - as I was notified, and this information was uplinked to the crew who, at that point, I think began operations on the - the limb event. As to the source of the event, there's some debate as to what produced it and just what it is. Our best guess right now is it came from a region that was about a day and a half behind the west limb of the Sun, active region 14 which the day before produced a, this seemed a similar type event. However, active region 14 was not expected when it was on the surface of the Sun to produce much of any activity. It seemed to have grown as it transited the west limb. And the only indication we have that it was perhaps from this region is that the geometry of the event was close to where active region 14 should be on the back side of the Sun.

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And it - the definition of the event is also up for question. We called it an eruptive prominence, however, an eruptive prominence you'd like to have a prominence in position to erupt before this happens, and we can't seem to find one. So, therefore we think maybe it's ejected material from a flare out of active region 14 on the back side of the Sun. And I'll pass that from that to Jack.

GOSLING Okay, like Bob and Joe have described the event and a little bit of our enthusiasm about what the way the crew has responded to catching it. Before going further, I'd like to make a point about this particular event, and that is its most unusual feature as seen by the coronagraph experiment is the extreme brightness of very concentrated knots of material coming out from the Sun. I think it's quite fair to say that these are by far the brightest that we have seen. And overlying these knots are a weaker looplike structure which I want to discuss in a little more detail as well as some of the implications. But the - certainly the unusual feature of this event is the extreme brightness of these knots as seen in our coronagraph experiment. Once the crew was alerted it was some 8 minutes after the event had been reported on the ground that the crew was notified. Ed spent a little time first pointing to it, and then going Sun center. By the time he got to Sun center there was already material out at two solar radii, yet the observations at the Earth had been reported out to point - about 0.3 solar radii. So, we're another solar - another - -

END OF TAPE

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SC Once the crew was alerted, it was some 8 minutes after the event had been reported on the ground and the crew was notified. Ed spent a little time first pointing to it and going Sun center. By the time he got to Sun center, there was already material out at two solar radii. Yet, the observations at the Earth had been reported out to point - about 0.3 solar radii. So we're another solar - another solar radius out, or should I say, 7/10 of solar radius out, beyond where it was last reported on the ground. And it's not clear that what we first see in the coronagraph picture that we shall see, is indeed that same material which they saw earlier or whether it's another manifestation of the same event. Further, out beyond this bright knot that you'll see, you'll see weaker loops that are out about 3 solar radius. In other words, they're another - by when I those distances, I mean from the center of the Sun. So 3 solar radiuses from the center, it's two solar radiuses out from the limb. And this is just a few minutes after they have recorded only several tenths of a radius above the limb. So we - I want you to I concentrate on that when we actually get to the pictures. It's also - I think, the first time we've ever seen a transient event like this in the XUV monitor. When we see - I think the first thing we have is the XUV monitor which was taken I believe shortly after the event occurred, so if I can have the XUV monitor on the screen, I'll try to describe that. If you noticed on the western limb there, that's the limb on the very far right, there's a - I can't see it well from here, but I think you can see - perhaps see it, if you get a closer view. Maybe we should have the lights out.

SPEAKER

(Garble)

SPEAKER

Okay. It's the very faint ray-like structure emitting from the west limb. This is undoubtedly prominence ejecta as seen in emission probably or predominantly in the helium 304 line. Now the NRL 82A experiment take pictures which are very similar to this picture but instead of being - seeing it in many lines like you do in the XUV monitor here, they look at the emission from this ejecta material in selected wavelengths. They will get pictures of the Sun and the ejected prominence material in the isolated wavelengths in which it primarily emits and that is primarily in the XUV region in the helium 304 line, I believe it is. They undoubtedly have a beautiful sequence of pictures of this material expanding out into the corona and hopefully and we think probably overlapping that region in the corona where the white light coronagraph is able to observe. Again as Dr. MacQueen pointed out, these are probably the best temporal sequence pictures we have, with the 82A experiment

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of such phenomena although they do have some beautiful pictures on some of the previous Skylab missions of such events, but no where near the good temporal coverage. One of the real questions we're trying to answer now, relating to events like this, is the intimate relationship between the material that you've seen in emission, that material that is ejected from the Sun, from the solar surface proper and the material that we see in the coronagraph pictures at 1 AU. At this time it's not completely clear that these big magnetic loops that you see, that these are really the material that is ejected itself or if this is material that was overlying the region where the eject occurred. If I may now, turn to white light coronagraph, we can see what this looked like in the coronagraph yesterday as taken by Ed Gibson. The bright knot there in the center is the ejected material that's at about two solar radius at that point, please note the overlying and surrounding diffuse loops connected with it. Dr. Gibson spent most of his time describing - describing and discussing the very bright knot in the center and certainly that's the brightest feature we have ever seen in the corona, I think it's fair to say, with the white light coronagraph experiment. That bright knot, the reason it's probably so bright is that it's probably emission line from elements that are not completely ionized. The surrounding material is quite likely primarily scattered light, although it too may be emission also. And one of the crucial questions we're trying to answer is what is that surrounding material? Is that coronal material originally or is that chromospheric material? And, indeed what is that bright knot? Can we correlate that bright knot specifically with the - -

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GOSLING (garble) The reason it's probably so bright is that it's probably emission line from elements that are not completely ionized. The surrounding material is quite likely primarily scattered-like, although it too, may be emission, also. One of the crucial questions we're trying to answer is what is that surrounding material? Is that coronal material originally, or is that chromospheric material? And, indeed, what is that bright knot? Can we correlate that bright knot, specifically with the NRL, 82A exposures of the prominence erupting? Those are some of the questions that we hope we might be able to answer with this. During the sequence that followed this we were able to observe for six consecutive orbits, the progress of this event as it moved out through the corona and its evolution, the magnetic evolution. It's very difficult to say from the few downlinks that we have of exactly what it did look like. But we do have Ed's words as they came down. And we do have some knowledge about similar events to this from previous experiments. It appears that this event moved out at a velocity of approximately 700 - 650 kilometers per second. That is - That is the velocity that we might associate with that bright knot in the center. However, it's not apparent to me that the outward loops above that are not moving faster than that. In fact, this particular picture here was taken, I believe, within 15 minutes to a half hour after the eruption was first noted at the limb. And you'll note that the outer diffuse area there stretches out to about 3 or 3-1/2 solar radii. So it's possible that that material is moving much faster than the knot itself. Also, following behind this bright knot later, there apparently were other surges of material and they have different velocities. Well, some questions that we might be interested in asking in events such as this, I think the first thing is, when we see something like this in the coronagraph, what is the cause of it? What is the source of it? That is, we know that a material was thrown out, but why was that material thrown out, was it a flare, was it a rearrangement of material, was it perhaps a difference in the pressures caused in the atmosphere that caused this? What caused this? Also when we're seeing here - when we're seeing this diffused material ahead of the bright knot, what is the cause of that and what is the effect? It's not true which is the horse leading the cart or whether the horse is pushing the cart? Some other questions, I think, that are interesting to ponder from this event and others like it, and I think this event possibly will help us answer these questions is - Let me comment first of all, that the speed that we observe here, like 650 kilometers per second, in laymen's terms, if we go non-metric, that corresponds to like 1-12 million miles per hour. So they are pretty fast.

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But, are they that much faster than what we'd normally observe streaming out from the Sun? Well it's difficult for us to see materials streaming away from the Sun, although, we know from the stretched out appearance of the streamers that are certainly doing that. But, we know from observations at 1-AU that it's not unusual at all to see the solar wind blowing by us at speeds 500, 600, 700 kilometers per second, very comparable to this. So the speeds here associated with these events are high, but they're not that unusual. What is unusual about these events is their density, their temperature, and the magnetic structure that we see associated with them. Some questions we might be interested in answering are these: Do these things all move out into interplanetary space, or do they eventually fall back into the Sun? Is the Sun's gravity strong enough to hold them in, or do they eventually just move out through the solar system? We think the answer is that they, by and large, are moving out. We have yet to have good strong evidence that any of these - this material ever really falls back into the Sun. Also, since we see such strong structuring associated with these events, what special effects do these cause? Well, there are several things that they might cause. Since there are strong magnetic fields there, we might expect that they'll contain particles, energetic particles that might eject from the Sun behind these, the so-called solar cosmic ray events, that we might expect these big loops like that would help to contain the ejecta of such particle. And they serve to modulate. Matter of fact, it's my personal opinion that such structures like these are responsible in a great way for the modulation of the energetic particle increases that we see. By that, I'm talking about particles in the range 20- to 30-million electron volts. They - -

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SPEAKER - - ese cause. Well, there's several things they might cause. Since there are strong magnetic fields there, we might expect that they'll contain particles energetic particles, that might eject from the Sun behind these, the so called solar cosmic ray events. We might expect these big loops like that would help to contain the ejecta of such particles and they serve to modulate. As a matter of fact, it's my personal opinion that such structures like these are responsible in great way for the modulation of the energetic particle increases that we see. By that I'm talking about particles in the range 20- to 30-million electron volts. They probably also have an effect on modulating the cosmic rays that arrive at the Earth. A well known modulation is known as the Forbush decrease of cosmic ray intensity, where for a period of two days at the Earth you may see a modulation of cosmic rays received at the ground by perhaps a 10 percent effect. My own personal opinion is that structures like this have a strong effect in producing that sort of modulation. Further, if we're sitting with solar wind satellites out at 1 astronomical unit, and I might add that Pioneer 6 and 7 are ideally located to observe possible interplanetary effects of this event which apparently came from behind the Sun, if they are operating hopefully we might see the interplanetary signature associated with this particular event. Question arises is how do we see such an event at 1 AU, if we're looking at it, let's say solar wind detectors. It's undoubtedly true that some of these cause interplanetary shock waves, this one seems fast enough. It's moving at about 650 or 700 kilometers per second, that's faster than the normal solar wind speed of like 400 kilometers per second, it's supersonic in that sense. We expect a shock wave to form at the end, at the front end of that and they'll probably be a shock wave associated with that event. And all the attendant effects associated with shock waves in the solar wind. However, it's surprising that when one looks at 1 AU that the net effect on this will probably be reasonably small in terms of the total energies of the solar wind flow that we see coming past 1 AU. One might ask how important is this in terms of mass loss from the Sun. The question to that is - the answer to that is the mass loss is negligible, the impressive points about this is the amount of energy released and, of course, the dimensions and the time into which this energy is released. And, I think I'll tie it up with that and ready to answer any questions that we might have.

SPEAKER Jack, before you do that, I'm told that Millnet 81 has lifted off and - -

SPEAKER (Laughter) Wonderful. (Laughter)

SPEAKER - - and Ed Gibson is doing another JOE R which is coronal transient, joint observing programs, the same

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thing he did yesterday. I think Ed is going to be very happy about all this. That's in progress now, apparently.

PAO Okay, at this time, we'll take your questions.

QUERY On this filament 51. Is this similar to this event, which is - that we're looking at now.

GOSLING Yeah, I think it's filament 81.

SPEAKER Filament 81.

GOSLING It may be similar to this event. In the past missions we have seen coronal transients of this - this character, not precisely this - this type, but this character as a result of filaments and that's just the word for a prominence, when a prominence is on the disk. A filament is a prominence.

QUERY Would - would 51 also be in active region 14?

SPEAKER No, it's all the way over on the other side of the Sun. In fact, on the northeast side of the Sun.

SPEAKER It's right about in the middle today.

GOSLING About in the middle today. All right.

QUERY Could you describe for us just what - how do you class a coronal transient. Just what is that?

GOSLING (Laughter) That's a tough question. And, I don't - we don't have - I don't have a pat answer for you, except to say a coronal - we class a coronal transient as any event that occurs in the corona that is something - on a time scale of minutes to hours. Now, that's a very poor and loose definition, because one of the things we've certainly found in the analysis, the preliminary analysis of SL-II and SL-III results, is that the corona is changing form and shape visually at least, over time scales of hours to days, but that's a coronal transient and I guess the best definition I can give you is, there is one. Anything like that we call a coronal transient.

QUERY Well, just one more question here. I know in our past discussions, one of the things we've talked about is - your're trying to learn how energy is transferred - uh - from one place to another in the Sun. Will this give you information about that?

SPEAKER Jack, you want to - -

GOSLING I'm not quite sure what the energy transfer you're associated with. Certainly there's a transfer of energy here from the solar surface out in through the interplanetary medium - -

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SPEAKER - - I can give you as - there's one.
Anything like that we call a coronal transient.
QUERY What - just one more question. I know
in our past discussions one of the things we talked about
is you're trying to learn how energy is transferred from
place to another in the Sun. Will this give you information
about that?

SPEAKER Jack, you want to - -
GOSLING I'm not quite sure what the energy transfer
you're associated with. Certainly there's a transfer of
energy here from the solar surface out into the interplanetary
medium. There's undoubtedly associated with these events
a rearrangement of the coronal structures which require
a certain amount of energy. I think there's definitely
associated with an eruption of material a - that's an energy
loss right there. And the energy loss with an eruption like
this is comparable to that expended in the radiation associated
with flares. So we have a comparable amount of energy released
here as released in a major flare. Does that answer your
question?

QUERY Yeah.
QUERY That - Jack, that leads into another one.
Is this as important to your studies as a - as a flare? And
when you - when you track one like Ed did yesterday, do you
learn as much about energy transfers et cetera of the Sun
as you do if you catch a flare from - from the moment it starts?
SPEAKER Beauty is in the eye of the beholder.

(Laughter).
GOSLING I - I think that's true to a certain
extent. The - I think one of the things we found on Skylab
is that we - the number of times this event has occurred has
surpassed what I think we expected. And certainly this type
of event that we've seen here we've seen more frequently than
we've seen large flares. And since the energy released in
these events is comparable to that, certainly we're talking
about a - an event which has a frequency as frequent as large
flares and with a comparable amount of energy. Like you say,
I'm primarily an interplanetary type who's interested in the
corona and the energy transfer through the interplanetary
medium and its effects upon the Earth. And for those type
of studies in the solar wind. In particular this is the -
the fruit of one's life. Solar flares where the emission -
when the emission is in the electromagnetic part of the
spectrum has a very small effect, per say, on the interplanetary
medium.

QUERY Did I understand you to say that you don't
know where this material is going, even if it's going to
fall back into the Sun or - -

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GOSLING I think we know the answer to that pretty well. I think the answer is that most of the material does not fall back into the Sun, and most of the material gets dissipated out through the solar system and eventually ends up in interstellar space.

QUERY Well, is it - is it headed towards Earth?

GOSLING This particular event was from the back side of the Sun and - we think. And it's very unlikely that this would cause any effect at all upon the Earth at this particular event. Events such as this that were emitted from the central meridian, like perhaps this one that occurred today, we certainly expect such an event to impact upon the Earth's magnetosphere to cause such things as Sun (garble) geomagnetic storms, and auroras and the like. And that's when - and it's then when you would see the modulation of cosmic ray intensity and the modulation of solar protons, energetic protons and what not.

QUERY Well, as you digest this fruit here, (laughter), what's it going to tell you about as it dissipates out into the solar system, what's it going to tell you?

SPEAKER What's going to happen as it dissipates?

QUERY No, what's it going to tell you that's important to you?

SPEAKER This particular event as this particular one dissipates out in terms of our effects on Earth here I think are negligible; that one particular there. But what we would like to understand is, I think some of these questions that I ask. What caused such events in the first place. How does the Sun conspire to release such an enormous amount of energy in the form of a concentrated partial emission like we observe here? Two, what's the effects of the ambient corona above it, and the magnetic fields that are associated with it? What are the dynamics of this event? This is one of the few places where we have a plasma of astrophysical significance that we can study directly to understand plasma dynamics in stellar atmosphere. It's just the Sun is the only - -

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SPEAKER In the form of a concentrated part of the mission, like we observe here. Two, what's the effect of the ambient corona above it and the magnetic field associated with it. What are the dynamics of this event? This is one of the few places where we have a plasma of astrophysical significance that we can study directly to understand plasma dynamics in stellar atmosphere, since the Sun is the only star that we have a close enough at hand to understand astrophysical plasmas. We can't produce this type of plasma in the laboratory. If they could produce this type of plasma in the laboratory and contain it, then we'd probably have nuclear fusion well in hand. However, I doubt that our understanding of the dynamics of this particular event will contribute directly towards understanding of nuclear fusion. But, it's the only place that we have in the physical universe where we can study plasmas like this. And, just from the pure scientific standpoint they're fascinating creatures. They're like pulsars or pulsars or quasars or beast of that category for the scientist.

QUERY Bob, I know you're starting to get low on film, as most of the guys are, this late in the mission. But if you had another event similar to this today, what would that do to you as far as your film budget and so forth?

SPEAKER Well, we - we sent a message up to the crew this morning, as part of the science conferences - we scabbled around last night and this morning working up our film budget and we gave the explicit go ahead to the crew that if they see another similar event such as this then we would appreciate all the operations they can get. And what it means is that if they really get a superb set of observations again then we will have to further parse out the remaining frames in our camera to cover from now to the end of mission. Indeed we're getting to the state where we have to be very careful about what - just how we operate the instrument. It's a very pleasant situation to be in.

QUERY I have one question - Oh, go ahead, Bob.

QUERY I'd like to know, how would - It's been a fairly quiet Sun, this mission. How would you compare the data you're getting on this one, say with the SL-III data where you had quite a bit of activity. Are you disappointed in what you're getting this time?

SPEAKER No, I think not. We've - let me speak from a personal viewpoint now, from S052, the coronagraph. We have some awfully nice sequences of observations oh, with temporal resolutions that we found difficult to get on SL-III because of all the activity. This is not to say that the corona has not been somewhat active. Ed reported approximately what was it Jack, a week or 10 days ago - -

SPEAKER 10 days ago.

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SPEAKER - - when we were running something we call JOP 19, Alfvén wave program, that we couldn't have picked a better time. It was purely fortuitous; I wish I could claim otherwise. We couldn't have picked a better time to observe the corona because he could see it changing on an orbit by orbit basis, so indeed we haven't had the flare activity this mission that we've had on SL-III, but I think that at least from the various voice comments that we heard from Ed and from this event and the like we will have a rather significant amount of short-term changes in the corona. And no, I wouldn't say at all that we're disappointed with the operations of this mission because we've been able to do a number of programs in conjunction with other experiments especially which were designed after we had seen SL-II and SL-III film. We've been indeed able to run those specific programs this mission and so what we're doing some new things and that's always very exciting. We don't really know what's going to be on the film as we examine these new programs, which for us are various temporal sequences and various correlative observations with the Harvard experiment and the like.

SPEAKER I'd like to add a little bit to that. What we'd really like is to run this coronagraph for a whole solar cycle, where we can watch the long term evolution of the corona and we consider every month closer to that 11 years well worth the effort that was put into them.

SPEAKER I'm glad to hear you say that Jack. I'll know who that we'll want to have down here for Mission Operations for that experiment. (Laughter)

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GOSLING - - add a little bit to that. What we'd really like is to run this coronagraph for a whole solar cycle, where we can watch the long term evolution of the corona and we consider every month closer to that 11 years, well worth the effort that was put into them.

SPEAKER I - I'm glad to hear you say that Jack, I'll know who that we'll want to have down here for Mission Operations for that experiment. (Laughter)

PAO Okay, - oh -

QUERY Speaking about the future. I understand either today or tomorrow you're having a meeting - uh - talking about applying ATM that you're learning from this to the Shuttle program. Or am I incorrect? I thought I heard someplace along the line this meeting was going to come up.

SPEAKER I'm not aware of a specific meeting with regard to that. We have certainly had discussions over the past several months, among ourselves and with various other people about applications of the ATM for future space flights and I think it represents one of many options that NASA could take for future space instrumentation. For example, it could be considered as one of the options for a solar package in the Shuttle era. The fact that the prototype, that is the other flight qualified ATM, the whole bloody package, is over in a clean room at Huntsville now and is of course is a totally flight qualified unit. So, I guess, I don't know of a specific meeting. We have been discussing this and we're - we the ATM principal investigators are interested in the possibility but there's a slip twixt the cup and the lip and the Shuttle's a little away, so I guess we'd really can't say what's going to happen.

QUERY How would you characterize Ed Gibson's enthusiasm on the ATM as far as helping you in your studies?

SPEAKER Well, I'd characterize it as extremely high. Ed, as you know, Ed and Owen Garriott were, if you will, the solar specialists among the Skylab crew members, and Ed and Owen both participated in the formulation of the joint observing program in the - participated in the refinements of the design of the hardware on all these experiments, 6, 7 years ago. Ed was right in the thick of it, with us on the best way to make these instruments. I - I'm - I have to point out that Ed Gibson, personally, was very much responsible for our coronagraph having a television system in it, that such that we can get that picture over there. We originally had not designed the instrument with a television system and it was very much at the insistence and urging of Ed that we installed the television system which has allowed him to respond to these coronal transients. So, historically, Ed's been one of the more enthusiastic of the entire astronaut crew, in terms of solar

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physics. And, I think that the fact that you heard him, you heard Jerry Carr, over the last several weeks making the specific request for more solar time as long as the activity was - these active regions were on the disk is an indication of how enthusiastic he is and how much he wants to get for example, most notably, preflare observations. And as you're aware from looking at the schedule in the last several days especially day before yesterday, and the day before that, he is now being scheduled in for many cycles per day, at his own request on the ATM panel. He's - I think he's spending more consecutive cycles than anybody in all of the Skylab have spent at the console. So, personally, he is extremely enthusiastic and I know he's - when things like this happen that prove his role in operating the instruments it makes him awfully happy.

MACQUEEN - - He's a little less bubbly about what he sees as some of the others. He likes to keep his cool professional manner when reporting down. I don't think that any reflection at all upon enthusiasm.

QUERY Just from what you've seen the first two missions. Can you speculate whether you can answer any of the questions that you posed? If so, which ones?

SPEAKER

Can we speculate that what?

QUERY That you can answer any of the questions that you posed?

SPEAKER

Yes, as a matter of fact, I hope that our data will have significant impact on answering most or all of those questions. I think the one that's going to be the toughest is what - -

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MACQUEEN - - probably about what he sees is some of the others. But he likes to keep his cool, professional manner when reporting down. I don't think that - any reflection at all upon enthusiasm.

QUERY Just from what you've seen the first two missions. Can you speculate whether you can answer any of the questions that you posed? And, if so, which ones?

MAC QUEEN Can we speculate that what?

QUERY That you can answer any of the questions that you posed?

MAC QUEEN Yes. As a matter of fact, I hope that our data will have significant impact on answering most or all of those questions. I think the one that's going to be the toughest is what causes them to go in the first place.

QUERY One other thing on this Shuttle business. Is the ATM of a size that it could be carried in the Shuttle?

MAC QUEEN Yes. It gives you a good feeling for the size of the Shuttle. (Garble)

QUERY (Garble) would it be man operated under the plan that you're talking about?

MAC QUEEN Yes. It would be - we would hope and I think that the various committees that have been studying the kinds of operations for the Shuttle era over the last year or two have been fairly uniform in their recommendation that the instruments should be capable of twofold operation. One complete operation by the man on board and, equally importantly, complete flexibility from the ground. And that is, it would be a considerable extension of our ability now to operate the ATM from the ground. As you know we each - a number of - not each, but a number of the experiments can operate limited modes from the ground. I think the Shuttle era with the proposed shorter duration missions, that are being talked, it's - it's - I hate to use the word, it's cost effective to operate the telescopes every minute that you possibly can at the most optimum rate. So, it's very important that one has complete ground flexibility with Shuttle instrumentation, at least in the solar class, where the instrumentation is extremely complex.

PAO I have a question that was phoned in. Addressed to anybody on the panel. It says "During this SL-IV mission. Has anything new been found in the Sun?"

SPEAKER Like to field that one, Bob? (Laughter)

MAC QUEEN Well, there are - there is quite a long list of - of good observations and interesting new observations that have come out of SL-IV. I won't even pretend to begin to go down those. For ex - I'll give you an example. For one, the Harvard College instrument, 3 or 4 days ago, I forget how many days ago, I guess it was when active region 14 was close

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to the limb, has some marvelous observations of a surge at the limb. Both time sequence and detail spectra of that, and that's the first time that they've been able to be looking right at the limb when material squirts out in a surge, and they have just simply beautiful observations of that. That's an entirely new observation that we haven't been able to get. And earlier I alluded to the fact that we have a number of new joint observing programs built on knowledge of SL-III and SL-II. We've run virtually all of those programs at least once and in some cases a number of times. They're new observations and whether or not they're going to tell us anything new about the Sun, we've got to develop some film first before we can even begin to answer that.

QUERY Any idea how many pictures have been taken of the Sun so far on this mission? With all the instruments?

MAC QUEEN Oh, boy. With all the instruments. I'll have to do a little rapid arithmetic. We are currently - we ourselves are at 14,000, approximately. Right?

SPEAKER You mean this mission?

MAC QUEEN Two cameras.

SPEAKER At this mission, that's right.

MAC QUEEN This mission. So we have 14,000 pictures of the corona. A - Marshall has 6,000 in their cameras and they're down to 2,000, so they have 10,000 pictures. American Science and Engineering has 7,000 per magazine - 8,000 per magazine, and I think they have about 2500 to go, so they have something like 13,000 plus. The 82B runs 1600 exposures per magazine, and they've got about 200 to go on this, so they have made 6200 - -

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SPEAKER A - Marshall has 6000 in their cameras and they're down to 2 th - so they have 10,000 pictures. American Science and Engineering has 7000 per magazine - 8000 per magazine, and I think they have about 2500 to go, so they have something like 13,000 plus. The 82B runs 1600 exposures per magazine, and they've got about 200 to go on this. So, they have made 6200. And 82A has 160 frames, is it, per magazine and they've got about 50, I think, to go; 50 or 70 to go. They're getting ready to do a heavy sequence in the next day, so they have 300 and so, and the Harvard College Experiment which doesn't take film continues to bang away every day all day. So, I - now you'll have to do the addition of those numbers. (Laughter)

QUERY

it Bob?

SPEAKER

Indeed. Some of that film was directed at the comet. In our particular - in the coronagraph case when you take the comet when it was close to the Sun you were also getting the Sun, so it's dual purpose. That's a lot of film.

PAO

Okay, thank you very much.

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SKYLAR NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 17, 1974
4:23 p.m. CDT

Participants:

Milton Windler, Flight Director
Dr. W. Royce Hawkins, Deputy Director, Life Sciences, JSC
Don Green, PAO

SL-IV FC102A/1
Time: 16:23 CDT
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PAO Okay, fine. Thank you. This afternoon's press briefing includes Milton Windler who is here with us at this particular time, as you can obviously see. And Dr. Royce Hawkins will be with us very shortly. Milt, go ahead and start it will you please, we'll have Royce come in later.

WINDLER Well, the big thing for the day so far has been this eruption on a prominence in active region 14 on the Sun, that you're probably aware of. We don't have a lot of data down here yet think in probably another - oh well, they may be playing that back in probably another - oh well, stood the lines we're going to be up at this time of day. And we may get some pictures back from MILA. But apparently it was a fairly strong prominence that lifted off. And Ed has spent, now this will be the second rev looking at it and plans to spend the next one also. The M509 is going on at the present time, and apparently that is going well. I haven't heard a lot from the crew about that, we're pretty well on schedule. This morning there was a M092 run and that all went well. Tomorrow is a day off. There is - we have one EREP scheduled, if we don't do that why, we'll do four ATM passes, otherwise we'll just do two. And they'll be a large science conference that takes six different passes to accommodate, must be about 40 minutes worth I guess. I don't know it's on the flight plan. Now, I gave you some bad information yesterday. Somebody asked me about the CMGs and I indicated that number 3 had faulted or at least had indicated an anomaly, and that was incorrect. Either I misunderstood an earlier comment made or whatever, but anyway that was a mistake. Three hasn't done anything at all in the last - there was some discussion about it a couple or three days ago while we were not on. But - but it turned out not to be anything, the current was just - just a small bit higher and there was no temperature change. And - and that we really didn't even count that as an anomaly. But there was a change in the rpm on CMG number 2 yesterday as was announced by the PAO and he was entirely correct there. And incidentally that rpm jumped back up today equally unexplained. Probably that was some small problem in the transducer which of course we don't know what would make it do that yet, but it's not a real, as best we can tell now anyway not a real physical thing that's going on with the rpm. And that's about where we are I think. We're consenting right now on trying to maintain the maximum amount of visibility on this prominence. And trying to inhibit the dumps as long as we can. And I think we'll probably be able to do that one more time. And I'll stand by for questions.

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PAO

(Garble)

QUERY Milt you said there was a CMG number 2 glitch yesterday. What about the one this morning?

WINDLER Oh, I sorry. There was - yes there was another one this morning. And I -

QUERY How would you rate this one this morning in severity?

WINDLER Well, it exceeded the criteria, and where as the one before was - was just in the rpm. I mean if we're talking about the same two. I'm kind of confused about that now. But anyway there was one this morning and it - it was, I don't know how you would - it exceeded the threshold level and it wasn't a real severe one. But it was the usual glitch with the bearing temperatures touching and the high currents at cetera, low rpm.

QUERY When did you discover the one that did occurred yesterday?

WINDLER Well, I discovered it when I talked to the GNS today about why I was confused yesterday.

QUERY Okay, in other words you hadn't been told about it yesterday?

WINDLER Well, I was but I - he though in my mind that I translated it into the CMG 3 problem. We discussed - I was trying to say that we discussed problems that had occurred over the past several days. So that was just my only - I was the only one confused. Whenever it was announced on the PAO it was -

QUERY We've had one I guess every day this week so far they're picking up to the point that they were when there was no work being done on the heaters or anything else. It was just, we have what 3 days in a row at least?

WINDLER Yeah, something like that. And I'm not sure before that. But they have come frequently. And you're right they are not - At one time we though that the temperature control was doing some good, but since then we seen them occur at the higher temperatures, as well as the lower temperatures. In fact -

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WINDLER - - thought that the temperature control was doing some good, but since then we've seen them occur at the higher temperatures, as well as the lower temperatures. In fact, the one - I guess it was today - was at the high range of the temperature, up in the high seventies, which is about as high as it gets. So - so whatever it is the - the heater cycle probably doesn't have any primary effect, but right now we're continuing to do that.

QUERY Well, when that heater work began, there was a lot of importance and security based on the slowing down of the number of occurrences, spacing them out even further when there wasn't any, and now we're back right to the point of having them all the time. Does this knock a great big hole in your feelings of security that it's going to last? And if it doesn't, why? Have you changed your theory now?

WINDLER Different people respond to different things in different ways, obviously. And personally I'm not any more concerned about it as I was - anymore concerned than I was earlier. I feel like still, that we're doing all that we can do to manage them correctly, and we - we have a piece of equipment there and we're using it as we - as we have to to maintain the workshop and get a mix of just staying in solar inertial and not getting much scientific data as opposed to trying to get the Earth resources data and do the other observations that require some maneuvering. So I just feel like that we're still doing all that we can. And we're - while it has picked up back where it was. Still the fact remains that it has lasted a lot longer, obviously, than the CMG number 1 did, which only went a few days before it gave us probl - it actually had to be shut down. So, every day we get closer to the nominal end of the mission and our reserve, if you look at it that way, builds up, or our capability builds up, maybe that's the way to say it.

PAO Go ahead, Jim.

QUERY Are they scheduled to take a shower tomorrow? Flight Plan says yes, and we were told earlier, no.

WINDLER Well, that probably comes about because the CAL COMP, the printed one that you normally get does have the shower on it. However, the last two days off, we have not put anything on the Flight Plan pad that we send up to the crew on the teleprinter except those things that we absolutely have to schedule, like ATM passes and EREP and on the other day, it was the comet. We - So the shower is optional. There's plenty of time there to take a shower. And that's the main reason that it's put down on the paper, just to show that if they want to take a shower, they can, you know. We fully expect them to, but we call this the do it yourself Flight Plan, so they can schedule it as they see fit.

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QUERY Well, we were told that they would not because the humidity would rise. What is this going to do to the humidity then?

WINDLER I don't know, but it goes away in a few hours. You've got me if there's been some decision on that, because I'm certainly not aware of it. And -

HAWKINS You'd get some elevation in the humidity -

WINDLER Have we told them not to take a shower?

HAWKINS No, not that I know of. No. But I don't think it would - -

WINDLER It goes away. We looked at this a while back and I think that in 3 hours it's - in fact, the temperature supposedly rises some too, we didn't see that last time, by the way. But when as it goes through the air circulation it's dehumidified again in just a short period of time. And the temperature, if there is any rise, it goes down.

PAO Responding to that last question was Dr. Hawkins, who has now joined us. Go ahead, Jim, you got another one?

QUERY Yeah, what about the temperature today, Milt?

WINDLER It's up. It was about 81 when I left over there, and we were in the process of running the M509 - -

END OF TAPE

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QUERY

Yeah, what about the temperature today.

Milt?

WINDLER

It was 81 when I left over there and we were in the process of running the - the M500, which, because it uses some high intensity lights, which we've tried to keep to a minimum, does tend to raise the temperature. However, it also dumps some gas into the cabin, which expands and then has a cooling effect, and there's a debate going on as to which one of those has the greater effect. We really think the net effect of it will be relatively modest. You know, less than a degree. A half a degree, perhaps, or something like that, but of course we don't have any maneuvers scheduled for today. The next maneuver will be tomorrow. We looked at that pretty critically at what it would do to it and we think it will get up to 82 degrees tomorrow and we're - unless something happens tonight, why, we think we can go ahead with the maneuver. However, if the temperature does something different - we did, I should mention this I guess - yesterday the crew tried to clean the air filter - the heat exchanger fans - ducts, and we wondered if they were able to do that satisfactorily and they did. They felt like they had really cleaned them very well and they'd used the same kind of tools that the Skylab II crew had used. The only problem was that we didn't see the flow rate increased, which it normally - which it had been doing up until now. Now, because of that, we spent about 30 or 40 minutes today changing out the fans. There's four fans in that unit, and they changed all four of them, even though they didn't see any of them that appeared to be - there weren't any of them obviously stopped up and it's hard to tell if they're degraded. I mean, they're spinning and you can't tell much about them. They changed them and that didn't have any effect on it either as far as the measurement of the flow rate. Now, that makes us suspect that there's probably something wrong with that transducer. The only other thing that we can do it to watch the temperature effects. There were some people down at Huntsville that did feel like - that the - when we cleaned them last time that there was a greater flow rate in there because they thought they could tell it in the way it res - in the way the temperature responded. But that takes a long time to decide and there's so many variables there, it's hard to say that you'll ever know for sure, but we think we've done all we can to increase that flow rate and that may, you know, also have a positive effect in reducing the temperature.

QUERY

Milt, back to this CMG 2, the last time that you had glitches occurring with this frequency you pulled out the manual heater operation. Have you got some procedure now

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that you can pull out and relieve the situation somewhat?
WINDLER Not any that I know of, there's not even
any scuttlebutt that I'm aware of that - I think we've exhausted
our bag of tricks.

QUERY Okay.
WINDLER And watch, tomorrow there'll be something.
But, I really don't know of any. I'd be glad to tell you
about it if I did. (Laughter)

QUERY In view of the frequency of the occurrences,
the last several days, is this having an impact on your
flight planning in any manner? Abbreviating or changing in
any fashion any maneuver whatsoever.

WINDLER No, it hasn't. We're in a period now
where we don't have the same - you might call it severity of
maneuvers, I guess, in the fact that we don't have these big
Kohoutek maneuvers any more. And we're not now changing our
Flight Plan because of that reason. Right now, we're mostly
concerned with the thermal aspects of the maneuvers.

QUERY Well is it changing your philosophy toward
performing maneuvers?

WINDLER No, not really. We have always had criteria
that we would - if the CMG got to these limits, which is just
somewhat slightly above the area that it's been getting
to, that we would stop a maneuver and not do it, and there
have been a couple of them that have not been made, as you're
probably very well aware of. Perhaps 10 days ago or something
like that is the latest one that I remember. We would still
implement that criteria. We haven't changed that and we think
that's still valid, so we've always had, you know, a sort of
a redline that if the CMG is in the process of giving one, and
since they are unpredictable, as we've already discussed, we
thought we had related it to the temperature of the CMG and
that doesn't seem to be completely valid. So there's no real
good way we can predict it and we feel like that we have to
keep on and if we actually are experiencing the symptoms at
the time, and they are above a certain threshold, then we would
not do a maneuver or if one's in progress, obviously it's very
difficult to terminate. You have to get back in solar inertial,
but you do what you can.

END OF TAPE

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because I'm not real sure if you're going to get down to the tenths of a degree, I'm not sure that I can give it to you, it's right in the order of 82 degrees though. Perhaps Royce remembers, I don't.

HAWKINS

Well, no I don't Milt off hand.

WINDLER

But it's along about there.

HAWKINS

It's 82 to 83.

OUERY

Then Dr. Hawkins is 82 or 83 degrees

going to impact the medical data at all?

HAWKINS

Well, it's hard to - it's hard to say just - just what that impact is. It's a new variable that is introduced into your data. And it'll have to definitely be taken into consideration in the analysis of that data. And I just really don't know how great an impact it might have.

WINDLER

Let me speak to two practical points. The - the - as opposed to, you know the medical science that I'm certainly not qualified to speak on. But the crew has told us last night that they were not uncomfortable at a time when we thought that the temperature was around 80 degrees. Now, I don't know what that means exactly when they say that they're not - not uncomfortable or they're not - uncomfortable may not be exactly what they said. That's in the transcript. But they implied that, you know, that - that they were still able to work and certainly they've been working all day today at that temperature. And bear in mind that the - the temperatures that we have - that we are using here are a mix of four different temperatures which are basically on this - various places on the structure that we average - I think they - if - if they'd be like today, where they'd be around 80, 81 degrees say, one of them might be as high as 83 or 4 and one of them is down in the 70's at about 78 or something like that. So there is that kind of a spread. Now on Skylab II when the crew first entered the OWS, we were concerned because the temperature was high, I've forgotten exactly what it was, it was in the high 80's, as I recall, something like that. And - and we thought, you know, that - that it would be very difficult for them to work in there, but they didn't seem to have a lot of trouble. And in fact, they did get a couple of thermometers during that mission and measure temperatures which appeared to be a degree or 2 or 3 or some number that I don't really don't remember right now. But it was somewhat less - -

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WINDLER - show them we would not do a maneuver or if one's in - one's in progress obviously it's very difficult to terminate it, you have to get back to solar inertial, but you do what you can.

QUERY This question seems pertinent now. At the three-week mark Bill Schneider said that if the CMG 2 goes out that they had around 21 days of TACS - of RCS left plus the reserving TACS. Then at the last news conference he had he cut it back to 5 or 6 days.

WINDLER Probably TACS, I imagine he said.

QUERY No, he was talking about RCS. Now, what - what guidelines are you all working under in the event that the CMG fails totally? Are you - the philosophy that you will bring them back within the 5 or 6 days or are you expecting perhaps work longer than that?

WINDLER No, we have a very detailed philosophy. And I know that - that Mr. King was given one and - and I don't have any problem in releasing it, as far as I know it may even be released. Okay, it is released, and this - about 4 pages that tell exactly what we're going to do. And in summary it says that we would go to the RCS control and we would stay there for some number of - of orbits to verify the - the rate at which we're using RCS fuel. Presently we think that's only going to be about 2 pounds a rev when we put in a - the optimum program in the command module computer. Then we would go back, put another pro - optimum program in the ATMDC and operate with that for perhaps a day and find out what the usage is - is under that condition. Given that - after you find out those two facts, then you'll know exactly what you have and can decide how much longer you want to stay in orbit and how you want to crank up any - any thoughts of rescue or early undocking or what have you. So that's what we were planning to do. And I'm not sure when Bill give you some of those numbers. The people have been working very hard at - at different programs and there's versions and there's improved versions and the latest model number I have is a thing called EMP58 which is supposedly - only cost us 2 pounds a revolution of RCS. So he may have been giving you a number based on an earlier - a higher cost of - of TACS per - I mean of RCS per rev. But certainly that's available to you. I think it's very self explanatory, as a matter of fact.

QUERY Have - have we got definite prediction now as to what the temperature - max temperature inside is going to reach tomorrow before they start hitting sunset again?

WINDLER We've got one, and I'm hesitating

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WINDLER - - during that mission and measure temperatures which appeared to be a degree or two or three or some number that I don't really remember right now. But it was somewhat less than the number we were getting by the average. And there is some consideration being given now in fact at taking those thermometers out. And since we're getting now where we're starting to kind of split hairs on the temperature, you know, and consider maybe making the maneuver or maybe not making the maneuver - that we ought to try to get a better handle on what the interior temperature is. So we may get those thermometers out and it looks like a practical thing to do and use those to augment our onboard readings. So it may be - the point is that the crew seems to be able to operate at temperatures like this. And also perhaps because it's so dry it makes a big difference of course, and then there may be some small 2 or 3 degree difference in - in our prediction capability or our measurement capability let's say.

HAWKINS Well, it's temperatures which all of us are used to working in. It's - it's not unusual to work at temperature outside around here at higher - higher levels. And you can kind of extrapolate your own feelings to what the you know the way the crew would - would perhaps feel under the same environmental conditions. It's not an unbearable level. It is out of the comfort zone, the comfort range at which the - the entire mission was built around. And all - of course all of the work schedules were designed for. But of course we've - we've been into higher temperatures as Milt says before in Skylab II higher than what we're going to definitely see here. And I don't personally have - have any great concern about the crew from a strictly medical standpoint in being able to - to work an - and adjust within those temperature ranges that they're - they're going to be exposed. There's definite ways of which they can - if they need be can back off and they can reduce the workloads and they can get out and get into cooler air, like in the MDA and all of this. And - and if - if it - come to the point of where they felt they needed to. So I don't really see any problem.

PAO

QUERY

WINDLER

that, but it's way on down -

HAWKINS

WINDLER

aren't you, around 40 something degrees.

HAWKINS

WINDLER

Jim Maloney. Go ahead, Jim.

What is the humidity?

Let's see, I don't know the answer to

40 - 40.

You're thinking about the dew point

Yeah, yeah, that's right.

The humidity is very low, but I don't

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have the number.

QUERY Well, the max you mentioned of 82, is that just for tomorrow, or is that the max period?

WINDLER No that's tomorrow. We think it will probably go just a little bit higher because it is tending to still perhaps coast up even though we're past max beta period.

QUERY What - is Saturday the day it's suppose to peak and then start down?

WINDLER Is - is that the 19th? The 19th is the day we've kind of been saying -

HAWKINS Yes, the 19th.

PAO Bruce Hicks. Go ahead.

QUERY Okay, it's going to be 82 - between 82 and 83 tomorrow, but then you are going to be making an EREP in the afternoon. What's it going to go up to during EREP and will it come back down right away, or will it stay at that temperature.

WINDLER The temperature is forecast to be above 82 - between 82 and 83 at the end of the EREP.

QUERY At the end. O - -

WINDLER Yes, that EREP is designed to have a small effect on the OWS temperature. The rates are somewhat higher. We're going to use more TACS than we normally use to do that.

QUERY Dr. Hawkins, the last time we talked to you we hadn't really gone past the magic point of 59 days and now we have. What does the crew look like? Have you seen any medical problems whatsoever with this crew? Anything that gives you any concern?

HAWKINS No Bruce, as we reported the results of the medical experiments and crew status to Dr. Fletcher the administrator on both occasions now. Last week and again this week. But we've - we've - find nothing which precludes our going ahead from a medical standpoint at this time.

QUERY At this point in time do you have any idea whether or not their readaptation to one g is going to be more difficult than the Skylab III crew?

HAWKINS I - I think what we have seen in - and I can't say that this is really true clear across the board in every - every system within the body. I think there are definitely some indications of yet of - of some -

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HAWKINS And I can't say that this is really true clear across the board in every - every system within - within the body. I think there are definitely some indications of - yet of some - perhaps some subtle changes. These have - have been for the most part the response - physiological responses that we've seen for the last month have been, I would say in a very steady state without - without any real significant fluctuations or any definite trends to - to - to decrease or increase. I th - I really do feel like it - that we've - we've arrived at a situation where really the crew looks more - more steady in their response to the - to the certainly the medical experiments of protocol that they've been under going, than what they really showed at about the end of the first 28 days of the flight. And for the last - really for the last month, certainly for the last three or four weeks I've - I feel that this is the situation. Based on this and the co - present condition of the crew I really don't expect them to look really different from what Skylab III looks like.

QUERY In other words, if I can interpret that a little bit. Would you say if they continue to progress the way they have the last month that they could - they could without physical harm probably stay up past 84 days? You, in effect, achieved that magic balance that you talked about before the first mission as a matter of fact.

HAWKINS I'm optimistic and I think from what we've seen over the last month that, yeah, I would - I would certainly think that they - that we could go beyond that - that point. Of course that - that remains to be seen certainly and we have to - we have to carefully reserve the - the final answer on that based on what the final weeks in this very critical extended period of man in space shows really.

QUERY You say that there were some small changes, but in the overall picture they were not significant. Could you just kind of tick off those small changes that have continued?

HAWKINS Well, we've had - we - we - we still have seen, although more - here again I - I st - I state the weights are stable. But, never the less there still have been some - some fluctuations in that. We have - there's still some - there's still some slight indication that maybe you may - may be still have some anthropometric measurement changes, the girth measurements. These have - more or less tend to still show some slight variation in downward trend there, although very s - very slight. And

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certainly of any sig - what I'd say is really significant amplitude changes at all. We're - we're still - we're still seeing some fluctuations within the - the O92 response for two of the crewmen primarily. These are not outside of - of the - of the limits which they - they've more or less been performing in. But they - they never the less still at times will indicate some - some - some differences in what maybe their previous run show. So, things are still of a - indicating a - a response to the environment and yet what all that means, whether it's just the - the changing within the env - the temperature, the thermal loads that they're experiencing or what not. We - you know we have yet to really say what - what that final cause is there. But they're not - they're not outside of what I consider to be a stable platform for which they've been operating in within the last month of the mission.

QUERY Is there any consideration being given to quarantining this group, or isolating them for a period of say 14 to 18 days or anything like that?

HAWKINS We've - Jim, we'll follow the same plan which we - which we followed for Skylab III. They will have limited access during the first week, limited to designated primary contact -

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HAWKINS - limited access during the first week - limited to designated primary contacts, they will not be confined to, you know, to the site here. They will be permitted to go home just as the other crew did. But their - their - of course their children will not be but - not be at home during that period of time there because they're not on the primary contact list. It's no different than what we had last mission really.

QUERY Well, none of their activities, say like a press conference or anything like that wouldn't be postponed.

HAWKINS No I don't think there's anything to be postponed. I don't recall when the first press conference is scheduled. I'm sure there's some activity planned for the, you know, onboard ship for that first, first day - R plus 1 time frame. When they get back here immediately and all but I don't - I don't know what the, you know, the first big press conference is for the - for them.

QUERY You don't know of any reason to postpone it for a longer period say than it was held for the last two crews, say a period of 4 or 5 days?

HAWKINS Oh - not, not, not from the medical standpoint, no. I think that would be just strictly a matter of scheduling it within the constraints of all the other requirements that the crew would be expected to meet and comply with. I mean the debriefing. Now that's going to be a - it's a full schedule. (Laughter) it's going to take a lot of time for a long time to - to really - to really get it all done. But no - nothing from a medical standpoint that would - would - that we see here certainly now.

PAO Yeah, go ahead, Paul.

QUERY Is that all the medical?
(Laughter)

QUERY Turning our attention to tomorrow. Can you kind of give us some details on the EREP targets of opportunity and you said they're going to be using a new method to get into attitude and out of attitude - number of mibs used and et cetera.

WINDLER By that I meant we were just going to go in at higher rates and we've also restricted our - our data take. We're going to come out - you know we've gone in at noon and gone around the whole rev and come out at noon but we're not going to do that this time. And we're going to use the TACS to get us in. That's one reason we did the noon to noon, we were already in the right attitude. The data take starts up over Great Falls, in that area, and sweeps down across the middle of the United States, I guess. It comes across - across, oh maybe, in South Carolina or something along in there and goes on down across the San Juan Trench and ends up at South America just north - off the coast of South America. And I guess I don't really remember the targets of opportunity.

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QUERY What are the predicted mibs?
WINDLER Around 10.
QUERY Around 10?
QUERY Ten mibs isn't very much if you are talk-
ing about using more TACS because on the noon to noon we've
used as much as, you know, 9 and 10 mibs on that alone.
WINDLER We have sometimes, that's right. But
other times we've used none. In fact the majority of the times
we've used none.
QUERY Well, the predictions have normally been
5 to 6 for about the last few EREPs as I recall and it's run
up to 12 or 13. Do you really not expect to go up into the
higher usage of 2 or 3 hundred pound-seconds?
WINDLER Two or three hundred?
QUERY Pound-seconds not mibs.
WINDLER No, no, huh-uh. Not even that much. Now
before we had - we had bad results with the predictions
because the 2-attitude was getting off a couple of degrees
and it - apparently was affecting the predictions so I guess
we think we got that better under control - under control.
QUERY Does this rapid in and out of attitude
put a great strain - it puts a greater strain on the CMG, doesn't
it?
WINDLER Yes, it does.
QUERY Okay, do you have a more strict constraint
on to being able to do that, I mean, does your CMG have to be
absolutely healthy before you'll try it or what?
WINDLER Well, the thing about the CMGs is that
every rev they do a dump maneuver, virtually, and of course
the rate involved there is higher than the kind we've been
using for the ZLVs. And - so that's - since we're below
that - that - -

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WINDLER - - they do a dump maneuver virtually and of course the rate involved there is higher than the kind we've been using for the ZLV's. And so that - since we're below that level we feel like we're operating in - in a safe area, and we're still doing that.

PAO Let me pass one last bit of information on to you. The - we heard from the control center in connection with the relative humidity, and that is announced as 39 percent at the present time. If a shower is taken then it is anticipated that the humidity would go up by 10 percent, to 49 percent, and then of course drop back slowly. Okay, thank you gentlemen.

END OF TAPE

DEVLAS NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January, 6, 1974
4:37 p.m. CDT

Participants:

Milton Windler, Flight Director
Don Green, PAO

SL-IV PC101A/1
Time: 16:37 CDT
1/16/74

PAO Okay, fine, we're ready to start today's press briefing with Milton Windler today. Go ahead, Milton.

WINDLER Well, I feel like I ought to say something clever, I wish I knew what that was. Y'all have probably been here since I have last. I've been off for 3 or 4 days. But we had - just - really a normal day today, and there's not any great amounts of excitement that I know. The only - only EREP pass was a solar inertial type where they wound up essentially sweeping the S192 instrument across the northern part of the North American continent up around Alaska, you're probably already well aware of that. Tomorrow, we plan to try the M509 experiment - the little jet device astronaut maneuvering unit. And we have a medical run. We're concerned, of course, about the the temperatures continue to go up, nothing much we can do about that other than coast through this Beta angle period. We do have some procedures - or procedures may not be the exact word, but we have some techniques, I guess, that we would use to minimize the effect of that. We essentially have already turned down a great deal of the - what you might call the optional equipment on board - the lights and things like that. We're going to suggest to the crew tonight some additional things that they can turn down, some of the speaker boxes for example. We've turned off a couple of logic units by putting the - the systems on and then pulling the circuit breaker, so it maintains it in the configuration we desire. We're going to restrict the maneuvers somewhat. We still plan to continue to do EREP maneuvers, although we're going to go into them and come out of them at a higher rate, so that we're not spending as much time out of solar inertial as we have in the past. And this, of course, will require a greater amount of TACS consumable usage, and that's obviously a trade-off and has to be made on each individual case. We have - have - trying to put the - the medical runs in the morning even though, of course, from a continuity point of view, we've - some of them have already started their runs in the afternoon, and we plan to move them, though, to the morning because it's cooler. The effect of changing the crew from a morning - or afternoon run, rather, to a morning run is less than the effect of the higher temperature. And as you're probably aware, the general trend is for the temperature to be lower in the morning, by a degree of 2 or 3, and then gradually increase over the day, depend upon exactly what activities are scheduled. So, we'd try to pick that relatively cooler time in the morning. And the crew, of course, will be given the option of whenever they desire to start sleeping in a different part of the workshop or the stack, I should say, presumably up in the MDA area, where it's somewhat cooler. And I guess that's

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a real brief summary of the - of the steps for the thermal situation. Day after tomorrow is a day off, but we will be considering doing an EREP pass and be doing a small amount of ATM activity. And I'll stand by for questions.

QUERY Well, you said the effect of - of moving the medical runs to the morning is less than the effect of the higher temperatures. Is it -

WINDLER Yes, on the data, I was referring to. The - you know - from a pure data point of view, you'd like to have the crew run at the - an individual run at the same time of day and so forth. And of course, we've always tried to do that when we can, and usually we're able to do it. But in this case, it's felt like it's better to make that change and get them just a little bit cooler. I don't guess I mentioned the temperature. Right now it's around 80 degrees. Tomorrow, we're predicting - since there's no maneuver - predicting it will be about 81 during - say the middle of the day.

QUERY None of the crew themselves complained about the heat at all. I haven't heard anything on the air-to-ground.

WINDLER Well, I - they mentioned it - complaint may not be the right word. They - they have mentioned that it's - that it's warm, and I think they've indicated that it's, you know, it's sort of a nuisance. They haven't - they've indicated that they having some - -

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WINDLER - - ed that it's - that it's warm and I think they've indicated that it's, you know, it's sort of a nuisance. They haven't - they've indicated that they're having some difficulty in getting to sleep in the evenings. And of course we've been trying to allow them a little bit of extra time in the evening to get relax and quieted down. And I - I think - or at least the doctors think, that probably - you know, the elevated temperatures are - just like you would be in the summertime without air conditioning. It's a little bit harder to get to sleep than it is when it's cool.

QUERY You may not have this kind of number with you and - and you may not know it, so that's okay. But if things go pretty much as they are right now, how close would you be down toward the redline for TACS th - at - on the 8th of February?

WINDLER Well, right now, we're only using ar - less than a 100 pounds a day. And we have around 16,000, I believe it is. So - we're not too close, it's only the - but, as you well recognize we from time to time have a little burst of 3 or 4 hundred and sometimes a thousand. So, we - we keep getting better and every once in a while we'll spend a little bit that we didn't count on. So, it's hard to say how far above it we'll be. But if - if everything goes well, we'll be quite a ways above the redline when we get to the 8th. I say the redline, it's a rescue redline.

QUERY Milt, tomorrow's supposedly is the next GO/NO GO decision on whether to go the next week. Do you see any reason why they can't get the go ahead?

WINDLER No, I don't but of course that's the subject of review with - up in Washington with the administrator George Lowe - Dr. Lowe, but I - I don't see any reason why we'd have any trouble making that decision to GO.

QUERY And could you describe the - the CMG number 2 funny today? It sounded a little different from the rest of them.

WINDLER Well, I - gosh, I really didn't pay a lot of attention to it. It - it happened really not during the day today, it happened before I came on. I guess it's just another typical little occasion with the - with the currents and the temperatures. I hadn't - it's happening so often I haven't really attributed anything unusual to it.

QUERY Well, they - they really didn't announce it on the PAO loop until gosh, just about an hour or so ago. And they said that it was different. And that only the wheel went down and nothing else changed.

WINDLER I believe you must be referring to CMG

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number 3 yesterday. Is that possible?

QUERY No. Well, he made it sound like it was all new this afternoon when he announced it about an hour or so ago.

WINDLER Well, you know you got me there. We - the GNS and I were discussing something that - that actually occurred before we came on. And we - we may have confused the PAO, but on number 3 they had a different event yes. In which nothing changed but the wheel speed. The - the temperatures didn't change, as you know we've come to get a higher bearing temperature relatively speaking, is - is one of the main criteria for calling the CMG stressed. Probably that's what he was referring to, because this afternoon, we did - he pulled some data out of the data retrieval system that had just been put in there, relatively recently, and - and was able to get the plot of it. And he and I had been discussing it once off and on during the day, and that's probably what it was. I believe that event occurred yesterday sometime. In - -

QUERY Was that - -

WINDLER - - in fact it may have been 2 days ago, I'm not sure - -

QUERY Okay, is that - -

WINDLER He didn't consider it to be an anomaly personally.

QUERY Is that the first such thing on number 3?

WINDLER I believe it is. Yes. And that was what was of some interest, but as I say he - he really didn't attribute that to his - as a real CMG stress.

QUERY Oh, was that the one where there was just a reduction of 50 revs?

WINDLER Yes, I believe that's - -

QUERY That is - -

WINDLER - - the same one.

QUERY That's number 3 then, yeah.

WINDLER And didn't that happen a couple of days ago. I'm not real clear on what day it was?

QUERY He just announced it about an hour ago.

WINDLER Okay, well, it - I guess you did - he did that because he just got the confirming data from the data system.

QUERY Has there ever been a - anything that you could see in all these months that - that has bothered you because you don't have one solar power panel?

WINDLER Well, the answer's got to be yes to that. But I can't think (laughter) - -

END OF TAPE

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QUERY - - that has bothered you because you don't have one solar power panel?

WINDLER Well, the answer's got to be yes to that, but I can't think why. We really - it's been an ongoing - off and on ongoing type problem. There were periods there where we had to power down to do some Earth resources experiments that we could have avoided if we'd had the other panel. However, that turned out to be more of a nuisance than a real limitation. We may have had to forego some passes I'm sure we did. That'd be the biggest thing, I believe that - so far that - the way in which it has affected us. But the system has worked so well that basically it really hasn't turned out to be the kind of a problem that I guess we would have suspected it to be if we'd have been worrying about it before the flight, all considered.

QUERY Back on that - on the CMG 3 hiccup or whatever you might call it, yesterday. Did it have any other characteristics or - of what has been happening to CMG 2?

WINDLER Not -

QUERY Did you see any kind of connection?

WINDLER No, not that we could tell in the data review that we've done so far, which is probably about as complete as we intend to make it unless something turns up. Marshall, of course, goes into these things in much greater detail than we do, but the rpm change was the only symptom that was similar.

QUERY And - I'm not sure about when the last time CMG 2 showed distress. Can you remember?

WINDLER I'm not either. I think it was also - -

QUERY Was that 2 days ago?

WINDLER No, I believe it may have been as late as yesterday, but I wouldn't - that's probably on the report somewhere that's available to you though.

QUERY Okay.

PAO Last night's press conference.

QUERY They're all beginning to run together.

WINDLER Yeah, that's the same problem I have.

(Laughter)

PAO Mark. Go ahead, Mark.

QUERY Once again - this may not be in your area, but there has been some discussion that there may be a quarantine of a couple of weeks after - for the crew after splashdown, have you heard anything along those lines?

WINDLER You're right. That's not in my area. No, I haven't, to tell you the truth.

PAO Okay. Thank you men.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
January 15, 1974
4:19 pm CDT

Participants:

Charles Lewis - Flight Director
Don Green - Pao

SL-IV PC100A/1
TIME: 16:19 CDT
1/15/74

PAO Okay, we're ready for the evening press briefing with Charles Lewis, whom all of you know. Charles you ready to go.

LEWIS Okay. With regard to the Flight Plan, we're - on the scheduled Flight Plan for today T020 this morning, the Pilot changed out the EREP S192 detector and as I was leaving I understand he got a good alignment on that - on the detector. So that all looks real good. We launched the NRL CALAOC at 19:00 GMT, got a good launch and the crew will go into their JOP 12 operation starting just before 22:00 GMT to support that. No maneuvers today, for tomorrow again no maneuvers. It's primarily medical and ATM operations. No systems problems, we did have CMC 2 and slight distress last night like we've seen before. And that's - that's all I have. Any questions?

QUERY When will the next maneuvers be?

LEWIS Well, right now there's and - possible EREP pass as early as mission day 65. But if our internal temperature gets up 85 87 like I said earlier, we may elect not to do that EREP. That would be the earliest. The temps are up we may delay EREP maneuvers until about day 66 or 67.

QUERY Have internal temperatures already caused you to surrender EREP opportunities either now or in the next few days that you've - -

LEWIS No, we've not cancelled any EREP thus far based on internal temp. Our internal temp today is about, well it's a little less than 78 degrees when I left.

QUERY Okay, we were told earlier that this problem is continuing to be studied and do you have now a more definite projection on what the final top temps will be before they start down?

LEWIS In the range - top temps in the range of 85 to - about 85 degrees possibly a little higher - 87. And we've tried to come up with a hard number as a limit but that's - we think impractical. We're looking at our Flight Plans to give the crew some flexibility if they get to feeling warm. Reduce the work load, move more of the work load, those activities up in the MDA in that area where it's cooler. Look a little flexibility and let them call the shot based upon their feeling.

QUERY It was our understanding earlier that it would be Saturday before they'd see darkness again and then today in air-to-ground they said 74 hours, could you clarify that, when they will in fact see sunset?

LEWIS Well I'm trying to remember, I gave that to you the other day and I've forgotten what it was, I don't have it with me. Was mission day - I thought it was early

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mission day 65 but I'm not certain of that. And I don't have that information with me right now. Now they did have 72 hours on the clock or 72 hours on the clock this morning sometime. But that doesn't tag up with Saturday, I don't know, it won't be Saturday - that sounds too late. It's earlier than that before we get back into some darkness.

QUERY Okay, now the early times that they start seeing night again, is this going to be what - just a brief glimpse at it or like 10 minutes and then back - -

LEWIS Starts with a very short sunset period that gradually increases.

QUERY Okay. And do you have a top projection for the skin temperatures and anything new on the out gassing problem.

LEWIS No, as a matter of fact we've raised the limit on that up to the point we don't think it's going to be any problem at all.

QUERY Okay and the skin -

LEWIS We're talking above 300 degrees before we'd ever have any kind of a problem and we're talking in the range of 310 to 325 is our red line. And our projections show we won't see that. I think the only thing that would effect our planning now would be the internal temp and we're looking at that still, and like I said trying to look at our flight planning and give the crew a little more flexibility based upon the way they feel at the higher temps.

QUERY Is there anything that they have said or anyway that you would anticipate there - there being sort of a line at which they might say hold back on giving us any extra -

END OF TAPE

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Query - - are anyway that you would anticipate that there being sort of a line which that they might say, holdback on giving us any extra things to do because the temps were - was a little too warm in there. That sort of connects with the question of do you expect to lose any - any data in any way? You know any kind of other effects that the - that the temps - high temps might have on - on the work of the crew's work so that you might lose something.

LEWIS Your first question I guess, has the crew said anything thus far? Not to my knowledge. As far as what else it might impact, we talked about the EREP passes possibly cancelling those. I don't know whether or not it would bias any of the medical runs or not. I just don't know. You would have to talk to one of the surgeons to see, or one of the medical PIs to see if it would influence his data the fact that they are at a higher temperature. I would suspect that it would not unless we exceeded 85, 87 degrees above that point. But that is only a guess on my part, and really ought to talk to a surgeon or one of the medical PIs. As far as the other, any other experiments, there should not be any effect, to my knowledge.

QUERY Is there any consideration being given to calling off the severe physical activity or exercise or medical experiments due to the high temperature?

LEWIS Not on our part. Like I said, I think we're going to talk to the crew about it probably the next few days and let them call the shots based on any discomfort -

QUERY You have received no -

LEWIS that they may have.

QUERY - indication on one of the other B channel or anything else from the crew regarding this?

LEWIS No.

QUERY Could you describe for us in fair amount of detail JOP 12, how the CALROC - -

LEWIS Okay, as I understand it what we do with the CALROC it is payload has similar instruments to what we have on board. We're talking about the 82A and B. They launched that in take data, recover the payload, and then - well, as you note in the Flight Plan sometime later it looks about 2 hours - 3 hours the crew starts operating JOP 12. The reason for the delay is we wait for the payload to be returned, the people look at the data and then they instruct the crew where they want to point the slits on 82A and B. Because they want comparison data, and they actually want a quite area because of the delay of the CALROC and when the crew run. So they pick a quite area, one they don't suspect will change much to get data to compare with the

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on board instruments and the payload instrumentation, calibration purposes and so forth.

QUERY I - I know the record on these CALROCs it's just - just absolutely perfect. But in the remote change that it doesn't go is - is there anything that can substituted for that JOP.

LEWIS Well, it's gone and it's GO. But we do -

QUERY It is go. I mean that part of the data and all that jazz.

LEWIS Prior to - - We do send up an alternate ATM schedule, in the event when we have a launch scrub or some problem with the payload that type of thing. So that would not - - we'd go into another type ATM viewing JOP for that time period.

QUERY The basic purpose of this is to calibrate the instruments though isn't it?

LEWIS Yes, because the instruments that we've got in the Skylab have been up a long time and so forth. And so it's a basically a calibration. They take and compare the data for calibration first.

QUERY All right. I didn't make myself clear. If - if this data from the CALROC is not good enough to calibrate the instruments on Skylab, what are we losing and what's the effect on the Skylab data?

LEWIS If it's not good enough to calibrate. Gee, I don't guess I can - I couldn't give you a specific answer. I would suspect that any type calibration like this as far as the ATM data, we would - it could be biased so to speak if we knew. But your saying is the CALROC data was no good. Is that - the point that you were trying to make? We don't have anything to compare it to?

QUERY Yeah, if you don't have anything to compare it to what is the effect on the - ATM data?

LEWIS I don't know, I really don't. Get one of the ATM PI people and that on 82 A and B to talk about that.

END OF TAPE

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LEWIS I don't know, I really don't. Get one of the ATM PI people in that - on 82A and B to talk about that.

QUERY Was there anything unusual Chuck, about the - the glitch on the CMG 2 last night. It was - had all the characteristic of the - -

LEWIS Same characteristics - it normally would happen when the two temperatures converge and they - they converged around 77-1/2 degrees, I believe and that's - that's point where we saw the current up a little and the rpm drop down 20 to 30 rpms. Same - same thing we've seen before.

QUERY Are there any new theories - -

LEWIS No.

QUERY - - on the old problem?

LEWIS No.

QUERY No.

LEWIS And we haven't seen anything - anything more on CMG 3. I mentioned the other day, we'd seen a little bit more current draw on it, when it was at low temperatures just before a heater cycles came on. We haven't seen anything on that since either.

QUERY Is there any new thinking on the prognosis for CMG 2? So far as the balance of the mission?

LEWIS No.

QUERY Nothing tha - -

LEWIS We still hope we will hold on - hang in - hang in there until - -

QUERY But nothing new indicating that it will - it won't then.

LEWIS No.

PAO Okay, thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 14, 1974
4:17 CDT

Participants:

Charles Lewis, Flight Director
Dennis Williams, PAO

SL-IV PC-99A/1
Time: 16:17 GDT
1/14/74

PAO We're ready to begin the change-of-shift briefing now. Charles Lewis is the Flight Director just coming off duty and we'll start it with a short statement by him and then we'll have questions.

LEWIS Okay, on today's Flight Plan we had a double data take on EREP, track 29 and track 30. Those went very well. I described 12 - track 29 and 30 yesterday. Track 29 basically came across Texas, the eastern part of the United States and up through Maine, St. Lawren - Gulf of St. Lawrence, and out across the North Atlantic. Now that - that track wasn't all that good weatherwise, it did clear up around Maine, St. Law - Gulf of St. Lawrence. We did pick up some sites there. And track 30 started southern California up through the middle United States and we picked up several sites there. Later today we have two more maneuvers; SO19 and 201 ops, on Kohoutek and that'll be the last of the Kohoutek observations until later in January. I think later in January about the 24th or 5th, we have a few more corollary Kohoutek observations. Tomorrow's Flight Plan has no maneuvers. We will do a - the maneuvering unit TO20 in the morning. And it's primarily ATM operation, some medical runs. And we have the NRL CALROC launch hopefully tomorrow afternoon. If we don't make that launch tomorrow, we have a window 2 days from now and 4 days from now. And in the systems area, there's really no change in the systems area. The temperature continues to go up slightly in the OWS as the beta increases. Any questions?

PAO
QUERY
the EREP?

Art Blooms?

If track 20 was bad why didn't you scrub

LEWIS Well, in the Maine and St. Lawrence area we had two mandatory sites and several desirable sites. And since this maneuver that we're doing now, noon to noon picked it up anyway, there wasn't any point in - in scrubbing it. Track 30 was a good track, it didn't cost any more to get track 29 - those sites on track 29. In other words, the noon-to-noon maneuver covered both those data takes.

PAO
QUERY
This morning they said that the OWS - OWS temperature was 71 degrees, and this afternoon they said it was 78 degrees. Was that an error on one - in one of those figures?

LEWIS Yes, this morning when I came in the temperature was 73 a little over 73 degrees. It got up to around 77 degrees right after the EREP. We expect it to rise, and then it - supposedly it drops back. But we had a CMG reset shortly thereafter, took us out of attitude for a short time, and it went to 78. But we expect that to drop back down - should this afternoon.

SL-IV PC-99A/2
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QUERY On that CMG reset the - ev - everybody
seemed to be surprised that it happened - -
LEWIS Yeah, we hadn't predicted that one.
QUERY Umm.
LEWIS Didn't see it.
QUERY And - and how much mibs did you use
today?
LEWIS One. Oh, one on reset - -
QUERY (Garble).
LEWIS On the EREP pass we used 11, ab - about
55 pound-seconds.
PAO Mark?
QUERY Now, that medically we're into - I guess
tonight we're into unknown territory, past the record
of the previous mission. Does longevity - is longevity
now - medical experiments, longevity is that the number 1
priority of the mission at this point?
LEWIS We - yes basing the way we've evaluated
our TACS capability and so forth, and - and budgeted that
I would say yes, we're going for duration now, primarily.
We've never stated it that's - that's a - the hig - the
highest priority item and we're going for that reason the
full duration, but our budgets and so forth are based on that.
QUERY Okay, well now that you have stated it could
you say that - that medicine - on a scale of 10, medicine
is number 1. Where would - on a scale of 10, where would
FREP fall? Where would Kohoutek fall - that sort of thing -
on a priority basis? From the standpoint of being able to
get through your 84-days.
LEWIS I think the EREP would have the priority
over the Kohoutek observations. And that's really all we're
talking since we're talking primarily TACS now. EREP would
have the priority.
QUERY But on this scale of 10 where would they
all fall - -
LEWIS Oh, I - -
QUERY - - with medical being one. I - I mean
can you give me a feel for it. Or is it 1, 2, 3, or is it
1, 5, 8 or what?
LEWIS I - I couldn't try to break it down
on a scale. I've never - we've really never discussed it
in that fashion. And of cou - -

END OF TAPE

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LEWIS

- - - Or is it 1, 2, 3 or 1, 5, 8 or what?

LEWIS

I - I couldn't try to break it down on a scale. I've never - we've never really discussed it in that fashion. And of course ATM's in there also with the medi - you know - with the medical - so I don't - I couldn't give you a scale breakdown.

QUERY

What - you see what I getting at is - is how important is getting this 84 days to you? In other words do you really feel that is much more important than getting anymore of this EREP, if it came right down to it?

LEWIS

No I think perhaps if we had good EREP passes, good weather and so forth and it would mean possibly shortening the mission a half a day to get it we'd get it.

QUERY

I think what he's trying to say is it's a lot more complicated - -

LEWIS

It's not that straight forward, it depends on the EREP pass that we may - we may have in the future - the weather on that pass.

QUERY

Okay, I got all afternoon - I got all afternoon if it's real complicated. I honestly don't understand what - I mean I know you try to trade things off and you're now telling me that medicine is the number 1 on the tradeoff list. But I'm just trying to find out how important it is to you in your own feelings? And how important it is to the Senior Management Personnel. Have they told you anything or have they just left it up to you.

LEWIS

Well, what we've addressed is the schedule of our medical, major medical runs. Now we have some flexibility - again, I could trade a medical run off on a given day for a given EREP pass and still accomplish both. And our budgets are laid out to take us to the planned end of mission duration. If for some reason we had a problem in our budget - for example in the TACS area and we lost a lot of TACS, what - we would plan the mission such that we'd - I'm sure it would go for the 84 - the duration and get what EREPs we could. So that's why I say medical would probably have a - the duration is an overriding factor. We - got a lot of tradeoffs we can make to satisfy those.

QUERY

Chuck, on Saturday you were talking about the possibility of scrubbing some EREPs to keep this temperature from getting to high during this high beta angle, has anything further been done about that as far as actually scrubbing any.

LEWIS

Well, we haven't - of course I scrubbed one yesterday but that was on weather basically. We're still looking at that, of course the temperatures that we're talking about are predictions from our thermal models. We seem to be following the predictions pretty close and there's still some discussion that January the 18th and the 19th, we might scrub a couple of EREPs passes. It'll depend upon what the temperatures actually get to. And we've got no hard temperature limit at this time.

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TIME: 16:17 CDT
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QUERY Chuck, you've taken about almost 4 hours to do T020, is that normal or is this, have these guys asked for more time.

LEWIS We've modified the T020 checklist and so forth and re-evaluated the time compared to what we used to have on our checklist. I would say really for what we're going to do we've probably extended it some, given it a little more time. At the same time we've dropped some items out and I think before the time frame was 3-1/2 to 4 hours anyway. I think we deleted some items and so basically we're getting a little more time for what they will do.

QUERY How many hours of science are you baselining a day now?

LEWIS Various from 25 to - I see one here that's got 30 on it coming up. Tomorrow we've got almost 30, 29-1/2 hours. But it varies from 25 to - usually 25 to 27 is the range we're - we usually get. You might note also that tomorrow morning we enter a period of no darkness, we're in daylight continuously now until, I think day it's 65, morning of day 65. No sunset.

PAO I have a call-in question. Does anybody have any clues on whether astronauts have seen the Comet in the last week and if so what did it look like?

LEWIS I don't know when the crew last saw the comet, I'm sure they've seen it within the last week. But I'm not sure when the last - what the last day was that they saw it. Saturday? Dimmer, dimmer.

PAO The (garble) is getting dinner. Are there any other questions? Thank you.

FND OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 13, 1974
15:31 p.m. CDT

Participants:

Charles Lewis, Flight Director
Charles Redmond, PAO

SL-IV PC97A/1
Time: 15:31 CDT
1/13/74

PAO - now Flight Director Charles Lewis and today's change-of-shift press briefing.

LEWIS Okay, with regard to today, mission day 59, we - as far as significant items in the flight plan, we NO/GOed the EREP pass 28 - that's track 15, which was over south central United States to the northeast and out over the North Atlantic. The reason for the scrub was bad weather. We're looking at possibly only one mandatory site made desirables which just wasn't sufficient to go into the EREP pass. In place of that EREP time, we worked in some additional ATM viewing time, science demonstration time for the crew. Later today, we have a S063 Kohoutek observation and an S183 observation. Earlier today - at about 13:15 GMT, we had a slight distress on CMG number 2. I say slight, the current was only up about 10 to 15 milliamps. RPM had only dropped down about 20. And this was not a factor in the decision on the EREP pass. So far today, we only fired one minimum impulse burst on TACS and that was earlier today during the 2 - S233 inhibit. And our average gas temperature now's about 74 and 1/4 degree, and that's slowly coming up as we expected it with the high Beta. On mission day 60, we have a - a EREP pass planned - that's - there's two data takes in that. There's a track 29 which includes part of Mexico, eastern Texas, and on up across the eastern United States. That's next - we have track 30 which starts just off of southern California and up through the central United States. Later that day - tomorrow, we have an S019 Kohoutek and a 201 Kohoutek observation. TACS usage estimated for tomorrow is somewhere between 60 and 70 pound-seconds for the EREP - EREP pass. And that's all I have.

PAO That concludes the change-of-shift press briefing with Flight Director Charles Lewis.
20 hours 33 minutes, Skylab Control.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 12, 1974
16:25 p.m. CDT

Participants:

Charles Lewis, Flight Director
Dennis Williams, PAO

SL-IV PC-96A/1
Time: 16:25 CDT
1/12/74

PAO We have Charles Lewis here chan - for the change-of-shift briefing, offgoing Flight Director. I'd like to make a little announcement before we start. As a prime side trip for Super Bowl '74 visitors an estimated 15,000 people toured Johnson Space Center today. The 15,000 to view the space exhibits today while the third Skylab mission is in its 58th day constituted one of the largest crowds in the Center's history. Okay, would you like to give a status report.

LEWIS Okay, regard to the Flight Plan we flew the nominal Flight Plan today. We had a good EREP pass over the continental United States and out across the North Atlantic. Later today we'll have a SO63 and 201 ops plus additional ATM viewing. Tomorrow's Flight Plan we have another EREP pass, track 15, about the st - a little bit earlier than to - the EREP track today. And a SO63 Kohoutek observation, 183 ops and 201 - no the 201 (garble) 183 ops. And a lot of ATM viewing. With regard to the systems operations - I don't know whether you've been tracking or not - but our Beta angle is up around - well today it was a 60 - minus 60 degrees. Tomorrow it looks about like minus 64 degrees, and the OWS internal temp is slowly rising. We are re - we have to consider now the old TDI cyanide out gassing problem from some of the insulation you may recall from SL-I. And today we - for the first time on our AM coolant loops they got warm enough that they melt - we melted the wax thermal capacitors and the loops were forced into an op - modulation mode that we really haven't seen in a long time. You may recall, we had some problems earlier on the coolant loops with - we call it TCVB modulating valve. We witnessed that operation today the loop got very warm and we suddenly saw a decrease flow rate from the warm leg of the loop as is opposed to a gradual change. We suspect that the TCB valve was stuck, it finally let go, and then drove hard over to satisfy the system's demands. Flow dropped down considerably but then it began to recover as the loop cooled. And it's back to nominal operation. In other words the loops worked as they're designed to work with the exception that the valve apparently was stuck initially and when it let go it - we saw a rapid flow rate change in the - one part of the loop. Now, in looking at the thermal problem we su - the Beta angle is going to continue to increase up to about minus 70 degrees, and this thermal situation is going to tend to worsen. We're looking at all aspects of that. The stress on the systems, the coolant loops, for example, other systems considerations being for - to crew comfort we expect the temperature to

SL-IV PC-96A/2
Time: 16:25 CDT
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rise up above 80, somewhere between 80 and 85 degrees internally, if we continue to make our EREP maneuvers. We're looking at all of that, and there's a possibility we may curtail some EREP passes to try to keep the internal temp down some, relieve system stress. And if in fact we approach any kind of critical temperature limit on the insulation and then subsequent evolution of the TDI, we may have to curtail some passes. That would probably be in the time frame of January the 15th through the 19th. There's a couple of days in there we wouldn't do any EREP passes anyway, because the lighting conditions aren't right. But, we may curtail some EREP passes. That's being looked at, so I don't know for certain. That's about it in the systems area. Any questions?

QUERY No anomalous behavior from CMG 2 I presume?

LEWIS No.

QUERY Okay, how about TACS usage. How

(garble) - -

LEWIS Today, we used 16 minimum impulse firings for the EREP pass, that's about 80 pound-seconds. I think we probably predicted some - -

END OF TAPE

SL-IV PC96B/1
Time: 16:25 CDT
1/12/74

LEWIS Today, we used 16 minimum impulse firings for the EREP pass - that's about 80 pound-seconds. I think we probably predicted somewhere around 25 or 30 pound-seconds. Again a little higher than we predicted. We seem to run that way we - we're checking our math models now to see if there are any mass properties or so forth that get updates to try to get that prediction closer to what the actual is.

QUERY At what temperature do you expect that outgassing to occur?

LEWIS Well, it depends on what - how much outgassing parts per million and so forth. As I understand it, they ran tests recently at 300 degrees Fahrenheit - I believe they had point zero two parts per million. Now it's my understanding that the - at two parts per million it's fatal, and we're going back to check all those numbers and reverify that. But - and the problem we have really is, we've got a thermal - we don't have any direct temperature measurements of what the temperature is at that - at the insulation. We were having to extrapolate data because we don't have any direct measurements, using the thermal model at Marshall. And we're going back to examine all extrapolation and - and - and so forth.

QUERY - (garble) that chucked in at 300 degrees what is your extrapolation guesses insulation at these beta angles?

LEWIS Well, tomorrow, we expect to see - we estimate, that the temperature at the insulation bond line would be around 250 degrees Fahrenheit. We go back and add something else to this evolution of cyanide or this - I - TDI from the cyanide - from the insulation. It also depends on the number hours - takes a number of hours it look like to get significant ev - evolution at a given temperature. In our EREP passes where we get these temps, we're only there for a short time. We come down, the temperatures drop rather quickly, so that's another factor.

QUERY Well, I guess two others in that - light, you get .02 parts per million, that's a long way from 2 parts per million. What does it take to get you to 2 parts per million if you get .02 at 300?

LEWIS Let me say this, they got .02 parts per million with the insulation they had in the test that took 40 hours - they baked it for 40 hours at 300 degrees Fahrenheit. So that's an indication of how long it would take to get that type thing. And that also was insulation that had not been subjected to any bakeout prior to that time. Whereas, this insulation has been subjected to bakeout back on SL-1. I really don't think it's going to be a problem, but -

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QUERY Well, does a previous bakeout increase
or decrease the chances of - of TDI?

LEWIS Decrease somewhat.

QUERY Okay, -

LEWIS I don't know how much.

QUERY - is there any reasonable feeling that
there's a good chance of - of a fatal dose of TDI reaching
2 parts per million.

LEWIS I don't think so. No. We're just going
back to look at it because we have - the temperatures are going
up.

QUERY Okay, these guys aren't going to check
out like a lightbulb, the - if they - if that gets in there,
it's going to increase slowly. So at what point will they
physically experience some effects from TDI, and at what
temperature would this occur?

LEWIS You've got me, I don't know. Have to get
a surgeon here to help us on that one.

QUERY Okay, you say that 300 degrees Fahrenheit
was possible temperature. Now, are you talking about the outside
skin or at the insulation bond line?

LEWIS That's an extra - that's the temperature
at the insulation bond line.

QUERY What do you expect to be the skin tempera-
ture at that point there?

LEWIS Well, let's see - I don't - I don't recall
the number they use. In all of our instrumentation goes off
scale high at about 190 I believe. So we can't watch it as
far as the instrumentation we've got. And the - I don't know
what the temperatures reach on the - in the thermal model, they
use - that they extrapolate that bond line temp from. They used
some skin temps, but then we can't watch to see how close
those predictions really are.

QUERY Okay, there was some comment earlier about
there being a physical law which states that an - an orbiting
object at this altitude and this beta angle only reach a certain
temperature, and I'm wondering if this temperature according
to this physical law is high enough to exceed 300 degrees
Fahrenheit at the -

END OF TAPE

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QUERY - - angle will only reach a certain temperature, and I'm wondering if this temperature, according to this physical law, is high enough to exceed 300 degrees Fahrenheit at the insulation bond line inside the spacecraft?

LEWIS No. If you stayed at an attitude that will allow that, probably yes. I would guess so. You see what I'm saying is that if we stay in SI, we got no problem. Basically, it's the fact that we roll over for an EREP maneuver exposing the external skin that - where we lost the meteoroid shield that we get the heat. We only stay there for a rev and then we roll back into SI and it goes down very rapidly. So we've had - we not concerned in a case where we will stay in a given attitude for any length of time where we'd reach a stable temperature. But it would be very high, I would guess. That's just a guess.

QUERY Trying to establish the thing in the proper perspective. The impression we were given earlier, and I've - It is that the chances are extremely remote, at best, that any TDI - harmful TDI would be released, and that what TDI was released would be quickly scrubbed. Is this - is this an accurate description?

LEWIS That's very accurate. We really don't think it's going to be a problem. We - Like I say, we've gone back to look at that since we've began to see all the temps go back up. We've established a red line earlier and I think it was around 200 or 225 degrees. But there's a lot on conservatism and a lot of pad built in that number. And that's the reason we've gone back to look at that, just to see how much pad, how much conservatism we've got in it, and I would suspect quite a bit, judging from the test data we've got.

QUERY Earlier this flight, we had one situation with a high Beta angle and we had something like 38 hours of continuous sunlight. Why didn't we get into this kind of a mode at that time?

LEWIS I don't - I'd have to go back and see what kind of maneuvering we were doing then, Bruce. I don't remember.

QUERY It was very early in the flight.

LEWIS I don't recall if we were doing any EREP maneuvering at that time or not. I just don't remember.

QUERY Well, if the chances are so remote and like you say, you're out of SI for one orbit and then back and you cool down rather rapidly, and it is so remote and you're right now behind on EREPs. as it is, you've got 44 percent completed at two thirds point in the mission. Why are you considering scrubbing some EREPs out, when there's

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hardly enough time to get in the number - -

LEWIS Okay, I - I did - I mentioned three factors and TBI was only one of them. And it was probably the least of the three. It's internal temperature, crew comfort, and system stress. And those are the - right now, the overriding considerations.

QUERY Would these temperature fluctuations tend to reach to the point where it could affect the CMG for instance. I mean, or is it - -

LEWIS No, we've looked at some of that data. The sup - let's see not the amplifier integrater - the IA for CMG 1 and the IA is the power supply for the CMG 1's temp has began to show increases, but we don't need that one anyway as the CMG 1 is the one that has failed. But we - looking at other hardware to see what effect, what other stresses we would have. That was one we happened to notice today, but it would be inconsequential really, since we don't have to have it. I mentioned the coolant loops. I guess we were a little bit surprised to see the one today. We went back to yesterday's data, and looked at it and we saw the temperature was coming up and we'd almost reached the point to where we would have started thawing the thermo capacitors, but we didn't quite get there. Today we did. We thawed them and we saw the loop response.

QUERY These capacitors which you said the plastic coating on them melted?

LEWIS No, they're wax. They're made out of a wax material.

QUERY Oh, wax.

LEWIS They were just a heat sink really.

QUERY Okay, I take it that wax cools again and no - -

LEWIS That's right, solidified, it just uses a little heat sink and for storing - well heat or lack of heat, whichever way you want to look at it. And we got to the point - they work like they're supposed to. It's just that once they do thaw, you see some rather dynamic change in the loop.

QUERY You have any good words on the target along the - EREP targets tomorrow along track 15?

LEWIS I knew you'd ask that and I didn't tag up with EREP - -

END OF TAPE

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Time: 16:25 CDT
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QUERY Do you have any good words on the target - targets - EREP targets tomorrow along track 15.

LEWIS I knew you would ask that, and I - I didn't tag up with EREP. No, I didn't and I'll be sure and do that before I come back over here next time. You asked me that yesterday, and I didn't look ahead at track 15 much. We were kind of busy this afternoon with - with what we saw on track 1. And track 1 as I said just - it was basically what we had the day before. It was a continental pass, Baja, Mexico, up across Oklahoma and into the northeast. And I failed to go ahead and look and see where track 15 was for tomorrow. But, I'll try to remember to do that so I can pass that on to you.

QUERY This appears to be the first day that people here in Houston might get a chance to see the comet. Is there any good words for the comet people as to what they will be able to see at this point, magnitude estimates or anything like that?

LEWIS I haven't gotten any, but the PAO people might have some. They would have more than I have I think.

SPEAKER Yeah, it's about a five. That was - That was the last thing we heard anyway. (Laughter)

LEWIS Whew. Would be kind of tough.

(Laughter)

SPEAKER If you're not drinking anything.

SPEAKER Okay.

LEWIS Huh. I - I haven't seen it yet. Has anybody had a chance to - -

SPEAKER I haven't seen it at all.

LEWIS - - look for it.

SPEAKER Yeah.

SPEAKER I think it's all a hoax.

LEWIS No we're going to bring a lot of pictures back showing that it wasn't a hoax. I got one yesterday from the ATM people that came in from Canary Islands on their observing sites there. Nice photo showing the comet with - and then also that same shot of that Jupiter. So you get an idea of relative magnitude.

QUERY Was it pretty dim, do you know?

LEWIS No it - it wasn't as bright as Jupiter, but it was very visible and you could see a tail and so forth. I don't remember the date on it. If I still got it here I will bring it over and show it to you. If I can remember tomorrow I'll bring it over and show you the one I got. They probably have much better ones but - I believe it's the eleventh. But I'm not sure, that sounds like - maybe older than that.

QUERY (Garble)

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LEWIS
yesterday then.
PAO

END OF TAPE

Today's the twel - well, it wasn't
Okay, thank you very much.

**SKYLAB NEWS CENTER
Houston, Texas**

SL IV - Change of Shift Briefing
Johnson Space Center
January 11, 1974
4:15 p.m. CDT

Participants:

Charles Lewis, Flight Director
Dave Garrett, PAO

SL-IV PC-95A/1
Time: 16:15 CDT
1/11/74

PAO Okay. We're ready for th - this afternoon's press conference, with the off-going Flight Director Chuck Lewis. And I'll turn it over to you, Chuck.

LEWIS Okay, today's fl - Flight Plan's going as scheduled - as we published it. Basically, we had EREP track 5 - track 58, earlier today. Again, we used a little more TACS than we - our programs predicted, but not much in the ball park. We have an S019 later. Tomorrow we have EREP track 1, S063 and the 201; both those latter two are Comet Kohoutek observations. Probably have a couple more days of corollary Kohoutek observations and that'll stop until about January 24th or 25th, I think then they're going to try for a couple of sightings with each of the corollary instruments. As you know we've completed the ATM Kohoutek observations. So, they're back on a full ATM solar - solar studies. On the AT - EREP track today we - we missed some of our S190A film frame coverage on our first sequence. The crew apparently hit - got a wrong switch and cut the 190A off prematurely and so we lost some frames there but it turned out the ETC was operating, so most of that was covered with ETC. And really no problems, the C&D - the ATM C&D loop as you know we've had some problems with it on and off. It's beginning to show some fluctuations in flow rate again. We corrected that last time by using the gas separator to remove gas from the loop, that's no big problem. That's about all I've got as a summary. There's really no change in system status. Any questions?

QUERY Yeah, Chuck what was that TACS usage predicted and actual?

LEWIS Oh, knew you'd ask. I think we predicted 9 - I think we predicted 9 firings which is about 45 pound-seconds and we used 14, which would be about 90 thereabouts. We usually - we usually end up using a little more TACS than we - in our programs if - if you noted that - that over the days. Anywhere from up to 50 pound-seconds more than our predictions show, but it's usually close.

QUERY Have we had any CMG glitches at all?

LEWIS No, not during the last day.

PAO Art?

QUERY Chuck, this being your first execute shift since the ops conference about 10 days ago. Can - can you tell any difference in the crew from what you observed say before the ops conference?

LEWIS Well, I was on summary shifts well, most of last week. Of course we talked to the crew the first couple hours in the morning and - and I've been involved - like all the Flight Directors and the teams, you know,

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reviewing the - the Flight Plan guidelines and so forth. And I noted when we were laying the Flight Plans out in the mornings they were - the crew certainly sounded cheerful and eager to get to work and I think in general, the Flight Planning guidelines that we moved a bit changed a bit and it certainly helped. I think the crew certainly have got a well paid - paced Flight Plan for them and they seem to be very happy with it. And I think they're just the way their discussion with us have gone over the last couple of weeks have indicated that. And by the way, we're back up around anywhere from 26 to 27 man-hours of science time each day. So, in fact, we've taken advantage of the time the crew has given us back in their post sleep and presleep. On the other hand, what we've tried to do as we scheduled the Flight Plan is where we can put a little open housekeeping just small blocks scattered through the day, not so that we can - there's - they don't have time critical items back to back, where they're rushing from one task to the next task that type.

QUERY Chuck, I noticed tonight, they're going to be up an extra half-hour?

LEWIS Yes. And that was to get in - I think it's an S019, I don't have my Flight Plan in front of me. It was S08 or S019 - -

QUERY Yeah, that's the last thing. Are they still doing the S183 at around 22 - -

END OF TAPE

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QUERY
LEWIS
think it's an S019.
of me - -

QUERY
LEWIS
QUERY
22 or 23 GMT?

LEWIS
QUERY
LEWIS
QUERY

tomorrow? Is that over Europe?

LEWIS
I don't have a copy of the track - It's across Mexico up to the northeast I believe. Same - close to the same kind of track we had today. Displaced a little bit I believe to the east, I think. I may be going the wrong way. We get part of Mexico. It's similar to today's track.

QUERY
I wasn't sure was it the beginning of track one or the end - beginning is over Europe and the end is over the United States. I just wasn't quite sure.

LEWIS
QUERY
LEWIS
QUERY
LWEIS

- -An extra half hour?
Yes. And that was to get in that, I
I don't have my flight plan in front

Yeah, that's the last thing, yes.
It was an S08, S019.
Are they still doing the S183 at around

Should be, if that's on the flight plan.

Okay, yes.

Yeah.

Is - do you know what track one is

No track one comes up across Mexico.

It's across Mexico up to the northeast I believe. Same - close to the same kind of track we had today. Displaced a little bit I believe to the east, I think. I may be going the wrong way. We get part of Mexico. It's similar to today's track.

I wasn't sure was it the beginning of track one or the end - beginning is over Europe and the end is over the United States. I just wasn't quite sure.

It's a continental pass.

Okay.

Are there any further questions?

Quiet day.

Yeah, okay, thanks. Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - 56-Day Mission Review
Johnson Space Center
January 11, 1974
10:a.m. CDT

Participants:

William C. Schneider, Director Skylab Program
Kenneth S. Kleinknecht, Skylab Program Office Manager, JSC
Dr. Royce Hawkins, Director Medical Operations, Life Sciences, JSC
Luther Powell, Skylab Program Office, MSFC
Bill Pomeroy, PAO

SL-IV PC94A/1
Time: 10:03 CDY
1/11/74

PAO Morning, ladies and gentlemen. We're ready for our Mission day 56 status review with the top management from the Skylab program. We have with us, to my immediate right, Luther Powell, the Skylab Program Manager's senior representative from the Marshall Space Flight Center, Bill Schneider the Skylab Program Director, Kenny Kleinknecht, JSC Skylab Program Manager, and Dr. Royce Hawkins. And we'll start off with some remarks by Mr. Schneider.

SCHNEIDER Okay. Good morning. It's a pleasure to be here on the day after the mission would've ended if we hadn't extended it. We think we've had a pretty successful mission so far. We did do a complete review of the crew health, the health of the spacecraft, the consumables, and the work we had ahead of us, to see whether or not we should continue the mission on beyond the 56- 59-day period. And as you know from our release yesterday, we did conclude that the crew is in good shape, the spacecraft is in good shape, and we have enough consumables on board and enough work to do to make an extension of the mission not only possible but desirable. And so we did give a GO for an additional mission extension. We will, as you know, review this every week on a weekly basis and continue that until we get up to the final 84-day period. So we expect we'll be doing that on a regular basis. But just to review where we stand on the mission and how then to forecast ahead a little bit and what we expect to get, we did do on day 56, a beam count of what we have accomplished so far in this mission and as we are at the 2/3 point, why it's quite interesting to find that in general, we have completed about 2/3 of what we had planned to before lift-off. In the medical area, we have actually produced about 62 percent of the performances that we'd planned. The ATM is at 67 percent on the solar and 94 percent on the comet Kohoutek and it will not get any better because ATM will not be looking at the comet anymore. EREP has been suffering a little bit primarily because of the problem that we've been having with the gyros and we have to date, produced 44 percent of what we had planned premission. The corollary has had a light period because of the comet Koutek observations and we have done only about 38 percent of the corollary. But the corollary Kohoutek observations are up to 65 percent. Student investigations are about 56 percent and our operational DTOs or about 59 percent. So in general, we're - we're roughly on schedule. And if you look and see what we expect to produce from here on out, it looks as if we will be able to get about 284 hours of comet - of ATM observations of ice - about a 200 - 205 hour mission requirement that we had established many months ago. The comet looks as if we'll be able to get almost everything

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that we had planned. We indeed have probably more hours available for comet observation than we will have opportunities. In the medical, we'll be able to get our whole 375 hours of medical and probably, the guys who will have the most difficulty in getting the final completion of all the requirements is in the EREP area and that will be primarily because the weather has not been very cooperative and of course, we're not in a very good weather situation right now. So we believe that probably while we have time to do the 24 remaining passes and we have enough consumables to do it, we probably will not have enough opportunities to do that. All other activities are schedulable and we think we will end up with a full compliment of experiments probably accomplishing something on the order of 1600 hours of experiments when we finish. We have 965 hours of experiment accomplishments as of mission day 52, and that's gone up probably, I would say, maybe almost 100 since then. So, a very - very productive mission so far. I'm looking forward to a continuation of that productivity. In the area of consumables, we're in good shape. The control moment gyro is - has not improved. It hasn't gotten any worse. We continue to watch it and it - -

END OF TAPE

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SCHNEIDER And that's going up probably, I would say, maybe almost 100 since then. So a very - very productive mission so far, and we're looking forward to a continuation of that productivity. In the area of consumables, we're in good shape. The control moment gyro is - has not improved. It hasn't gotten any worse. We continue to watch it. And it gives us our heartburn every day to ensure that it's still working. It obviously can always fail at any time. In the event of a failure of that, we have our plans well made out and we would proceed and adjust our schedule from there on out. So -

SCHNEIDER - - medical and health. I guess that's (garble). Did I leave anything out?

SCHNEIDER I guess with that, why, we ought to turn it over to questions and find out what you're interested in.

PAO All right. If you'll wait until we get the microphone to you.

QUERY Bill, could you tell us what some of those plans are, say the CMG number 2 fails, say, today or tomorrow. What are contingencies -

SCHNEIDER Well, if the CMG failed, why we would shift over to RCS control as soon as practical. We would put in our quasi-inertial patch and we would check out that quasi-inertial patch. And we would make a decision there to - whether or not to stay on TACS or RCS. We wouldn't assess our ability to - from watching what the consumable usage was. We've never used all those systems so we'd check our consumable usage. We would probably end up doing an EVA and then what I would call an orderly return. We do not have such capability to do maneuvering. We do have some. Every-time you maneuver, why you shorten your expected life in orbit. So we would not do much maneuvering, although it's conceivable we might maneuver once. But in general we would - we would be coming home in an orderly basis, getting our data, doing an EVA and that sort of thing.

QUERY By orderly basis, a matter of a few days?

SCHNEIDER Yes, yes. It'd be no emergency -

QUERY At the first possible return? - The first possible return?

SCHNEIDER Not necessarily. Depending upon the situation, whether or not we could get an EVA in and get our film back and things of that nature, and what the consumable rate usage was. We would come back in an expeditious, but not on an emergency basis.

SPEAKER I think it's a new mode of operation and we have to see what the consumables situation's going to be. Certainly we'd like to orderly get through an EVA, so we can bring back the data we've collected. And to get - I think the important

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thing first - most importance is to get back the primary landing area, then to get the EVA and orderly get the spacecraft stowed and bring back all the information we have.

QUERY Well, on that, what would be the time parameters between 5 and 10 days, between 6 and 12? Any idea at all?

SCHNEIDER We really can't tell, because if the consumable usage was much higher than what we anticipate, why we might come home the first primary recovery area that we see. However, we go over the primary recovery area every 5 days. So in general, you'd say it'd probably be on the order of 5 or 6 days something like that. But we really can't say with any concreteness until we went into those modes and saw what the consumable usage was.

QUERY But you wouldn't try to go the - as long as you possibly could using the TACS and RCS to their utmost ability? Going for 25 days?

SCHNEIDER We would always preserve enough - enough attitude control capability to be able to activate the rescue. So we would always maintain the ability to - when we - we'd always plan on coming home with at least 10 days of attitude control left.

KLEINKNECHT I think a direct answer to your question is yes. So we'd go as long as we could reserving those requirements for a primary landing area EVA and having enough consumables which is attitude control really to do a rescue should it be required at the time you would plan to separate.

QUERY Then in numbers it would be up to no more than 15 days?

KLEINKNECHT Probably on that. No more than that and somewhere between 5 to 15 is a good broad band. (Laughter).

QUERY That's what I asked - That's what I asked in the first place. (Laughter)

QUERY You use the terms, you're going to give approval week by week from here on. Do you recall see anything standing in the way of an 84-day mission?

SCHNEIDER Right now, there's nothing - nothing at all in any one of those items that gives us any question - any doubt about the first 15 days. Obviously, we do want to continue to look at the health and how they're behaving. And they're behaving well.

That will - will be good. The CMG is obviously something that will - will be good. Consumables unless they - unless they have a problem and eat up a lot of food. why, that seems to be good.

QUERY I've been reports off and on about this crew being more enthusiastic than previous Skylab crews. Could you please elaborate on this please, sir?

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SPEAKER Yeah. They're your reports, not ours.
This crew is very enthusiastic. We have no problem with
them. They had set as a goal, that they're going to make
the 85 days and they are.

END OF TAPE

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SPEAKER - - probably on that. No more than that and somewhere between 5 to 15. Broad van.

QUERY That's what I asked in the first place.

QUERY You used the terms you're going to give approval week by week from here on. Do you really see anything standing in the way of an 84-day mission?

SPEAKER Right now there's nothing - nothing at all in any one of those items that gives us any question - any doubt about the full 84 days. Obviously we do want to continue to look at the crew's health and how they're behaving, and they're behaving just fine. The CMG is obviously something that will - will color our judgement. The consumables, unless they - unless they have a party up there and eat up a lot of food, why that seems to be in pretty good shape.

QUERY There have been reports off and on about this crew being somewhat less enthusiastic than previous Skylab crews. Could you comment on this, please, sir?

SPEAKER Yeah, they're your reports, not ours. This crew is very enthusiastic, we have no problem with them. They had said as a goal that they're going to make the 85 days and they are. They are in good health, they've maintained their health very well. They've maintained their exercise regiment. They've managed to eat and sleep. They have done all of the things that you would expect them to do to put themselves in the best posture for the 85 days. As I've said, the performance here on the experiments has been right up to expectations. This crew has not done what the last crew did which was to kind of excellerate and go beyond our expectations. However, this was the way this crew planned on doing it. They planned on maintaining their health and well being with the 84-day as the primary goal. That's the way they are running it and that's the way we're running it, and we're satisfied.

QUERY Dr. Hawkins, from what you can tell from the medical data you're getting from orbit, can you compare the state of this crew's vital capacity or general health with that of Skylab-III, the last crew of the second manned mission?

HAWKINS Well, yeah, we're comparing the results of the data that we have at this point in time. This crew looks very much like Skylab-III crew, or perhaps maybe a little better in some - in some ways, in some areas.

QUERY Have you found any plateau effect at all that the curves are leveling off?

HAWKINS The results that we've seen in our major medical experiments all have been more or less in a plateau over - I'd say the last 30 days, and which we've really not

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seen any appreciable fluctuations or deviations from the -
from their established inflight adaptive lines.

QUERY

Which areas would you say that they're
better or they are in better shape than the SL-III crew?

HAWKINS

Well, I think the - we're seeing some
- in the cardiovascular system where the responses to the
lower body negative pressure are perhaps a little more less
inclined to fluctuate than what we saw with the Skylab III
crew. And also at this point in time, of course, we had
more aborts, more terminated runs in Skylab III than what
we've seen with this crew. Now on the other hand the bicycle-
ergometry work, their work performance there, their - this
crews heart rates are running at - under the maximum work
loads, are running a little higher than Skylab III, just
to look at comparisons. But this - this is an established
level for them, and I see nothing wrong with this. I don't
mean to flag it as something wrong in any way whatsoever.
It's an established level for this crew which is a little
bit higher level than what we saw with Skylab III. I don't
really yet know what that means.

QUERY

Dr. Hawkins, are there any other areas
besides the cardiovascular where this crew seems to be a
little bit better? What about their sleeping habits?

HAWKINS

Well, again this is an individual thing
and you - you certainly see differences from one individual
in their sleep patterns. We have - we have definitely
seen some, in this crew especially with one crewman, where
he - he wants more - more positive time devoted to sleep.
This is partly in just using time and preparation for sleep
as well as total - total time at sleep.

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HAWKINS - - he wants more - more positive time devoted to sleep. This is partly in just using time in preparation for sleep as well as total time at sleep. The crew, Skylab IV crew, tend to sleep perhaps a little bit longer than what we saw in other previous flights. Earlier, you might recall, we seemed to kind of get the impression that - that in flight that the crews tended to sleep less of what they normally do on the ground. But this crew tends to kind to shoot that conclusion out because they tend to require just about what they did on the ground. So I don't - I don't yet know if that measures up any major differences between crews but it is an interesting point.

QUERY

HAWKINS

QUERY

HAWKINS

SPEAKER

in health.

HAWKINS

They're - they're sleeping well. That's the important thing. They're resting. They're benefiting from the amount of sleep that they're getting and they're showing this in the performance of the day's activities, which is pretty long. And the weights have remained very stable. We have seen with this crew, in the Commander, the first time where - in Skylab where a crewman maintained his preflight weight. In fact, the commander's even perhaps slightly gained, maybe a half a pound or a pound. The other two - two crewmen, lost between 4 and 5 pounds in the first 10 days of the mission, and they have remained at that level of - throughout the remainder of the flight. This is not too much unlike previous crews.

QUERY

Mr. Schneider, out of the 44 percent of the EREP data that you gotten so far, you - would you say that a minor reason for that is the problem with the filters being left out. That is, a minor reason for having achieved less than you would've expected at this point?

SCHNEIDER

Oh, that hardly even contributes to this. This is primarily a case where - between the control moment gyros making it more difficult for us to maneuver and the fact that we've had some pretty bad weather, has just prevented us - and I must add, the comet observations have made it difficult for us to put EREP passes there. So that filter incident was fairly minor.

QUERY

Dr. Hawkins, yesterday when Joe Kerwin was talking to the crew, he seemed to indicate that they had found something new about the pooling of blood and so on. Could you elaborate on that? He didn't get in too much detail on it.

SL-IV PC-94D/2
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HAWKINS Okay. The - We've been concerned with body fluids throughout the whole Mercury, Gemini, Apollo and Skylab programs. And there's always been this report about the feeling of fullness in the head and even observations of rounding of the face and distention of neck veins indicating that there is probably more pooling of blood in the head, the upper part of the body. And we have star - when starting back in Skylab III, we had it on some - some minor experiments that we ginned up in order to try to take a closer look at what is happening to the blood flow and the limb volumes - the volumes of the legs primarily. And this proved to be rather - rather informative and useful information and we have continued that now in this mission. And we are definitely seeing here what seems to indicate a shifting of body fluids to the torso and to upper extremities and out of the legs. Now, this is determined through the girth measurement of the extremities and body torso as well as through actual blood flow measurements into the legs. And we are gaining some rather useful information here, I think, that's going to tell us a lot more about redistribution of the body fluids and that we're not losing fluids from the body per se, as we originally thought.

SPEAKER One of the things that perhaps is happening is we may be developing a whole new series of missions because the way I see - the way I interpret the data from Dr. Thornton those of us with middle-age sag when you get in zero g, why there's a tendency for that to go back up into the chest where it used to be.

HAWKINS Yeah, there's - as you know, there have been reports of - from the height measurement in this mission, now, that there is an increase in body height. And this - I think this doesn't surprise me, really. But the amount of difference does surprise me a little bit. It's a little more than I would've expected.

QUERY Can you put some numbers on that? In other words, how much have they lost around the circumference of the legs as opposed to how much they've gained in the arms or in the neck?

HAWKINS Abby, let me see. The calf circumference have been on the order of about 1-1/2 inches. I don't have those exact figures here with me. But I can make those available to you. I just really don't recall all of the limb measurements which we are doing. I'd have to go back and dig those out. And the upper extremities, we've - we have only had now two measurements and that was earlier, much earlier in the mission. And we will be getting some some more of those now and in which we can compare and see whether there's been any further changes as a result of the flight itself.

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HAWKINS And we will be getting some - some more of those now, which we can compare and see whether or not there's been any further changes as result of the flight itself.

QUERY Dr. Hawkins, can you recall the - you said they've grown slightly. Do you recall approximately how much. You said you were surprised at the amount.

HAWKINS Well it - Yeah. It's about 1-1/2 to 2 inches. I don't remember specifically for each crewman what, exactly, that is.

QUERY Dr. Hawkins, is this the first time you've seen that? The first time it's been recorded?

HAWKINS Yes. That's the first time we've measured them.

QUERY Do you suspect it's happened to other - -

HAWKINS I sure it probably has - -

QUERY - - other crews?

HAWKINS - - because it's - It's just an unloading of vertibral column, really, is what it is. How you can - You can test this out on yourself if you measure your height before you go to bed at night and then when you get up in the morning. It's not uncommon for unloading of the spinal column in the horizontal position to - and thus your height would be a little more in the morning than it would, not that drastically changed, but this is definitely known.

QUERY Then they won't keep this extra height after they come back?

HAWKINS (Chuckle) No.

SPEAKER The stomach will sag, too.

QUERY Bill, about 10 days, or so, ago, they

had this ops conference in which they cleared the air in a lot of things. And since then the crew has been performing a lot better, and things have been going a lot better up there. For some time, Jerry had been asking for this thing, why wasn't it done earlier?

SCHNEIDER I don't recall that it was asked for. We were trying to respond to the things he was sending down to us on channel B. And we finally decided that we would tell them what kind of restrictions we had. It became apparent to us that they were not aware of the kind of restrictions we were having on our flight planning. And we had been trying to respond to the restrictions our flight planning had been putting on them. And so we ended up having that conference. I wouldn't characterize it as a change in the crew's performance, I'd characterize it as we were able to clear up some of the restrictions that had been placed on us that have allowed us, then to flight plan a little more flexibly.

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which is then, therefore, reflected in the amount of work that we've been able to do. The exercise and the pre and post sleep and things of that nature were very constraining on the flight planners and we got that cleared up.

QUERY Bill you reported having completed about 64 percent of your ATM experiments. Now that the comet is out in left field will you go back to your viewing of the Sun? What exactly do you have in store for the remainder of the flight with the ATM?

SCHNEIDER Well, we will continue our solar observations. The Sun has rotated again and just I guess, today the period of - that the active portion of the Sun is coming back in front and we do expect to do quite a bit of solar observations from here on out until the end of the mission. So we will be concentrating on the solar activities with the ATM.

POWELL Bill, we ought to put that percentage in perspective, though, that's hours of observation. Every hour of observation is solar phenomena that they're observing and there isn't anything magic about the number of hours and the data you get back is the significant thing. Not the number of hours of course. If the Sun is dynamic and the more you look at it the more different phenomena you see and more data you get that can be analyzed and put into the total pool. In all of these numbers in percentage is more or less the number of data takes that we had planned. It isn't necessarily directly indicative of how much information and how much science is coming back.

KLEINKNECHT I think we've said repeatedly, the success of Skylab from anything other than just an operational, we did this kind of standpoint, won't be evident for years. Some of the ATM solar scientists told me that they expect to spend up to 10 years analyzing their data.

SPEAKER At the same time, we believe that we're getting creditable and good data out of all of this time and opportunities for all the experiments.

QUERY Mr. Schneider, when last we met, you mentioned the possibility of it's being studied to advance the launch readiness of the rescue rocket at the Cape. What is the precise state, at this time, of the launch readiness?

SCHNEIDER As of this morning, we were at minus 9 days and holding and we have no plans to do anything differently. If for any chance - for any reason we'll - if we lost another CMG, that - -

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QUERY Mr. Schneider, when last we met you mentioned the possibility that was being studied to advance the launch readiness of the rescue rocket at the Cape. What is the precise state at this time of the launch readiness?

SCHNEIDER As of this morning we were at minus 9 days and holding and we have no plans to do anything differently. If for any chance - for any reason we - if we lost another CMG, and something else went wrong at the same time, it's conceivable that we might countdown further, but we have not made any decision like that. We will hold there until something drastic happens that tells us we should move on closer

QUERY As we're getting down to the final leg of the final manned Skylab mission, do any of you have any idea of what you think Skylab will most be remembered for when it's all over?

SPEAKER No, I guess we all have our own pets. I think Skylab will be remembered because it has proved that man can go up into space and do useful work in a variety of categories. I can't say whether the Earth resources or the materials processing or the solar science will end up being the most important thing. I'm sure that solar scientists will remember Skylab for its solar science. I am sure that the materials people will remember Skylab for its contributions to materials processing. I'm sure the Earth resources people and geology people, for example, will remember Skylab. The thing that I'm convinced of is that Skylab is going to be remembered by a great number of people for a great number of reasons, and I can't tell you which one I think is most important.

SPEAKER

I agree.

SPEAKER

I agree with that too.

SPEAKER

have nothing to add to that.

SPEAKER

in, I must be good. (Laughter)

SPEAKER

I say naturally medical standout is the minds of most of us. Nah, I'm just kidding. I think they're all extremely valuable pieces of work. They're certainly going to be beneficial to all mankind, really.

SPEAKER From a NASA standpoint, you know, from space flight for space flight's sake, I think the most memorable thing, I think, is going to be that fact that we've shown. You can do a great number of things with a great amount of flexibility. And Skylab, from our internal standpoint is going to be remembered for its contributions in that area.

PAO Okay. If there are no further questions, thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 10, 1974
4:18 p.m. CDT

Participants:

Phil Shaffer, Flight Director
Mary Fitzpatrick, FAO

SL-IV PC93A/1
TIME: 16:18 CDT
1/10/74

PAO Okay, we're ready to get started with this afternoon's change-of-shift briefing. We have with us the off-going Flight Director Phil Shaffer.

SHAPPER Shaffer.

PAO Shaffer.

SHAPPER Short a.

QUERY What are they doing, waiting for LOS?

PAO No.

SHAPPER We're in progress, didn't you see the red light? We just got started. Is it going out all right? Okay. Today was a day off as you know. We've just finished the science conference and there was certainly a lot of information that flowed during this beauty. We had a lot of guys in there addressing all the different areas. We keep having the distinct impression that the crew really enjoys those. As a matter of fact, there was one area that we did not get to that I'm sure we'll get to next time, and that's the comet work. And I might say something about the comet, as I understand our plans right now, we will continue to look at that beauty with the corollary instruments, the instruments we put into minus-2 SAL until day 60 and then after day 60, we'll stop looking at it for awhile. I cannot tell you the pros and cons or any of that except that that's our current plan. The work today as you know was scheduled to be about 11 hours total science and we're way ahead of that. Ed has been on the ATM all day. The S201 sequence to look at the comet today was uneventful, with the exception that prior to that we did fire one mib which was not predicted. And after we did the maneuver to the S201 attitude, we did have some very low level CMG distress in CMG number 2. But it - if I were to characterize it, I would say it was about half of the kind of hiccup we've been having in that CMG for the past few weeks. It just seemed like it started to happen and then quit. And the wheel speed dropped just a little, the - see at bearing 2 which is the one that has the problem started up but it never converged to bearing 1 like we've seen in the past. The normal delta between those two bearings is about 3 degrees and it got within about a degree and a half of bearing 1 and went away. The EREP pass this evening over Japan is still go. The weather looks pretty good, we do not yet have the final weather for that. So - out it looked good in the - and the forecast was good. That means that the crew will be up an hour late tonight until 04:00, and it means they'll sleep in tomorrow an hour. It was fairly obvious to me today that the crew enjoyed us not scheduling all of their personal kind of work if you will like showers and PT and eating and all that we just made it all open time and they managed it very well and had a ball with it. Tomorrow is a Skylab-IV day, two investigations of the

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comet, an EREP pass, track 58, a major medical with Bill Pogue being the subject, 26 hours of science planned. I - I, you know I get the feeling that if I go into details on these predicted Flight Plans, particularly after you guys have seen them, we're wasting both of us (sic) time, but there's really nothing outstanding about tomorrow other than it's a full day of science, it looks just like yesterday did for the most part. Why don't we try some questions.

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SHAFFER - - tomorrow, other than it's a full day of science, it looks just like yesterday did, for the most part. Why don't we try some questions.

QUERY When the CMG 2 registered this very low level anomaly did y'all respond by turning on the heaters?

SHAFFER No, we were at the top end of the heater range when that happened. The top end of the heater range is 80 degrees and we were at about 78 when it happened. I think that is probably the reason that it was so small and went away so quickly, was the fact that we were at the top end of the range. The - if we had - the heaters were off at the time, if we had turned the heaters on at that point in response to that problem, we would have then - got an auto disconnect, not disconnect an auto turn off before the next station. And if that happens then the bearing temperature, both of them have to go all the way to 60 degrees or lower before the heaters will come back on. And that would have been bad news, turning the heaters on would have given us a - a couple of degrees of temperatures. And it - we really didn't think it would help, in fact it was obviously in our opinion hurt more than it would help because then we'd - when bearing - to get bearing 1 to 60 bearing 2 would have had to go to about 57 or 58 and we - we don't want to get it that cool.

QUERY Phil you said day 60 was the last comet ops -
SHAFFER I'm saying today, that's our plan that day 60 would be the last comet for a period -

QUERY But you don't know how long that will be or when you may pick up again?

SHAFFER Well we're - we're expecting about a 10 day moratorium on the comet observations. With the decision in that interval about whether or not and when to resume looking at the comet.

QUERY How many mibs are expected for the EREP tonight?

SHAFFER 9.
SHAFFER Do you want to read that now while we're waiting?

PAO Okay.
QUERY How do you feel here on day 56, which is of course the original duration for this mission, what when it was long ago, how do you feel everything is going as far this sort of -? At this point, you're about to break the Skylab III record?

SHAFFER Well I think things are going along very well. You know the workshop in terms of anomalies in it has been very very stable for about 2 weeks now. We really haven't had any new significant anomalies since the last biggy we had

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in terms of either operations or science is loss of the star tracker which was about 2 weeks ago. And - but all of the systems are doing this fine. The next trauma that we face is the 100 percent sunlight period, which we're starting into now and the temperatures are going to come up in workshop and in anticipation of that we have turned off about half of the lights in the workshop to cold soak it. To get the average temps down. And the rest of the lights, when they're not being used are at low intensity to reduce the heat input. We left the primary coolant loop, airlock module coolant loop up after the last EVA which increases the heat rejection capability of the system. And right now we're predicting that temperatures somewhere between 75 and 82, somewhere in that range. If we had not left the coolant loop up and if we'd left the lights on, that would have probably gotten totaled at 92 - 95 degrees. It -

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SHAPPER - - the coolant loop up and if we'd left the lights on it would have probably have gotten totaled at 92 or 93 degrees. It - the big - the biggest impact at this point, if it goes to the high side that that temperature reads and that is the 82 degrees then it's going to be relatively uncomfortable for the crew when they're sleeping, and we may very well skip showers next time - next crew day off because that'll be in the - the hot interval. The reason for skipping the showers is that when they take the showers the humidity in the vehicle goes up and the heat rejects mechanisms, the coolant loops and the heat exchangers then instead of rejecting heat end up spending their capability removing the moisture, the humidity from the air, and the showers would cause the temperatures to go up a couple of degrees or so for some period of 6 to 12 hours. And the thing that's concerning me right now, probably because I'm - I'm - I've been ignorant in that area, is that if the temperature goes up it's not obvious to me what's going to make it come back down. So if the - if the gas - the average gas temp went up a couple of degrees as the result of the showers I think it's 2 degrees on top of wherever we are - I mean it bothers me, I don't know that that's a fact. And if we were sitting at 82 then that couple or more degrees would add insult to injury.

QUERY How would you describe the light level inside the workshop at this point?

SHAPPER Adequate, and since I'm not there I can't describe any better than that. But Ed told us that - that they were having absolutely no problems doing their work and occasionally they turned on a light that's off as a function of what they were doing and what the work station was. But as - those guys have not given us absolutely any indication that the - the light level is bothering them, and that's what makes me say it's adequate. You got to remember that on SL II until we got the wing out the other array, we were at a whole lot lower light level than this, I mean it was gloomy then because we just flat didn't have the electrical power to support all those lights, and we're well above the light level that the SL crew for the - for the first half of their mission or whatever it was until we got the wing out.

QUERY You think they're - the light level now is requiring them the use - occasionally use flashlights off in some corner or anything like that?

SHAPPER Sure don't.

QUERY Okay, so it's adequate for them to read dials or a newspaper or whatever was on board wherever

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they are?

SHAPPER You missed the point I was trying to make. When they need light they turn it on and when they're finished with it they turn it back off. Okay, it's not a matter of the lights that are off stay off, the lights that are off stay off most of the time except for relatively shortly intervals when they need them.

QUERY Sort of related to my question about the - the reaching 56 days. Do you think that, I know that you've indicated that the crew is working with great proficiency now, working very hard and do you think that they're still - their learning curve is still going up, they haven't even peaked yet, or - or they -

SHAPPER Yes.

QUERY They still are going up?

SHAPPER Yes. I - I'm going to find it interesting when - you know I and my guys are going on a break now - I and part of my guys are going on a break now, some of us are going to run an entry sim tomorrow as part of the refresh - get back into the business of monitoring an active CSM and at cetera but it'll be interesting to come back in 3 or 4 days when we go on the evening shift and compare the crew of today or yesterday since today was a day off with the crew of next Monday, which is when we'll be back again, because I really expect that they'll be cranking out more and more. Not necessarily in - in terms of work - hours of work, although that has gone up tremendously, but the amount of time that it's taking to do any given job is going down. So even though we're scheduling an average of around 27 hours of work now - science work, I'm not - you know we don't include housekeeping and PT and eating and all of that in that 27 hours, the 27 hours is science. That probably - the 27 hours of work that they're doing now is probably compatible to 32, 33 hours of work equivalent at day 30. Yeah, their - their efficiency is up tremendously. And for 2 weeks now they've been given us back time, in that, for instance we say, we used to schedule 2 hours for EREP prep, and they've given us back a half hour of that now, so when it comes time to an EREP prep we only give them an hour and a half to get ready for it because that's all they need. I think that we haven't - we'll be getting back into the time when we'll be wanting to start doing some M509's again, and if I remember right they've given us back 45 minutes of the prep - -

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SHAFFER - - we only give them an hour and a half to get ready for it because that's all he'd need. I think that we haven't - we'll be to get back into the time when we'll be wanting to start doing some M509s again. And if I remember right, they've given us back 45 minutes of the prep for that and that's a full ATM pass, you know that's what the guys have got to do. So hours of science versus science accomplishment are not necessarily equal because the efficiency factor is a big impact on that.

QUERY Well would you say the efficiency level has reached the point attained by the Skylab III crew?

SHAFFER No, I wouldn't deny it either. But in some areas, I think they're probably doing better than the Skylab III crew did and in other areas, they're not doing as well. So I can't give you an overall answer. The EREP prep by this point in Skylab III, EREP prep for the Skylab III guys was taking us 1 hour, instead of an hour and a half. Okay, but these guys are doing what appears to me to be a whole lot more visual observations, the out the window stuff. They are making time for that on top of the other work that we were doing. Now you know these guys have gone to the unscheduled housekeeping bit now, they're doing that like the Skylab III did and EREPs and the medical runs are really about the only big pieces of time that we're going to get back now. And the prep for those, and Jerry told us yesterday, that we could stand by and get 15 to 20 minutes back on the medical runs. That the last two or three times he's done it he's had more than enough time and he's says he's sure that it's consistent and he's going to give us that time back and then the major medicals to be very close to the Skylab III performance.

QUERY In our continuing series on innocuous questions and answers -

SHAFFER I was hoping you wouldn't forget. The - this mission began with what was called an M equal 5 rendezvous and the expression M equal denoting the number of rev in which the rendezvous is complete and has been used since back in the Gemini program. Can you explain for all the space fans out there what M equal equals?

SHAFFER Yeah, the - when we - when we NASA first started talking rendezvous there was some conventions to be made and M equals is one of them. Okay, when you're rendezvousing with a target vehicle, in terms of the amount of propellant that it takes to do the rendezvous there are efficient ways and inefficient ways and the most efficient way is to do homing transfers, that is take the chaser orbit and make it bigger

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to catch the target at the apogee and perigee or line of apsides. So we started building processors that did maneuvers at apogee and perigee of the chaser vehicle to produce the minimum fuel rendezvous. And in a little while you find out that you can't always do that, that's too constraining in that sometimes you want to maneuver away from there. So they said aha when you do a maneuver, not apogee or perigee that started that sequence going, it turns out you still want to do the maneuvers at the same point you did that one or on the exact opposite part of the orbit. And the concept of maneuver line was born. Now normally the maneuver line is at apogee and perigee but it's not constraining to be there. And maneuver line was shortly shorten to M line. And all of a sudden we discovered that the number of times you crossed the M line equalled the number of orbits, being very clever people. And all of a sudden it was M equals. So we dissolved from maneuver line to M line, to M equals kinds of rendezvous. And it's still the number, I - some of the things and I've got to carry this a little bit forward because it's the old nomenclature thing, I -

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SHAFFER - - some of the things that - I've got to carry this a bit more because it's the old nomenclature thing, I - NC1, NC2, NCC NSR has got to bother you the same way. So, let me tell you about N's while we're in it. N stands for number, and it's the number of times you've crossed the maneuver line or zero designation, the point of origination of it, okay? The C stands for catchup and the 1 stands for the first catchup maneuver. So NC1 is - it was a designation of where you did the maneuver and what its purpose was. NC1 is the first catchup maneuver NC2 is the second catchup maneuver, NCC is a corrective combination maneuver because it was both a catchup and a height adjust. There used to be an NH maneuver which was up your height adjust, and NSR was the coeliptic maneuver and the SR stood for slow rate because that was the slowest catchup rate you ever had during the course of the rendezvous. And it was NC1 equal 1 which meant you did it at first perigee after insertion - 1 rev after insertion.

PAO Okay, we have a question from the Cape. On the do it yourself flight plan did you get more or less than you had - than if you had used the regular schedule and why can't a modified form of this type flight plan be done everyday?

SHAFFER The - as I mentioned earlier, the do it yourself flight plan I - I think was enjoyed by the crew. The reason we did the do it yourself flight plan is because the - the bulk of the day is made up of noncritical items. The things that were time critical such as the Kohoutek observations, ATM passes and EREP were scheduled in that flight plan at the beginning or end of open periods. In a normal day the vast majority of the activity is time critical mostly because of its relationship because everything is a power user so you've got to - you got to not do a Kohoutek observation right beside a EREP because you haven't got - you've got to get the batteries charged back up, you cannot go out of solar inertial twice in a row. You must watch the momentum very carefully. So again you've got to be carefully about where you put Kohoutek or momentum inhibits for any purpose relative to EREPs and that sort of thing. And by the time you get all of the critical things in which - in a normal day which is much busier than a day off. The only thing you have left are the holes, okay? So you have to worry about things like PT and eating. Well we got all kinds of constraints on the PT when we're doing a Kohoutek maneuver we can't ride the ergometer because it shakes the vehicle too much. And we can't do the toe ups on the treadmill because it shakes too much and blurs the data.

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So now I got another constraint that I am forced to put PT in a special place in the flight plan, i.e., where I'm not doing Kohoutek. So I don't have many options on that. When I do a major medial, NO92 I have to eat a minimum of a hour before I get into the tank so there turns out there are only a few places I can do a - and the answer is I got too many constraints on the work day, it's only on a day off when the bulk of the day is - is open time that I can give them a do it yourself flight plan. Electrical, momentum, geo - orbital geometry et cetera force the things to be where they are, that comb - basic combination that is all the other open time they could have and they get it; it's called open housekeeping with nothing scheduled in it. Do you have another question?

PAO No. We have three announcements, one the program review will be held tomorrow January 12, 1974 at the JSC News briefing room 135, Building 1 at 10:00 a.m. NASA Skylab management will review the mission to date including the physical condition of the three crew members Gerald Carr, Dr. Ed. Gibson and Bill Pogue. Scheduled to take part are William C. Schneider, Director Skylab Program and Kenneth C. Kleinknecht, Skylab Program Office Manager, Dr. W. Royce Hawkins, Director Medical Operations and Luther Powell, Skylab Program Office. The next one is, the crew has been cleared for another week in space. The three Skylab Astronauts now in their 56th day in orbit today were given a go ahead for 7 additional days. For the remainder of the mission, weekly evaluations of the hardware, consumables and crew will be made by NASA officials. The first such weekly review was completed this afternoon. William C. Schneider, Skylab Program Director said the crew members, "are in good spirits and excellent physical condition. And the spacecraft is in good shape to continue." Originally the three Skylab manned missions were planned successively for 1 of 28 days and 2 of 56 days. The first mission lasted 28 days the second was extended to 56 days, and a third was then planned as an open ended 60 day mission with consumables aboard to provide for as many as 85 days. Final announcement is that on Monday January 14 at 08:10:37 p.m. CDT the Skylab IV crew will pass the Skylab III endurance. That's all.

SHAFFER
PAO

Thank you.
Okay.

END OF TAPE

**SKYLAB NEWS CENTER
Houston, Texas**

**SL IV - Change of Shift Briefing
Johnson Space Center
January 9, 1974
4:20 p.m. CDT**

Participants:

**Phil Shaffer, Flight Director
Dave Garrett, PAO**

SL-IV PC/2A/1
TIME: 16:20 CDT
1/9/74

PAO Okay, we're ready to get started with this afternoon's change-of-shift briefing. We have with us the offgoing Flight Director, Phil - offgoing Flight Director Phil Shaffer.

SHAFFER Well yesterday I was impressed with the crew. We had scheduled about 28-1/2 hours of work for them and they turned in another hour and a half or so and I shouldn't have been impressed because they did it again today in spades. Ed came over the hill at about 14:00 Zulu or so and not only did he have everything done up to that point, he had also already accomplished about a hour and a quarter's worth of work that was due around in the afternoon. And that work was specifically a malfunction procedure on the M133, the sleep monitor gear and he'd changed out the tape in the M133 recorder. And he says, "Can I have an ATM pass", okay and it was musical flight plan for the rest of the day. From that point on. And we moved some stuff around and Bill Pogue took on some extra work, some stuff that was time critical, the stowing of the S063 instrument out of the minus Z SAL and opened it up for work, we gave him some AT - ATM pass there. And we swapped some passes around, Jerry and Ed swapped a couple of ATM passes. And Jerry did maneuvers while Ed did ATM passes and that opened up Jerry for some time and he did another science demo that I think is soapy film, it builds a little wire frame and dips it into a soapy film solution that - see what happens to it in zero g, point is that we made 30 hours again or - damn close to it. The EREP was predicted to cost us 6 mibs, it took 15, so instead of 30 pound-seconds, it's about 75 pound-seconds. And to give you a little more background on this particular thing, our predictions are showing when we run these that the CMGs are very, very close to saturation. During the period while we're waiting for solar noon to come back so we can get back to solar inertial and we like predict 90 percent saturation. And the computer starts firing desaturation mibs at 96 and that's the way it is. We're doing beautiful, we made another 300 pounds or so today back on our average I guess it's about, yeah, very close to 300 pounds again today. The only reason I point that out is we lost, not lost, we used 800 more than we were supposed to day before yesterday and we got 600 of that back, against our 370 pound seconds a day. So we're cooking right along, we talked more flight planning things with the day and Jim for you we talked a lot with the crew today. They had time to talk to us, okay in addition to having really a super day. Tomorrow's a day off and there's two ATM passes, a Kohoutek observation with the S201 instrument and an EREP over Japan. And the EREP

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falls late in the day. It's at about 02:00 and if we do that there's some, you know, you always got to look at the weather you can't predict it, but if we do the EREP the crew will be staying up an hour late tomorrow night and then getting up an hour late on day 57, Friday. The gimbal stop business that I told you happened to us yesterday, happened to us twice again -

END OF TAPE

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SHAFFER - - on day 57, Friday. The gimbal stop business that I told you happened to us yesterday, happened to us twice again today. We didn't get into trouble with momentum it just got in - it got defined such that the gimbal got on a stop. One time the gimbal came off itself and the attitude did not go away far enough to interrupt the ATM pass that was going on. The second time it did and Ed very adroitly did the little trick that enables the outer gimbal drive logic and pulled the gimbal off the CMG and we pressed on. Questions.

QUERY Did I understand on the air-to-ground earlier they were talking about tomorrow's flight plan and they were talking about the day - the off-time activities, that on my Flight Plan all shows up blocked off but I gathered from that they were just going to give them all open.

SHAFFER I had that funny feeling you were going to be interested in that and it turns out I have one here. We call this at least in the building over there, the do-it-yourself Flight Plan and the only thing that shows up on it is the stuff that is time constrained or gym- geometrically constrained like an EREP pass or the ATM passes or whatever. And everything else says open and that includes eat and post sleep and PT and showers and all of that kind of stuff and we're going to let them do it the way they want to tomorrow. In whatever order and I got a copy of that just to give you a little headstart on it but all it is is great big long blocks of open time that they can do whatever they want to in them.

QUERY Have they got a shopping list along with that -
SHAFFER Yes, yes they do.
QUERY And in case they want to do some work on some other things.

SHAFFER Yeah, there are cup - couple of optional things that we put in here that are synoptic in nature like the S233 photos of the comet and we built a kind of a special thing and if they - somebody feels like they want to take one during the night pass he can. And the ED61, the rice growing trick that's going on we'd like to have a picture of that everyday so we included that if they feel like getting it it's okay, if they don't it's okay. And in addition to that they have a shopping list that includes such things as the science demos and some other things to do as they wish.

PAO Any other questions? Howard.
SHAFFER I know there's going to be one question at the end.
QUERY Yeah, we got one, we're saving - -

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SHAFFER
QUERY
QUERY
pass than that Japan one?
SHAFFER
QUERY
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QUERY
SHAFFER
QUERY
pass track and so forth on it?
SHAFFER
QUERY
SHAFFER
QUERY
anything else in general?
SHAFFER
QUERY
Phil, down at the bottom of that Flight Plan something that has been bugging me as you say, what the hell is an IMD and an EMD and why are the three of them in there never filled out, or rarely filled out?
SHAFFER
EMD is enable momentum dump and we fill these out when somebody either the crew or the ground has to make an overt action to cause it to happen. Okay, now a lot of the times they happen automatically. They may only happen automatically in the solar inertial mode. So if we have the control system in attitude hold or in Z-local vertical, it can't happen and those are called auto IMDs, EMDs and we don't put them down here. The only time we put the in is when they're required and like for the crew day off only one is required. Only one is not automatic, that somebody has to take an overt action and the ground has managed those historically. We command the inhibit/enable from the ground.
QUERY
Also down there what -

END OF TAPE

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SHAFFER - crew day off only one is required. Only one is not automatic, that someone has to take overt action. And the ground has managed those historically, we command the inhibit enable from the ground.

QUERY Also down there wh - what's the sense in the ascending node times?

SHAFFER The - the crew has a world map. Just - just a map, and it's actually - I guess, it's like two maps. It's a full map and then two halves on each end. And they've got a plastic overlay that has a 50 degree ground track drawn on it. So we give them an ascending node and a time that they'll be there and they slide that plastic overlay over to that longitude. Okay, for that particular rev, then they can see where on the world they're going to pass over for that complete rev. And they know that they'll be 1300 miles - I forgot wh - west of it next time at the equator. And this helps them keep track of where they are. And for things like handheld photos and visual observation things and the - the EREP stuff, they can just put that in there and see what they're passing over. And it's - it's just a mechanism for them to keep track of where they are.

QUERY Wh - where is that information get up to the crew then?

SHAFFER It goes up on the - on the summary flight plan - on - on the tail end the EREP slider map ascending nodes and it's got the same information on it - the longitudes and the times, and it's in the remarks, when you see that, it falls in the remarks. I thought you were going to ask something innocuous.

QUERY We got one.

SHAFFER (Laughter)

QUERY When am I ever going to do with what I - get that information.

SHAFFER It's academic. It's part of your background. Use it if you want. It's - it's - it's for you guys - it's for your personal edification. You know, like the - like the numbering system. Jim - Jim needed that yesterday.

QUERY The APs trivia question of the day. What is a MIRROR AUTO RASTER?

SHAFFER I'm sure that goes with the S055 instrument.

QUERY Could you help me in terms of the - -

SHAFFER No, no.

QUERY - pause in time in-between the question and the answer?

SHAFFER No, I was - I was trying to decide whether it was to - to try and convenience myself it was really the S055. The S055 takes instrument in lines or RASTERS. Okay? And it does that by swivling a MIRROR. Okay? And the mirror cycles

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back and forth, and steps down to fill out a block of data. The individual data take, I think, is like 5 arc seconds wide and 5 arc minutes long. And that'll fill up a frame - if you will - of 5-1/2 arc minutes by 5-1/2 arc minutes. Taking a half of 5 arc seconds at a time. And a mode in S055 is a MIRROR AUTO RASTER that starts at the top of - of the little box with the sweeps through it, much like the TV system works. It takes very granular data, because it steps in 5 arc second steps, an MIRROR AUTO RASTERS - I think. No - hey - if you guys are trying to catch me, you're not playing fair, because I'm on your side.

QUERY

Do they have MIRROR manual RASTERS?

SHAPPER

They don't have a manual RASTER per se.

They do have manual pointing, and they can look at a 5 arc second by a 5 arc second area which is exactly what we did pre-launch of SL-IV when we tried to - tried to eclipse - when we tried to catch the Mercury going across. And we wanted a full eclipse of the - of the little 5 arc second by 5 arc second field of view, so we stopped the -

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SHAFFER - eclipse (Laughter) when we tried to catch the Mercury going across. And we wanted a full eclipse of the - of the little 5 arc-second by 5 arc-second field of view. So we stopped the thing which is essentially manual mode and let Mercury come across it. And Mercury was about 10 arc-seconds in diameter so it was big enough to eclipse the little manual mode if you will. So there is a mode like that, but it's not really raster as I understand it.

PAO Well, here are a couple of questions that were called in from the Cape for this change-of-shift.

SHAFFER Is what the biggest storm. Are we talking about the one in the Atlantic?

PAO Yeah.

SHAFFER Well -

PAO Let - let me read the question so we can just get on the line.

SHAFFER Yeah, it - the question is this the biggest storm in terms of size not intensity that any Skylab crew has photographed? And - I really don't know how to answer that. I - it's big but it seems like I've seen some some times when the whole continental U.S. was under cloud cover. But I can't tell you whether that was a single storm system or not. One of the things about intensity on this one although a hurricane is obviously in places more intense than this kind of thing - But we were reported that at one time this storm in the Atlantic was producing waves 75 feet high. And on at least one of the data takes we went over it with the S193 instrument the SCATTEROMETER, RADIOMETER, ALTIMETER. I know the waves at that time were 45 feet high. So it was a real beauty, and we think we should have got some real nice data out of that. One of the other questions is to what do you attribute the sudden surge in the increased efficiency of the SL-III crew? And I wish I could specific with that, and I probably can't. One of the contributing things is a continued up swing on the learning curve. I can only relate to you that this appeared to happen after the ops conference we had 10 days ago. And they and we are having a good time with it. And as but - they decided to have at it, and I can only tell you the conditions around it, not why.

PAO Any further question from here?

PAO If not we - one announcement we do have an update of the consumables on board that Ed Harrison, back here has available if you'd like a copy of it. Thank you.

SHAFFER You guys want to look at this, the way we did the Flight Plan for tomorrow?

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
January 8, 1974
4:15 pm CDT

Participants:

Phil Shaffer, Flight Director
Dave Garrett, PAO

SL-IV PC91-A/1
Time: 16:15 CDT
1/8/74

PAO Okay, we're ready to get started with this afternoon's change-of-shift briefing. We have with us the off-going Flight Director Phil Sheffer. Phil.

SNAPPER Yesterday, I told you all that today was the biggest day we'd scheduled, consisted of about 28-1/2 hours of science. And it has been a super day. And I want to demonstrate that by telling you that instead of the 28-1/2 hours those guys are going to turn out about 30 hours of science, strictly by staying ahead of the Flight Plan and doing the job right and putting in some shopping list things, create a big hole in our Flight Plan by doing things early as they get a chance, and asking us for more stuff to do. Those guys really cooked along today, had a lot of time to visit with us, too, about various and some different things in the way of flight planning. In terms of TACS usage you remember, yesterday was a problem. And I'll remind you that our - our average budget to stay above our redline now is 370 pound-seconds a day. And we got 300 of that - of yesterday back today. We've used 70 pound-seconds so far today, and that's all we expect to use. We had predicted to use about 40, now using 70 - have used 70 and that's it for today unless something else happens. The - the only thing we have left to do today that has any potential for using TACS is a comet observation with the SO63 gear. And that is not predicted to use any TACS at all. And we get into that beauty with four good dumps. So, we ought to be right where we said we would be. Tomorrow is not as big a day, relative science, it's 28 hours. But we're doing some malfunction procedures tomorrow, that have some potential of taking a little longer than we think they will, but that's not expected to be a big problem - - an EREP pass, more comet observations, atmospheric investigations with the SO63 instrument, and lots of ATM. I don't have the TACS prediction expect that it's - it's minimal, it's probably 10 mibs or less. The day - the day sets up pretty nicely. I don't know whether you guys were listening to the air-to-ground or not when we left Honeysuckle, but we got a gimbal on a stop, one of the CMG gimbals. And that plugs up the energy source for attitude control of the vehicle was beginning to lose attitude during an ATM pass. And the system's automatic in that as soon as it gets out 1.4 degrees it shuts all of the doors on the ATM and exits the EXPERIMENT POINTING MODE. The - the problem is not that we don't have enough energy in the CMGs to maintain attitude; the problem is we get the CMGs at a posture that we can't deliver it, i.e., a gimbal on a stop. So what we do in those cases is enter a small maneuver time, in this case 3 minutes, and reselect the - the mode that we were in which the computer interprets as a new job. And it calls a

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activity a routine, and it's logic is called outer gimbal drive logic. And what that does is maintain the momentum state, but reposition it by driving the gimbals around. And that will pull the gimbals off the stop. We did that. It probably cost us 5 minutes worth of ATM data, zero miba, put us back on the nominal gimbal trajectories. When we saw the crew next at Hawaii they were back looking at the Sun. We expect that to happen occasionally, and it'll probably happen more often as the Beta angle continues to boil up, but gimbals on a stop, when you can catch them, are not a big deal. And when it got right - -

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SHAFFER - - gimbals on a stop, when you can, catch them are not a big deal. And with a guy right there at the C&D panel it really wasn't a big deal. Ed did the same thing for us yesterday. Questions?

QUERY We haven't had any CMG 2 glitches?

SHAFFER No sir.

QUERY You talk about (garble) hours, does that include any of the MALF procedures?

SHAFFER Yes.

QUERY It doesn't -

SHAFFER The only reason I point that out is that MAL (sic) procedures have a potential of being more than you intend for them to be.

QUERY Those 28 hours of science does include those?

SHAFFER It does include - and the reason it does is because we're working on scientific gear, we're not working on basic spacecraft systems like, one of the MALS (sic) is on S063, and the problem there is that the batteries and the circuits that light the reticle in the S063 viewfinder are not lighting the reticle. So we're going to try to do some work on that thing to make that reticle light up and we'll need that for the atmospheric observation with S063. The other malfunction, I'm sorry there are two more MALS (sic) that we're doing besides that one. The M133 data, the sleep monitor data disappeared on us the other night for some unknown reason and we want to look into that and see what's involved and be sure there's not some clinker in there, we don't really know why it went away and then the pointing reference system in S082B, the one that keeps the instrument pointed at the limb of the Sun. In certain areas it appears to go unstable, the little mirror starts vibrating and we're going to find out where that instability position is tomorrow and then stay away from it.

QUERY I'm sure this is on (garble) forecast but I haven't looked, when's the next crew day off?

SHAFFER Day after tomorrow.

QUERY And how much longer are we going to be doing Kohoutek ops, are we going to be doing it all the way up through February -

SHAFFER I think it's till January the 15th.

QUERY Just be doing S019 -

SHAFFER With the corollary instruments.

QUERY Corollary instruments?

SHAFFER Yeah, that - but that includes 201 19,

183, 63.

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QUERY Carr sounded this morning like he wanted a full day off, but said he would be able to do the ATM and Kohoutek?

SHAFFER No.

QUERY What're y'all planning -

SHAFFER No he didn't, well I guess -

QUERY He said he wanted more than 2 or 3 hours and a shower.

SHAFFER Yeah, you got to remember that the that the last day off we had was the day of the press conference, and that takes a bunch of time to get set up and then of course it takes the time to - to execute the press conference. There were a couple of MALS (sic) that we did in there but the end result of the science, our normal day off now is 1 EREP, or two ATM passes, two ATM passes and a Kohoutek observation corollary. Okay, and that typically is about 10 or 11 hours of science. And then we have the - the science conference which typically last about a half hour. And the rest of the day is free if you will and the thing that happened last time was that - by the time the day was finished, all they had was a couple of hours somewhere and a shower. And the rest of the day was pretty much like a normal workday. And for day after tomorrow, we have the - had an EREP pass scheduled which may or may not be done, we have two ATM passes and a Kohoutek observation, and from my subjective position, Jerry was more than willing to do that but he didn't want to do anything else, okay.

QUERY He said he'd go for everything except the ATM, he didn't mention that.

SHAFFER Well that's part of the normal - the normal bit, we try to get the synoptics. Jim, I get the feeling you're hunting for something, what -

QUERY No, I was going to make -

PAO Just going to say something wise, (garble)
(Laughter)

SHAFFER Yeah, all you get is frustrated, you ought to take advantage of every chance you get.

QUERY How much actual free time off to relax or relapse or whatever they want to do does this normal day off give them.

SHAFFER Well, let's see, the first thing you do on a day off is nothing because you sleep in for 2 hours. Okay, the night period preceding a day off is a 10-hour sleep period. All of the meals are hour periods, vice a half hour for lunch. Okay everybody's got an hour to take a shower. However, long -

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SHAFFER - periods, nice a half hour for lunch. Okay, everybody has got an hour to take a shower; however long it takes there's an hour budgeted to take a shower. And there's a full hour and 45 minutes scheduled for PT; however much you do, there's an hour and 45 minutes scheduled for PT. Now the guys usually use all that because it - they enjoy that. And - but to say it a different way, the science time on the day off coming up day after tomorrow is 4 hours per man, okay, and a half hour per man for the science conference. And the rest of the day is PT, and sleep, and off duty, and showers.

QUERY Phil, how much science work or work do you do on your day off. I mean - and not being to facetious, I'm just curious what a flight director does. Do you end up coming into the office for any time or doing any work at home?

SHAFFER Really it - that's - that's kind of an interesting question, because I don't know about - about all of the other four flight directors, but we have gone occasionally as much as five weeks without a day off, okay. And then you turn right around and sometimes you get three days off or four days off. And we'll - you know, we got some built in things we got to take care of around the house, and we take care of those things. On the - I just finished a five day break, and I spent three of those days in the office - 2-1/2 really - 2 full days and a half day. And the rest of the time I was taking care of stuff that had to be taken care of like Uncle Sam, you know it's Income Tax time; and my car gets the miseries, you know, and it has to be serviced and that sort of thing. Now I'd - by no stretch of the imagination will I deny that we have more time off than the crew does per se, because as soon as I get rid of you guys, you know, I'm going to have myself a big orange and then about 9:00 o'clock I'm going to hit the sack. That's 4-1/2 hours that I can do anything I want to, which excludes talking to some guy on the other end of a microphone.

PAO

(1 lighter)

PAO

Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 7, 1974
4:27 pm CDT

Participants:

Phil Shaffer, Flight Director
Bob Gordon, PAO

SL-IV PC90A/1
TIME: 16:27 CDT
01/7/74

PAO Huh? I know it. Okay we have Phil Shaffer
who will review today's activities and look at tomorrow's
Flight Plan. Phil.

SHAFER The EREP cal this morning turned the vehicle
and looked at the Moon with all the EREP instruments - went
along very well. It - it's nothing special about that. EREP 22
along track 71 though didn't go all that well. The - the pass
itself and the data take associated with it went all right.
And with our momentum problems you know one of the things
we do to - to reduce the amount of energy required to maneuver
the vehicle around is go in and out of the Z-local vertical
at - at orbit noon so that generally all that's required
is a roll maneuver. And when there are long periods between
the end or the beginning of the data take in orbit noon we
offset the vehicle from true Z-local vertical a little bit
to balance the gravity gradient forces so that we don't have
a continuous one directional torque on the vehicle. And Jerry
today, due to I think mostly to being in a hurry, in the process
of offsetting the vehicle to this biased Z-local vertical
went on to - to solar inertial mode. That - the maneuver
time that was loaded for that was 10 minutes and it was about
a 4-4 degree maneuver, slow. With a 10-minute maneuver time
loaded it was 110 - 115 degrees back to solar inertial. And
the poor old CMGs didn't have enough stuff for that kind of an
attitude so we burned a bunch of TACS. Approximately 1000
pound-seconds. When you go back and read the pad - if you
read it from left to right and from top to bottom and do the
things that are in that order on the pad you end up exactly
where Jerry was - in the SI mode because one of the things we
do after we enter the fine maneuver in the computer is load
the maneuver time for the return to solar inertial. And that's
the sequence of events. It says after the maneuver starts, load
for SI mode load (garble). And the next thing on the left column
after that is SI mode and over on the right side is the GMT to
throw it - clear across the little strip of paper. If you
haven't done that very often and do it in a hurry it'll get you
and it did. So we have blocked out now the - on the pad
uplinks that specific box that has the SI mode and separated
it from the rest of the information. But today was expensive.
The rest of the day Ed cooked along very well, we had a few
minor anomalies. We thought we'd popped a circuit breaker
on the forward motion compensation device in the S190 cameras -
that 6 camera gang there. And our best guess now is that it
was just not reset after the EREP cal because when you -
when you look at the Moon with those instruments you don't
want them compensating for orbital motion. The Moon doesn't
move; we think it just didn't reset. We had some film advance

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malfunction lights on cameras 3 and 5 in that same gang at the same time and we've had those lights with new magazines - magazines that have just been filled and haven't been run before and that was the posture we were in today so we don't think it was anything there. S191 lunar cal this evening where we're looking at the Moon with S191, then looking at the Moon with a piece of backup hardware from Mount Capulin, New Mexico is marginal right now, because of the weather. It's been NO GO all day because it's been overcast all day but the last report I had just before I came over was that it was some broken places now in the clouds, so - -

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SHAPPER - - New Mexico is marginal right now because of the weather. It's been NO GO all day because it's been overcast all day, but the last report I had just before I came over was that it was some broken places now, in the clouds. So we might be able to get that done. That's about it. Tomorrow is without a doubt the biggest day we have scheduled for Skylab IV. You know since we had the ops conference, a little over a week ago, just about a week ago, and rearranged some of the Flight Plan guidelines and did those kind of things we have been scheduling more for the crew than we had been. Our - our baseline or guideline prior to the ops conference was about 24 hours of science. And you had to add on that the PT and the eat and the housekeeping, and all of that stuff. Well, the crew gave us a lot more room to work in. As a result, of the ops conference, and we've - our new baseline - When I say baseline I don't mean a constraint. You know it's a - it's like a goal and you can vary about it either way. When we were scheduling baseline 24 we ended up anywhere between 23 and 25. And so, with a 27-hour baseline we ended up 26 to 28. But tomorrow has got about 28-1/2 hours in it. Okay, now they have accomplished a day this big before, but it was not scheduled. They did it by doing a lot of shopping list items in the open time that we left. But tomorrow is scheduled, it's not really that tough a day; it all fit together very nicely. But it is a big day. It will contain two maneuvers, to look at Kohoutek with the SO19 instrument, and the SO63 instrument. SO19 being the first thing that they do after they go to work in the morning, and the SO63 being the last thing they do before they go to bed. In between there is an EREP, track 23 - EREP 23, track 14. And I didn't have time today to find out where that is for you. Major medicals - oh, one of the extra things we're doing is looking at the Earth's limb with the EREP instrument tomorrow too. And Ed - the major medical on Ed, and the ATM passes, that fills up the day. CMG 2 got distressed today too, during that exercise during the EREP, that kind of gave the old CMG a ride when it tried to do its thing and couldn't. Nothing special about this distress. It looked just like all the rest of them, went away relatively quickly. As soon as we saw it we turned the heaters on which may or may not have helped a lot but it went away. Questions?

PAO Bruce?

QUERY Yeah, Phil on this CMG 2, what were the temperatures du - at that time of the glitch?

SHAPPER 71.5.

QUERY That's a lot lower than you've been trying to keep them the last few days, isn't it?

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SHAFFER No sir. The - the original heater management - bearing management was 67 to 77, 78. The new range is 70 to 79.5. Okay, so it was at the bottom end of the range if you will. But it was 4 or 5 degrees higher than we had been running toward before.

QUERY You got any kind of a hack on how long it might have lasted, 20, 30 minutes or anything - -

SHAFFER No, because we don't know when it started. But there was - from the time we saw it and got the heater on, it ran a half rev - it was obvious that the distress was over because the wheel speed was back up. The wheel dropped about 40 RPM, the currents were up about 20 milli - amps. And those were down in the bearing 2 which is the one that has the problem of starting to cool off.

PAO Jim?

QUERY A couple of things. I noticed - I thought I noticed on the Flight Plan for tomorrow, two EREPs?

SHAFFER No, it's EREP 23 on track 14. And EREP 23 Earth limb. Those are back to back, but are - only one of them is Z-local vertical, if you will.

QUERY Okay, now what is it you're going to try to do - -

SHAFFER You look - you look through the atmosphere with the instruments and it's - -

QUERY Why you - you anticipated the wrong question. What is it you're going to try to do to keep from this TACS screwup again?

SHAFFER We - -

END OF TAPE

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Time: 16:27 CDT
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QUERY What is it you're going to try to do to keep from this TACS screw up again?

SHAFFER We see - is there some chalk down there? (Sounds of writing with chalk). That's the - that's the way the pad looked before we made the mod stud - and the information up here is the information to do the - the fine maneuver to the offset ZLV. Okay, and - and it's a bunch more DAS codes and things, but the fact of the matter is that this set of information here, is really a part of this because it's all one sequential sequence of events. You load this information as soon as the maneuver starts, then you do this part down to here. Right then, and then later today it was an hour later. You got an assignment of - so what we've done is instituted this line, called out who this guy is that's going to do that. And remove that line. So that now, this is all one set of activities, obviously separated from the - from the other set.

QUERY It's just a poorly - poorly organized method. Is that what it boiled down to, or poorly written, or something?

SHAFFER Well, it - with my 20/20 high insight it think it should have been this way all the time. Okay, but you have to - one of the things you have to remember Jim, is that we never had this exercise to do until the CMG failed, because we never had to go to this offset. We always had enough energy to go do the ZLV and get the hell back to solar inertial attitude or wherever else we wanted to go. Okay, and we instituted this little sentence here, okay, to keep us out of another problem. Since this activity was typically a long ways away, the guy could have a tendency to go rolling up to the command panel and just throw the switch. Okay, because, the pad may be an hour old. And if you didn't have the pad, or remember to load this maneuver time here, you know then we could do the same thing from the other end. So, we put this sentence in here, but the fact of the matter is, that I - in my opinion this line was in the wrong place. And after 53 days it got us.

QUERY Is - is 50 pounds correct as to what you estimated should be used?

SHAFFER Yes, 55.

QUERY What - does this - using this much today does this keep them within that 37 - - 370 pound average that you want?

SHAFFER No.

QUERY It's what above it?

SHAFFER It's too much.

QUERY Like how much?

SHAFFER I don't know. I - I would guess 500

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pound-seconds below where we want to be. But what that means to you Jim, that if we - if we do very good for the next 2 or 3 days, we'll be back above our average. The point of that being is it - it's not that big a concern at this point. See the 2 or 3 days preceding this we used significantly less - -

QUERY That corresponds -
SHAFFER - - than the 370, and in the succeeding
days, we intend to use significantly less. In fact we
do an awful lot of work to keep from hitting that 370
pound-second. The - the Flight - -

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SHAFFER In fact we do an awful lot of work to keep from hitting that 370 pound-second. The Flight Plan for tomorrow is, from the momentum standpoint, is really very good. The maneuver for SD19 to look at the comet is followed by 2 undisturbed momentum dumps to restore the state. We have a - we missed a single dump to do the EREP and it is then followed by 4 good momentum dumps and then we miss a dump to do the SO63. And in terms of - of usage that is - that's better than today was, okay. The - the AUTO CAL attitude is - you have to call that inconvenient for momentum, and out of the 200 and something pound-seconds that was predicted for today 150 of it went into the EREP CAL. Yeah that one - that one's not to swift, but you got to have that information to reduce the data right.

PAO

Howard.

QUERY

What is your prediction for tomorrow then, on the 3 or 4 maneuvers you're going to have?

SHAFFER

Well, you're not going to believe this. But one of the things we do in our normal course of business is every so often record the contents of our great monstrous number crunchers over there. And last night after we'd gotten the preliminary runs on this we recorded the contents of one of our great monstrous number crunchers called the ASP or the activity scheduling program that has the momentum management model in it. Not only was the recording no good, for some reason unknown to us it dumped the contents of the machine, and it was all lost. And we only know that we could do it, and we know that we didn't into gimbal stops but we never got the results recorded. The guys are doing that right now, they're - they're rerunning those things to get it in detail, but it is - it's better than - it's better than today, but I can't tell you precisely because it's one of those things that happen when you fool with the number crunchers.

QUERY

Has Rosemary gotten the job down here now, is that what you're trying to tell us?

SHAFFER

What's a Rosemary?

QUERY

Rosemary Woods.

SHAFFER

I though you were doing a Rose Marie's baby to me. No, it is - you know it's - it's a form of insurance, you know you take it and ever so often the insurance gets you, you know, companies go broke.

PAO

Arthur.

QUERY

There was something I was trying to remember from a day or so back, wasn't there something that the pilot did in maneuvering that caused that extra use of TACS on one of these things and is that similar to what happened today? Yeah, well answer that question, if you can remember, I think you mentioned -

SHAFFER

Well let's see it happened to us on the EVA, and there was - And it happened on the EVA because the ground left out one sentence on contingency instructions.

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Although we talked to them about what we should do there. The fact of the matter is that we left a sentence on the contingency instructions that would have saved us from that problem and it's of about the same magnitude as this. Okay. And that caused the EVA to be significantly more expensive than we expected it to. And specifically what it - I really kind of hate to get into this but I will if you want. Shall I?

QUERY

Why not?

SHAPPER

In the attitude HOLD MODE TACS ONLY the computer and its reference system tries to control you to a deadband that is 3 degrees plus or minus about X and 2 degrees plus or minus about Y and Z. Okay, and it's immediate, it defines that - that limits around where you turn it loose. Okay, and if it gets outside there, it gets super excited and goes roaring back just as hard it can, and it's double penalty, it sets up a big rate and uses a lot of TACS getting started back and then it has to use a whole of TACS to get stopped. Well during the S201 exercise we got gimbal on a stop and we lost control as we do when we get gimbals on stops and run out of momentum. And there was one extra step in the process of recovering from that lost of control and that was to reselect ATTITUDE HOLD mode which redefines the center of where the limits are established. So -

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SHAFFER - - which redefines the center of where the limits are established. So that you're not way outside the deadband when you - when you turn on the TACS. We left that step out. So we were 20 degrees outside or something like that and he turned on the TACS and boy did we come roaring back. Okay, but it's - it's mode selection, it's computer management. Okay and that's - that's what happ - I'm trying to remember exactly what happened the other day. But it's something like that and it's the same thing that - it's that one little step. Either you do it or you don't do it and if you - you're out of sync with it it'll get you every time. Bruce.

QUERY Phil, do you know what the - when you say about a thousand pound-seconds, was that for the EREP cal or - and everything, the lunar cal today too?

SHAFFER Today? No the - we had predicted 32 mibs, 160 pound-seconds for the EREP cal. We in fact used 35. Which makes that a very good prediction. I think we were predicting 11 for the EREP itself and 3 or 4 or 5 or something like that for the activity at the end of the day. Not very much. So the thousand is over and above the - I think it's about 240 pound-seconds if I remember right that we were predicting so we're - we're down - 60 - we're down 950 pound-seconds for today.

QUERY Do you know what the total TACS remaining is?

SHAFFER About 17 thousand. 16-8, 17 thousand something like that.

PAO Howard.

QUERY You have 17 thousand. You have to hold 6 thousand in reserve and if you get into a situation in the EVA say where you use 3 or 4 thousand more again, you have to consider that possibility again I guess, and you're going to have to be awful scarce with the gas aren't you?

SHAFFER Not going to let me use the CSM for attitude control on an EVA? Where I have got pounds and pounds and pounds of gas.

QUERY To honor your request of last night we've got a (garble) question number 1. What's a - what's a nuZ update?

SHAFFER Stran - no, no - Strange - strange that you should ask that after the star tracker's cratered on us, which is what the star tracker did for us. NuZ is an angle. Okay? And it's a - it's a funny rotation kind of angle that is defined as the angle between the X-principal axis which is a mass properties coordinates system in the orbit plane. Okay?

QUERY Sorry I asked.

SHAFFER Now, but - but let me - let me tell you how it works. Play like this is X and I'm right exactly at orbit noon. Okay. So the X is horizontal but I got a Beta angle of some number so I got to roll over to point the ATM

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at the Sun and because the - the mass properties axis, the minimum momentum sets over here somewhere I've got to rotate to get that X mass properties axis in the orbit plane. And the amount of rotation around the Z-axis that I have to do to get that minimum perturbation mass properties thing in the orbit plane is the angle called nuZ. Now the - the computer monitors the momentum samples and it decides where the mass properties coordinate system lies. And it does a maneuver to do that. The rate gyros in the Z-axis drift and they don't have this nice thing like the Sun sensors to correct the X and Y. So we use the star tracker to tell us where we were in this rotation and that was a nuZ update. No but it's a - yeah you - you talk - one of the things that happened is that you hear a nuZ is 17 degrees. You say uh-huh! The X-axis is 17 degrees out of plane. It really isn't. It's only about 4 because you roll - roll that beauty over and then rotate around the Z-axis. The X-axis is really not that far out of plane but you have to do - -

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SHAFFER - and then rotate around to Z-axis, and the X-axis is really not that far out of plane, but you have to do - because of the roll angle a big rotation to get it out.

QUERY You'll get another one tomorrow. (Laughter)

QUERY That's about the first right-hand rule I've seen for not - not for any - for electromagnetic radiation or something of fields or whatever. But -

SHAFFER Well, space - space business is built on clocks and right-handed coordinate systems.

QUERY And left-handed flight directors.

SHAFFER And left-handed flight directors.

QUERY Yes, what I was going to ask you is in light of this stuff, have you got somebody going through all - all your possible messages to see if you can find and eliminate any other possible things like this?

SHAFFER Yes, it goes on all the time, we don't just -

QUERY Have you found anything else that you might be correcting ahead of time instead after - after the horse is gone?

SHAFFER Not yet.

QUERY Are you any - how do you feel now about the TACS situation? Any different than before?

SHAFFER No. I think 2 or 3 days we'll be back above our guideline and press on doing our thing.

QUERY Sir, do I understand you to say that the star tracker cratered?

SHAFFER Yeah.

QUERY And by cratered to you mean broke?

SHAFFER Do you understand what I mean when I say an airplane has cratered?

QUERY Yeah.

SHAFFER That's a verb, it made a crater. And it's ruined, every time that happens the airplane is no good any more, just - that's the condition of the star tracker.

QUERY The star tracker is gone?

SHAFFER No, it's still there.

QUERY It's not working.

SHAFFER Well, it's - it has all the characteristics of a burned out light bulb.

(Laughter)

QUERY Well, does this do anything to you?

SHAFFER Yes, it really does Jim and I shouldn't be facetious about it. The - but 2-1/2 years ago we decided that that was one of our likely problems and we had so many ways to - to get around that adequately that it's not that big a problem. But specifically what it means to us is JOP 13 exercise is using the SO55 instrument can't be done anymore because we never know the Z-axis that angle, well enough. We

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get it down to about 2 or 3/10 of a degree now. And in order to do the - the JOP 13 exercise with the S055 instrument we have to know it to less than a 20th of a degree. So there's just no way to point it. If we had continued JOP 18 Deltas and the crew still could not see the comet in the TV then again the narrow field of view instruments like S055 would not have been able to - to track the comet. The people who will reduce the ATM data on the Sun have now lost their number 1 reference for where the North Pole of the Sun is in that data, because that was the instrument that gave it to us. And we needed to know that information to 1/6 of a degree, and we're just not going to know it that well. It produces small errors in EREP because we never know that orientation, we always got cramped a little bit when we go through EREP 2/10 of a degree. It's that kind of problem, it's a minor degradation to the data we're getting and will cost some extra effort to reduce that data discreetly. But we're there.

QUERY And what does the failure of the star tracker do as far as the crew's time is concerned?

SHAFFER Makes life easier for them. Because they don't have to do star tracker updates now. When we had a star tracker we did one in the morning, we did one prior to a maneuver, Kohoutek, EREP whatever, in order to remove the gyro drifts to that point. After we'd done the maneuver we did another one to remove the scale - the gyro scale factors, you know the thing doesn't read the gyros exactly, we'd do one to remove the errors so that wouldn't slip into the ATM and then we did one at night. And on those days when we were doing 2 or 3 maneuvers a day then you ended up with 5 nuZ updates. And you can't just go do it, you got to do it when you can see the star when it's not occulted by the Earth, it's not occulted by, I mean you're not in the middle of a momentum dump because you have to be in true solar inertial to do it. So in terms of the impact on the crew it's made life considerably easier for them.

QUERY Could - could -

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SHAFFER We do want to remove the error so that
wouldn't slop into the ATM and then we did one at night.
And on those days when we were doing 2 and 3 maneuvers a
day, then you - you ended up with 5 nuZ updates. And you
can't just go do it. You got to do it when you see the
star, when it's not occulted by the Earth, it's not occulted by
- I mean you're not in the middle of a momentum dump cause
you have to be in true solar inertial to do it. So in terms
of the impact on the crew it's made life considerably easier
for them.

QUERY Cou - could you estimate how many
minutes this hands back or - or gives you to do other things
in?

SHAFFER Well, it - it doesn't work like that
Art. Because the - the activity of doing the nuZ update took
2 or 3 minutes. The - the penalty was that it interrupted
what was going on to go do it. And it meant if a guy
was - could have gone to do something else, he may have to
sit around for 5 or 10 minutes and wait for the star to come
up. There's not enough time to go do something, to get
started in something and say ending up having to sit around
and it presented a Flight Planning conflict at - it was a
loss of time, because of the geometry constraints - i.e.
waiting for the star outside a momentum dump.

QUERY Okay, on a different subject. The only
thing I'm curious about is how this time for reflection
is going to work is - is this just part of the pre-sleep
activity or you're just not going to call them from 9 to 10
o'clock, or?

SHAFFER That's right, that's the guideline.
QUERY Okay, so they are reflecting and pre-
sleeping activitying (sic) at the same time.

SHAFFER I don't know what you said.
SPEAKERS (Laughter)
QUERY (Laughter) Well, you know I thought it
might be nice to give the transcript girls some excitement
at the end of - -

SHAFFER Well, say what you said again.
SHAFFER You English majors have got some many
big words - (laughter).
SPEAKERS (Laughter)

QUERY I said so they - they will be reflecting
and pre-sleep activitying (sic) at the same time.

SHAFFER Yeah. The post sleep's the same way
about that. Unless, we've got Flight Plan updates or pad
updates that they have to have to get the day started we
leave them along then too. With the exception of the news.

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We - we've stopped reading the news in the evening-are now reading it to them at breakfast.

QUERY (Garble)

SHAFFER Poor baby.

SPEAKERS (Laughter).

SPEAKER Okay.

SHAFFER It's a - of course we get it out of the Post now. (Laughter). I never guessed. No - -

QUERY (Garble).

SHAFFER Yeah, if - it's always better for us to wake them up because it gives us a double, you know they have the alarm clocks that they use, but you don't constrain it to that. They - they wakeup at 11:00 and if we got a station there we - we call them and if we don't they use the alarm clock.

QUERY (Garble)

SHAFFER Say it again?

QUERY Say you can be sure they're there.

SHAFFER There's not too much question about that Jim, they're always there.

PAO

Well, if we have no more other questions, I hate to bring this light session to a close. (Laughter)
One of our lighter change-of-shift briefings. Gentlemen, thank you. Thanks Phil.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Kohoutek Review
Johnson Space Center
January 7, 1974
1:04 pm CDT

Participants:

Dr. Horst Uwe Keller, University of Colorado, Co-Investigator
S082A/S082B

Milt Reim, PAO

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PAO All right. We have Dr. Horst Keller representing the University of Colorado, also the co-investigator on the S082 A and B for the Comet Kohoutek. I'll turn it over to Dr. Keller.

KELLER I feel it's somewhat appropriate to talk a little about the comet due to the point that the ATM observations are now finished, and there was a real great effort on the ATM observations. I just got the figures. About 30 man - manned cycles and 17 unmanned cycle - cycles. They are devoted to comet observations and this is quite a record, and I hope the results will be comparable to the effort. And I'm pretty sure that at least the S052 white light coronagraph will show beautiful and very interesting features about the development of the comet near perihelion and - and very short the - the - and the minimum elongation - They made pictures every orbit, several pictures every orbit and this is very important to have those observations made in short time intervals, to see the development because so close to the Sun even the dust tail develops very fast and changes its structure. And talking about the S082A and B we - as you all know, we made ex - exposures with an instrument during minimum elongation, and - but I will say those exp - exposures, they are more or less experimental. I don't have much hope to find helium or the chances are very, very small because helium is a very volatile compound or atom, and might be possible to detect O plus, which has also strong resonance (?) line in the far ultraviolet line. And we know that O is very abundant in comets normally and - and the - every O atom is converted into an ion and therefore we might be able to see O plus on those pictures, but the data of S055 indicate that the Lyman-alpha emission was at a - approximately as strong as we expected it to be, and therefore in showing us that the short wavelengths exposures of S082B should be able to show the Lyman-alpha line and also probably the profile of the Lyman-alpha line which is unknown until now and very important, and the profile will tell us something about the temperatures of the hydrogen and we also might be able to deduce an outflow velocity from this profile and when we deduce an outflow velocity we might be able together with other observations about the structure of the hydrogen cloud to say something about the solar Lyman-alpha flux intensity, to make a sort of calibration of the solar Lyman-alpha flux using the comet data - comet ex - the cometary emission. And the long wavelength's range in S082B is the most promising experiment because it has a fantastic resolution and - if we have results then those results should - will probably be a - a some new lines and some new emission features and - but the - the pointing accuracy is not

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very very known until now of the instrument and the feature we are aiming at - for, or we aim for, was a coma - the inner part of the coma and this is very small, and therefore it - we have to wait until the end of the mission to be really sure how good our results are - they are, and - but altogether I feel it was a large effort. The observations we have are somewhat more complicated than we thought beforehand because of the effect that the comet was not so bright as expected, even at perihelion, and we couldn't use the - the S055. We initially hoped that we could use the real-time S055 display to point really on the nucleus, but the real-time never showed data. And therefore we had to depend on the S052 white light coronagraph and - which was very helpful and which just - only due to the white light coronagraph it was at all possible to use the long wavelength range of S082. And I feel it was very difficult in the beginning of the observations and also especially at the end of our observation time for the crew and mainly for the science pilot to find the comet on the white light display and to be sure that he's looking at the comet and to use the comet on the - on the - -

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KELLER - - of S082. And I feel it was very difficult in the beginning of the observations and also especially at the end of our observation time for the crew and mainly for the Science Pilot to find the comet on the white light display and to be sure that he's looking at the comet and to use the comet on the - on the (garble) margin of the TV display to make the right maneuvers - to point at the nucleus. And I feel they - everybody was very - everybody involved in this job did much about it to get a success out of it and also the planning and the operation itself, was quite different from the usual ATM solar observation and yet, in the first week of - during the first observation week, we had to learn how to handle and what maneuvers are possible how to compensate and all those things. But afterwards, we - and after perihelion, we knew how to - what to do and then we were able for the last observation on January 6, we used as - you might say it was a trick we used Venus which was very close by to show up in the display instead of the comet and we knew the location of the comet in respect to Venus and then we could make the right maneuver from looking at Venus, we - then he moved away from Venus and moved the instruments toward the cometary - coma. This was very fortunate because on the last day, it wouldn't have been possible for the Scientist Pilot to see the comet and resulting - the comet, the error in pointing is in all of 20 arc-minutes or so due to the course maneuver, you can predict that much - much better. And - but all together, I - I really hope that this large effort will - give us good data and there's no reason now to be in any way disappointed due to the fact that the comet didn't show up so bright as predicted half a year ago and I feel that its behavior was quite as you could expect from observations in December. So the latest observation, in December more or less, showed that the comet is less bright than the predicted curve compared to Arend-Roland or so and its max - its maximum brightness probably was around minus 2 or so and was interesting to hear the comment of yesterday when Venus appeared on the white light coronagraph. Venus was much brighter than the comet ever was in the white light coronagraph and Venus was so bright that they had to dim the - the white light coronagraph display and Venus had a magnitude a little bit - brighter than minus 4. And another - thing I should mention, I feel I should mention is that it is very useful and very important to go on now with other observations which can support as the AI - the larger effort which is made in the ATM observations and - and most of the theories or - the results which are predicted or calculated on cometary physics can definitely only be proved or best proved by their prediction

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of - of the evolution or development of a comet and depending on the heliocentric distance of the comet. The changes - if you make a momentum picture you get information how it looks like in this moment but you can make many model which fits this moment. But if you know the evolution of - of - and the changes - this heliocentric distance. You can much better decide between different models and therefore, the most important thing I feel is that if (garble) going on with the col - corollary instruments and also with ground-based instruments with rockets and so on, go on to observe the comet and we had the unique chance that we are already now after perihelion - we covered all (garble) 3 nearly with the ATM observations and heliocentric distance. And the larger the (garble) the better you know about the evolution things or development decrease in brightness and decrease in several emission lines and how maybe some of the species are decreasing faster, some are decreasing with a slower speed and this is very valuable to get this information. And the comet is still - it is not a very bright comet but it is still of medium brightness. And if - the reduced brightness might be slightly less than Comet Bennett, but I'm sure if - it's better - it's a little bit better here and it is far enough in the sky like it will be - right now, in the next 2 days maybe then it will be impressive to look at it. Also together with constellation of Venus and Jupiter, and it should be no problem to find it with naked eye and with binoculars you should find the tail in the order of 4 or 5 degrees and it is not a bright feature so you - you have to look for it. That's - -

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KELLER - - And, this is very valuable to get this information, and the comet is still, it is not a very bright comet but it's still of medium brightness and, if, if - the reduced brightness might be slightly less than Comet Bennett, but I am sure if, it's better than, a little bit better here, and is far enough in the sky, like it will be right now and the next two days maybe then, it will be impressive to look at it, also, in - together with the constellation of Venus and Jupiter, and should be no problem to find it with naked eye and with binoculars, you should find a tail in the other 4 or 5 degrees and, it's not a bright feature, so you have to look for it, that's - but if you look for it, you will find it, I think, and it behaves more or less like expected from pre-perihelion data, and it might be that, equivalent heliocentric distance, there might be a change in magnitude, but might be a little bit fainter now, but I'm - I feel it's too early to say that because all the estimation of the brightness, until now were made more or less under bad conditions, but weather condition and also the comet was very near to the horizon and this - it was still twilight, and all those factors normally tend to reduce the observed magnitude of - of the comet and - and it - it seems to be dimmer than it actually is because if it's really black you see the whole coma and you don't have the background and we should wait some more days to - then you be able to say definitely that the comet is less bright than before. And if you look - it's the same thing happened before perihelion; there the observational circumstances were even worse than now. And if you look at the observation point and it's a predicted curve you see that the - the difference between the observation and the predicted curve increased when the comet came nearer to the - to the Sun. But it is this not clear whether this is a real physical effect until now or it might still be that the circumstances of the observation are bad and therefore you - the observer saw it dimmer than it actually was, and this got worse and worse the closer the comet was to the Sun. And - and to say something about the nature of - of this comet, I feel it's pretty - there are strong arguments or strong hints that this comet is a new comet maybe a very new comet but this is already stated from other persons. And a new comet when sometimes you might make the argument that you would expect that the new comet doesn't show up so bright close to the Sun as you would think it will be if you look - see it far away from the Sun because some part of the gas is already - has already evaporated when the comet is close to the Sun and as it comes closer to the

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Sun and the resolution is not so fast. And I think maybe we should have the last picture - we - and - which was (garble) by the crew and we can see like the - how the crew sees it and - and the ground-based observation now show - indicate a tail of the comet in the order of 4 to 5 arc minutes' lengths. And what you can see in ground-based observation is - normally you only see the dust tail because (spacecraft comm piped in) the plasma tail is normally too blue and therefore dim because the eyes are not really able to see the very blue light coming from the - from the plasma tail. And this might be one of the reasons that the overall brightness of the comet as seen from ground-based observation and also (spacecraft comm) with naked eye is not as bright as expected. One of the reasons might be that the dust - the comet doesn't have very much dust, if you compare it to Bennett. I'm pretty sure that Comet Bennett in 1970 or 69 had much more dust compared to this gas part than this comet has. It - there were observation in December showing pretty long dust - plasma tail of 3 to 4 degrees and I also feel that photographic observations, those observation must be made photographically with blue sensitive plates will show an - also a dust - a strong plasma tail after perihelion; that's my feeling, it's no observation actually reported. But I think as the ratio of gas to dust is larger than - -

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KELLER

This comet has - it - there were observation in December showing a pretty long plasma tail of 3 to 4 degrees. And I also feel that photographic observations also - observation must may - be made photographic with blue sensitive plates will show and also a dust a - strong plasma tail after perihelion that's my feeling. It's no - no observation actually reported. But I think the ratio of gas to dust is larger than in Comet Bennett. All right - this is the drawing of day 5. January the 5th and the tail length here on this picture is between 4 and 5 degrees as indicated. And you see as overall its appear - appearance of the comet is more or less smooth, you don't have too much structures some spots are indicated and the comment of the crew was that it looked watered. Sometimes this is probably due to the fact that the variation of the dust is not - is of the dust production is not constant you have some smaller actions and also due to the fact that the variation is changing this heliocentric distance drastically of course and this gives you some sort of structure in this comet. And here below you see (garble) that are lines - those are lines of equal brightness. If you - the comet is of equal brightness into this - at this line and that so long-elongation from the head of the comet, but this is just due to the fact probably that the dust density around here is higher and that's exactly what you expect to get those elongated (garble) due to the more recent not so much dispersed dust production. And the first time - can you get this back or in the stop or - Okay fine. The first time if you look at those two words here, white, und violet and the first time the crew definitely says she, they, see some violet color, they - they are relative cautious about that and some explanations they discuss that might be airglow background or so, but - but all together they make the statement that this violet is probably from the comet and this is probably true because the tail sets later than the head and therefore if airglow is there, then you would expect the influence of airglow more intense here than here, and of course you can look through the tail if there is background you can nearly look as good through the tail here as you can here. The whole dust tail is optical thin. You will see any background there. You would be a star you would see it through - even pretty close to the - to the coma itself. And that indicates violet features on this side and - It might be that they are able to see the - the plasma tail, there is - I have to say - that is very difficult to see it with naked eye and this might indicate that the plasma tail is really very strong. And it is also clear that you can't make a difference in - in form or in shape between the plasma tail and the dust tail because the plasma tail and the dust tail are in the same - in the same plane and you are looking nearly in the plane of

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the orbit and - and the dust tail - the plasma tail would be more or less here in front of this plasma tail. But just here it might be shifted a little bit to this verge here to this rim here but that's all. You can't in spite of the point that in the plane of the orbit they are pretty well separated, due to the fact that you are - you are, if this is the tail and this is dust tail down there you are looking from here and the plasma tail would just be before it and therefore you see it projected on the dust tail. And therefore you can make by shape a difference between those two tails. You can - you might be able to tell it by color. But the best way to verify a plasma tail of course is photographic observations through sensitive plates. But another thing is that in the development of the comet I - which I didn't - not quite understand and is that a tail length increased very rapidly after - after perihelion and on the 29th they report a tail I think or maybe on the 30th, I'm not sure. One of those two days.

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KELLER

Photographic observations with blue sensitive plates. But another thing is that in - in the development of the comet I - which I didn't - not quite understand and is that the tail length increased very rapidly after - after perihelion and on the 29th they report the tail, I think - or maybe on the 30th I'm not sure about those two days, they report a tail of α of 7 arc - 7 degrees and this is very long. I made some calculation and I - and - that show if you have dust - a normal dust tail than it should be much shorter and you would reach a distance of 4 to 5 degrees in - maybe on the second of January that - yes on the second of - first of second of January but not on the 31 or on the 1st. And this might indicate - can be explained by two things I feel. The first explanation might be that the part of dust in the dust tail is of small - very small dust particles is pretty large and the dust particles are so small that they radiate a force on this - these dust particles as large as in the gravitation attraction of the Sun, and they are very fast driven away from - from the nucleus - from the nuclear region. And if this explanation will show not to hold, which we will - will be able to prove those things using the white light coronagraph pictures and then another explanation might be that they actually see - saw at least in the farther tail part of a very strong plasma tail. But I don't know - I would still stick to the (garble) that it should be dust - if this is a - this is more or less a thing, I really don't understand quite off hand. And also they indicate afterwards that the tail length shrank and 1 or 2 days later the tail length shrank. And it's very hard to say which is - whether this is real - a real effect as discussed by the crew. The crew itself said - Ed Gibson said that it might be just an effect due to the point that they haven't been so good adapted, not to the - not adapted with their eyes and therefore they didn't see the tail as long. And because a dust tail should not shrink and - and be larger afterwards - again, it should go steady, begin to be larger and then it - it begins to shrink when the comet is farther from the Sun and you can't see it anymore against the night sky, it's gone too dim, but in the first time it should steadily increase. The fact as also described by Ed Gibson that the projection is much better just two days afterwards, if you - the first - the real direction which is more or less a leading edge to - towards the dust tail and projection was nearly away from the Sun - nearly away from the Earth shortly after perihelion then - and as you see the comet turned around the Sun very fast and - and you see my - my - my - my arm - you don't see the arm length but if it's turning around you'll see it immediately - grows very much in spite of the fact that the arms itself doesn't grow. And this

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effect caused a very rapid increase of the tail length of course but still it is not - to me it is not quite clear how the tail could increase so fast to certain degrees. And what else - I would say what you see with this naked eye is dust and what they predominantly saw is dust. And maybe I should comment also on the - on the colors a little bit which were described by the crew. Of course the yellow color is more white yellow color is more or less reflected sunlight from the dust and if it's described for the coma part and then it might be coma gas emission not - ion emission but gas emission and gas emission is over the whole spectrum distributed and it might well be white. And then they also stated something about an orange color and - on the 30 of December I think or - yes - and that is also not clear what the cause for this orange color is. And it might be two possibilities might explain it at I think it's the first time that somebody observed an orange color actually on - on the ta - on a comet and in comet and it might be due to the fact that the sodium lines were very strong and the sodium lines are near 6,000 angstroms and this is an orange, more or less orange color.

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KELLER - - for this orange color is and it might be two possibilities might explain it and I think it's the first time somebody observed an orange color actually on - on - on the ta - on a comet and in the comet and it might be due to the fact that the sodium line is very strong and the sodium lines are near 6,000 angstroms and this is an orange, more or less orange color. The sodium lines are closely connected as far as we know to the dust distribution and the sodium is evaporating if the comet isn't close enough to the Sun from the - probably from the dust and has a very short lifetime in these distances. And there are some indications that sodium can get very intense in comets. We had some examples and sodium was already detected in the pre-perihelion observation phase. And another explanation might be that I didn't make any calculation in this direction but might be that you have some sort of black body radiation just due to the fact that the dust grains are very hot. You expect temperatures between 500 and 1000 degrees Kelvin and if you have stone which is 800 degrees hot it radiates and this radiation might be - is mainly in - in the long wavelengths range, mainly not visible but some of it is visible as red light. And - but it's very hard to comment on those color observations actually, and to say something definitely about it. As we - as we - as we saw that to make definite statements of the nature of the comet and on the behavior of the comet it is - I feel it is too early to do that now because we have to wait for good ground-base observation - good in this sense that you know what you expect of ground-based observations and because you have - you are able to compare them to other ground-based observations to other comets. And also you have to know what is the development when the comet recedes from the Sun and to - and to get all the pictures together. And I don't really want - I would not like to give any interpretation more than I feel I've said already maybe too much about interpretation and I should be careful with those interpretations, now - right now, afterwards of course we will have a real good picture of the whole development and - but we should wait until this point. I feel that's all I have to say and -

PAO We'll take questions now; wait for the
mike. There you are sir.

QUERY Okay, Dr. Keller, I wonder if you could explain to us a little bit more about your position as far as the Kohoutek observations are concerned. You were described as sort of a leader for the World research team and I'm not quite clear exactly, what's your - -

KELLER Yeah, my first connection is I - I'm coinvestigator this S082A and B instrument with NRL group.

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And on Ko - Kohoutek observations - for the Kohoutek observations. I got in touch with this group in last August or July and when the talk was about whether Kohoutek should be observed by Skylab or not and I prepared the observational program for SO82A and B. And my field of - I worked until now on my PHD thesis and afterwards especially on ultraviolet emission of comet on the results of OAO 2, satellites OAO 2 and 5 of different groups.

QUERY Are you coordinating also ground-based observations?

KELLER I'm not coordinating ground-based observations. No, I'm - I make - I am - together it's more or less an informal thing - together with a friend of mine we try - we try to make H-alpha observations also from the ground-base but not - nothing seriously. And what I'm - another thing that I am involved in is right now I am going to White Sands to launch a rocket for the - together with George Lawrence (?) of the University of Colorado a rocket which is devoted to ultraviolet observations of the cometary spectra of this comet - That's on Tuesday.

QUERY Okay, I - I hate to belabor the point but I want to make sure I understand this. Then you are the person who - who drew up the Kohoutek observation program for 2 of the instruments on Skylab.

KELLER Yes, yes. And my status here is more or less loose, I'm not paid by NRL or (garble) and also not paid by Skylab mission here and I get -

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KELLER - - which is devoted to ultraviolet observations of the cometary spectra of this comet. That's on Tuesday.

QUERY Okay, I hate to belabor the point but I want to make sure I understand this. You are the person who who drew up the Kohoutek observation program for two of the instruments on Skylab.

KELLER Yes. Yes and my status here is more or less loose. I'm not paid by NRL or (garble), also not paid by - by Skylab Mission here. I get my money from - from the University of Colorado.

PAO Excuse me just a minute. Do you need the TV picture anymore?

KELLER No I don't think so. Might be if there are questions, of course, but otherwise not.

QUERY Okay, the - now I - ask you about the comet itself. Can you at this time make any definite statements at all as to the composition of the comet? Also can you - can you in miles give us some idea of the - what you mean 7 degrees worth of tail versus 4 degrees worth of tail, that is length in miles, kilometers or something?

KELLER Yes. Yes.

QUERY And - well answer those two and I have another one.

KELLER Yeah, okay. Concerning the first question I would say - isn't - the HCN was detected together - together with CH₃CN which was reported already earlier. Very recent report on - came yesterday in and they looked, I know it was one of those guys who made this observation is (garble) I'm going to talk to him after White Sands and many scientists are - suspected those compounds or similar compounds in the comet in similarity to molecules you find in interstellar space - which are found in interstellar space and one of the reasons to look for those is of course that we know the radio emission features of those species, and we know where to look for and therefore the obvious thing is first to look for those species and there might be other species and I know that people try to find CH₄ and they are not successful and right off the composition. From the composition here you would think that CH₄ it pretty probable molecule, too. And also, I think people will try to look for HCO, formaldehyde. And those are all molecules which are already and interstellar (garble) space and which we believe are formed in some sort of pri (garble) matter and the pri (garble) matter during the phase when the solar system was created. And especially this molecule might

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hint to the - the point that the comet is created very far away from the Sun. It is not clear - I feel most people agree on this point that comets are part of our solar system and they are most probably created when the solar system is created, when the planets are created but, it is not clear where the comets are actually created. Are they created near to the Sun on the verge of the planetary system that means near to Jupiter, Saturn, Neptune, or so or are they created much farther out? And never touched by solar light actually and this molecule might hint, but all those things has to be - have to be calculated in that they are created farther out. And - and that's the reason why comets are very interesting is that they are probably the only bodies which we can observe, which we are able to observe from time to time which are still in this more or less pri (garble) phase of existence and if you - that's to say it's a probe from former times and just conserved, still conserved and more or less conserved. Of course there are some things going on there and one of those things you can explain of course you say - can say all right the comet was created near to the Sun and then it was put onto another orbit very far from the Sun and it for several billion years it went around to the Sun there and it might have been able to pick this molecule up on the surface in large enough amounts to evaporate it in the first orbit near to the Sun. But I would say still water is - was not definitely detected until now and the people are looking still for water and probably water is - is one of the most - at least one of the most important constituents of the comet and there might be other equivalent - there might be other constituents with equivalent amounts. But I don't think that there are other constituents which are much more available than water. Water should indicate if you know - when we know the water contents and probably know the water contents by looking at age.

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KELLER - of the comet and there might be other constituents with equivalent amounts but I don't think that there are other constituents which are much more available than water, and water should - should indicate if you know - when we know the water contents and probably we know the water contents by looking at H in Lyman-alpha because H is the first disassociation product - product of water, then if you know the H amount then we know more or less the water amount and I think that this amount is really giving us a good indication how much gas is available in the comet and how much is evaporated. And I don't think that any of those more complicated molecules exceed a number, the number of water molecules.

QUERY Before you go on to the length of the tail, HCN is hydrocyanic acid, I guess.

KELLER Yes.

QUERY And what is CH₃CN?

KELLER Methyl cyanide.

QUERY Methyl cyanide.

KELLER Methyl cyanide, was reported I think before perihelion already. This (garble) reported yesterday, but also observed before perihelion. And all right, I think this is a composition - until now nothing happened which is surprising - really surprising with the comet. And - and - but the most value observation will be now because the comet is easier to observe, it's higher in the sky than it was before perihelion. And - and one - some of the things those - those observations are very much depending really on the brightness of the comet actually because they are - the observations are marginal, they are marginal and therefore it is - it is important whether you have a factor of 2 or 4 or 10 more material available or not for those things because emission features are very small and - and the - and the main difficulty is that these molecules are only very close to the - to the nucleus, and the nucleus - very close to the nucleus and say if you go farther away and (garble) diameter for a cloud of these complicated molecules is probably in the order of 10,000 kilometers or say 10,000 miles. But that might be the right-radius or - or the diameter of this cloud were those molecules are - afterwards the molecules get very rapid by solar radiation disassociated. And they get disassociated producing molecules like CN. CN is one of the most observed molecules in - in the coma, it's very strong normally, if you (garble) in any - in every comet. CN is very strong in - you find it in both of them and this CN you observe is a disassociation product from the - those complicated molecules and also as I mentioned water is very dominate - excuse me, hydrogen is very dominate, and is probably due to, not all of it but a large amount probably due to H₂O. And all right

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I think - we have to wait and - and it might still be possible that we got some other (garble) and also maybe observations and maybe also infrared gas, I feel that the comet for infrared observation the comet will not be bright enough probably. And I know that the same group of people tried also in comet Bennet to find - to find HCN and were not able to find it because the instrument they used was not quite so good as the instrument they used this time, and they had too much distortion and - and they looked at a too large area, and as I said the area is very small. All right, and going to the tail length now. We - all we can say that 1 degree corresponds to 2,000,000 kilometers and 2,000,000 kilometers is - or maybe we should say now - the comet is now a little bit closer, lets assume 1 kilometers is - is 1 million miles - approximately 1 million miles. Yeah, okay, it's - it's a little bit closer now than 1 astronomical unit or so and might be a little bit larger if - if you take careful, if we say that the comet is 5 degrees long then it's 5 million miles on lets say 5.5 million - 5.5 millions or 6 million miles that is corresponding to 5 degrees, approximately.

QUERY Oh so - so in summary the tail has - has from 30 - 30 - 31st December gone from, what 7 or 8 million miles down to 5 million miles, is that what you're saying?

KELLER I would say that is what the crew observed. But also the crew made the statement it - it went up, it went down and up again. They observed very early, at the - maybe that was on the 30 - 30 or 30 - on the 30 of December 7 mi - 7 degrees tail length and after that the tail length decreased to 5 degrees on the 1st of January, a little bit and then it went up a little bit and it is smaller, more or less constant now and the crew made the comment, and I think that's an important comment that its difference in tail length might be due -

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QUERY So - so - so in summary the tail has - has from 30 - 30, 31st December gone from what? 7 or 8 million miles down to 5 million miles is that what you're saying?

KELLER I would say that is what the - the crew observed. But also the crew made the statement, it went up, it went down and up again. They - they observed very early, maybe it was on the 30 - 30 - 30th of December, 7 - 7 degrees tail length, and afterwards the tail length decreased to 5 degrees on the first of January. And then - then it went up a little bit and there's more like - more or less constant now and there's - the crew made the comment and I think that's an important comment. That - that the difference in tail lengths, might be due to the different observational possibilities. If you look at a by dusk - if it look closer to sunset, if you look at it when it's closer to the horizon, it looks less long and also it's depending on your eye adaption. I would say a good figure is 7 million kilometers and 7 million kilometers might be (garble). 7 - 7 degrees and 7 degrees might be somewhat like 8 million kilometers. As the crew is comparing the lengths to the Earth/Moon distance, tells us - tells us how many times it is from the Earth to the Moon, you know that - I don't know the Moon is 200 miles - thousands miles or something like that. I'm not so familiar with miles; I'm more thinking in kilometers.

QUERY That's fine, then you're just talking about 8 million kilometers maybe on the 30th that they observed and now it's about 6 million kilometers?

QUERY - - plus or minus - (Laughter)

KELLER Miles, miles, miles, I'm talking all the time about miles.

QUERY Well, talking kilometers - -

QUERY - - significant.

KELLER Okay, if you want to talk me kilometers then that's fine, it's more better for me. That I think - it's one - one times 10 to the 6th kilometers approximately, a little bit more even. And, I said - the crew said that the longest tail they observed was - was 7 degrees and 7 degrees would correspond to 14 million kilometers - lengths. What is visible is also for sure that the tail is longer than you can actually see it. Then it decreased down to 5 - that's to 10 million kilometers, but was visible. And increased a little bit to 5 to 6 and now the latest report I - I don't - I think that on this picture it says 4 to 5 degrees. That was the latest reported and also we have ground-based observation giving more or less the same number. Karl Henize made an observation I think he said 4 to 5 degrees. This go to - also you have to take into account that Venus, on the 6th of January - Venus was very close to the comet and if you looked

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at it with binoculars you have Venus in the field of view and Venus is not so bright that you - you get blinded if you want to look at the tail, by Venus.

QUERY Okay, before we leave this what is your guess now on why it is not as bright as it has been, or predicted rather?

KELLER We have to - if you ask me this question, I have to ask you what is the predicted - when - to which predicted brightness do you refer? The - - point is when it was detected, then it was very bright in the very far way, and 4 to 5 astronomical units away. It was very bright and people said it will be a tremendous bright comet. All right and afterwards it wasn't so bright when it came closer to the Sun. And people said it will be a bright comet and I still would say, it was not a bright or very bright comet, it was a medium bright comet. But I feel that the observations before perihelion indicate what we could expect after perihelion, and what we got after perihelion. I don't think that the brightness now of the comet is - is at the same heliocentric distance, or comparable heliocentric distance is less bright or more than - less bright than one magnitude than before. Might be 1 magnitude, but I don't think it's more than 1 magnitude less bright than before perihelion. And, therefore - and the reason why it didn't get so bright it the - there might be several reasons. One of the things is just that the comet just might be very small, actually, not so large. And if you have a small comet, then you don't expect it to - expect it to be very bright. Small means the nucleus is small. And - and then the question is how do you explain that it looked so bright when it was very far away. And this might be due to the effect that you had already some gas evaporation there. If it's a very new comet, it might be that those things like C - C - CH4 methane - -

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KELLER One of the things is just that the comet might be very small actually, not so large. And if you have a small comet then you don't expect it to be very bright, small means the nucleus is small. And - and then the question is how do you explain that it looked so bright when it was very far away, and this might be due to the fact that you have already some gas evaporation there. If it's a very new comet it might be - those things like C - C - CH₄ methane has a very low gas - very high gas pressure and is evaporating far far away from - from - from the - from the Sun and it might be that we had already some activity of the comet far away from the Sun in 4 to 5 astronomical units. And these activity for - might have caused an unusual brightness so far away and we have some indications that new comets - new comets are not very seldom; they are only seldom coming to - so close to the Sun, but they are not seldom all together and we have relative of - many observations of new comets which are far away from the Sun, this perihelion in the order of 3 to 5 astronomical units and we know that those new comets are often pretty bright there, and - but we don't know how - too much how the development is. And this is also one important point in - in - of this observation that we are really able - have been able to observe the comet nearly through its whole passage, even to perihelion passage. We have several comets which came close to the Sun - which have not been detected before peri - at all, and also some which disappeared after perihelion and for several reasons, and it is very difficult to observe it from ground-based observations. It was not poss - I don't know of any observation at minimum elongation. Normally you can look at it with coronagraph but that really was not very good. And also those observations are not very valuable because you only see the inner part of the comet and not more due to scattered, stray light. And I - but I want to say is the comet now is more or less as it was expected from the preperihelion observations. Maybe one magnitude dimmer, but that's the most I would say, and we have to wait for those because as I said until now the ground-based observations - and the situation for ground-based observations are not very - very fortuitous. And - but they will get better. Tonight and tomorrow maybe we have more information and also one indication is that the comet didn't really decrease very fast. As the crew was able to see it the last time on the 5th of January GMT - nearly on the 5th of January GMT to see it still on the white light coronagraph. And the - two days before they said it was very dim, we hardly can see it, they had to move it to be sure it is the comet. And - and - but still two days later they were still able to see it, nobody expected it because it was already (garble). That indicates

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to me that the decay was not very rapid, it was not as - it was a normal decay in brightness but no special rapid decay I would say.

PAO

Tom.

QUERY

How much more observation are you going to be doing with the other instruments other than of course the ATM which you're finished with now?

KELLER

Yes, I hope - I'm not the right person to ask, I don't know too much about the corollary instruments. But I hope that those instruments are really going on and make observations because as I said one of the most important things is to get the evolution, and to have comparable data with one and the same instruments if possible to see how the comet changes appearance when it recedes from the Sun. And I - I really hope that those observations will go on and there's no argument about it, the comet is not so bright as I expected, therefore we are not interested in - in the comet, that's no argument, the comet is very interesting from physical standpoint. And we should are not at all in any way disappointed also. And we should make - get real scientific results if we are going on and make those observations. This is very important to do that, to get these evolution effects.

QUERY

You said that afterwards we'll have a whole picture of the development. How long do you think this is going to take before we really have a whole picture of the development of this comet?

KELLER

I think if we are going to wait for 2 or 3 - 3 more weeks I would say then the main observational period will be gone and we - we might be getting results from the ground-based observations and one of the disadvantages - or I shouldn't say disadvantage really, is that the Skylab observations or, at least, the ATM observations are not real-time observations and we had to wait for splashdown to - to get this part of story. And if you want to look at the whole evolution including this part you have to wait until the end of February or so, and even maybe in - into March if the splashdown is has scheduled.

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KELLER - the main observational period will be gone and we might be getting results from the ground-based observations. And one of the disadvantages of - or I shouldn't say disadvantage really - is that the Skylab observations or, at least, the ATM observations are not real - time observations. And we have to wait for splashdown to - to get this part of story. And if you want to get the whole evolution, including this part, you have to wait until the end of February or so, and even maybe into March if the splashdown is as - as scheduled to get the first results from those observations.

QUERY Have one more question. Do you have any comment on this theory that's put out by Page and Packer yesterday by - about the Packertite that they were talking about?

KELLER Yeah, I - I'm not sure whether I should comment on this. (Laughter) And - but I - some of the statements - some of the facts that are stated - I think they are - are not really facts. But maybe - I - I feel that you shouldn't take this too serious. It's -

QUERY That's the way we think. (Laughter)

PAO Any more questions? Is that all? Okay, thank you.

KELLER Thank you.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 6, 1974
4:30 p.m. CDT

Participants:

Phil Shaffer, Flight Director
Bob Gordon, PAO

SL-IV PC88A/1

Time: 16:31 CDT

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PAO Okay, we have the change-of-shift for January 6th with Flight Director Phil Shaffer. Review of today's flight activities and then we'll go to Q&A.

SHAFFER We had a Skylab first today, which is at least amusing. The Public Affairs Officer called me on my loop to ask me what time to come talk to y'all; he usually just leans over the console. (Laughter) Guy's Dennis: I didn't know what to do with it. He said, "FLIGHT, PAO," and I said, "What?" (Laughter)

PAO He probably didn't know which one was the flight director.

SHAFFER No, that's - it was a surprise. We did an EREP again today that we got started a little bit late on, primarily because we haven't been doing any EREPs in a long time and we been doing an awful lot of maneuvers in the ATTITUDE HOLD control mode. And, you know, during the EREPs, because of our momentum problems, we go in and out of the Z-local vertical attitude at noon, and then take - take the EREP data wherever that occurs. And there are several things that you do there - before the Kohoutek work started, the EREP data takes were in the morning - morning of the orbit, post sunrise, pre-noon. So we were going into Z-local vertical and going all the way through the afternoon of the orbit and through the nightside and then doing the fine maneuver, if you will, to point the instrument directly down the nadir, down to the sub-satellite point. Well, the data take's not in the morning now; it's in the afternoon. So we went - we had a fine maneuver to do, but this fine maneuver today was to remove the mechanical misalignments between all of the different pieces of the Skylab - the ATM and the MDA and the workshop itself where the different instruments are. And instead of going to Z-LV, Jerry went to ATTITUDE HOLD, just like he's been doing for 2-1/2 weeks and proceeded to enter the - the numbers for the hardware misalignment - averted it. It was very obvious to him very quickly what he'd done and he did (cough) - excuse me - exactly the right thing. He reselected, or selected the Z-local vertical mode in the computer, which zeroed out the offsets and reentered them and pressed on. So we got a good data take. That storm out in the Atlantic that we took the altimeter data on is said to have 45-foot seas. And a couple of days ago, there were 75-foot seas. So we ought to really get a hack on the kind of sea state monitoring that we can do with the kind of equipment we've got in the Skylab. ATM operations: Mostly for the - for the rest of the day with the exception of a Skylab last that'll be occurring in about a half hour, and that is investigation of the Kohoutek with the ATM; it's the last one this afternoon. We have a lot of data on the comet but one of the problems that - that we have now, which has

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certainly entered into the judgment to make this the last one, is that Ed can't see it in the TV anymore. And if we're unable to see it, then we're not able to point the very narrow field of view instruments at it. And if you don't point at it, you don't get any data. It was a very nice day, you know, being that the purple gang has been on break for 5 or 6 days and it was our first day back. It felt good and the guys sounded good and we had a nice day. Tomorrow is about an EREP day, is about all I can tell you about it in a general sense. We will calibrate the instruments on the Moon first thing in the morning. We use the Moon, as you probably know, because it's a known light source and we know what kind of signature we're supposed to get and then we can take the rest of the data, the real EREP data itself and with the known light source, for calibration can really find out what is in - -

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SHAFFER And we know what kind of signature we're supposed to get and then we can take the rest of the data - the real EREP data itself and with the known light source, well calibration can really find out what is in that information. We have an EREP pass tomorrow on track 71 which is a CONUS pass again. And late in the evening we're doing a S191 lunar cal. And one of the things - one of the problems we're having with the S191 data is that - having some trouble reducing the SL II and SL III data. So what we want to do is take an equivalent piece of hardware to the S191 and shine it on the Moon - okay, at the same time we do it from orbit and right now the - that extra piece of gear will be on Mount Capulin in New Mexico. Unfortunately the weather's beginning to look bad, so that may or may not get done. Major medical tomorrow on Bill, M092, M093, and some AIM passes. And that's about the day. Questions?

QUERY Do you have any anomalous signatures from our friend CMG 2?

SHAFFER Haven't had any for 3 days. How much - do you know that we're doing something different with it now?

QUERY The manual control of the heaters?

SHAFFER Well, we've been doing that for quite a while.

QUERY Higher temperature?

SHAFFER Yeah, it turned out that - you know we went for many days after we started managing the heaters without a glitch and then we got one in EVA. And then we got another one some number of days later, I've forgotten which. And in compiling all of that data it turns out that we were getting those glitches after several times essentially in a row of going to the lower end of our control band - not to the lower end of the auto heaters. And I guess three of those in a row makes it fairly conclusive, every time you get one following a series of - in the lower end of our control band, so we stepped up the control band. And instead of essentially absolutely not going below 65 degrees, we now don't go below 70, and instead of turning the heaters off at 77 degrees or so we're turning them off at 79. And it turns out that that heat up rate begins to flatten out at around 78 - 78-1/2 or so, so the frequency of commanding is not increased, but it's running it in a higher region. And no clinkers yet since we started doing that.

QUERY Have you done this on the ground and - and the -

SHAFFER Yeah, we do it all.

QUERY I mean, have you run the heaters on the CMG on the ground as a test, and does it appear that this might

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solve the whole problem?

SHAFFER Well, first of all you have to say that you know absolutely what the problem with the CMG is, okay. And then you have to make a CMG do that. And I don't believe we can claim either that we know absolutely what the problem with that CMG is and we are precluded from simulating it because we have to work in a one g Environment, and it's in zero g. And you guys have heard the most likely sets of problems and none of those are reproducible here in one g. So it's working, I can't tell you any more than that.

QUERY Okay. What was the TACS usage today?

SHAFFER We predicted 8 mibs which is about 40 pound seconds, we had used 14 when I left and no more expected. So that 14 is about 70 pound seconds. That's good, if I could fly everyday that cheap I'd be happy. It's going to be more expensive tomorrow, it's going to be 200 to 250 mibs. That's because we spend so much time setting out at this strange attitudes during the FREF calibration work.

QUERY You may have answered this, but I - I checked in the advance planning on the Kohoutek thing and they are - -

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QUERY You may have answered this, but I've checked into the advance planning on the Kohoutek thing, and they're - according to the advanced planning they're considerably down on the total, as of yesterday - for the total amount that was expected. Now, does this mean they're going to have considerably less because the thing flunked out on us or are did they miss some early that had been expected?

SHAFFER I think it's probably a combination of that, although I would take exception to the word flunked out on us, you know, I realize that it's not as bright or as spectacular as it was predicted to be, but it was a prediction, you know, you can't take something sitting out there in the boonies N-teen months away and say what it's going to do. In fact, I understand there are some theories around that the lack of brilliance demonstrates that it's really a new comet. Now I don't know whether that's true or not, but I hear that. Okay. The a - We did miss some observations, although not very many, because of the momentum management problems. And we most likely will curtail it early, although all we've curtailed to date is the ATM part of it. This is simply because the instruments are too narrow. You weren't going to ask any questions.

QUERY Yeah, but now I have one. So you say as of 17:00 Houston time this afternoon there will be no more Kohoutek data.

SHAFFER No, no, no. That's when the in - the last investigation starts. It will start at 23:00 Zulu, which is 18:00 local. And that'll run for about 3-1/2 hours with the ATM.

QUERY Okay. And that's it.

QUERY With the ATM. But other data can still can still be (garble)

SHAFFER Yeah, the corollary instruments - the corollary instruments now that we use out of the minus 2 SAL, like S019 and S201 and those instruments have a wide field of view, so they're for giving in terms of the pointing errors. And you know, those instruments take data whether you can see them in visible light or not. And of course there will still be the handheld photography.

QUERY As television has looked through ATM only really, at the Kohoutek, because the polaroid was a visual thing, therefore we are finished with television completely, even on the black and white, except for sketches made -

SHAFFER I never saw it on TV. Did you?

QUERY I think so.

SHAFFER (laughter) Yeah, re too. I saw some white things, you know, some dots in there, but I don't know what that is.

QUERY Did you ever see it from the roof?

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SHAFFER No, I got up early a whole bunch of days
and went out there and tried to find that beauty and I never
could find it.

QUERY

You never did?

SHAFFER

Did you see it? You reckon it was really

there?

QUERY

Lubas hasn't seen it either, so -

SHAFFER

Do you reckon it was really there?

(Laughter) Okay.

PAO

That's all. Thank you, Phil.

SHAFFER

I'm surprised, gee, what are we 230

days, 270 days, 237 days, and you guys as a class have never
asked me some innocuous little question that has bothered you
for 237 days and you just can't stand -

PAO

Give them a chance. They'll figure one

for tomorrow night. You got to work on that.

SHAFFER

No, the reason I say that, you know,

there's a lot of things on the Flight Plans and you hear
them on the air-to-ground etc.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 5, 1974
16:07 p.m. CST

Participants:

Don Puddy, Flight Director
Dr. Thornton Page, Principal Investigator S201 Experiment
Don Green, PAO

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PAO Okay, thank you. We're ready to start this afternoon's briefing with Don Puddy, the off-going Flight Director. And on his right, I'm sure most of you know is Dr. Thornton Page, who's going to talk about the comet who ain't with us no more. Don, go ahead.

PUDDY It - it's still there, it's just hidden. I'd like to deviate a little bit and go back and say a few words about what we covered yesterday. I talked to you briefly last night, and said that we did have a fairly good storm out in the North Atlantic that we happened to pick up during that EREP pass. We went back and looked at that a little bit more - I should say the weather people did. And a search of the past weather records indicates that that storm that we did have in the North Atlantic yesterday, which we kind of coined the term, "storm of the decade," is more or less unmatched in size, intensity and duration of any storm that has occurred since December of 1959. The surface winds on that one range between 25 and 60 knots. The average wave height was running somewhere in the order of - of 45 foot, with individual waves somewhere in the 60 to 75 foot area. So, it wouldn't have been the time to been out to sea in a rowboat. The most significant portion of that weather was over the western portion of the North Atlantic. As far as today is concerned we - I went over this, and I'll just cover it very briefly - went over it with you yesterday. On the ATM we had about 6-1/2 hours of viewing time including our next to the last JOP 18D or the ATM viewing of the comet. M092/M171 on the commander, and S183 star observation. And upcoming is an S063 comet observation. You probably heard some words on the ED31, we scrubbed out. Today the operations on that particular one plus the stow, it's no particular problem as you're probably well aware that - that's an experiment where we're observing and photographing the growth of several bacteria. They're just not growing quite as fast as predicted and what we're doing is just delaying that for a couple of days to see if there will be any further growth and then we'll go ahead and complete our final photography of that particular experiment, and go ahead and stow it at that time. At the beginning of today, just to give you a status we had a little over 18,000 pound-seconds of - of TACS left. We had used 65 sec - pound-seconds today, that was on the - the EREP and the S183. Our predictions indicate that we should not be expending any more TACS for the rest of the day. To give you a feel, I think right now more or less, the way we're doing our planning, we should be able to expend somewhere in the vicinity of 350 pound-seconds per day, make the

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end of the mission with no problems. And that'll just give you a ball park field that you can interpret from there. You may have copied some conversation going on in the Control Center today with our old friend TDI, that if you remember was discussed some at the - it was the beginning of Skylab-III, as I briefed you on before we are running into the higher Beta cases. And as a result of that any maneuvers outside of attitude do cause us some increased structural temp problems. And as you're probably well aware aware from previous briefings that you have had on that subject, when we do get into these higher temperatures there is a possibility of some release of TDI, that's toluene di-isocyanate, anyway it's toxic. It's more or less colorless, odorless, and - and really can't be detected at - in any means by the crew. But we do have sampling techniques on board. Anyway, to make a long story short, we went through quite an exercise today to determine whether or not, because of these elevated skin temperatures there was going to be any significant problems from that. And basically, the end result of that is that there is not. Any anticipated problem throughout the remaining portion of the mission even though we're going to be pretty high in the Beta angle, and the surface temperatures, when we make maneuvers are going - are going to get fairly high up in the order of 225 to 230 degrees. We're presently using a limit of around 250 degrees, that has about 150 - 100 degree pad in it. Basically, TDI is a constituent, used in the manufacture of the polyurethane - -

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PUBBY 150 or about 100 degree pad in it. Basically TDI is a constituent used in the manufacture of the polyurethane foam that is used to line the walls of the spacecraft. And the problem is not so much one of outgassing, as it is a - a release of TDI that may have been trapped in some of the cells of the foam since manufacture. And the only concern that you have with the elevated temperatures is that you could for some reason cause a breakdown in the foam. Therefore a breakdown in some of the cells where this TDI is trapped. As far as temperature criticality up until that point in time it's - it's more or less a - a constant curve just a constant outgassing from ambient temperature, not an outgassing but a constant release from ambient temperature all the way up to around 350 degrees Fahrenheit. So the point I'm trying to make is that we have had TDI present in the spacecraft to some concentration since day 1. And the trapped TDI that's still left in the foam which could cause a problem if released, we do not expect to get anywhere near the temperature where it would be released. So there is no problem there. If there - if there is some small amount of release of course the charcoal and - and or the mol sieves will scrub that out. From a system standpoint you may have also heard that again associated with these Beta angles there is some concern being expressed that we may have a little more problem in keeping the CMG gimbal angles off the stops. We discussed this quite a bit today and have tagged with Marshall. And - and other people have been working with us on the CMGs. And basically we feel like - that we can take care of any problem that can come up there just merely by changing the biases that we have. Possibly we'll have to do a little more work in our momentum predictive - prediction programs to make sure that we do not get close to the gimbal stops. But we don't expect any problem around the Beta angle of 36 degrees is - is probably where we will run into the maximum problem if we do have one with a region extending anywhere from a Beta of minus 30 to a Beta of minus 45. And tomorrow we do reach a Beta of minus 30. It's - it is possible that some of our maneuvers will become a little more expensive in TACS, but still well below the figure that I - I just got through quoting to you. The only other problem in - or concern in the area of systems is that this morning we did have the urine dump capability fail. This particular capability is used a couple of ways. We use it in the morning to, since it is a vacuum, use it to evacuate our urine collection bags and also if for some reason we do

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care to dump the urine that has been collected and not used for samples which we return, we can dump it through this system. We had a little problem the other day where we were getting some lodging or some resistance in the trash airlock when we dumped the urine collection bags. And today the crew had attempted to go ahead and rather than put them down the trash airlock, had attempted to put them through the urine dump system and found that it was clogged. We left the heater on throughout most of the morning, at that time it was still - still clogged. We have given the crew the procedure that they could go ahead and either stow the urine for a couple of days or go ahead and put it into the trash airlock instead of putting all three bags into one of the transfer bags that we normally put down the trash airlock - split it up, make a smaller package of it so we would have the resistance problem. Or we felt like that in short order it would - the dump probe would either clear from sublimation or we do as you're probably well aware have two spare dump probes on board that we can change. And if you'll remember on Skylab III when we were having the condensate system problem, we did change one out. Found that there was nothing wrong with it, but we did change one out. We have that one plus we have one that we had used in the wardroom that we removed - -

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PUDDY - change one out found that there was nothing wrong with it, but we did change one out. We have that one plus we have one that we had used in the ward-room that we removed when we replumbed the lower body negative pressure experiment into the waste tank. So there are two there. We don't plan to take any further action if it doesn't clear itself. We don't plan to take any further action until mission day 53, or day after tomorrow. You probably might have also copied on air-to-ground today the fact that the weather around the nation is - has taken its toll as far as our tracking sites. Although the people at Goldstone did a tremendous job today, they - about 50 miles away from - usually from where they live, and they've got about a foot of snow and a tremendous blizzard going on out there which is rather rare in that portion of country. But through the efforts of all the people in that area, they were able to remove the snow and get there just before their first pass, and got configured and then were able to support. No telling how long they're going to be there, but they're there right now with plenty of food. Tomorrow, we have 5 hours of ATM viewing time including our last ATM look at the comet, we're running S201 corollary comet observation. We're going to get the commander's comments on the comet that's part of TV77, as I mentioned to you yesterday, we did get the pilot's comments then. We have an EREP pass over track 57, I'll give a few more details on that one in just a second. We have a SO63 air-glow observation and the beginning of one of the last corollary crystal growth experiments that have been going on for the last 10 days, and also some documentary photography in science demos. As far as the EREP pass itself is concerned on track 57, it starts out west of the Mexican coast, goes across Mexico City, Veracruz and the Gulf of Mexico, southeast United States, crossing the East Coast near Norfolk, Virginia, out across the North Atlantic and ends up at the east of France. Some of the primary objectives that we're trying to accomplish on this particular pass or to identify the areas in Mexico where the crop planned irrigation is, or should be used, and when is the most practical time for effective crop growth to - to use that irrigation. Around Orizaba, Veracruz, Mexico, we're helping them with some highway engineering and regional planning. In the Atlantic off the East Coast and the Gulf of Mexico and the North Atlantic, we're making a group of altimeter measurements to help us determine the shape of the Earth under various wind and sea state conditions. Basically, what we're trying to do here - you're probably well aware, we've made numerous of these measurements. And we're trying to catch them under various wind and sea states in order to go ahead and to be able to take the bias out of the data that results from these

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varying environmental conditions. In the Chesapeake Bay area, we're doing some techniques as far as mapping to permit analysis of temperal changes. We're also doing some 190A multispectral photography and 192 scanner data over the ocean upwellings just west of the Gulf of Mexico, and some geological data and mapping of Mexico City - west of Mexico City. I think that's a fairly decent summary of where we stand as far as the Flight Plan and the systems problems that - that we're currently working. Let me turn it over to Dr. Page, who - I think, is going to discuss the comet.

PAGE May have looked like it, but I've not come to bury Kohoutek, and I'll try to praise him a little bit. The comet is certainly there, but is much fainter than than had been expected. And the change is an interesting - makes an interesting curve. We were running lower than the predicted - predicted brightness -

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PAGE - - an interesting - makes an interesting curve. We were running lower than the pre - predicted brightness ever since mid-December. And it got quite bright near perihelion but then has dropped off very rapidly since. And I suppose you've all seen these diagrams which are copied from sketches made by the astronauts. This one back in - Christmas Day, another one on the 29th and several more in the last few days. That show the latest image or sketch the very bright nucleus and the very broad and faint tail that extends perhaps 6 degrees behind the comet nucleus. A couple of us last night dreamed up a theory to try and explain the lack of brightness of Kohoutek. The comet certainly remains the best observed comet of the century, though not as bright as had been predicted. And the question is of course, why should it have faded out so quickly? The theory which - I wrote - wrote up rather quickly this afternoon is a little bit with tongue and cheek, but does explain the observed facts fairly well. You remember of course that the orbit of the comet with eccentricity very near one, is fairly good evidence that it is a new comet that's coming from a very large distance from the Sun. And is passing the Sun for the first time. This might lead you to expect that the materials on the surface of the nucleus are somewhat different from other comets that have passed the Sun, like Halley's comet many many times. When it was first discovered it was quite bright, and this - from this it was inferred that the nucleus is quite large for a comet. Another indication perhaps of newness. Large being something like 20 kilometers across. The tail that's shown in the earlier sketches here, is certainly a dust tail. And winds around behind the comet as the astronauts were viewing it. And it has certainly faded recently in the last few days. But this establishes that there is - certainly was a lot of dust in the nucleus of this new comet. Other evidence of what is there, has been obtained by radio telescope, by optical spectroscopy, and it certainly includes hydrogen, oxygen, sodium, OH, CH, NH, CN, you're seen this list I'm sure, carbon, carbon monoxide, NH₂, water, CH₂ or CH₃, CN. And the dust is probably oh, carbonates, sulfates, silicates, that is seen in the tail. So we know that all of those materials are there. And our theory - Dan Packer and I is based on some material being formed from these components, that would affect the comet in the way we've observed it to be affected. And what happened, well it was of lower certain brightness before perihelion, but got fairly bright at perihelion. And then dropped off very rapidly. And so a reasonable assumption to make is that the materials in the comet nucleus formed a compound which is somehow hampered the generation of gas that causes the comet's brightness. The gas that would give us a

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plasma tail, that has not been observed recently. And it would keep the dust and - dust tail and the coma extended around the nucleus. Well, in a fit of good humor I hope I've decided to call this material "Packertite" since Packer was one of the ones discussing it with me last night. And the Packertite must have the following characteristics; must be opaque, and white. So, this explains the bright nucleus that is now seen on the last sketch of the astronauts, it's still there. The nucleus has a very high albedo, reflects - -

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PAGE - and the Packertite must have the following characteristics: must be opaque and white. So this explains the bright nucleus that is now seen in the last sketch of the astronaut is still there. The nucleus has a very high albedo reflects sunlight and is the brightest part of the comet now. The fact that it's opaque and white would mean that this Packertite layer on the outside of the nucleus is in effect shielding and cooling - or keeping - maintaining the low temperature of the material inside, so that no gas is coming off. And of course, we assume that Packertite is some kind of slimy, sticky substance that keeps the dust from coming out, and that's why the dust tail is fading out. In the last few weeks, the Packertite - if it was - if it's actually the substance we think it is - has been formed - perhaps in patches which slowly kept growing in the comet, therefore its brightness was suppressed even before it reached perihelion. The temperature these compounds might be formed is the order of 800 or a thousand degrees Kelvin and so I think there's plenty of chances - chemically for such a compound - something like tar perhaps only white color to be formed. So this is a - a new theory which we propose with the firm conviction that it'll be proved wrong next - in the next week or two. But, it's the only way we can explain the comet's behavior. I see Dr. Keller's in the back of the room there, he may have some objection to it. But the decrease in brightness of something like a factor of 50 below what was expected is - possibly explained by materials formed on the surface of the comet nucleus.

PAO
questions.

Gentlemen, we're ready to take your

QUERY

Page, how are you spelling Packertite?

PAGE

Dan Packer and I are both from the Naval Research Lab and he spells his name P-a-c-k-e-r. And you know, minerals are very often called by the name of a discoverer. And the letters i-t-e at the end, I put in the extra t to make it sound a little more euphonious Packertite - t-i-t-e.

QUERY
dimmed?

Dr. Page, has the nucleus itself also

PAGE It would be very hard to say from the evidence we have. It is as most recently described by the crew, the brightest thing in the comet. So you see a haze - the h - the - the coma - the halo around and then a very bright spot in the middle. So the bright spot indicates - as we would expect from this theory of mine, that the nucleus is ref - almost reflecting Sunlight, very - a white substance. Whether it has - I guess it's almost certainly diminished in brightness from - say two or three days ago when it was closer

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to the Sun. But - and as a general idea is that it is the
brightest feature in the comet, the tail and the coma having
diminished in brightness so much. Does that answer you?

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PAGE - - in the coma having diminished in brightness so much. Does that answer you?

QUERY Has - has this been observed in previous comets that pass near the Sun, that they dimmed this rapidly?

PAGE I think - there have been several comets which were actually lost after they passed the Sun, and probably had decreased in brightness this much. But the normal behavior of a comet isn't like this at all. There is a curve which has been handed out numerous times by the Kohoutek people here that was predicted for this comet. Which is generally followed roughly by a comet with a characteristic that at equal distances from the Sun. And of course you have to take account of the distance of the Earth from the comet too. But at equal distances from the Sun the absolute brightness of the comet would be the same. So it goes up as it gets closer to the Sun in brightness and comes back down again in a symmetrical way. This comet didn't do that. It went up rather slower than expected, reached a maximum and then suddenly dropped way off. I'm not familiar enough with past comets to know whether this has been observed specifically in any one case. Do you know Dr. Keller?

KELLER I will say (Garble) observed in some cases but the normal behavior is that - will probably be that the comet is as bright after perihelion roughly as bright after perihelion as before. And we have several comets which are brighter after perihelion than before. It's very hard to say to make a general case out of it. The prediction - very rough and you actually can't make any predictions. You can only say something about statistics but not about individual a - a case.

PAGE We will have much more accurate or quantitative data after the mission is over and all the films and plates are brought back here and processed. Then I think we'll be able to draw this curve with greater precision. I'm sure we will. And at that time there will be something more specific to explain. This Packertite theory is just a rough idea to get away with while we have rather incomplete data and inaccurate data.

PUDDY We do have a copy of that curve that Dr. Page referred to. It gives you not only a couple other comet profiles, but the profile that has been measured by visual observations on Kohoutek. But you're welcome to take a look at it if you'd like to later.

QUERY Do I understand you correctly that the data brought back from Skylab will either confirm

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or deny your theory?

PAGE Well, this is the question the spectroscopy which we do not have back so far S082B will certainly give more information about the various - oh - molecular and quasimolecular componets. The quantitative data on the size of the hydrogen halo which my experiment S201 will obtain may give more precisely the amounts of hydrogen released and possibly will show some results of the assumed characteristics of this Packertite but, I must admit that my theory is almost unprovable or undisprovable. I'll be glad to give you a copy of it if you want.

QUERY Do you have an idea what the comet will look like from the ground now revised - idea.

PAGE It's going to be the great disappointment. It's kind of lucky we have this bad weather. (Chuckle) I'm affraid it'll be a very - rather a faint object, rather than as I described it on my Christmas cards to my friends as having a tail that would extend half way up to the zenith.

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I'm afraid it'll be a very - rather faint object. Rather than - as I described it on my Christmas cards to my friends as having a tail that would extend half-way up to the zenith, the - the description given by the crew, I guess the last one was by PLT was it, this afternoon - It's - it's just very much fainter, but the form - this picture I'm speaking of, is sort of standard for a comet that is - has this rather sharp nose end pa - pointing towards the Sun. That little bright nucleus is right down near the end here, and then it fades away from that. So that my expectation is it looked like a sort of normal star, not a particularly bright star, with I guess to the naked eye, might be able to see a little bit of the tail. But I think PLT said that he could see it much better in binoculars. So that the view from the ground, certainly won't be any better than that, and I suspect that people will have to use binoculars to see Kohoutek's full glory which isn't very much.

SPEAKER

(Aside) Nothing on the comet you're going to need.

QUERY

Don, I don't think I quite understand about the - exactly how you - how the urine collection systems works. Is it - can you -

PUDDY

It's - -

QUERY

clogged up?

PUDDY

- - run over exactly what it is that's

There is a small probe that connects the - essentially urine collection systems or dump system that connects that from the waste management compartment into the waste tank. And of course, since it's sitting in the vacuum ou - our normal operation is to go ahead and turn on a probe heater to make sure that we will not get ice forming, as any liquid is poured through the dump probe. We did do that this morning, on both buses, expect from what we've seen so far that we don't have any - any pro - any problem with the heater element itself. Although you've got to suspect that we don't have any reason to - to determine that that's the primary cause or we'd be taking action right now. But it - it's still something that could be causing the problem, it could be some granules that have gradually gathered in this orifice which is very very small. Just in case you should develop a leak, that's one reason it's very small. That has just gradually plugged it up, it could be that the gradual buildup of ice particles has moved far enough up the probe assembly that it can no longer be effectively removed by the heater. Various things like that could be happening. Of course even with the - with the probe heater off, over a period of time we'd expect unless we are talking about solid material, that it would gradually

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sublimate. And in general, we've had a - a period of at least 8 to 10 hours for sublimation. The crew did use the assembly this morning, as best as we can determine to go ahead and prepare the collections bags for this morning. Seemed to have flow then. When they got ready to - to dump the urine, it immediately did not have any flow, as I was leaving the Control Center this evening, there was some indications that they were picking up the vacuum again. So, it is possible that running the heater as we did and the time since they tried that dump has allowed the material to sublimate. There is also a possibility, as you're probably well aware on this particular flight, we had been unit - using boric acid tablets in the urine in order to preserve the urine in the event we lost the refrigeration system. We have had some reports although none of significance recently, that those boric acid tablets have not completely dissolved. And it is conceivable that one of the - -

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PUDDY - - of significance recently that those boric acid tablets have not completely dissolved and it is conceivable that one of those has been pulled down into this orifice, which, like I say is very, very small, and could have clogged it. Certainly the action if we can't clear this up in the next day or so with just a heater or sublimation the action would be to take that probe assembly out, run a wire in there and see if we do have any solid material. If we don't have any solid material, we'll have to assume that there is something wrong with the heating elements itself, and go ahead and at that time replace it with one of the other probe heads. It's - it's certainly not something that we're extremely worried about.

QUERY Could you go into detail on the type of testing that was performed to eliminate the danger or eliminate the - or to explore the possibility of there being any danger from this outgassing from the styrofoam insulation.

PUDDY Well, I'm not sure I understand exactly what - as you're probably well a - let me - let me make a stab at it and you tell me if I get off on the wrong direction. As you're probably well aware, once we lost the meteoroid shield, on Skylab- launch, we lost a lot of our thermal protection. And thereafter, we've always had some degree of concern about the thermal environment that we would reach both from the standpoint of crew comfort itself and from the standpoint of the possible release of toxic gases. As - as soon as that occurred, there has been a - a constant program - testing program going on on the ground at various temperatures and at various pressures of the various constituents that could either cause the release of toxic gases by either an outgassing, a decomposition or one where you could just release them because they were essentially a constituent of the material. Now let me emphasize that the TDI that I'm talking about is strictly a constituent that is used in the manufacture of polyurethane foam. It's just like the vinyl in your car so to speak, you know, that you can pick up a substance that's constantly outgassing from that vinyl regardless of what temperature it is. It's what most people figure is causing the film that you gradually got on the inside of your windshield, for instance. So TDI, more or less acts in that fashion. There are other compounds such as - or other substances such as carbon monoxide that is indeed at very high elevated temperatures - is something that is a breakdown of substance and is a true outgassing. Basically, the ground testing was to determine just exactly how much of the substance would be released at normal conditions and at a gradual increase in temperature. What they found out from that testing was that essentially, up through 150 degrees Fahrenheit, the curve was essentially flat, negligible release of this particular material. From 150 degrees Fahrenheit

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on up to about 350 Fahrenheit - or 357 if you want to get exact - there was a very slight increase and from 350 upwards, there was a fairly rapid release of this. And this is caused by essentially a breakdown of the polyurethane foam itself and a release of trapped TDI from cells that were in the - that were more or less sealed in the foam itself. Now the temperatures that I'm talking to you about are external skin temperatures. Now there is - you - you can - when I start talking about temperatures like this and the fact that right now we're getting in the order of 200 to 230 degrees or so, you can say, oh my gosh, that's - that's pretty significant from the standpoint of crew comfort. But let me emphasize to you that across that foam we're actually dropping from somewhere in the order of 190. You're dropping some across the skin. And then as you go in through the - -

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PUDDY - - across that foam, we're actually dropping from somewhere in the order of 190 - you're dropping some across the skin, and then as you go in through the foam, you actually drop all the way down until you get on the inside of the foam. And you're talking temperatures in the order 110 degrees, if you're talking 225 exterior temp. And of course -

QUERY Interior wall?

PUDDY - - the interior wall. Yeah, and if you're talking about that affect on the crew atmosphere you're - right now we're running 73-1/2 in - in the cabin, if that gives you any indications of what that translated into as far as gas temperature itself. There's also an aluminum foil that we had found out - that covers the polyurethane foam, that we have found out is a very significant retardant to the release of TDI under any thermal condition. Did I get anywhere close to what you're - -?

QUERY Yeah, but the thing I was curious about is - is as I recall this has already been subjected to much higher temperatures than this, during the unmanned period immediately after its initial launch - -

PUDDY Yes.

QUERY - - and before the Skylab-II crew went up there, which would - to me it would seem 11 - it would already have cause this affect so it's already - already occurred. And number two, I'm wondering if the - to test the thing completely have you got - have you had this foam kept in a parallel thermal state throughout the mission? And that's the type of details I was curious about.

PUDDY Yes. We - I think one of the - the main things rather kept in a parallel thermal state one of the main things you're concerned with is that it is kept in the same aging process. And some of the original testing that was done early we found was from a different batch of foam. And subsequent to that we did go back and get a batch of the foam, that was used in the spacecraft - in the spacecraft manufactured in the same time frame with exactly the same compound. And we have followed that particular sample, or set of samples throughout all of the ground testing. And I think that - that aging part of it is far more significant than any thermal consideration just because of the - the thermal aspects I just went through with you.

QUERY As I recall, the test from the initial - before Pete Conrad's crew went aboard, is that even the high temperatures encountered at that time did not cause this problem. Isn't that correct?

PUDDY You're 100 percent correct, but let me emphasize to you that there was if you will remember

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several purging cycles that we went through prior to their arrival. If you remember that, we dropped it down to half PSI and back up to 2, we did I think it was 5 times prior to their arrival. Now, that would have removed had there been some release of the TDI, that we had hoped would have removed the majority of it. The sampling going in with the mass so on and so forth, were strictly precautionary measures. And of course when we did sample, we did not find any trace of that particular compound. And we do have confidence that the techniques that we are using for sampling will pick up any amount that would cause any degradation whatsoever in the crew health.

QUERY And we were told at that time that - that these measures - the purging and the mass were just super cautions and that tests already completed on the ground indicated that there would be no hazardous gas released in any manner from the material. Was this correct?

PUDDY Yes, I think that's correct.

QUERY That brings me back to my point, why - why was there - this concern suddenly arising from this milder temperatures after this longer time? Has there been some indication from this material that you've been examining all along from the same age that it could still occur or what?

PUDDY No, no. And I don't really think you're talking about that much milder temperature, as far as the - as far as the temperature. The only Delta that you were really talking about there is possibly over a longer period of time and over a more extensive period or - extensive area of the spacecraft. But I think all along and - to be real honest with you, when you start talking in terms of temperatures of 250 - 300 degrees, you're getting pretty close to the maximum temperature that you can reach, a body in this altitude, for this duration. And these angles. You're not going to go much higher. So we - we're talk - -

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PUDDY When you start talking in terms of temperatures of 250 to 300 degrees you're getting pretty close to the maximum temperature that you can reach, a body in this altitude for this duration and these angles. You're not going to go much higher. So we're talking temperatures as best as I can recollect that are exactly in the same ball park. It's just whether or not there is any continued release of this substance once we get back to those temperatures. And I can't positively tell you that - that I'm within 5 or 10 degrees, but we were talking before temperatures that were - to be real honest with you I think that the constraint that we had used up until we had gone back and looked at this data again that the temperature we were using was 200 degrees which had about a 75-degree pad in it. So we were looking at a maximum temperature of 75. So actually we have released, we have been able to say that we're less constrained now and we are getting to higher temperatures now than we have been.

PAO Okay, for the transcript typists the Dr. Keller referred to earlier is Dr. Horst Keller who is associated with the University of Colorado. If no further questions we'll conclude the press briefing. Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 4, 1974
3:52 p.m. CST

Participants:

Don Puddy, Flight Director
Bob Gordon, PAO

SL-IV PC86A/1
Time: 15:52 CST
1/4/74

PUDDY

Okay, as far as today's activities are concerned we've got scheduled about 4 hours and 9 minutes of ATM operations. We had a M092/M171 run on the science pilot, which was in progress when I left. This afternoon later we have an S019 comet observation. This morning we had completed an S183 star operation, and also had run EREP track 20. EREP pass started off the coast of Mexico, ran up through Mexico across the United States and out over the North Atlantic and on into Europe. Our main sites were one in Mexico, Durango where we were doing some mineral exploration work. We were interested in the jet stream up over northern United States. Also we're doing some mapping of the Pittsburgh area. One of the primary sites we were after was the effects of the cyclone that you've probably - have heard about in the mid-North Pacific. We were covered there with of course Skylab instruments and we also had a C130 out flying in that area. Winds were from anywhere from 35 to 50 knots, sea state was somewhere between 35 and 45 foot waves. And of course this is probably the highest that we've taken a look at in - in the Skylab operation, and so they were extremely interested in that. We also had over in the Bay of Biscay an area where we had a front. Of course had some rain preceding it or following the front, and in addition to that had a clear area that we were able to get. So we're able to get some very good data as far as a good contrast between what we would pick up on the various instruments with and without the rain. As far as systems work today you probably remember some 18 days ago when we were having quite a bit of problems with the ATM C and D loop pumps that we hooked up a liquid gas separator and pulled quite a bit of gas out of the ATM C and D loop. And the pumps began to whine and we turned them off at night and et cetera. The flow rate had dropped off over the past couple of days, couple of short intervals where it dropped to about 100 pounds of flow. And to preclude any chance of pump cavitation should it decide to drop off even for a longer period of time or deeper. Today we went ahead and installed the liquid gas separator to again pull out the gas. The flow rate rapidly increased from where our nominal baseline was of around 250 pounds an hour on up to 298. We have run that through all the various loop modes as we ran an EREP pass once we had the filter in there. And we plan to pull the filter out tonight. We may have to do this again before the end of the mission. Probably again approximately the same interval some 18 days from now. It's no problem, I think probably what you will hear however, is that again

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the crew will be desirous of not running the loop during the sleep period. That will be evaluated tonight, but from what we noticed in the past once we got the loop completely cleaned up the pumps have a very annoying whine. And as a consequence they will probably want to turn them off and we certainly have no objection to that. Also had a little TV today which has already been dumped and should be available to you shortly I hope. On the TV 77 this is an on-going TV program that you're probably well aware of. Today we had the pilot's comments on the comet. As far as tomorrow's Flight Plan is concerned we have got 6 hours and 30 minutes of ATM operations. We're accomplishing the next to last of the JOP 18D's which of course is the ATM instrument viewing of the comet. The last one being as presently scheduled on Sunday or day 52. And we have an S063 comet observation. Deke Slayton came over to the Control Center today to let the crew know that as of 17:39:59 Z today that the Skylab IV crew had exceeded Pete Conrad's total time in space of some 49 days plus. And an added sidelight to that on January the 25th at 17:47:08 Z the Skylab IV crew will exceed Al Bean's total time of 69 days 15 hours and 45 minutes in space. And therefore these three crewmen will become the most experienced as far as crew time in orbit of any of our astronauts. So it's pretty hard any more with these guys already being number two to refer to them as rookies. As far as just keeping you up to status on where we are at this point in the mission. The primary recovery ship the USS New Orleans has departed San Diego today. They plan to arrive in Pearl Harbor on the 11th of January - -

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PUDDY

- - primary recovery ship the U.S.S. New Orleans has departed San Diego today. They plan to arrive in Pearl Harbor on the 11th of January. The mobile laboratory will be flown to Hawaii on the 10th of January, loaded on the PRS on the 11th of January. And they will begin active support of the target points on the 13, January. And this is all part of the nominal plan. I do have a little information if any of you are interested on - on some of the handheld sites that we're taking a look at, which I can go over with you after the formal portion of the briefing. Like I said if you so desire. Today they were - they were all optional and we do not have a status, and will not have a status until the evening report as to just exactly which ones of these were accomplished. But there were some fairly interesting ones that we had scheduled on an optional basis today. I think that's about all I have, so let me open it up and see if y'all have some questions.

PAO

Tom (garble).

QUERY

You experienced no more problems with our friend CMG number 2 today?

PUDDY

None. Let me say a couple of words on that. We're continuing to look at that of course. And right now the data would tend to lead us to believe that there - since there is a thermal delay between actually what the bearing temperature is reading and what the thermal nut or the area where the thermal grease is - is actually released. Since there is a DELTA there it appears to us like it is probably prudent to maintain that in a slightly evaluated temperature. We have been running, as you're probably somewhere between 68 and 78 degrees. Where possible we're trying to maintain that temperature now in the 70 to 78 possibly 79 degree region, and hopefully this will counteract any further problems with that particular CMG. As you're probably well aware when we went to the manual heater cycle, and - and started the work on this about - I guess it's about 10 days ago. We've only had, to my knowledge, two glitches in the CMG since that time. Both of them very minor.

QUERY

I noticed the preliminary Flight Plan for tomorrow calls for a comet TV, and I forgot the designation somehow, but it was different from that ATM comet TV. And I'm wondering is this op - is the out the window TV they've been talking about off and on?

PUDDY

Right, right. That's if they have a chance, it's strictly a crew convenience type thing. If they have a chance to catch it.

QUERY

Have y'all studied that? And - and what would you expect them to be able to pick up with the TV of the comet?

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PUDDY I think at the present time it's - and it's just a personal opinion, and I think it's very remote that we're going to be able to pick up any real good usable TV of the comet. We felt like it was - it was worth a try and if the crew thought they could record it, it certainly would be a worthwhile thing to have. But it - I don't hold a lot of high hope for it.

PAO I've got several here phoned in.

PUDDY Okay.

PAO You got any more?

QUERY No.

PAO These are from Mary Bulb a friend of the Cape. In weak - in wake of the operational conference and what the astronauts had to say at their press conference, do you feel that communications between the crew and flight directors have improved?

PUDDY Well, I don't think - and this is a personal opinion I don't think it was ever as bad as some people might have thought. I do think that we came to a point in the mission where it was - where it was very desirable to sit down and have an opportunity of going through things in a more less a formalized fashion rather than piecemeal, and try to put the whole story together at one time. And this was the primary reason for the ops conference and it was also a good chance to go ahead and answer the commander's request to let him know just exactly where he stood in - in light of mission accomplishments. But I - I do not feel that - that up until that point in time we had had anything approaching - -

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PUDDY - - mission accomplishments. But I - I do not feel though that - that up until that point in time we had had anything approaching a breakdown in communications between ground control team and the spacecraft crew.

QUERY
efficiency?

PUDDY Oh, yes, I think that's a certainly very obvious observation that and this has been true on both the Skylab II and the Skylab III crews. I think, I don't know where I can put my fingers on the exact day that there was a significant difference probably - as you're probably well know we started out and I think we over scheduled them. And this was I think primarily because the last thing we remembered was the last few days of Skylab-III where that crew had already picked out on their efficiency curve and we really had them at it. We started out that way on Skylab-IV and it was I guess I feel like it was more or less an error on the ground's part to have done that. Once we - once we got back to what I consider the real recognizable pace, we could see immediately that the crew was beginning to increase daily as far as efficiency was concerned and I think that where we're at right now their again approaching the level that we might expect of the most experienced crew, which this crew by the way is rapidly becoming. For instance on tomorrow's Flight Plan if you noticed we're - we're running well over 26 hours worth of science and that doesn't include all of the housekeeping and other miscellaneous task that are scheduled in the Flight Plan. So there's certainly no question in my mind that this crew has - is increasing in efficiency and I expect that they will probably continue to increase for the remaining portion of the mission. Like everybody else. The longer you work at it the better you become.

QUERY One last question, has the concessions the crew made on breaking up the exercise times influence the overall flight planing and operations?

PUDDY Yes, I certainly think that is true, the things that you run into when you have say unbroken PT, extended time in the preps for certain areas, things of this nature is - it's more difficult especially when we're doing the amount of maneuvering that we are for both PREP and primarily for the comet observations where we're working sometimes as many as three separate maneuvers a day. It's very hard to work those in along with the maneuver monitor which we were doing up until a few days ago, because of the CMG 2 - or CMG 1 failure. It's very difficult to work in these things in the Flight Plans and not violate say the jitter constraints. associated with the maneuvers. It's something that you can do

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but it's a combination of spacecraft constraints, the - as far as jitter, the equipment constraints as far as only having two CMGs and the desires of the crew to more or less have interrupted - uninterrupted operations. When they relieved that it certainly made the job on the ground much easier as far as scheduling. It wasn't that it was impossible the other way, it just made it easier for us to do and as a result of that, I think now our operations are considerable more efficient. Where we had to set aside a block before of say an hour and a half or an hour and 45 minutes uninterrupted for PT, we can now say split that up into a couple of 45 minute segments where we have to and consequently can interspace those in various places in the day and I think that this is some of the reason you also see - will see in the future increased scientific man hours. It just allows us that flexibility. It's easier to crank out a Flight Plan and it's more productive we think.

PAO Okay, a fourth question you've already answered, so unless there are their some more from the floor - Paul.

QUERY During the EREP today they mention that a cable was inadvertently not connected or came disconnected, did this result in the loss of permanent data or is this just the monitoring cable?

PUDDY Paul, what we're checking on -

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QUERY - - vertently, not connected or came disconnected. Did this result in any loss of permanent data or is this just a monitoring cable?

PUDDY Paul, what we're checking on there was a cable that enables - over the TV downlink - enables some of the EREP data to be sent down. Kind of gives the ground a leg up on how everything is - is working. As far as - I do not know whether that cable came loose or was not connected or just exactly what the problem was there. And I'm not - I can't even say that the two items are even associated. But yes, we did lose today some 192 data over the cirrus - the jet streams that we were trying to catch in the northern United States. It looks like from all we can put together right now, that the S192 MODE switch although hit did not go all the way to the READY position. In other words, that's a 3-position switch, you normally go from CHECK to STANDBY and STANDBY on up to READY. And we had a call out in the pad for that switch to go from CHECK to READY, the crew reported over the voice loops that - that it was in that position approximately 3 seconds late which would have not been any problem whatsoever, when they got down 2 minutes and 20 seconds later to the point where they were suppose to put that switch back in STANDBY, the commander reported that he must have missed getting to the READY position. Now, why that happened I'm not certain. But just looking at the switch positions I surmised that the switch was hit. It went from CHECK to STANDBY which is the center position and just not - did not either go to the READY position or didn't hold in the READY position. And we haven't had a chance to go back and check whether or not we have any problems with that switch yet. But we did lose about 2 minutes and 20 seconds worth of data, as best as we can piece together right now.

QUERY Was - was this mandatory stuff or target opportunity weather stuff?

PUDDY It was - we had on this particular pass four mandatory sites. And it happened to be over one of those four mandatory sites. That was the jet streams.

QUERY Just for the record, Don. I believe that you said that the cyclone that they caught during the EREP pass was in the North Pacific you mean the North Atlantic?

PUDDY If I said North Pacific - -

QUERY Right.

PUDDY - - I was grossly in error. It's in the North Atlantic. And let me emphasize that they did not go over that cyclone. All they were doing was catching the fringes of it. It was considerably north of our groundtrack today. But the - the effect of that storm was well noted

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over the groundtrack.

QUERY

You used no TACS today in the EREP?

PUDDY

No, that's not true. We used - I think

It was a total of 12 mibs or around 60 pound-seconds of TACS. This was in the ball park of what we predicted. I think we predicted 10 mibs and we used 12, predicted 50 pound-seconds, we used 60, which is well in the granularity of our predictions. And I think there is also some additional TACS expenditure - I take it back. We were finally able to iterate the S019 comet observation tonight. It had originally started out costing us some TACS but we now have it down to zero. So we should be hopefully through with TACS usage for today.

QUERY

Okay. I understand you plotted the TACS usage. How do we stand against - on the plot on that? Are we still well above the curve or - -

PUDDY

Yes.

QUERY

Well, okay.

PUDDY

Yes.

QUERY

Are - -

PUDDY

Go ahead.

QUERY

This - this is unrelated, okay? Okay, and I'm wondering this is - of course the longest mission for you guys over there too. And it's been 7 weeks now. Is there a personal feeling of weariness setting in of any of the troops, I mean just physical wearing down of you?

PUDDY

Do I - -

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QUERY - - a personal feeling of weariness
setting in any of the troupes, I mean just the physical wearing
down of you?

PUDDY

Do I look weary?

QUERY

I suspect you're just back from a rest.
How true. No I don't feel that's the case

PUDDY

at all, I think as is true of these missions, you certainly
get to the point where there is some repetition but at the
same time I think on this mission more than any other, we
recognize the long duration of the mission. And not only have
we tried to adjust that for the crew, i.e., ensuring that they
get their rest and tried to eat as regular as possible. We
have tried as much as possible to do the same thing for the
ground personnel. And as - let me just point out a couple of
things that we've done here, for instance we are sticking with
the five teams throughout the mission. During the holiday
season, we - we wor - arranged that work schedule such that
each one of the flight control teams was able to take a week
in a row off and in general the free time has been a little
more liberal than it was on Skylab II where we were operating
with 4 teams and of course Skylab III where we didn't take
any breaks. We had - we consistently had a couple or three
days off between shifts but there was never anyone spread
where - we had something where you could almost walk away and
completely forget it for a few days and then come back and
catch up, which is what I think this week provided. If I
could categorize the spirit right now I would say that, in
general, the ground control teams are operating in a spirit
that's equal to any time throughout the mission. They might
have ever been a little more tired at the end of Skylab II -
Skylab III, excuse me, than they are right now. But at this
point in time I think the ground control team's in good shape.
As too I think the crew is in excellent shape.

PAO

Thank you, thank you Don.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 3, 1974
15:11 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Mr. Robert Pace, MSFC
Ed Harrison, PAO

SL-IV PC-85A/1
Time: 15:11 CST
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PAO Okay, we'll start the change-of-shift briefing here with Neil Hutchinson. In a little while we'll have another fellow from Marshall Space Flight Center Bob Pace which be arriving shortly. Okay Neil.

HUTCHINSON Okay, I'll talk a little bit first about some of the things that went on today. Just before I came on shift today, about 11:48 Zulu, we had another occurrence of our characteristic distress signal on CMG 2. The nature of it was exactly or relatively the same in magnitude and duration as the last couple, three that we've had. About 3 or 4/1000 of an amp, 50 or so rpm, and varying temp changes of 3 or 4 degrees. Again it lasted as it did yesterday about an hour or so. I think Bob Pace - Bob Pace is going to be here in a little bit from Marshall. I'm not sure exactly what he's going to say, but he's probably going to talk a little bit about - about the CMGs, I don't want to steal any of his thunder. I'm going to go back and talk about that a little bit - some more here before we're finished - before I'm finished and maybe - and I'll wait until her gets here before I do, so he know what I've said. Let's see, we had a couple other malfunctions today. One was on the ATM C&D and that happend this morning. We lost the intergral lighting BUS on the ATM control and display consol this morning. That particular BUS supplies power for background lighting basically. So it's loss is not bothering us in the least. By background lighting I mean if - it would be like the lights inside the speedometer of your car, still read the dials and the speedometer still works but it doesn't have any - any lights around it. We ran through initially - the initial symptom was we had lost all the lighting on the ATM C&D which of course would have bothered us considerable. Mainly because - well not only because we would have trouble operating the ATM instruments but because we couldn't use the little keyboard to get into the computer because you couldn't tell what you'd entered. In the process of troubleshooting it we ran through some quick check verbally with the CDR who was on the panel at the time, then he ran through a detail malfunction procedure, a prescribed malfunction procedure, that they had on board for the particular failure experienced and turned up this short on the intergral lighting BUS. And I guess we consider that lost for the flight, and like I said it isn't going to bother us much. We had a recurrence of an anomaly we've had before on the S082B mirror shortly after we had the C&D problem probably about an hour, in fact it was the next daylight cycle. The S082B has a mirror system in it that allows us to do things to point it or to direct light into it from a different place than the overall canister is pointed which allows us to maneuver the

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instrument. The 82B is the scan - the slit - the XUV slit - allows us to maneuver the slit out to the limb and maneuver it around in the limb and so forth without changing the basic pointing of the rest of the ATM instruments. We have seen this mirror and the servo system that drives it act up before. I believe this is the fourth occurrence in the program that we've seen it, and I - and I don't have any history data on when the last one was or how frequent they've come. The characteristic of it is that the mirror starts shaking oscillating back and forth and there for the light image coming onto the screen is unusable of what ever you're looking at on the Sun to the slit. There are other modes we use this mirror in where it is not gimbaling that work all right. The severity of the anomaly this time is evidenced by the fact that the last three times it's happened, which are - it's happened a total of 4 times, we were able to cycle out of the mode that we were using the mirror in into another mode. And cycle it back and it was stable when we went back. The CDR -

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HUTCHINSON - - We were able to cycle out of the mode that we were using the mirror in, into another mode and cycle it back and it was stable when we went back. The CDR tried this about, I think about a half a dozen times and they were all unsuccessful, the mirror was still unstable. When we went back to the SCAN SPEC MODE or the LIMB POINTING MODE either one. And I guess we're kind of scratching our heads about that one right now. We have given them instructions not to use S082B in those two modes for the rest of the today's ATM operations and I think we're going to think about it for awhile. The - there are several JOP and building blocks that require that we be able to manipulate that mirror in that mode. As far as the Flight Plan today goes, we - we had a fairly smooth day. The EREP went well this morning, of course it was 190 only pass but it went well and we had good APCS operation. We spent about the amount of TACS today that we anticipated spending. And during my shift today we had no - no further occurrences of anything on CMG 2. There is another maneuver coming up tonight and we got a JOP 18D tonight that will be the big gas user for today, it's expected to cost us about 150 pound seconds. One other thing I ought to mention that you may have heard some conversation about that's not a system anomaly but it's going on, we have misplaced somewhere 23 urine sample bags. We've been looking for them for about a week and a half now and frankly we're about to give up. Urine sample bags are the little square bags about this tall and about that square that we take urine samples out of the collection bags and freeze them. And we're short 23 urine sample bags and consequently some plans are in the mill which you probably will hear more conversation about on the loops to readjust our sampling rates between now and the end of the mission such that for several days, not successive days but on certain days we are going to be working on a 36 hour pool instead of a 24 hour pool for sampling. And I think most people feel that isn't going to compromise the science on the postflight urine analysis. The plan still has to be completely formulated, I'm not sure exactly how many days it's going to be where we're going to be sampling every day and then go to a day and a half span. We're also making sure that we don't have any problems holding a day and a half's worth of urine in the urine drawers and so on and so forth. Tomorrow's Flight Plan we've got just another full day of science. Another EREP pass, this will be EREP 20, it's track 29 and it's the first pass up across the continental U.S. for picking up EREPS here in this next series. This will be the first of many that we'll be doing and it's pretty

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much, the pass goes up across Mexico and up the Rio Grande Valley and right over the Houston test area and on up eastern U.S. out over Maine and out across - out across the Atlantic and there's a big storm up in the North Atlantic that we hope to get some 193 RAD/SCAT data on that we've been trying to get for ages with 60 knot - greater than 60 knot wind. So it looks like a very good pass. Major medical tomorrow, more ATM, the Kohoutek work of course is starting to slow down now. Just looking at the Flight Plan here, we only have one Kohoutek operation tomorrow as a matter of fact, that's S019. And I guess that's about all I have except that we go back and Bob I was starting to talk about CMG 2. Like I said we had another occurrence this morning and we are now looking at one other possibility in terms of something we can do, I'm not sure how - it's just in the planning stages now and I'm not sure how far we're going to get with it. But, of course the plots that I've showed you of frequency of occurrence -

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HUTCHINSON It's just in the planning stages now. I'm not sure how far we're going to get with it. But of course the plots that I've showed you of frequency of occurrence of the anomaly. In fact the one that I brought over here yesterday it had the little X marks on it you recall, demonstrated pretty vividly that when fin - when we went to heater cycling we did help the situation very definitely. There is a theory that's being talked about that suggests that maybe the thermal characteristics of the bearing enclosure and the bearing itself are such that the temperature excursions are not totally contained within a single heater cycle. In fact that they might carry over from heater cycle to heater cycle. For example, as you know we're managing the heaters by hand now from the ground via command. And our ability to manage them depends on the site coverage we have. And sometimes we can get the heaters back on at a certain temperature and sometimes we have to wait and they don't get on until a little lower temperature. And some of the folks at Marshall have recently and Bob is probably going to address this in more detail. But they've recently been looking at some correlation that's going on between these distress characteristics or the onset of the distress and the fact that prior to the onset of the distress we had had several cycles where the bearings were - the heaters were not kicked on, until say a little lower temperature. And what that might lead you to believe is we might be seeing something accumulative here. In other words if we have three or four cycles where we're - get down around 63 or 64 degrees the total heat input is - over the long haul integrated over the 4 or 5 revs is less. And therefore the in - entire structure temperature may be a little lower. Well, be that as it may we're looking at the possibility of trying to increase the amount of management we do on the bearings. We certainly aren't going to be able to do too much more than we are now, but there is - there is - we can - we can keep the overall temperatures higher. The cost is more commanding and more cycling of these relays that we're cycling to get the heaters on and off. And of course we can't do it consistently because the site coverage just isn't that good. But we can probably keep for a majority of the time the overall bearing temperatures up higher than the 68 to 78 range we're trying to keep them in now. And of course if this theory doesn't - doesn't hold that - that wouldn't help the situation any. If it does that could keep the overall - if we have a cumulative thing here where the total heat is being integrated over more than one bearing temperature - bearing

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heater cycle that could help. And I think that's all I have.

PAO Do we have any questions for Neil, before we go on to Mr. Pace? Howard.

QUERY Yeah, Neil on Kohoutek, is it just about the end of their viewing of this comet now, I mean visually?

HUTCHINSON You mean the crew - where the crew can - no I wouldn't say that Howard. I think we have two or three more days here where we're going to be doing - where the crew still has - in fact there are probably quite a few more days. I would say no definitely not. As a matter of fact I was just looking here when you asked a question about some of the - the operations coming up. The ATM viewing of Kohoutek is just about over. Looking at this Flight Plan - but corollary 201, S063, S019, S073 are continuing to - to shoot it. And I assume we're continuing our - as a matter fact we already see one here, S233 operations with the hand-held work on Kohoutek that the crew does. So the answer to that is no, the crew is not through seeing Kohoutek but we are winding down on the big ATM JOP 18 operations that we have been doing here ever since. As a matter of fact the last JOP 18 and - and of course this is just a 7-day forecast. The last JOP 18 I see is tomorrow.

QUERY On the CMG - was the EREP maneuver today respon - -

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QUERY On the CMG, was the EREP maneuver today responsible do you think? Was the EREP maneuver in any way responsible today, it seems that these things always seem to happen after a maneuver, which is curious if that could have had anything to do with it.

HUTCHINSON Well let's see, 11:48 I don't know where the EREP maneuver was relative to that I don't know whether we have an onset time for this one, do you know?

PAO I don't remember the time it was after that but the EREP maneuver really wasn't that severe you know it's - we go in at Z-LV, it's a very small maneuver.

HUTCHINSON We have - the EREP today was one of our nooners - in and out at noon which is almost nothing relative to putting any - any high gimbal rate movement on the CMGs. The CMG time, I wrote the time down, the time in the anomaly at least when it started was 11:48 Zulu. The first time we observed it here on the ground and I don't know if they've gone back and taken a look at the tapes. However let me correct something I said a minute ago. The last JOP 18D is on day 52, not tomorrow, three days from now.

PAO Jim.

QUERY Two things that are totally unrelated, one related to Howard's question. How about them actually being able to eyeball a comet, not just the instruments -

HUTCHINSON Naked eye.

QUERY - - recording it - naked eye observation.

HUTCHINSON Yeah, I wish we had that comet fellow here today Jim, I think - I think it's reasonable to assume that they'll be able to do that for many days - many days yet of course, we're supposedly going to be able to do it from here, from the ground here in a few days and their view has got to be better than ours. So I guess reason would tell you that they probably have another week or two of being able to see it with the naked eye or the binoculars.

QUERY The other thing, how in the world could you lose 23 bags of urine and how did you discover they were gone?

HUTCHINSON Okay, we didn't lose bags of urine, we lost the bags that the little - it's - and they're samples - the sample return bags, empty, not used, new not used ones. They're little square jobbies (sic) about that big a round and I can't answer how we - lost - lost - launched them all on SL-I, we augmented the supply when we extended the SL-IV mission, we found the ones that we flew up on SL-IV, so the missing ones are out of the original supply that we flew up back in May with the SL-I vehicle. And the way we turned it up, we did a urine return container inventory along with - we're constantly doing inventories of this or that or the

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and the other thing and the crew came up short. And they - we were originally 45 bags short and since then we have scoured around and found all but 23 bags and we're about out of places to look, we think. And we have not found the other 23.

QUERY Could those bags be used for anything else, it's not possible that they got mixed up or something else.

HUTCHINSON No, they're unique in shape and size no dual purpose.

QUERY But they're stored in different places?

HUTCHINSON Yes. Several and not only that, Tom, they're moved around as they're used. You know they bring them out upstairs and bring them into the waste management compartment and then some - you know there's a rotation sequence.

QUERY I'd like to ask Mr. Pace, what type of troubleshooting work is going on and how extensive is this troubleshooting work on the CMGs?

PACE Well we had a - the most recent activity we had a, I guess what could be appropriately classified as a blue ribbon committee with, the best bearing experts that we could identify in Huntsville for two days last week, Thursday and Friday to review the data from the CMG number 1 failure. The anomalies that we've seen on CMG number 2 and also reviewed with them the measures that we have implemented to try to preserve and prolong the life of CMG number 2.

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PACE - 2, and also reviewed with them the measures that we have implemented to - to try to preserve and prolong the life of CMG number 2. That's the most recent activity. Of course when we - when we fail CMG 1 we of course went back and looked at all of our ground test data, including a review of the - of a failure that we had had during ground test here at - here at Houston, as a matter of fact with the thermal vacuum test premission to review the results of our analysis of that failure to see if we could find some correlation. We of course have done some - some laboratory testing. There are tests that are continuing as a matter of fact on CMGs in Huntsville that are - where we are just running CMGs to see what kind of life we could get on them. That's sort of what's been going on.

PAO Excuse me Howard, do we have any more questions for Neil, he's -
HUTCHINSON It's all right. I'll - I'll hang with it here.

PAO You going to hang in?
HUTCHINSON Yeah, so lets press on.
PAO Okay, go ahead.
QUERY How many anomalies did you have on CMG number 1 before it finally went out compared to the number you've had already now in number 2?
PACE Let's see we had 30 - day 307 was the first.
HUTCHINSON Nowhere near as many I can guarantee you

that.
PACE They - -
HUTCHINSON We had what - I'd say no more than 5,
absolutely. Yeah, no more than that, that's a good
PACE outside number. Which is probably less than half what we've
HUTCHINSON had so far on CMG 2. So, what have you decided that - that tells
QUERY you about - there are - there are two different problems here
that -

HUTCHINSON Tells me that we don't understand the failure mode. But I don't know if Bob might ha -
PACE Well the - I think there was unanimous agreement with the results of the group last week that the anomalies that we are seeing on CMG 2 is a result of insufficient lubrication. And that I guess is - is causing some retainer instability in the bearing itself which-those two seem to be the most common cause of the problems.
HUTCHINSON Those by the way were - they're both pertinent theories as to the CMG 1. You recall all the discussions about the wick and the little pool of lubricant and so on and so forth.

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And that of course fits with us trying to keep it hotter.
QUERY Are there any theories on how long it
might last?

PACE No. They say - they didn't really offer
any suggestion - they thought we were doing the right things
as far as trying to prolong the life of it, that is manage
to the higher temperatures. It's - I guess if you could
come way turn the heater on and maintain a stable temperature
you know at - at the upper limit would be the ideal solution
but the circuitry doesn't of course afford us that opportunity.

QUERY Neil, what are the latest figures now on
if it should fail how long we can go on the TACS and also
on the RCS with the command module?

HUTCHINSON Well, we're - of course we're constantly
looking at this TACS - it just so happens I have a plot.
Constantly looking at the TACS posture relative to how long
we could keep ourselves up there. And of course you know
we had some requirements to - the ability to - to rescue.
posture where we're without a - the ability to - to rescue.
It's a fairly complicated thing, let me see if I can simplify
it. If and when another CMG fails we're going to put a
new computer program in the ATMDC which does this quasi-inertial
thing you know. Which is just nothing more than a sloppy
attitude hold -

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PACE - DC, which does this quasi inertial thing, you know, which is just nothing more than a sloppy attitude hold around the Sun, that allows us a sort of let the gravity gradient mess around with the vehicle and not fight it too much, but still maintain it close enough to the Sun to get the power we need. Where we sit right now - right now, today, we have TACS for a rescue posture, and that rescue posture is 10 days of the ability for this - for enough gas to fly around with a CMG gone for 10 days without any help from the CSM. And still have the end-of-mission redlines to accomplish some extra docking attempts, an EVA, and so on, and so forth. Now, you know that the vehicle at the Cape - the spacecraft 119, I believe right now, in fact, I know right now, is sitting at minus 10 days. We have been and I'm really out of my bailiwick now, but there are people looking at ways to get that vehicle below 10 days if we deem that that's the proper approach. And, of course, every day you can chop off of that countdown is another day's worth of TACS that you've got up there that you can eat into that you don't have to save to preserve a rescue capability. Now, sooner or later as we pass on through these EREPs we're coming up on, we're going to have to break that magic TACS 10-day redline. Now, what that means is that we no longer have the capability to use only TACS to stay in orbit, and we have to depend - if we had to stay in orbit for rescue - I'm still adding failure on failure now, we have to depend upon the CSM RCS, and when get to that particular point, I think we're probably going to examine where we're going to go from there fairly carefully. We aren't there yet. Depending on where the Cape vehicle can be taken down to, and there are things like - for an example, if you chose to arm the vehicle pyrotechnically, you could probably take it down to minus 8 days without a lot of headache. I shouldn't say without a lot of headache, I don't know that. But that's another break point. And minus 8 days is the place where you load hypergolics, and of course once you do that, then you've got a significant turnaround to get that vehicle ready for the - for it's support role in ASTP. And so it's - anyway, we're above the posture where we have to compromise that particular 10 days worth of rescue. You ask about CSM propellants. We also have developed a computer program for the CSM that does this same sloppy attitude control thing. And it's very, very economical. And without breaking any deorbit redlines, in other words, preserving two methods to get down, both with the RCS and the SPS, we have, with that new computer program loaded in the CMC which also - it's not loaded, it's been developed and verified and it's - we've

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had it for a couple of weeks now. We have about 16 days worth of attitude hold in the CSM. It's fairly economical. Now, I'm not saying that that means if you add those two numbers up, we'd stay up there for 26 days if we had a failure right now. That - that would be a management decision and it would have to be made based on what we could accomplish. Obviously, even this quasi attitude hold you don't get any - no ATM experiments. Of course you could always continue the medical. You might be able to do some EREP work in solar inertial or if you wanted to spend the gas, out of solar inertial. I know that's all kind of weasel-worry but that gives you a general feel for - it's certainly not a jump in the CSM tomorrow and head home type operation.

QUERY

Would you say that with the management, despite the continuing glitches ever so often, with the managing, of the heaters that it looks now like you - as of the latest look at it, that you can go on - -

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QUERY - - heaters, that it looks now like
you - as the latest look at it, that you can go on like this,
almost indefinitely, that is, you know, until the end of the
mission?

HUTCHINSON Yes, there is no - but you know there's
no reason to say that we - it's going to break and die tomorrow
anymore than there is to say that it's going to go until
next July. There is - there's something wrong with the
wheel and it - and it's manifesting itself every once in
awhile. I told you yesterday that the manifestations
were not getting any more severe, although this morning
here with another occurrence they do seem to be getting
more frequent. And you know we slowed the frequency down
considerable when we started the heater cycle. And like
we commented awhile ago, we've seen twice as many or more
occurrences on this wheel without the failure or stress being
catastrophic as we saw on CMG 1.

PAO Do we have anymore questions? That ends
the change-of-shift briefing then for today.

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Skylab News Center
Houston, Texas

S/L IV - Change of Shift Briefing
Johnson Space Center
January 1, 1974
3:26 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Bob Gordon, PAO

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PAO Okay. We'll have Neil Hutchinson, who will review today's activities.

HUTCHINSON Okay. Today's Flight Plan. We seem to be steaming along a little better every day. We had a good run today. Of course, there's still quite a bit of executing to do. We've got a JOP 18 to do tonight. We did the early morning EREP this morning over South Ups - South America and over Africa, and it went well. In fact, except for the fact that the PLT did not acquire the Falkland Current in the VTS I think we got everything we were going after. The weather cooperated fairly well, and we didn't have any problems with the instrument operation or anything like that. No new anomalies today. One little strange thing that we're still trying to understand on the - our old friend the ATM C&D coolant loop. As a matter of history, go back a little bit and recall that that's the loop that we lost the pump in and then we had a lot of trouble with it before the holidays off and on. We went through a procedure whereby we flushed the loop, or purged it, if you will, by running it through a heat exchanger, a water/gas separator that was used in the - in another water loop in the vehicle. This separator has a filter in it and also has the ability to take gas out of liquid. And since that time, since running all of the coolant in that loop through this separator we have had pretty nominal performance out of it up until about a week ago. And then it started doing something I call hiccuping. It's not a very engineeringlike term but basically the loop flow, you will recall that back before we flushed it, the thing was cyclically every once in a while having a severe dropoff in loop flows if it was not circulating the liquid around the loop. After the flushing it worked great at a flow rate that was higher than any we had seen since premission testing on the ground, up around 290 pounds an hour. The glitches before flushing were down to around 160, some of them, some of them even down to 0 for short periods of time. Then after flushing, the flow returned to its premission nominal, close to 300 pounds an hour. Then about a week ago, I don't recall the exact timing on this, we started seeing these little burps out of it and they were cyclic, very cyclic, when they were occurring, roughly once every minute, more or less, plus or minus a few seconds, which is approximately the time it takes a unit of fluid to traverse the loop completely around, which gives you a st - kind of a strong indication that probably it had a small gas bubble in there and every one in a while it's passing the flow transducer and causing a drop in flow rate. Now that phenomenon started up about a week ago, and at first

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it was intermittent. It'd cycle every 1 - once a minute and then it'd go away and the loop pressure would return back up to the proper flow rates, up around 300, and then it would start again and, oh, I don't know, several days ago it has become very consistent in that fact that it's continually hiccuping. And the hiccups are around 30 pounds per hour flow. It goes from 290 or close to that down to about 260, and then immediately back up to 290, and then 55, 50 or so seconds later it drops again. This morning when we ran the EREP - We have a valve in that loop. The loop has two functions, as you know. It cools the EREP gear and also cools the ATM C&D. There's a valve called, appropriately, the EREP bypass valve, which has two positions on it, FLOW and BYPASS. In the FLOW condition it routes the coolant through the EREP gear, on the BYPASS position it - the coolant just flows through the C&D loop and then out through the heat exchangers and back again. We normally run the EREP in BYPASS except when we're having an EREP pass and we require the cooling then we put it in FLOW, which we did this morning. And normally - -

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HUTCHINSON - - and back again. We normally run the EREP in bypass except when we're having an EREP pass and we require the cooling and then we put it in FLOW which we did this morning. And normally when we put it in FLOW since there's more plumbing for the coolant to flow through and thus a slightly higher resistance, overall resistance to flow in the loop, the flow goes down a bit. It went down this morning and when we put the valve back and by the way, it stopped hic-cupping, when we went to flow which I hadn't confirmed that we saw the last time we went - we did an EREP pass which was about 3 days ago. Anyway, we went to flow on the EREP valve to total FLOW in the loop drop off about as expected. And the EREP pass is over, we went back to bypass and the flow stayed low. And it's where it sits. It about 260 which is nothing to be worried about and that is about what it was before we started experiencing anomalies way back here before the holidays. And we're not sure we understand that but it's something to think about, in the systems area. I don't believe - I don't believe we had any other system ditties today. We had a - we did some work on the 82B door, you recall that that hung up about 3 or 4 days ago and we've been operating with it open, except on occasion during these maneuvers we've been closing a companion door, the XUV mon door which is tied to that same door motor, door operating sequence. And we - the engineering folks at Huntsville and the thermal people have in the last 24 hours come up with the fact that we no longer need to continually open and close the XUV mon door to protect the 82B instrument. So we'll be leaving both those doors open for the rest of the program without any modification or closing of them for maneuvers. See I talked about EREP. The CDR this morning or just last night at least since I was over here, came down with his, what are we going to do to help the flight planning situation answers and they were all very favorable. I'm not going to go over every one of them, I'll go over any of them that anybody wants to ask about or maybe if you want to talk about each one of them in the question and answer we can. Basically the proposals that we put up, a couple of days ago in our flight planning conference were accepted. In a couple of areas they chose to do it a little bit different than we had suggested. For example in the pre- and post-sleep areas, they still would like - they reduced the total amount of time in the pre - that they're that they'll accept in the pre - and post-sleep significantly, for example they went from an hour and a half to an hour in postsleep. However the hour that they kept, they still prefer to keep that

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fairly free of air-ground and free of scheduling things other than the postsleep activities. In other words, when they get out of bed, they want to get awake and get with it. However in general, it seems that a lot of the things that were giving us trouble, another example is the PT, they did agree to split the PT and to split it in a fashion that'll help us out just dandy et cetera. Cutting down on the amount of time - prep times for certain things. Not scheduling housekeeping but just working it in during the day when they can. All the basic premises that were outlined in that - in that flight plan discussion were accepted. So we're - were super pleased that - and think that we're going to start seeing in these Flight Plans as we begin to produce them over the next few weeks, more science hours for the same amount of time invested. And as a case in point, with a flight plan that's no more complicated than any other ones that I've seen, for a day off where we generally been getting from - trying for 10 hours, but generally been getting 5 to 7, 10 science hours I'm talking about. The day off tomorrow, got 10 science hours, in fact we got 10-1/2 without any problem at all and the next day's flight plan - the preliminary looks like we're going to be up around 26 science hours. So you can already see -

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HUTCHINSON Day off tomorrow. We got 10 science hours, in fact we got 10-1/2 without any problem at all. And the next day's Flight Plan the preliminary looks like we're going to be up around 26 science hours. So you can already see that the flexibility in some of the guidelines, plus the fact that the crew has taken upon themselves to try and keep there everyday living - keeping the workshop clean and everything sorted out and organized and so on. Taking those things upon themselves, as opposed to having us block out units of time for them, has all ready started to pay off. I think we had a couple examples today. The crew ran pretty much ahead all day today. They just seemed to be coming down on almost a regular basis and not restricted to one crewman, either, with, "Hey, I was looking at what was going on this afternoon and decided to do this this morning," type of thing. Which is the kind of stuff we were seeing out of the Skylab III crew along about the middle of their mission. And so I think the flight planning thing, at least it certainly appears that we're really on the road to picking up our productivity from the levels that we had, which certainly weren't anything to snuff at in themselves. I don't think I - see the Flight Plan tomorrow. Tomorrow is a day off. You all probably know about the - about the press conference which will be held tomorrow at the scheduled time, which I think you have, but let me give it to you anyway. It's over a Continental U.S. pass, MILA, Bermuda, Madrid type pass, where we'll have television for the first site, first 7 or 8 minutes, and then we'll be voice only for the remainder of the press conference. All three crewman - and that occurs at about 19:08 start, so that's ten minutes after one. Like I said, the Flight Plan tomorrow has got about 10 hours of science. We've got quite a bit of off duty time setting up for an early EREP on, the next day. Which by the way is still on, early EREP for day 49, January third: some corollary Koshutek work, some ATM passes, and some time off. And I think that's all I have.

QUERY Neil, do you think with this new productivity that they'll be able to make up some of the lost experiments from the first half of the mission?

HUTCHINSON Well Howard I, you know I don't think we lost any experiments in the first half of the mission first off. We are certainly behind in some of them. I think we're going to have to wait and see how this thing develops. It's got all the earmarks of exactly the same way that we begin to see a maximization - maximizing of the available time in SL-III, and I really think it's kind of early to tell. It certainly is - I mean, you know, we only talked about this

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two days ago. And in the last two days I suspect - I've been on executes, of course, so I heard the crew doing a lot of talking to the ground - but I suspect that I've probably personally heard of maybe a half a dozen instances of individual crewmen coming down with comments or suggestions or cutdowns in time allotted for given things led me to believe that there not only getting the job done that we're scheduling them for now but they are able to have enough time to say to themselves, "Hey, you know, they've got me doing so and so this afternoon. If I could get this done this morning I could probably be more efficient on that thing this afternoon." It's that kind of thing. And that's the kind of stuff, not anything really that we can do, but that's the kind of thing that really helps to turn these Flight Plans on.

QUERY Do you have any theory, Neil, about why you're seeing this increase in the efficiency curve right now, or why they, here in the last couple of days they've seemed to have really found their pace?

SPEAKER Well I think it's a combination of things. I don't - I don't really have any pat theory. Certainly not. But I think that - that the planning conference that we held with them, where we presented some of the things that have been hanging us up like this no split the PT and the long preimposed sleeps without any activities. They're really

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HUTCHINSON - - we presented some of the things that have been hanging us up, like this no split the PT, and the long pre -and post - sleep without any activities. Their relaxation of what they felt was acceptable on those areas has got to have helped us. That in itself probably accounts for - for a good part of it. As far as them coming down with the recommendations on outdowns on time most of the things they cut down - well not most of them but some of the things that they cut down were things that we had indicated to them. They were still (garble) above levels that we saw in SL-III. As - in terms of amount of time we scheduled them for. Some of them they volunteered this attitude or approach or look ahead thing, I think is something that is just starting to hit them that if they do it, they can make their own day a heck of a lot smoother. I think in that planning conference we tried awfully hard to emphasize that and - and I think they've really gotten the message, that no matter how hard we Flight Plan down here, in the end the - the real planner is the guy that's doing the work. And he has got to bend and give and - and stick things in where he can, and sort of - you know you have to sit down at the beginning of the day and say to yourself, well what have they got me doing today, and kind of walk through it. And if you do have the time and preogative and motivation to do that, it ends up that you're going to have a better day and if you have a better day, you're bound to be more productive. And if it continues to go this way I fully expect that you probably seen the last of the - the flight planning conferences, and we'll just press right on here.

QUERY Even despite this new schedule still these little errors are cropping in, like they put the teletype prin - the teleprinter paper in backwards yesterday and today, Bill, apparently started the EREP maneuvers an hour early or something, and - and what caused that by the way? But - And what is cau - and why are they still making these little mistakes?

HUTCHINSON I - I don't know about those two. The two that you reference indeed, were minor errors that it turned out on - on the teleprinter paper of course as you know we got our roll loaded in backwards, which has happened a couple of times before. One time on SL-III that I can recall. The DAS entry on starting the EREP maneuver early, actually it wasn't starting the maneuver early it was getting into the Z local vertical part of it early, the actual fine maneuver, where you have the instruments oriented exactly towards the ground. He misread the pad, which I think is - you know he was off by exactly 1 hour; he got an hour digit mixed up. And that turned out that didn't cost us. We had

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predicted about 31 or 2 mibs roughly 150 pound-seconds for this EREP today, and we spent about 38, I believe. So I - I can't account for either one of those Howard. I - I think that there's just a - a small level of things like that that go on continually. And we hope that most of them are just of the bothersome nature.

QUERY With the - some EREP that you're going to have to run over because of the problem with the filters - where are you overall in EREP? And now - now that you're starting your - another phase here?

HUTCHINSON Okay, well the passes that we're getting right now are not ones that we - most of them are foreign as you notice. The big continental EREP doesn't start until well - for another couple - another couple or 3 days here. By continental I mean generally over the western - in the Western Hemisphere over the United States type of thing. I really can't give you an accurate accounting of what 190A sites we're going to be picking up in the next week or so or 2 weeks, that we had already gotten and felt that we needed to get again because of the filter situation. That's a piece of day that could be had very easily, I'm sure that's easily accountable if we could run that down for - I - I just don't have it in my head.

SPEAKER Kenny went over those briefly once before.

HUTCHINSON Yeah, I think - I think in general you probably going to find that without unduly repeating a lot of EREP work, we're going to pick a lot of them back up to where the lost - -

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HUTCHINSON - - without unduly repeating a lot of EREP work, we're going to pick a lot of them back up where the loss in that first session of EREPS of that one kind of data is going to be fairly minimal. And I think it would be very easy to give you guys an accounting of exactly where we stand and where we expect to stand on that particular subject. In fact, I can do that for tomorrow. I don't have a pencil but I'll remem - if you'll remind me - remind me after -

QUERY I probably didn't ask my question directly. I really meant where you stand in the overall EREP work and how much more, basically, you have to go.

HUTCHINSON You mean in a gross fashion, well you know right now for example, the EREP pass today was what, EREP 18, I believe, and we are generally starting to pick up on the EREPS fairly heavily and of course, they just build up. As far as the Kohoutek goes down, the EREPS go up, you know as far as the number and the amount of time we're spending on them. You know that we had planned approximately 50 passes before we lifted off. We're at 18 now, I think we're looking realistic at getting somewhere on the order of 40 to 45. So that means we're probably not going to get quite all we'd anticipated because - but - and of course the reasons for that are many in varied. You know we've been all the experiments have been off just a tad on the total amount they're going to get and that sort of, you might say EREP's share. And of course we are being fairly - not stingy but careful about our usage, of TACS propellant. But that's a - that's kind of gross look, and it really is gross. You know that's almost misleading to talk about EREPS in terms of total passes. Because you really, you know, if those five passes we don't get have five sites in them, you know you're talking about 1 percent or 0 - you know, 1/2 a percent or something of the total we were trying to get, as opposed to looking at it in terms of five passes out of 50 that we didn't get. So you really need a site tally, and I don't have that either. But I can get that, that's easy data to get ahead of.

PAO Okay, thank you Neil. Hey, Tom, in the daily report there is -

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SKYLAB NEWS CENTER
Houston, Texas

SL-IV - CHANGE OF SHIFT BRIEFING
JOHNSON SPACE CENTER
DECEMBER 31, 1973
5:28 pm CST

PARTICIPANTS:

Neil Hutchinson, Flight Director
Horst Uwe Keller, University of Colorado
Jack Riley, PAO

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PAO - and we'll go ahead and Neil will run down the shift and then Q&A for him. Then after we're through there, if you have any questions on Kohoutek, we have Dr. Keller here who can answer some questions and provide you with some information about that. Neil, you want to go ahead and get started?

HUTCHINSON Okay, happy New Year. Today, you probably heard about our daylight time ditty. We decided early this morning and at the beginning of my shift when we came on that since we have a couple of EREP passes in the next three days that our early wakeups - we have one on day 47 and then another on day 49. Yeah, warm it up, Bruce. One on day 47 and one on day 49. And since the U.S. is going on daylight saving time on the 6th of January and, of course, we were going to do it at that time - the control center and the crew, we chose to go early and so we're going on daylight saving time in Skylab tomorrow morning. And the crew will get up one hour earlier Sun time, and we all have to be to work an hour earlier and all the shift changes are an hour earlier. And whoever comes over here tomorrow - which will be me - will be an hour earlier. So, - and we'll maintain that, of course, through - the rest of the flight. This 11 - 11:00 Zulu wakeup, 03:00 to bed, Zulu time. You also probably have seen the air-ground on the flight planning conference last night that we discussed yesterday afternoon briefly and I'm not going to comment much on that except to say, you know, we can entertain questions on it. There are two things so far that the crew has come back on - they were both early this morning. We frankly did not expect them to come back until tonight during the evening status report. I suspect tonight is when we'll get in another conversation about the contents of the - the planning conference and what other steps the crew feels they can accommodate in the way of accommodating our flight planning process. But this morning, we cut the EREP prep by one third down to an hour, and we've also removed the need for a second crewman to monitor the maneuvers on all maneuvers. Those were two of four or five items we had expressed a desire in the planning conference to put into effect to help accommodate our flight planning process. We had a kind of an uneventful day today. I think we had a real good run at JOP 18, we have another one coming up. Unfortunately, on the JOP 18 last night, we - we - yesterday, we got in a little discussion about the crew - about the vehicle not being built to fly around the sky. Well turns out last night, during my shift in the control center yesterday, we had the numbers - we had to compute some numbers for - to slightly change the attitude that the vehicle was going to

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be at during the Kohoutek data take last night on JOP 18. We flat out made a mistake in the number. It ended up putting the X-axis of the vehicle out of plane a little bit which didn't take it off of the comet, but screwed up the momentum and we ended up spending about 300 pound-seconds for that JOP 18 last night - roughly, not quite that much, 250, I guess. We got most of the data take. We probably smeared a bit of - of film because - particularly in 82B because we got some firings during the data take. The one today went great and we don't anticipate any problems with the one tonight. The EREP tracks - I've already talked about one of them - the one on day 47 is - it's an ascending track goes up the south - the east coast of South America and it's going to take a whack at this current that we've - Falkland Current zone that we've been looking at in the South Atlantic off the coast of South America which as you know, has created some interest in a considerable amount - -

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HUTCHINSON - - talked about one of them, the one on day 47 is - it's an ascending track that goes up the south - the east coast of South America and it's going to take a whack at this current that we've - Falkland Current zone that we've been looking at in the South Atlantic off the coast of South America, which as you know has created some interest and a considerable amount of discussion during the flight. And then it goes up across Africa and it crosses right over a couple of areas in a - it would be southwest Africa that we're - that we've been trying to get, in fact there's a mandatory site there. These are extreme drought areas. The early EREP on day 49 comes up over Africa and northern Sudan and terminates just before we go - just after going into Iran. And that again is an early wakeup, and I'm not sure exactly whether it's saving time. It turns out the one on day 47 with daylight saving time works out just fine, you get up at 11:00 and it's not a early wakeup in other words, if you want to class it as that. That's a sneaky way to get the crew up an hour early. Flight Plan tomorrow is fairly full. Again we're going after the comet, we have the early EREP and going after the comet with the - with the ATM instruments. And we've got a major medical tomorrow. And I don't have much else.

QUERY Neil, when you said southwest Africa, I really mean - I think you meant northwest, did you not, Mali, Mauritania area.

HUTCHINSON

Yeah, for which pass? Oh for the - 47, day 47.

QUERY

Yeah, 49 - it comes up across South Africa

HUTCHINSON and of course it goes right off over the Sahara there.

PAO

It crosses around the Ivory Coast, or something

like that.

HUTCHINSON

Yeah.

PAO

And then it comes up - -

HUTCHINSON

I'm, trying to remember where the - where

the thing -

BEAVER

I looked at it on my track to make sure - it's track 54.

PAO

It showed it coming over Mali, Mauritania

SPENNER

area so

HUTCHINSON

Yeah, it's 53, 54, and that is where the drought area is, it's up there in the, I believe it's up there in the northern part. If you want to verify it like I said, it's track 53 and track 54 - it's 53 at - starting off and 54 going up - coming up over Africa.

QUERY

Neil, you said that under this new system of operating there would be no need for the crew to monitor any

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of the maneuvers. Who'll be performing that or how will that function be performed?

HUTCHINSON Well, you'll recall that - that that's not what I said, you misinterpreted what I said. We have had since we lost a CMG and ever since we've been doing maneuvers we have had an extra crewman there that has no other duty but to monitor the maneuvers. Back, must have about 2 weeks ago we put a patch in the ATMDC that during maneuvers takes away the automatic fail over to TACS ONLY the thing that costs a lot of propellant. And when the computer detects the particular set of circumstances that indicate the maneuver is not going well momentum wise or attitude wise it rings a buzzer instead of failing over to TACS ONLY. And it does so at a time that allows the crew enough time to get up there and take appropriate action. Now, what that means is that we don't have to dedicate a guy for monitoring - for maneuvers. Now we have - would have been able to do this long ago but we wanted to make sure everybody was comfortable with it, the crew and us before we did this, and we've been comfortable with it for quite some time, and that was one of the points of discussion. Now as far as starting the maneuvers, and for example when you're going into a - like this JOP 18, there's a man there doing the JOP 18, there just isn't an extra man doing nothing but the maneuver monitoring. So effectively there's guy there. Now an example of when there wouldn't be a guy there with a maneuver in progress is going to come up tomorrow morning. We'll start this - we'll go into this FREP, and it's kind of a hybrid thing tomorrow to save TACS. We haven't got enough electricity - enough solar power to go two complete revs in Z-LV. You know - let me back up. You know the Z-LVs we were doing the last time we were doing Z-local verticals we were doing this thing, we went in at noon and came out at noon. Well, turns out at the FREP tomorrow and a lot of the ones coming up are going to be centered around orbital noon, therefore you can't go in at noon and come out at noon without spending two complete revs in Z-local vertical. And the power system -

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HUTCHINSON - at the EREP tomorrow and a lot of the ones coming up are going to be centered around orbital noon. Therefore, you can't go in at noon and come out at noon without spending two complete revs in Z local verticle. And the power system, - can - it can accommodate that, but it's a pretty tight fit, and it requires a significant amount of powering down onboard. A lot of switch throwing and a lot of equipment turned on and off. So rather than do that, we're doing a hybrid and a hybrid is a - go in at noon and you spend a - that - the rest of that daylight pass the night side in Z local verticle and you come out in the day side and take data and then you go back out at midnight. So you're back in solar inertial when you get Sunrise again. Now that particular maneuver - when the maneuver is initiated to ZLV, of course, you're going to initially - initiate it when you're in a ZLV attitude, you're going to initiate it at - at orbital noon. Right? And once they get into ZLV, which they will be instantly, you know, and you'll be orbiting (?) then. There won't be a man at the panel until it's time to take the EREP data. So in that sence, there's not a maneuver - a guy monitoring a maneu - a maneuver - it's a maneuver that's going on - it's a ZLV maneuver.

QUERY Well, is this hybrid still free as far as TACS use.

HUTCHINSON No, sir.
QUERY Okay, what's the estimate of TACS?
HUTCHINSON The cost estimated for example this early morning EREP tomorrow is about 160 pound-seconds. Now as opposed if you want kind of a comparison number, as opposed to a pure - this particular pass run - a pure ZLV is about twice that. If it wasn't - if we didn't take advantage of going into ZLV at noon.

RY Neil, have we had any more glitches at all on UMG 2.

HUTCHINSON None.
QUERY Are there any plans this evening - or I guess, at other 20 minutes when we hit Greenwich mean time, New Year any special plans, you know, from the ground?
HUTCHINSON No, not unless Milton has something cooked up - but there I don't know about, which wouldn't surprise me. But that - far as I know, there are none. There was a comment this morning that you probably heard that they were going in and out of 73 and 74 regularly which is an interesting experience.

PAO That it? Okay, thank you, Neil.
Dr. Keller, you have something you want to say to us - or you just want to take questions? Okay. Oh, you've already talked to him? Paul have you got any comment? Questions? No? Why don't you come on up and sit down and -

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QUERY Dr. Keller, based on the updated observations of the crew, do you have any updated estimations of the magnitude of the comet Kohoutek when it's - becomes visible from the ground on the fifth?

KELLER I would say I don't have a figure, but am a little bit confident that it might be that the comet is brighter than you would have expected it from the last observations before perihelion. And this hope is based on the fact that it seems that the comet is now producing more dust than it did before perihelion. I would - before perihelion - the last ground-based observations at least indicated that the comet was mainly a gas comet and was relative - the small amount of gas - dust. But I would say it might be that we will see now more dust than before perihelion and the fact that the dust is staying relatively close to the nucleus or to the center of the comet or nearby to the comet will increase its overall brightness - increase its overall magnitude and therefore, I think it might be a little bit bright -

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KELLER - - its overall brightness - it's - increase its overall magnitude, and therefore, I think it might be a little bit brighter and the same heliocentric distance after perihelion than it was before. But this is still a guess.

QUERY Could you put a number on that or a comparison to one of the planets perhaps? Visible - -

KELLER My estimate is that it will be between Jupiter and Venus in brightness. Let's say, tomorrow or the day after tomorrow in that it's the first time visible. And it's very difficult to compare a comet with J - with - to Venus or Jupiter because Venus and Jupiter are starlike whereas a comet - the overall magnitude of a comet, it's a cloud and it's optical (garble) outside and it's extended, and if you - you have a tendency if you compare it with a point source you only compare the nuclear part or the condensation part - the very bright part and the middle part, not the overall magnitude. Therefore, there's a tendency that you underestimate with your naked eye and also this telescope - telescope observations. If you look at it you normally underestimate the overall brightness because the overall brightness is defined by all the light which is emitted. But you are only looking for the very bright part because the other object you are comparing with is very small. Therefore, you compare only the very small parts.

QUERY Do we have any updated findings from the radio astronomers? Have they discovered any new evidence?

KELLER No, not that I'm aware of. I didn't have any - No. I don't think that during the - the passage nearer to the Sun there wasn't - there - I think there have been no other observations because if you're looking to the Sun then the sunlight - falling on the disk - radio disk and this causes normally a distortion of the disk due - due due to the heating of the disk. Then you'd lose resolution. And therefore, daylight observations nearer to the Sun are possible if you put a screen - several disks - used to have a screen like a roof above them which are occulting the sunlight but not the radio transmission but the - they have - at the time you lose a factor of 2 or so in the radio wavelengths but you don't get sunlight on it. But normally the observations are not done when the comet's so close to the Sun. You can wait a little bit on - I think the next which are planned are somewhere in the 10th or 6th of January, as far as I recall. Radio astronomy - make good observations.

QUERY Has the reaction of perihelion on the tail of the comet been a surprise or is that - that's about what you expected?

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KELLER No, I would say that's exactly for the dust tail and that's - the dust tail's the thing the astronauts observe mainly. It's exactly as we anticipated it. Mainly that you will see some sort of a spike, and how strong you see the spike. The spike is a part of the tail. I should emphasize this - this point. It's just part of the tail like the other part of the - like the fan part is a part of the tail. It's all a part of the tail and we know that those spikes are very often - very often to be seen in special constellations. Nearly always when the comet, as they are so often in the Earth passes through the cometary orbital plane, then we often see this spike, and 10 years ago it was a little bit controversy what is going on in the spike, but nowadays we know there are many computations made which can explain how this spike - that the spike is actually part of the dust tail and not - nothing else. You have those spikes - sometimes you have outbursts in direction to the Sun. Especially if the comets are near to the Sun. But those outbursts are much smaller than this spike here. They are - in all of the diameter of the comet itself are in the order of arc minutes, whereas this spike is in the order of several degrees - visible and it's also, I should say that the astronauts today or yesterday as I said, the spike is now better visible, it's easier to see it with naked eye and also it's easier for them to see the stuff, or the dust which is in this - which is feathering out between the new created plume-like dust tail and the spike part. We are - that's due to -

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KELLER - - between the new created plume-like dust tail and the spike part that your - that's due to two affects probably. The first is that the comet is now farther away from the Sun; therefore, there's less scattered light and you are able - you see this against the black sky, or the astronauts see it against the black sky and they don't worry about scattered light of the Sun and therefore you see fainter things. That's one first point and the other point is that now the position of the Earth is going to be larger or more above the plane of the cometary orbit. That's the inclination, the plane of the cometary - the orbital plane of the comet and the ecliptics, that's a plane that the Earth is moving in, are nearly - have only a very small inclination angle. That's only 14 degrees, that's very unfortunate because it makes all observation very difficult and also the interpretation much more difficult because you have all the time a very strong projection effect on it. You don't really see what is happening there you - because most of the thing is happening in the plane of the cometary orbit. And you are looking just parallel to the plane and therefore you don't really see what's happening. That is unfortunate. That was quite different in the case of the lot - latest comet, Comet Bennett, it was the opposite. Comet Bennett had an inclination which was perpendicular. The plane of the orbit of Comet Bennett was perpendicular. Nearly exact perpendicular to the plane - to the ecliptic. And therefore at perihelion we looked exactly perpendicular into the strain and you saw the tail; you could make easy calculations to verify the physics in it and this would be very harder here and also the observation times were much longer because when the comet is ascending to the north vertically, then it more near - then he is f - above ecliptic. And therefore it is north of the Sun; therefore, compared to this comet it would be - it would stay longer. Now, longer now in the evening sky because if it's in the ecliptic then it's lower to the horizon. If it's north of the ecliptic it's farther to the horizon and at the time you can observe the comet or you could be able to observe it much earlier and much longer, at sunset and twilight time as it is now - this comet. And - but I am sorry, I lost actually my point in talking about - about Bennett. Coming back to your question, I think the thing I mean to say how they evaluated or how they developed - the tail developed since we got the sketch of the astr - of the crew, we actually asked today and I hope we will get another sketch indicating the changes which happened. The main changes now as far as I understand it from the conversation is that the plume part of the tail

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is getting longer now. They see it farther out. And the spike part is better visible and there's also - oh yes - that was my point, it's also better to - to look at those parts which are in between the spike part and the plume part on the far end, if you look at the sketch on the right-hand side, which is the feathering, faint, very faint. It was barely visible on the EVA. But is better visible now due to the effect of very short orbit that there's less scattered light. The things are very faint and you have to have no doubt about it, there's material feathered out between the spike and main tail, or new tail. And the scattered light, and also the effect, I think, the Earth is going to be higher above the ecliptic as so - above the orbital plane of the comet. Those two effects may - are going to give us a better, a little bit better view on the tail. And therefore it is easier to see the tail. The projection is getting a little bit better and it's increasing as the Earth will go farther away from the comet - from the orbital plane of the comet.

QUERY The crew made mention of several different colors that they sighted in the tail, and this feathering and the spike, will this be apparent to ground observers when the comet becomes prominent?

KELLER

Yes - -

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QUERY The crew made mention of several different colors that they sighted in the - in the tail in this feathering and in the spike. Will this be apparent to ground observers when the comet becomes prominent?

KELLER Yes, the - we know - we know well that on - that the tail - two tails, the gas tail or a plasma tail and the dust tail can very well be differentiated by the color. The gas tail is looking - is blue and it's not so good visible for the - for the human eye, we are not very sensitive to - to blue light, therefore, even if there's much gas around you don't see it so easy. Whereas the dust tail is just reflecting the sunlight and the - and the - the human eye is very sensitive to sunlight, it's exactly like the - sensitivity curve of the human eye is exactly like the curve - the emission curve of the Sun. And therefore, we see the dust tail much better even if you have comparable less amount of dust around. And normally on the color photo of the - of the - especially Bennett - the Comet Bennett. If we have - Goddard Space Flight Center made short - couple of colored photos for this purpose, to determine between the dust tail and the gas tail. If you look at it you see faint color all the - you can just distinguish between those two tails by the faint color and the dust tail normally looks yellowish, whereas the gas tail is bluish. And I've - that's also conf - confirmative to the point that as the crew looked at - mainly the dust particles when they talked about the color. And I would say, as far as my understanding is, that they saw it at - use EVA more that - than they saw it yesterday or so and their description was more of this red colors in it that might be due to the fact that it might have been airglow that made the comet a little bit more red than it is today because they see it as a elongation and it's much larger today than it was two days ago. And it was very near to the Sun, and they had to look through the Earth's atmosphere at the comet, more or less. But they also mentioned blue streamers or white light and the white light and the blue streamers are probably due mainly to plasma and gas particles which are - and streamers are typical for - for gas tail you expect to have structure - the gas tail is very structured compared to the dust tail because the velocities are very high compared to the dust tail. Velocities in the gas tail are on the order of 75 kilometers per second and as the dust tail typical has - begins with 1 kilometer per second or less than 1 kilometers per second and goes up to maybe as much as 10 kilometers per second always in respect to the comet nucleus. You said the brightness of this when it becomes prominent in the twilight sky for

QUERY

One final question. You said the brightness of this when it becomes prominent in the twilight sky for

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Ground observers will be between Jupiter and Venus. Now is that going to put it at the previously estimated minus 4.2 or - or will it be less in your opinion?

KELLER

QUERY

an estimate.

KELLER

QUERY

KELLER

QUERY

KELLER

QUERY

KELLER

it's not much too bright about - Let's talk about Venus.

Venus is minus 4.2 right now.

QUERY

KELLER

say the overall brightness I would estimate that on the 3rd of January I would say the overall brightness might be minus 2 or so - 2.5 that's what I would say. And therefore, it is less bright than Venus and the - yes, it would be probably less bright than Venus.

QUERY

KELLER

QUERY

be about -

KELLER

QUERY

KELLER

less bright than Venus - -

QUERY

KELLER

PAO

people listening elsewhere around, I guess we should get Dr. Keller's first name, what - what -

My - yeah - I'm actually carrying 2 first names with me, it's Horst Uwe, H-o-r-s-t and my second - my - can call me U-w-e

PAO

Okay, and he's temporarily affiliated with University of Colorado but your permanent affiliation is - is classified -

KELLER

physics in Munich, West Germany.

PAO

Okay, thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 30, 1973
17:05 p.m. CST

Participants:

Neil Hutchinson, Flight Director
Dr. Karl Henize, Principal Investigator S019
Bob Gordon, PAO

SL-IV PC-80A/1
Time: 17:06 CST
12/30/73

SPEAKER - - sure we don't need any introductions for Mr. Neil Hutchinson and Karl Henise so we'll start with Neal and give a rundown on today's activities.

HUTCHINSON Okay, we had a pretty normal day today. Just kind of running along on the flight plan. We worked on the comet again today fairly extensively with the ATM instruments, particularly 82B. And all the instruments ran, all except 82A, but 82B was the - was the one that we were really looking for today. And the operations really went fairly well. We did have a pointing error this morning, we made a mistake on the ground and got a couple of signs reversed and lost some 82B data. However, all in all we had a pretty good - pretty good day on the comet. You may have heard the crew comment that they are able to see it again, and we think they're able to see it out window S3. They were able to see it when we were in the - in the ATM D attitude for one of these JOP 18D's. And there were several descriptions and I brought Karl along, Karl CAP COMMED for me today, substituting for Bruce McCandless and he also happens to know a lot about the comet, so in case you have any questions about some of the descriptions the crew made or anything you can address them to him. We have a final TACS cost on the EVA yesterday, it was 3864 pound-seconds, which is a tad more than we had planned on spending seems like. And basically we ended up, of course like I said we spent about twice what we'd planned on spending. Turns out after - after all the smoke has died down again we figured out - figured out what we did. The vehicle got out of attitude about 10 degrees during you remem - you were probably briefed on the plan, how we were going to fly the EVA. The basic plan was to use effectively a TACS only mode with the CMGs assisting being cage' all the time but not actually controlling the vehicle but resisting the vehicle's impulse to move or torques on the vehicle to move it anywhere. And during the data takes we went to CMG control to get the very fine attitude point in control. This little anomaly happened where we spent a lot of the TACS, in fact about half of what the EVA cost us when we were in CMG control during the 201 data take. And the sequence of events goes kind of like, one of the gimbals got on a stop and I don't remember which CMG, it's really irrelevant, it was an outer gimbal. We lost - basically lost control in that axis, and started to drift, the attitude error is built up to about 10 degrees or so and the crew took action to when they discovered that the attitude errors were that large, took action and inhibited CMG control. And when they did this the system immediately saw a large attitude error, and when you inhibit CMG control it goes to - inhibiting CMG control is the same as selecting the TACS to control you and it goes to a 3 through 22 deadband.

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So it drove it back to attitude very rapidly. And again it was one of those things, I guess this attitude control system I - it was not meant to fly around like a space ship. And we keep running into these little things. This was a different - this is not one we've run into before, it was different set of circumstances and a different sequence of events. And you can't really say that you know that we just - the system - the crew has not trained on the system to fly it around like a spacecraft, we've not gotten ourselves completely s -

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BUTCHINSON - - trained on a system to fly it around like a spacecraft. We've not - not gotten ourselves completely straight on passing up instructions on how to fly it around like a spacecraft in a - with one CMG gone and the thing as sensitive as it is, it seems like every time we get it into a posture where we're trying to do something a tad tricky, some little gremlin that we didn't think of or some little thing that we didn't quite get straight between us and the crew jumps up and gets us. And it happened again yesterday. The only anomaly we had today during the X - in fact I guess since Milt's been over here - was over here yesterday, we've had another one of the ATM doors hang up on us. It won't be long until they'll all be opened. This time it was 82B it's the first time it's done it since we lifted off. And characteristics were exactly the same as they've been on the other doors. On this one, it's on the close cycle, it doesn't seem to come all the way closed and the motor times out, as you know those motors have timers on them after they've waited X amount of minutes and seconds and I believe it's 90 seconds in this case for the door from the time it starts closing until it get - hits a micro switch which says "I'm closed" and shuts the motor off. If the motor doesn't get that signal it will turn itself off to keep from burning out and that's what happened. We've chosen to - we've gotten - we've got the door back open without any problem, this morning we did lose that. That cost us another little tad of 82B data when the door got fouled up. We got the door back open and we've left it open and did that by opening it up and then turning off the power to the door motor. This door is also hooked to the XUV MON door. They run together and we're going through a little thing now to manually control the XUV MON door open and close from the ground because we're not quite sure the thermal effects or ramifications of leaving it open all the time but we're aiming to leave them both open for the rest of the flight. And we may have to modulate this 82 - this XUV MON door for the maneuvers when we get out of solar inertial. Tomorrow's Flight Plan is another heavy day on COP 18. Major medical - in fact we're really assaulting Kohoutek again tomorrow. It's a pretty full day in fact it's one of the fuller ones we've had recently with about 27 hours of science in it. Coming up here on the 7-day forecast in the next couple of days not tomorrow but the next day, we got an early morning EREP on the first of January. Good way to start out the New Year - EREPs. And I think that's about all I have. I don't know whether you want to say something Karl or whether you just want to let

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then ask you questions, maybe you'd like to comment on some of the stuff that Ed's had to say about the -

HENIZE I've got nothing special to say, assuming that people have already heard interpretations of what was observed yesterday. About the only thing to be said about it - and the - that changed significantly is that Ed found that the spike of somewhat dimmer today than it was yesterday. Has anyone ever discussed all the interpretations of what this spike is?

PAO Yeah, Dr. Thornton Page did that -

HENIZE Thornton did that was yesterday - Okay sounds like it's been covered. Unless you've got further questions.

PAO Bruce.

QUERY Several - Neil, have we had any CMG foulups at all, or any glitches?

HUTCHINSON You mean as far - not today, no sir.

QUERY When was the -

HUTCHINSON The last one was, let's see, it was while I was off for a couple of days I guess it was - and it was before the EVA, so that would have made it Friday I believe was the last - last one we had on the CMG 2. Does that make sense? I'm sure whoever came over here must have said something about it, was it maybe Thursday?

QUERY Thursday, Thursday would be it, yeah -

HUTCHINSON Okay.

QUERY Two days after, that's right okay. And Karl on the spike, Ed was talking about it is much dimmer today, what - does that tell you much or did you expect it to be dimmer and why is it dimmer, is it because it's getting farther away or just why?

HENIZE It's - it's what to be expected this is probably the old tail, the tail is probably a great big cycle shape and the old distant tail which curves around and still goes back toward the Sun and we see it projected in the direction between the comet and the Sun. Of course, it's moving out getting farther away, dissipating more and more and therefore getting dimmer and it should disappear within a couple of days one would expect.

HUTCHINSON You're looking at the comet right in the plane Bruce as if you were right here and you - this - this - in other words, you're really looking at a tail and a half. A full tail and the remains of the tail that hasn't quite swept on around yet. If you could kind of imagine like one of these optical illusions things that you twirl.

QUERY Okay, that seems different than an interpretation of what the spike was from the last several days -

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HUTCHINSON - tail and a half, the full tail. And then the remains of the tail that hasn't quite swept on around yet. If you can kind of imagine like one of those optical illusion things that you twirl.

QUERY Okay, that seems different than an interpretation of what the spike was from the last several days.

HENIZE Tell me what the interpretation was that Thornton gave you.

QUERY Well, at least the understanding I got from what the spike was, it wasn't the remains of the old tail, but it was - it was a great amount of dust particles - had built up and began to be expelled 25 to 50 days before perihelion. Now, I suppose that could have been in the last tail - the old tail, and I just didn't realize that's what they were saying.

HENIZE In a sense, you can call that old tail, but there is a conflict in theories, I must confess. And I myself sort of favor the concept that the - the spike itself is more - more than simply being the - the dust tail that you generally see. It's probably the heavier - the bigger elements in the dust tail which don't move out from the Sun so rapidly, and therefore, they stick closer to the comet orbit. And when you happen to see them edge on, you suddenly see them, whereas, if you see them sort of face on, you'd never see them at all. And if this is what Thornton said, I tend to agree with him. In a sense, that is a part of the old tail, but it's sort of tail in a slightly new sense - that these are the very new particles in the tail probably. Again, this is rather speculative. These spikes that we saw - a really good spike on Arend-Roland back in - what 58 something like that. And it's been interpreted fairly well, and this is the - this is the next really good spike that's been seen. And there - the explanation isn't completely cut and dried yet. Except we do know that it's particles that's been left behind and the dynamics needs to be - perhaps - I'm not sure that even - the last word has been said on it - exactly what particles, how big they are, and when they left the comet.

QUERY For Neil, what are the implications so far as EREP, the 20 or so y'all are planning to try to gather from this large usage of TACS.

HUTCHINSON Well, Paul, we're still - you know the old TACS - I don't know who it was who decided to put all that stuff on there, but it - it continues to - we have had a couple of fairly severe usages of TACS in these last two EVAs. However, if you look at projections - I just happened to bring a curve along with me of what we'd been projecting

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and where we are and what kind of a usage rate we've got to the end. And let me just give you a number and - and when you hear this number, then we can talk a little bit about how much EREPs cost. But right now, based on where we are in SL-IV, based on how much TACS we have and how much reserve we have to maintain at the end of the mission for a rescue contingency and so on, you've probably seen all these numbers. We could average about 310 pound-seconds a day, average every day, day in and day out, all the way to day 85 - 84. Now, you also recall that some EREPs are expensive and some aren't. And you know sometimes you get away for 100 pound-seconds and sometimes you spend 4 or 500. However, the days that you - you spend 4 or 500, are - are not as numerous as the ones that you spend 300 or 200, or 100. Particularly, since we've been doing these noon to noon jobs. You know, we spent an awful lot there at the beginning when we - before we really got smart about how to do the maneuvers cheaper and more effectively. And the electrical power situation looks like we're going to be able to continue to do these noon to noon pat - passes. You know what I mean by noon to noon - going in at noon coming out at noon. And - so I really expect that the 20 or 30 or however many we - I guess we've got about 20 or 25 left, are projected to be completed. I don't think that the TACS is going to end up being a constraint on them. Now, also recall the - that if required and if we deemed that that was the way to spend the gas, we have the capability and prerogative of doing the EREP pass with a CSM. And I don't suspect we'll be doing any of that, but I really don't think the - this kind of gives you an idea of - let's see that's the curve and you can - you can kind of see what went on there. You can see that we were making a - this was a projection - the top curve is the one we would like to stay on. The bottom curve is the one we have to stay on. The - you can see that we were making money like a bandit till we hit that EVA about 3 or 4 days ago. And then we took a pretty good dive down and then we had another one, but we still are in a posture where a line drawn from a - -

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HUTCHINSON - a bandit until he hit that EVA about 3 or 4 days ago. And then we took a pretty good dive down and then we took another one. But we still are in a posture where a line drawn from right here all the way to the end of the mission would represent an average expenditure or about 310 pounds a day. And of course we don't do, you know with 20 passes, you know, you're not doing 1 every day, some days you'll do 2 and many days you'll go without doing any. And not expending 310 pounds - not expending the kind of money or kind of gas that we expended there at the beginning of the mission, I really don't think it's going to be a problem.

QUERY Milt made a comment in passing as we were leaving the other day that there's some thinking underway to run the last EVA on CSM. Is that still looking or are you aware of that?

HUTCHINSON Well, yeah, I think - I think Bruce, that question - that is an option we've always had. And that was an option that was discussed fairly thoroughly for this one we just ran. I think that option remains - will remain open to us, and I think that when we get closer to that last EVA, in fact probably when we get within a couple of days of it, we're just going to look at our TACS and say well have we got the margin we need to be able to accomplish this EVA on the TACS, and if we do we'll go ahead with the TACS. And I think the margin that we're going to - going to reserve for it is probably going to be a bit bigger than we've been saving in the past. Just because this one that we had planned this last time, we were working inside fairly close to the PAS, we were not out for very long and the particular computations that we'd done before hand predicted we'd be pretty close to 2000 pound-seconds. And of course we would have been pretty close to that if we hadn't had the deal - deal during the 201 maneuver. So, I think that when we get close to the end of the mission we'll look and see what kind of TACS we have, and I really suspect we'll have the kind of margins where we'll go ahead and do it with the TACS, although there's no reason to say we wouldn't chose the CSM we got there.

QUERY Your comments earlier that this wasn't designed to fly like a spacecraft of course are interesting because it is a spacecraft of a form. Just exactly what was the control system designed to do - I mean, to what -

HUTCHINSON Point at the sun, sir.

QUERY (garble) just strictly?

HUTCHINSON Yes sir.

QUERY Well about EREPs, don't they -

HUTCHINSON You'll recall that EREP was added - the

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majority of the EREP instruments were added after the control system was designed. Added to the program. And really that system if you leave it alone and leave it sitting on the Sun it'll work forever, and it will cost you nothing. It's an amazing setup, but it just wasn't built to - it not only wasn't built to maneuver the vehicle around like we've been doing ever since the day we lifted off but it wasn't built for the man. You know, it isn't a flying machine, it's not like a CSM it doesn't have sticks and eight balls and neat little things, pilot aids and things that people need to turn things around in space. You know it's got one little display counter and a key board, and a system that reacts slowly and has all kinds of pit falls in it, you know. Every time you put something into it it does something - some little thing that you didn't expect it to. But I say again that when used the way it was designed the darn thing is - marvelous. And I think we've done a pretty darn - darn good job of using it for what it wasn't designed for, all things considered. When you consider we've got - we've still got about better than 25 percent of the total TACS we lifted off with, and you know we're three-fourths finished with the program.

QUERY In view of the fact you've had signatures on CMG2 continued pretty much the way that they were before you tried the manual manipulation of the heater cycle. Can you assess the success or failure of this manual manipulation and do you plan to try anything else to keep this CMG2 well?

HUTCHINSON I think - I haven't looked at all the data spread out as to the frequency the occurrence or the severity of the s - particularly these last couple that we've had. The one couple of days ago, which I know happened to have occurred during a non-gimbal stress period, and then the one during the first - second EVA which occurred when the gimbals were being torqued around pretty good. Those are the only 2 occurrences I know of since the - we've started the heater cycling. And I do know that they both occurred at temperatures considerably higher than we saw before, you know normally they were - before that time they were occurring at temperatures down fairly low, at the low -

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HUTCHINSON - - temperatures considerably higher than we saw before, you know, normally they were before that time they were occurring at temperatures down fairly low at the low end of the spectrum. I think, I'm not sure, but I think the fre - we've reduced the frequency of the occurrences. And I'd have to go back and look at the data to make sure when - when they all were falling. But they were getting to where they coming every other day or so, before we started the manual cycling. You know, we're - to answer your - the second part of your question about what else we're doing at the moment I don't know of anything else that we have in mind or that we could have in mind to help the situation out. We're keeping the gimbals as warm as we can, we're trying to be very judicious in the maneuvers we do to make sure that we're getting really good science every time we go out to do one. And, you know, we're just - we've put the patch in the computer to lower the gimbal rates on the inner gimbal drives and that's about all the tricks we have at the moment. And far as success, you know, you've got to say we're successful because it's still running.

QUERY Okay, how would you evaluate the status of the concern as far as the survival for CMG 2 for the balance of the mission, I mean is there - is there any change in attitude toward the thing. Is the patient becoming in better shape, worse shape or - -

HUTCHINSON I think it - I think it seems to be about holding its own and I can't - I - I think we can say it's not - it hasn't become worse over the past week or so. Because the frequency of occurrence isn't picking up now. Interpretation of what it means when one of them cycles at a higher temperature is very hard to say and I really don't know. I - I don't personally share anymore concern for it but I think that everybody has been concerned about the thing since you know we first began to understand that there was something going wrong with CMG 1 and you know, the concern has been there all along, like I've said we've done all we can for it, at the moment. And I don't - I don't personally - don't know of any other tricks in the mill.

QUERY Karl, would you assess the crew's efficiency on observing the comet and the work they've been doing? How that rates with what y'all would like or is it all just gravy to you?

HENIZE We're getting a lot of great science. If you want me to get into the details of what percent of mistakes they have made if any, I'm not - I haven't been watching the comet observations that much. And I think they've been doing a great job.

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HUTCHINSON I would offer a comment on the crew's versatility on the current - having the crew there on the comet as opposed to something unmanned on the comet. It turns out, if you'd listen to any of the conversations today, we ran a JOP, a series of JOP 18D's today. The ground made a mistake in the pointing on one of them and the crew corrected it. It turned out - it turned out that we had some - the comet doesn't stay inertial with respect to Skylab, so as you go through one of these long data takes you have to be continuously maneuvering the vehicle a little bit - a little bit at a time, like a hundredth of a degree or so every few minutes. We had based on ground ephemeral data, the comet trajectory and a lot of other things, APCS stability had computed some numbers that - that the crew was given in their pads to apply to keep themselves inertial with the comet, it turned out that by visually watching the comet move on the 52 display and so on and so forth, they were able to come up with some better numbers. And as it turned out that tonight we're running another series of JOP 18's - we're using their numbers instead of ours. That coupled with the fact that the crew is, you know, we're getting some incredible visual descriptions of it, for example they saw it again a couple of times today and commented on this and that and the other. And I'm not qualified to comment of the scientific worth of that but it's got to be, you know, worth something. So I think that - I think that all in all again we're kind of proving it's kind of nice to have somebody up there looking at it and watching the other equipment perform and making adjustments as we go along to enhance the amount of data we'll get.

QUERY Dr. Henize, from the crew's description and other things that's been observed regarding the comet, is there any change in the estimate of the brightness, the magnitude of it when it becomes visible to ground observers.

END OF TAPE

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QUERY - - comet, is there any change in the estimate of the brightness, the magnitude of it when it becomes visible to ground observers?

HENIZE As we've learned, it's not really safe to predict what the comet's going to be like a week from now, or a month from now. Let me - Let me say this, that the comet, of course, was considerably below predictions during the month of December, something of a disappointment. But, from what I can understand of the crew observations over the last two weeks, I, personally have a hope, now I'm not making a prediction, I have a hope that the comet's going to be a little closer to its predictions of being bright visibly to the public in January. But I - Comets - I mean - I get the impression that it actually - some - about the week before Christmas flared up a bit, and came close to what the predictions were. And maybe it'll stay there. Maybe it won't. I frankly hate to predict comets. We'll wait and see what it looks like a week from now.

QUERY Dr. Gibson noted today that the tail seemed to be somewhat brighter and longer. I don't know if that's a function of the angle at which he's now viewing it or is this brightening as it gets away from the Sun or what, and will this have an effect on the magnitude? I mean, or your estimate of the magnitude.

HENIZE Yes, the total magnitude of the comet has to sort of include the tail effects too, and right now the tail - or at least yesterday, the tail was very stubby. And one expects over the next - over the next week's time, the tail will really bloom, become large and long. That's happening right now is, as we've been sort of discussing here, is as you go wheeling around the Sun so rapidly, the far end of the tail was emitted when the comet was back over in this part of its orbit, so it's back this way, whereas the comet is now here moving this way with the tail - a new tail trying to push out ahead of the comet, which is away from the Sun, so the tail is making a big arc, and as we look here, we only see this stubby new, recently formed part of the tail. Then it curves around so that it's sort of - it's rather foreshortened. Now as the comet moves further from the Sun, this older part of the tail will completely dissipate and more and more of this so-called new tail is going to push out further and further ahead of the comet, and within a couple of days, the spike will disappear, almost certainly, and the tail - and the tail will grow greatly in length over what we see right now. And this will indeed, boost the total magnitude of the comet over the next few days. But the basic question is, is going to be - the question is again rather hard - difficult to predict is when will we

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start seeing the comet from the ground. We have to wait until the comet gets far enough that people on the ground - that the Sun can set, maybe by a half hour and still have the comet appreciably above the horizon. I would guess myself that we would be lucky to start seeing the comet by the 3rd, maybe even by the 5th of January. And again, I hesitate to predict how prominent it's going to be. It might be quite prominent, and again it might be something that you have to have binoculars to see. I'll wait and see before I - I don't want to stick my neck out.

OBRY Okay. They reported an orange color. I don't know if that would ever in any case, be visible from the ground, but if it - if it - the radiation and all makes it possible to see it from the ground, will it still be there when the comet comes into view on the 5th, or around that time?

HENIZE Possibly, it will be.

HUTCHINSON I don't know what the atmosphere does to -

HENIZE The atmosphere itself has a reddening effect. We'll see it low in the atmosphere, and the atmosphere will have a reddening effect. I guess about all I can say is, in my past experience with comets, I've tended to get a feeling visually that the tail tends to look bluish - grayish or bluish. I've never seen a markedly - I've never seen a marked yellowish color to the tail of a comet. And I got a feeling the guys in space are sort of getting a cleaner, more brilliant view of the comet than anyone's ever gotten before.

OBRY Was this color a surprise? This yellowish-orange?

HENIZE I must confess that I was surprised when - You'll notice there's a little conflict. Jerry comes down with orangish, and there was a time when people talked about - at first they talked about reddish colors to the tail, whereas Ed hedges a little bit and says, well, the brighter parts looked sort of bluish to him and the rest maybe a little yellowish. He doesn't quite say orangish. And frankly - basically what you've got here is a big cloud of dust with sunlight reflecting off it. And sunlight is -

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HENIZE - Jerry comes down with orangish. And there was a time when people talked about ru - first they talked about reddish colors to the tail. Whereas, Ed hedges a little bit and says well the brighter part is sort of bluish to him and the rest may be a little yellowish. He doesn't quite say orangish. And frankly, what you - basically what you've got here is a big - a big cloud of dust with sunlight reflecting off of it. And sunlight is basically yellow light. So it is not completely surprising to find that it should look yellow. Now if one says it looks orange or red, one feels that this perhaps is an exaggeration - I - I'm - I - I wouldn't say for sure, I haven't been up there seeing it myself. Yellow - yellow is not a surprise, orange or red would be a surprise to me. But, you know, again - it's a rather subtle not all that bright an illumination, so colors are difficult to judge on - on rather diffuse, tenuous objects like this that are not so terribly bright.

QUERY For Neil, the early EREP on New Year's Day, what - what - what are going to be the targets, you know?

HUTCHINSON Yeah, you know I don't know exactly what they are. It's an African pass. It's a track 40 - op - pardon me track 54. I believe the last time I heard there were at least 3 mandatory sites in there that we had not gotten in the program. It is our last chance at this pass, mainly because of lighting and - it's not our last chance - I mean, if we wanted to get up even earlier, you know, we could do it. But it's the last whack at a reasonable hour based on the crew time.

QUERY Is it - what is it an ascending pass there, isn't it?

HUTCHINSON I really don't know.

QUERY At that hour of the morning, it almost has to be.

HUTCHINSON It's got to be. Yeah, I believe so.

QUERY Yeah.

HUTCHINSON Certainly it is. Because look where you are right now. I mean, you're descending right now.

QUERY Okay. On the crew request for the - the private comm, could you kind of go in -

HUTCHINSON Go ahead.

QUERY Did I understand correctly - Yeah, well, in the air-to-ground, there was a reference to that private comm do you understand the reason - their reasoning or why they - they particularly wanted this private - this conversation to be private And what is the subject of discussion and do you - have you read the ground input into this conversation that's set up for this evening? And can you just discuss that with us some?

HUTCHINSON Yeah, I - probably have a lot more data when they get on - get that teleprinter message finished which

SL-IV PC800/2
Time: 17:06 CST
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was in the process of being reviewed. I think - let me address your questions - go back. First, I did very quickly scan the comments that Jerry made about the possibility of using private comm to discuss the mission progress and scheduling and so on and so forth. I would say that the reason - and this is my own personal viewpoint - I haven't any inside dope or anything - I would say that they're - just putting myself in Jerry's shoes. The reason he would have liked to have - or he suggested it or said, hey you want to have a private comm, it's okay with me, is mainly to make sure that there isn't anything he - he's got to ki - appears to have a keen desire to get a - a viable discussion on how the mission is progressing and where we think the soft spots are in the flight planning process, and where we think they can help. And I think that he suggested the private comm merely to allow us any avenue we choose to discuss it with him. Now I don't think that there's anything in the entire subject that would warrant a private comm. And if you stick around here awhile, you're going to hear a whole darn thing discussed on the air-to-ground about - whenever they're going to do it. They teleprinted them up this long 5 page message they - it wasn't up yet, but they were reviewing it over there. And the message - let me tell you the kind of things - I mean you don't have it yet -

PAO

HUTCHINSON

We have got some out here. Okay, the kind of things it says are - it gives a status of where we are, it says some things about some of the reasons why we aren't farther than we are and why some of the premission - the numbers look like maybe we aren't so far but, we really are farther than you - than it looks, because the pre - a lot of the pre-mission numbers were based on a different context and a different amount of science hours per day. And they didn't include having to do things like have two guys run all maneuvers because the CMG broke and so on and so forth. So there's the first part of the thing is basically a status of where we are for each one of the disciplines. Like you know, it says, we've run 20 of su - X number of EREPs so on, and so forth. The middle of the message basically talks about some of the things that have been giving us a lot of trouble like flight planning, you guys know what those are. Things like continuous PT, no activities in the presleep and postsleep, or keeping them as clean as possible, et cetera. There three or four particular things like that that we address in there that - that are things that are causing the Flight Planners a tough time.

END OF TAPE

SL-1V PC80H/1
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HUTCHINSON - - is there that - that are - things that are causing the flight planners a tough time in trying to maximize the science. No split PT is another one, you know we've addressed that to them a couple of times and the crew doesn't want to split their PT up and I don't blame them, I mean, you know if I was going to a gym to work out, I wouldn't want to go work out and then go back into my office and then an hour later go back down to the gym and work out again, you know. And when possible not to do that obviously the most efficient way's to do it all at once, but you've probably heard all that stuff. But anyway there are a bunch - there's is a lot - a bunch of conversation about those kinds of things that we think, if we mutually agree that for the benefit of everybody concerned we can alleviate then we'll alleviate them and I think that's one of the prime things they're going to discuss tonight. I think also the message conveys a kind of a balance of how this flight is going overall compared to SL-II and SL-III and I think you'll find all the hokey pokey that goes on about oh- these guys aren't working as hard or whatever it is you here, nowadays and I don't know what you've been hearing because I haven't been over here but I think you'll find when you stack them up against the way the SL-III thing, went at the pace it went and the way SL-II went, these guys fall right in between the two. And you know, I think every group of guys is different and this group of guys work at one pace and another group of guys works at another pace and I think it's all going pretty well. And I think this conversation that's going to be had tonight will enlighten the crew on where they stand relative to the kinds of objectives we had before we lifted off, I think it will give them a pretty darn warm feeling about where they stand relative to the kind of performance that's been put out by the other crews that we've had in Skylab. And I think it will give them emphasis on the kinds of things that are bothering us, flight plan-wise that they may or may not be able to help us out with.

QUERY
directly?

HUTCHINSON
I can't -

QUERY
comm or they talk about the private comm requested that Phil and Dick and several others.

HUTCHINSON
Yeah, well they happened to be a team that's on.

QUERY
came down, I mean it was a thing directed to Phil and to Dick Truly directly.

HUTCHINSON

Oh, I doubt it, I don't know he might -

You know the request for the private comm requested that

Yeah, well they happened to be a team that's

Right. Well, that was not the time Channel B

Yeah, I read that.

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QUERY So I was just - I was just curious if he's going to get on the loop.

HUTCHINSON I don't know, I doubt it. I suspect Dick'll do the whole thing.

QUERY I've got two questions phoned into us, one for Dr. Henize. Any prediction in the tail length and degrees to the necked eye when we see it and when - when it will have its biggest spread?

HENIZE No predictions. When - I - I would say this though trying to give a positive steer to the general public looking at the comet, if the comet comes back relatively faint, I would then say the best time to go out and look for it is probably going to be on the ninth of January. Because if it's relatively faint, we're not going to see it to say the fifth or the sixth because it's way down in the atmosphere, just after the Sun is set and it's in the twilight. And then on the - up until the eighth we also have a bright moon, but the moon reaches - the full moon on the eight so on the ninth there's going to be a period of a half hour before the moon rises when it's probably going to be the best time of all to look for the comet if it's relatively faint. I would say on the ninth and tenth of January. Now if the comet comes back really booming and strong, it is going to be visible to us on the fourth and the fifth and the sixth. And the tail then will be longer than it would be say on the eighth or the ninth as I predict might be the best viewing. So unless it's really got up to prediction and is really booming and bright I would say the best time to be looking for it's probably going to be on the ninth and tenth of January.

QUERY Neil, I wonder (garble) do the wives or Flight Controllers or to your knowledge management have anything specially tucked away for the crew for New Year's Eve?

HUTCHINSON Not to my knowledge nothing. From any of those sources.

QUERY Any other sources?

HUTCHINSON No - no - no sources, no to my knowledge nothing.

PAO Okay, Neil thank you. Karl, thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 29, 1973
16:27 p.m. CST

Participants:

Milt Windler, Flight Director
Bob Gordon, PAO

SL-IV PC79A/1
Time: 16:27 CST
12/29/73

PAO Okay, we'll just pick up with Milt for a change-of-shift. Do you want to review what went on and then throw it open for questions?

WINDLER Well, we had an EVA, as you know and I guess you already been talking about the comet, it sounded pretty good. Probably you've already heard something about the science. We got the prime exposure on S020. Which was a 45 minute and we only got to do that on one pass, one daylight cycle I should say. We got two, well you've already heard about the 201. We got all the exposures on the T025. And the clip that was holding the material on, the cover I should say on the S230 turned out to be gone. The best speculation is that it got knocked off during the EVA. The last EVA, and you probably heard all that on sir-to-ground. But they - they were sure it was there just prior to the EVA because they were looking at it. Crew workload turned out to be very small. In fact the SPT only averaged around 730 BTU and his heart rate was almost nominal about 84. And the CDR averaged about 560 for 76 heart rate and it really was a very, very small workload. We used a bunch of TACS. We don't know how much yet. As you know in fact I told you the other day that - one time I told you that the EVA 2 was 35 to 4,000 then I said it was 4400. And now I'm going to tell you today that it was 3150, I believe. I found that when I went in today, and that's our new best guess on that EVA. And with that I'm going to tell you that we think it may be around 4,000 for EVA 3. So you can either write that number down or not, as you choose. We really of course don't know although we do know that all the TACS firings were probably real, so - so we probably are talking in the order of around 4,000. We're not sure why this happened yet, if you were listening to the EVA which you probably were. The first part of it went well. We got a few extra firings during the hatch opening. But as you know the vent that covers - ice that covers up the vent on the hatch makes it propulsive in directions that are hard to predict. So that wasn't really too significant compared to the overall part of it. The first data take really didn't use any, went just fine. First daylight pass and then we did the 201 maneuver. And that went pretty nominally, they heard the tweak - they did the tweak or really about four of them. And in fact they took out 11 degrees of roll which if anything, improved the momentum situation. And really everything seemed to be pretty nominal going LOS at Australia. And then of course the crew did the - the spacecraft did get off of attitude and they did what we asked them to do in stopping and protecting the instruments

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and realigning the attitude which they were in the process of doing when we got them. And they finished the data take and the rest of it was fairly straightforward. Now like I say we're got the data in the control center over there in the computer and trying to extract it and we've gotten the dump data back from Bermuda. So we're in the process of doing that and it will be awhile before we can tell you much about that. It was about 3 hours and 28 minutes and we are expecting them to - to give us some information on the sketch on the TV later on today. And apparently the crew thinks they won't have any trouble in doing all that, that will be about 23:30. And that's about where we are.

PAO

Bruce.

QUERY

You said 3 hours 28 minutes. How did you figure that down since I know they were out, out, did you figure back from where they were when you -

WINDLER

They told us. They - that's - they hack a clock in the MDA, and they gave us the number.

QUERY

Okay, I - I missed that. But as you say you think the 4 - 4000 about on this EVA is going to be more likely correct because you didn't have TACS inhibited like you did during the last EVA where you got the false fire in space. I guess they were registered but they didn't actually fire?

WINDLER

Yes, yes that's right, both of those two things. Okay. They should, I think the 4,000 is probably, of course the TACS does, I mean the pound-seconds per mib does fall off as we use it. But that's a secondary effect compared to this other thing you mentioned, so it's probably as close.

QUERY

Oh -

WINDLER

Closer anyway.

QUERY

When they were doing the S201 they were in the CMG - -

END OF TAPE

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WINDLER - - mentioned it so it's probably as close -
closer anyway.

QUERY When they were doing the S201, they were
in the CMG attitude hold, weren't they?

WINDLER Yes.

QUERY And the thing started to roll at that
point. What would be the reason for the rolling, wasn't the
CMG holding it then?

WINDLER Well it was, the only thing is it's at a
this funny attitude wound up around 45 - 42 or 43 degrees and
it rolled over and it's out there at a high torque, you might
say counting the gravity gradient pulling down on the AIM
section. So we did expect it to gradually build up and when
we lost, you know, when it went LOS, the rates that the CMG
had to move to compensate for this were small, the gimbal
angle changes. But ultimately the gimbal does get to a stop
and then you lose your capability and then it starts the
attitude deviating. We really thought we could get through
the whole data take. And that's one of the things obviously,
we have to go back and look at but that's - that's the
reason.

QUERY Well how much - how much roll did you get
and -

WINDLER Well we put in 54 and we took out 11 in
the tweak maneuvers. Wound up - took out 12 and put back in
1, so -

QUERY Milt did we have anymore glitch at all with
CMG 2 since we talked with you yesterday?

WINDLER I don't think so, I didn't ask that specific
question, nobody mentioned it to me so I assume we haven't
had any.

QUERY Are we going to have enough TACS to get
through this flight with everything? We were talking the
other day about what kind of margins - you gave us some figures
and you were saying that with the EVAs and so forth and
we still have a margin 6000, if we did 4000 a day, that
margin's been cut down substantially.

WINDLER Yes we got a thousand back and we used really
a thousand more than we expected for our red line was 3000,
we used around 4 so you were right. I don't think - We still
should be able to do all the experiments but we certainly will
have to look at any of them that require large angles which
right now we don't have any of those. I mean not in the immedi-
ate future. So some of the EREP maneuvers tend to get that way.

QUERY Do you have any idea how many EREP maneuvers
we're still looking at, how many we might be able to - -

WINDLER It's around 20, a few over 20 I believe 22 or
23. I've forgotten the exact number.

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QUERY That'll throw us - -
WINDLER In fact we may. I don't know if you remember
or not but -

QUERY That'll throw us considerably shorter of
the 50 we guessed at or that was projected before the mission
but now part of those were cut out by delayed launch, I
believe.

WINDLER Yes we lost some opportunities there. The new
number I believe we're looking at is around 40, I think, haven't
we done 14 to date? Is that the number?

PAO I think so.

WINDLER And I believe we get into the low 20 so
it will be somewhere close to 40 is the kind of number that
we're thinking about now.

PAO Okay? Okay, Milt thank you.

WINDLER We are doing the EREPS in a way that
makes them not cost very much either. Soon to noon, they cost
more -

END OF TALK

SEVILAD NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 28, 1973
17:36 p.m. CST

Participants:

Milt Windler, Flight Director
Louise Dick, PAO

SL-IV PC-77A/1
Time: 17:36 CST
12/28/73

WINDLER I get the impression that people that find comets are not necessarily the people that spend a lot of time studying them afterwards. Seems like to me all the - all the excitement is in the discovery.

PAO All right we're ready to go with change-of-shift briefing, Milton Windler, Flight Director.

WINDLER Okay, well today was a fairly standard day. We did a little comet thing there and of course as you know we had Dr. Kohoutek in the Control Center. We all looked at the comet on the AIM TV, and did some more work with it this afternoon. Did one medical run that went okay, as best as we can tell, of course the data won't be in until later on this evening. The crew seems to be progressing fine with the - the preparations for the EVA. And I - earlier today, I think we gave them a copy of the time line for the EVA that's fairly detailed. So, you probably all have copies of that. That pretty well explains EVA. I would like to mention one thing, some information I found out. I told you yesterday and it was incorrect. I mentioned about the experiment accomplishments that we've been doing indicated that we're pretty well on pre-mission flight line, and that's not true in the corollary area, primarily because we have not done some M509s which are - as you're very well aware of are fairly large time users. So, we are somewhat behind in the - in the corollary area, and the crew asked us last night in fact to summarize a status of all that, if you've been reading the dump tapes or the air - air-to-ground transmissions. So we're planning on doing that in the next day or two, in fact it's a - it's being worked out now. But it usually takes a while to get everything - all the right numbers and everything put together. So, we'll be going up to them with - with some discussion on that subject. And you'll be obviously seeing the results of all that. And I'm ready for questions.

PAO Louie?

QUERY Milt, I understand that the crew will - either has gotten a look at the comet after perihelion or will get one soon, would you tell us when they did that or will do it? And what they've seen, if they've seen anything yet?

WINDLER I e - I think they said on their discussion with Dr. Kohoutek they hadn't seen it since then.

QUERY But isn't there a - -

WINDLER There were - -

QUERY - - a viewing session scheduled for some time - -

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WINDLER Tomorrow after the EVA, yes there will be one then.

QUERY Oh, right.

WINDLER And that'll be our first chance. And the last one for awhile I think just due to the mechanics of the distance it is from the Sun and the instrument capabilities and so forth.

QUERY That will be the last one for some time?

WINDLER About 30 hours or some number like that, 36 something. It's not - you know a lot - a number of days, but as comets go I guess it's a fairly long time.

QUERY Is - is there anything at all tricky about tomorrow's EVA? I haven't really looked at that.

WINDLER Well, I certainly hope not. (Laughter)
The - the EVA is - is simpler than the one we did before. It's like the first half of it, you might say. You know we - we do the three basic scientific things, the 20 - the S201, the I025, and the S - the S020, which we have already done before. The - the events are about the same. The difference is that we don't expect the crew to be out there on the Sun end, which makes the control problem simpler. We do plan to operate in - essentially in TACS attitude HOLD mode, which we think will probably cost us around a thousand pound-seconds. But will protect us against a - getting into another 3 or 4,000-pound job. We did go back and look at some of the data from the other EVA. And while it's not a direct cause but we did have times when we had a couple crewmen out on the outside of the sp - the airlock - the work station, one of them at the Sun end, and another out in - working on the - the S054. So, that kind of put a maximum torque on this system at that time. We'd probably got into some - used some TACS anyway, this probably served to increase the TACS usage somewhat, that's - -

END OF TAPE

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WINDLER -- We'd have probably got into some - use some TACS anyway, this probably served increase in TACS usage somewhat, that's what I think we've already said. So we don't have that part of it. We're going to get some samples business and it's pretty straight forward. We're going to do that during the night as that's a low priority type thing.

QUERY Has there been any glitch of any kind with CMG 2 since you told us - since the one yesterday?

WINDLER No, not that I'm aware of anyway. Sometimes they discover those things after you leave. Right now there haven't been any. My mention the roll is great, I think I've already said that it's - the other time I believe it was 15 degrees and it's about 54 degrees this time. That's the - you know the shade of the instrument, the S201 instrument.

QUERY A couple of questions, Milt. One which you probably can't answer but I'd appreciate a try. You talked about putting the maximum torque on the spacecraft when one man was working at the Sun end and the other at the workstation. Could you give me any kind of feel for it, any kind of numbers or push in terms of thrust or any other - - ?

WINDLER No, it depends a great deal on, you know, how he is. If he's at 90 degrees to the ATM, it of course, has one lever arm and if he says some other angle, it's a different effect on it.

QUERY So what was the thrust you estimate?

WINDLER And, I don't know, people at Marshall do that some of those numbers that they've been working on, but I don't know what they are.

QUERY Could you explain that - explain that TACS ATTITUDE HOLD? Does that mean that all of the maneuvering will be done using the TACS thrusters?

WINDLER Basically yes, we're going to use the TACS thrusters to maneuver the spacecraft and to relieve the stress on the CMG's. And we're going to - except when we're doing the date take which is essentially is on the two - we expect it to be any the way, two orbits on the sunside or two - parts of two orbits while the spacecraft is on the sunside. And then we're going to use the CMGs because that's a more accurate pointing method. And this is, of course, not too dissimilar to what we did before and we didn't have any trouble in during that part of it. We're had our problems later on during the dump maneuvers and we're not going to do those this time.

QUERY Milt, was that crew position on the last EVA providing a most torque in the vehicle maneuver, was there any movement also due to suit out gassing and leakage from this?

WINDLER We really don't think that's too -

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that was too significant from the little water leak. By the way I guess y'all aware we checked that out, maybe I said that last night but they checked that all out and it works okay. It primarily was due to the gas, oxygen out flow. It could have been worse, I could have two guys up at the Sun end but this was close to the most we could have gotten.

PAO Anymore questions? There's one that was called in, now if Dr. Kohoutek considers the visual observations so important during this period, why won't MCC let the crew make the maneuver to see the comet from the window without the solar pan - panels blocking the view as Ed Gibson requested.

WINDLER Well I don't know how much importance he puts on visual observations as opposed to putting instruments on it. I think there's got to be a big difference in those two and the real data comes from getting photographs or not photograph - well you know data takes. And the - there's a lot we don't know about - just how to calculate those maneuvers. We could do it and we are looking at ways that the crew can see it better, but really the scientist have lead us to believe, in general, that the - that's there's not that much importance in visual ops. And I'm not so sure that he implied that there was all that either, in his discussion with the crew. He was interested in what they had to say of course, but he's going to be much more interested in people are, the scientific community is, in the data, the hard data.

PAO All right, we have this picture of the crew talking with the Kohoutek taken over the TV monitor. It's out at the QUERY desk, if you haven't picked it up. Thank you very much, Milt.

END OF TAPE

NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
December 27, 1973
4:59 p.m. CST

Participants:

Milt Windler, Flight Director
Guy Jackson, PAO

SL-IV PC-74A/1
Time: 16:59 CST
12/27/79

PAO Okay, we're ready to start today's change-of-shift briefing. And Milt I feel it's going to be more productive than the last briefing we had this afternoon, when we didn't get to see the Comet Kohoutek.

WINDLER Well, sorry about that I was looking for it myself. I - but presume they will bring it - television back from MILA and it'll be on there. I'm sure you heard the crew describing it anyway. That's a - it sounds like they really had it. We had a little bit of a breakthrough today the commander asked us to give him some extra work to do. He said he got about an hour ahead of the Flight Plan, and - and so we did give him a small amount and he can go to the shopping list and do that. But they did call down also and ask us to reduce some of the time that's required. So maybe that forbodes good things or something, we'll be able to reduce some of our other - our activities and - and get to where we're accomplishing a little bit more science. We're - today was nothing - I don't - well there's two eventful things, I guess in the way of hardware as far as the crew was concerned they pretty well operated on the time line day. The star tracker has got an anomaly in it. Apparently the outer gimbal - I can't think of the word now, the thing that transmits where the gimbal angle is - is not working. Somebody tell me what that word is? Anyway it's not working either on the ground or - or on the crew's panel. Same instru - sensor, so until we figure out how to work on that right now, we are not able to use the star tracker. And this primarily affects the ATM, but we can operate in a - in a little bit of degraded mode without it. And the CMG number 2, exhibited another one of these litt - little transients where the current went up. And one of the gimbal temperatures went up. And the unusual thing about this one is that I told y'all yester - several unusual things. One is I told y'all yesterday it hadn't happened except during the EVA. And here lo and behold it happened a day later. Also, th - it occurred when we were not maneuvering, this is a - one of the few times if - if not the only time that - that there hasn't been some maneuvers involved in one of these. So, I guess this is kind of renewed our determination during the EVA to avoid stressing them. And I might make a sidetrack here to say that the prime attitude control mode that we're considering for the EVA is to - is to fly around in TACS attitude HOLD mode with the CMGs CAGED, so that they're not being stressed, except when we're doing data takes. Some of which of course are long, there's one that's 45 minutes. Basically, during most of the sunlit part of the orbit we would be in the CMG mode. But the rest of the time we'll be in TACS ATT HOLD. And this reduces the possibility of us getting into unusual control situations

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that we did last time because instead of the vehicle maneuvering to dump the momentum like it has in the past why, it'll be a constant attitude. So it'll take one of the unknowns away. And of course it doesn't - as I said already it doesn't stress the CMGs. The EVA - last EVA period cost more TACS than I indicated yesterday. Our final number on that is 4434. Yesterday I said it was between 35 and 4,000 so it wound up being about 4400. We are pretty well converged on the EVA for Saturday, looks like it'll be about 3-1/2 hours. We plan to - it'll be similar to the one we did before with the exception to the ATM work. The hatch open time has been set up on the Flight Plan anyway to be 17:30 which is somewhat later. But it's in accordance with the time that the crew has really been opening the hatch anyway. And we plan to go out somewhere close to sunset although that's not mandatory, get the gear set up, and at the next sunrise we bore site it, take the data on the S020 and I025, which is - the I025 exposures are just about the same. Probably take us most of the daylight pass to do that. The next dark pass we'll do the maneuver which is about 50 degrees, in this case for the 201. And then we'll do the 201 data take during the next front side, the next solar pass - sunlit pass. And that'll probably take most of that rev and when we get through doing that we would get the gear back inside and terminate the EVA. We - -

END OF TAPE

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WINDLER - Make the most of that rev and when we got through doing that we would get the gear back inside and terminate the EVA. We are going to do on a noninterference basis, you might say some sail material return and some little odds and ends of engineering samples. We plan to do those on the night passes where they don't interfere or extend the EVA. If they cause us to extend the EVA why we'd - we'd not do those. And that's about where we are. The PLT will - will be inside, the SPT will be aiming the instruments and the CDR will be outside with him - helping him.

PAO Ready for questions.

QUERY I have several Milt, starting back with the star tracker anomaly, you said it will effect the ATM and it'll mean operating in a little bit of a degraded mode. Just how much degraded mode, and what types of instruments, I don't really need a real detail, but, I mean, how degraded is it?

WINDLER Well, mostly it's - it's difficulty in - in working with the - with the data after the fact because we use the - the data from the star tracker to give us accurate pointing indications. But they can take the - the pictures that they get and correlate them to the ground pictures and - and evaluate it in that fashion. But it's - there is a little bit, and I can't put any quantitative value on it, but there is a little bit more uncertainty involved in doing it that way and they prefer to have this accurate - more accurate pointing.

QUERY Okay, the next thing on the CMG, as you say couple of things unusual because it wasn't during a EVA - -

WINDLER It wasn't doing any kind of a maneuver. Most of them have happened during dump maneuvers in the past.

QUERY Okay. I know at one point in time, and I don't know how early in the ball game this was with the problem CMG 2. We'd been told that they didn't seem to be associated with maneuvers, and I guess they - they must have later become so because, I know early in the game we were, at least my memory recalls that they said they were not. But if it didn't occur during a maneuver or anything else does that tell you then that you know even less than you thought you did about this CMG problem?

WINDLER Well, I don't know, that's probably basically true. Certainly we don't - we don't understand exactly what's going on in the CMG. We still think we're doing the things that are required to minimize the - the stress on it. And - and I think probably you're talking about pretty early in the game, we may have said that they weren't associated with the bigger maneuvers and it didn't seem to be. But then as they occurred with more regularity it became apparent that they were associated with - the time when the temperatures were at the low end of the - of the cycle and during the maneuvers. And I

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wouldn't know for sure whether both of these two things had to happen or not. I think usually they did, I'm not sure they always did though. And today - and I also point out to you that the - that the temperatures were relatively high today when we had this higher current, they were up around 76 degrees, which is pretty close to the 78 or 80 degrees that we try to manage the heaters to, the maximum. So we were at the high end of the scale.

QUERY

WINDLER

Does that indicate that - -
However, let me say one other thing about it. The current increase wasn't, it was about 1 - the current went to 1.03 and that's more than it usually is. But 1.05 or 06 is a fairly - is a strong current increase. So we had sort of another one these medium increases I would call it, I guess.

QUERY

Does that indicate then that maybe the - the heater management on the bearings is maybe not as effective as you'd hoped? And the second part to that - -

WINDLER

I hate to speculate too much on that since this is only the first time we - as I said yesterday the - the cycles were or the glitches were coming at about 1 - 1-day intervals there just before we started the heater management and we hadn't had any for about 4 days and now we've had a couple in a - let's see - today - it was yesterday - yesterday wasn't the EVA, I guess it has been 2 days apart - so. We just have to watch it and see what it - how it acts in - in the future here before we can say too much about what's happening now, and whether the heaters are still effective. We plan to continue doing it.

QUERY

And lastly, you - you yesterday expressed a great am - or a fair amount of confidence that heat - that the CMG 2 would still be around at the end of the mission. Do you start having nibbling doubts today?

WINDLER

No, I wished that - that that little anomaly hadn't occurred today though. But I still feel like it'll be with us. Course that's -

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WINDLER - - continue doing it.
QUERY And - and lastly you - you yesterday expressed a greater - a fair amount of confidence that the heat - that the CMG 2 would still be around at the end of the mission. Do you start having nibbling doubts today?
WINDLER No, I wished that - that little anomaly hadn't occurred today, though, but I still feel like it'll be with us. Of course that's - you know, it's a piece of hardware. It's worked pretty well so far but you never know what's going to happen to it in the future.

QUERY Milt, did they ever settle the day off question for next week? Are they going to go first or the second?

WINDLER Well, we're pretty well homing in on the second now. It doesn't look like we - the crew gave us some options and we're still thinking about these. But it looks like the - the first is not very desirable from EREP point of view and some other things. So, we'll probably just go ahead with the second.

QUERY And what - what time will Mr. Kohoutek be in the viewing room, tomorrow, to talk to the astronauts?
WINDLER Let's see, 21:09, isn't it? That's the time I think the real-time pass is.
SPEAKER 3:08 or something like that.
SPEAKER Central standard - -
WINDLER Yeah, okay, yeah, a little after three.
QUERY Okay - -
WINDLER They can tell you more about that than I

can.
PAO You get that?
QUERY Is there TV?
WINDLER Yes there is. There's live TV at that time,

from the crew.
(QUERY And Milt, tomorrow's the halfway point in the mission. Wonder if you could kind assess for us the - the general attitude and performance of the crew right now, and how the - how the spaceship is performing and you - your odds on that it will go all the full 84 day?
WINDLER Well, I still think - let's start with your last question first. I think the odds are very good that we're going to complete the mission for the 84-days, both from a hardware and a crew standpoint. The crew appears to be stable to me. There are, you know, some things that they've asked us to do from a flight planning standpoint, that - that causes us to spend a little time. There are other things that they do that - that are quicker or takes less time than some previous crews have taken. I think it's obvious that - that the total science level right now is - is not quite as high as that of the Skylab III crew. However, I think we're getting good quality science from them. And we're getting the

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expected pre-mission type quantity. And I guess I don't -
I really - personally, I don't look for any great changes
in the - in the workloads or anything like that. I think
probably we're operating at a plateau, we may tweak some
things up. Although as you well recognize, we are - every
once in a while we do something new for the first time and
we get that behind us and then we can decrease the - the
amount of time that it takes to do it. So that occasionally is
still happening, but there's not too many of those things left.

QUERY
the multiplexer problem?

WINDLER
Yes, we really don't know too much more.
We checked some other things and sent some more data down
to St. Louis, but we don't really know any more about that.
That's - -

QUERY
Just how much - -
WINDLER
a - more of a nuisance type thing.
QUERY
Just how much is your data degraded by
this thing?

WINDLER
I - I guess I really don't know how to
answer that. It's - it occurs in - in multiple parameters
and - or many parameters. And I - I couldn't be looking for
- it's not a serious here hind - hinderance to us, no.

QUERY
Is Marshall or any of the contractors been
able to duplicate the CMG transients, in - in any of
the ground test that they might be doing? That might be
anything similarly like you had in flight? Are they doing
this to begin with?

WINDLER
I don't know the answer to that. I - I'm
not aware of any, but a lot of that early CMG work went on
while I wasn't around and - and it could have been some
reports on that. And I really - that they made earlier -
the engineering data. Usually that comes in right away
and I missed some of that, so I - I really would hate to say
one way or the other on that.

QUERY
I didn't necessarily mean pre - pre-mission
data, but - -
WINDLER
But since that time.

QUERY
Yeah, troubleshooting they've done of the
ground since?

WINDLER
I know that they've done work on the heater
cycling and - and on some other - other potential techniques.
Exactly how much they've done I don't know. But they are -
they are doing some. And like I said the heater cycle was
a direct input as a result to some test work that was done.

QUERY
Milt, what is JOP 18C?
END OF TAPE

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WINDLER They've done, I don't know. But they are - they are doing some. Like I say the heater cycle was a direct input as a result to some test work that was done.

QUERY Milt, what is JOP 18C? I don't remember that one coming up before. I know 18D, but I'm not sure what 18C is.

SPEAKER Well, we run through the JOP, you know, and they've sort of in a degree of how far away from the Sun you have to point the ATM in order to get the comet. And A is the closest and D is the furthest away and C is one of the intermediate ones. And it's one - it's one where it's pointing -

QUERY That's just a degree?

SPEAKER Yes. Okay it's a fine maneuver essentially. Instead of having to do a big maneuver and then a little tweak. We just do the small tweak.

QUERY Will we be doing unattended ops of perihelion in the morning?

WINDLER Oh, I'm sure we will. We do unattended ops whenever - whenever the crew isn't there, so we will be.

PAO Milt, I have a question from one of our listeners at the Cape. Would you evaluate what has been accomplished during the first half of this mission compared to what was expected in terms of science, crew performance, and hardware performance, and give any statistics available.

WINDLER Well, I can't give you any statistics I don't believe. Although we - there are some available. I probably almost answered that. The basic crew performance as far as science is concerned, I think, is just about even. In most cases it's actually slightly above the - what I would call the flight plan nominal. Each flight plan has got a - a - an estimate of man-hours or science-hours, crew-hours that you'll spend doing various categories of things. And we have these in each of the four or five major experiment areas, ATM, corollary, et cetera. And on almost all of these they were ahead of the so called nominal flight plan curve. I think we just got spoiled by Skylab III. And we expected to get further ahead than we - than we because of Skylab III than we are able to on IV. But we are still at least getting what we intended to. The - my impression of the hardware has been kind of different. It hasn't done exactly what I thought it. On Skylab III it seemed like to me that we had problems when the hardware was started up again. And these all tended to go away as we used it. In Skylab IV it seemed like that there wasn't really start up problems, but - but we've had occasional

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problems with - with the gear after the initial activation period. I guess it's more like what you would have expected in the very beginning of the Skylab period, just a gradual series of difficulties with the gear. Of course we've been able to work around most of these so far, but it's getting more interesting every day.

PAO Any further question. Okay thank you
Milt.

WINDLER Let me make one other statement here. Several times people have asked me about numbers about the TACS. And some numbers were calculated today based on the recent TACS expenditure. And we think we can do all the science that - that we have the time left to do, comet observations, ATM, EREP observations, et cetera. And do the EVA Saturday, and do the one at the end of the mission and leave ourselves rescue redline, and still have about 6,000 pound-seconds left over. So that - that was a number I didn't have until today. But that's the kind of margins that we're talking about. Now - Paul isn't here today, but we're part of our redline is - is dedicated to EVA and based upon what the - the studies showed on the EVA we're planning now. And the actual results from the EVA Saturday we will be updating our EVA section of the redline. So - so our redline of 6,000 pound-seconds is liable to - to go up or down. Probably not likely to go down, but we may increase it if we feel like that's the thing to do, based on our actual experiences. We certainly don't have 4,000 pound-seconds in there for the EVA.

QUERY Milt, that raises I guess another question that I wanted to ask about Saturday - -

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WINDLER - will have 4000 pound-seconds in there for the EVA.

QUERY Milt, that raises a - I guess another question that I wanted to ask about. Saturday with the TACS only attitude control, will that entail more TACS firings than say going CMG only, but it reduces the stress on the CMG. I'm not exactly sure what your trade off there is.

WINDLER Well, the - the normal mode would be to fly CMGs and do nominal momentum dumps or momentum cages. That theoretically uses the least number. It also is the most sensitive to problems, and we are not going to do that method. And I can't tell you exactly what the - the penalty we're paying for is but you're right, there is an increased cost there. And we're considering a couple of different - slightly different attitude hold modes. And we're are making runs on those right now to see the differences in those two. And one of those two further protects the CM - in fact one of those two protects the CMGs from stress and the other one really protects the overall attitude of the vehicle and gets us out of this atti - big attitude excursion we got, but does not protect the CMGs.

QUERY You don't happen to know any ball park figures on predicted TACs use do you?

WINDLER No, I've given up on that. And we've been trying all day to get everything set up to make that run and they - they should have it this evening. But they did not -

QUERY Do you think they could give it to us by tomorrow by any chance?

WINDLER I sure hope so.

QUERY Okay.

WINDLER I hope it's available when I come back tomorrow morning. I would like to have had it this afternoon.

QUERY Well, I wasn't around during the last EVA, but when you had those maneuver excursions and you fired quite a bit of TACS to try and get straightened out again, wasn't the CMG stressed pretty heavily there in all that operation?

WINDLER Yes they were.

QUERY And you didn't see any - see any problem then.

WINDLER Yes we did - we did have an anomaly during that - or right after that period, yes.

QUERY Did you? Oh, right after that.

WINDLER Yeah, a combination of that and then right after that we did the comet maneuver which involved a series of small tweak maneuvers to shade the 201 and bo - at - right after both of those - those two came fairly close together. And right after all that happened we did have a s - a higher current et cetera in the CMG.

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QUERY
you say that it's the SPT and the CDR who go outside on
Saturday?

WINDLER
QUERY

Just want to doublecheck something. Did
And PLT stays in. Okay.

Yes.

And PLT stays in. Okay.

END OF TAPE

SKY Lab IV

Vol. III

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Skylab IV Post Recovery Briefing
Johnson Space Center
February 8, 1974
12:00 p.m. CDT

Participants:

Dr. James C. Fletcher, NASA Administrator
William C. Schneider, Skylab Program Director
Kenneth S. Kleinknecht, Skylab Program Manager, JSC
Leland P. Belew, Skylab Program Manager, MSFC
Phil Shaffer, Flight Director
Alan B. Shepard, Rear Adm., Chief, Astronaut Office, JSC
Dr. W. Royce Hawkins, Deputy Director for Medical Operations, JSC
Col. Alan R. Vette, Director, DOD Manned Space Flight Support Office
William J. O'Donnell, Public Affairs Officer

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TIME: 12:00 CDT, 05:17:00 GMT

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FLETCHER Well I - I would like to read something from the - President Nixon to the astronauts before I begin. This was just TWXed to the ship. "On behalf of the American people, I salute the third crew of Skylab astronauts on your safe return to Earth and on your successful completion of man's longest space journey. Your mission has brought to an end one of the most scientifically productive endeavors in the history of human exploration. Skylab now joins the ranks of the Santa Maria, The H.M.S. Bagle, the Spirit of Saint Lucas - Louis and the Eagle. Each of these great vehicles has carried us beyond the contemporary limits of human knowledge into a new comprehension of our own possibilities and a new definition of our own destiny. We welcome you home and we salute you and all your predecessors who have launched us on this great adventure." Signed Richard Nixon. This is a most historic day and I don't need to tell you it has great meaning for all of us. Naturally, those of us that have been directly involved are terribly disappointed that because of no network coverage at splashdown, the world could not share this experience with us. Everything that we have done in the Skylab Program has been necessary for future progress in space. And the Skylab experience has confirmed that we are really on the right track in proceeding to develop the Space Shuttle and its spacelab manned module for use in the 1980's and 1990's. Skylab in all its aspects has demonstrated that this nation is capable of conducting broader and more useful beneficial activities in space that directly relate to our own planet Earth. It has served us well as a true orbiting research facility. And namely our astronauts to carry out a wide spectrum of scientific engineering and biomedical studies. To appreciate the broad capabilities of Skylab, we should take note of President Nixon's landmark speech on this space exploration which he made on March 7, 1970. In that speech, the President stated that three purposes should guide our space program - exploration, scientific knowledge, practical application. Surprising as it may seem, Skylab and the Skylab men have accomplished simultaneously all of these purposes. It was also said that we must see our space effort, not only as an adventure of today but also as an investment in tomorrow. And that space activities will be a part of our lives for the rest of time. Skylab has shown the way. In a very real sense Skylab can be considered a turning point, for while it was basically a experimental space station, it nevertheless possessed many qualities and ingredients that will characterize operational missions for the future. It has moved the space program from the realm of the spectacular into a new phase that can be characterized possible as almost businesslike if not yet quite

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routine. Now even the splashdown portion of it was not exactly a routine today. The investment in Skylab has contributed to an orderly transition from the Apollo era, the 60's to the space - rather the shuttle spacelab era of the 1980's and as continued U.S. leadership in man's space flight. We have clearly - clearly demonstrated that man can perform valuable services in Earth orbit as observers, scientist, engineers and repairmen. Skylab has given us a wealth of new information about the dynamic processes of the Sun and how this effects all of us here on Earth. It's provided new evidence of the value of Earth observations from space, helped us defined the feasibility of making new products in zero gravity, and has stimulated interest of international cooperation in space. I must say 271 days is a long time, but that's how long it's been from the first launch of the Skylab orbital workshop. And to all of us it's a significant step in the long term duration - long term flight in space. All of these returns from our Skylab investments are impressive and I should point out, the returns are not all in. We will be hearing much more about what has been found in the months ahead. Indeed, we will all be living with Skylab achievements for a long - long -

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FLETCHER - we will be hearing much more about what has been found in the months ahead. Indeed, we will all be living with Skylab achievements for a long, long time. Thank you very much.

PAO Okay, ladies and gentlemen, we have with us today the Skylab team. Beginning from my right, William C. Schneider, Director of the Skylab program. Next to him is Kenneth S. Kleinknecht, Skylab Program Manager here at JSC, Dr. Royce Hawkins, Deputy Director for Medical Operations, JSC, Mr. Leland Belew, Skylab Program Manager at the Marshall Space Flight Center, Admiral Alan Shepard, Chief to the Astronaut Officer here at JSC, Flight Director Phil Shaffer, and on the far end, Colonel Alan Vette, DOD Manager for Manned Spaceflight Operations. Bill, you want to open with a statement?

SCHNEIDER Well, as you know, Skylab IV just had a most successful completion of their mission after 84 days and 1 hour and 16 minutes, and Dr. Love told me we were 8 seconds late in our splashdown. But that marked the completion of what I consider the historical phase of Skylab after 271 days of useful work in orbit. And now we begin the science phase of Skylab. And for the next year - next few years, I should say, there'll be just as an intense effort - probably not as visible to you folks, but probably very meaningful examination of all the data that we've brought back. And as we've said, that's the pay-off of Skylab, that was the reason for Skylab, and it has been successfully completed - our portion has been completed. The Science phase has just begun. Let me take off a few things that happened during Skylab IV in the area of accomplishments. We had planned 30 EREP passes, and we achieved 39. In addition to that, we had about - we also had planned 2 solar inertial passes, and we completed - we completed four. In the ATM, we had planned 350 hours of - of solar observation, we actually completed 338. The Comet Kohoutek had 13 obs - separate observations by the ATM and 111 observations by the other instruments. We did all the major medicals; and incidentally, we spent more hours on major medicals in Skylab than we had on any previous mission. The corollary, we batted a hundred percent, we had 28 planned and we accomplished 28; same with the student experiments; and the same with ETOs. We actually achieved exactly what we had planned. In the ATM world, I understand the ATM scientists are particularly pleased because during this mission, we were able to catch a flare right from it's initial phase right on through. All previous flares, we caught sometime during their build-up or fall-down. This one we got the thing from birth through death. Turning then to the entire program, which, of

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course, this also marks - Let me - let me tick off a little bit of statistics, and as I said, statistics are meaningful only in this historical phase. As far as duration is concerned, if you go back to what we had said we were going to do back before the May 14, we'd planned on 241 - 240 days in orbit. We actually accomplished 271. Of the m - that time we'd - we'd thought we'd be planned for 140 days, we actually did 172. In the science world - and incidentally, in - we did something of -

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SCHNEIDER - planned for 140 days, we actually did 172. In the science world, and incidentally we did something unusual in our mission planning, something that is unusual for us. We were not ultra conservative. We thought we were being quite bold. We thought we were scheduling our premission flight plans more fully than we expected to be able to accomplish. The ATM world, we planned on 565 hours and we got 755 hours. The medical world, we had planned 701 hours and we got 822. EREP, we thought we would be lucky if we got 60 passes. We got 90 Z-local vertical passes plus 11 solar inertial passes, almost 60 percent more than we had in our fondest dreams. Technical experiments, we had planned 264 hours, we got 294. Materials investigations, we had 10 or them planned. We actually did 32 separate investigations. Astro physics, we had 168 planned we actually did 412. Even in the student investigations we had thought we'd get 44 of those operations, we actually got 56. If you look at the percentages they range anywhere from 320 percent of what we had planned to well over 100 percent in the worst ones. So I can say we certainly were able to - through the hard work of a great number of people - achieve what more than we really had expected. I received a great number of questions in the last week asking me what I thought the greatest achievement of Skylab was. Skylab has been a multidiscipline facility. And it's been a something different to each individual. Each discipline, each scientist has looked upon Skylab as having meaning in a different area. As far as I'm concerned Skylab's greatest - greatest achievement was to prove beyond a doubt that there is no limit in our space research that just like anything else that America sets out to do, the limit is only our resolve not our ability to do work, not the ability of men to work and not our technical knowledge.

PAO

Okay, we'll take questions.

QUERY

Dr. Hawkins, what do you think of the crew when your first - quick information that you have, and are you now willing with - with the condition that they appear to be in, to say anything about a one to two year mission?

HAWKINS

Well, I'm elated with what I've heard. I wish that we could all seen this exit this from the spacecraft on this certainly monumental occasion. But they did sound great. Their voices were strong and by their own admission they did feel good. You I think heard about as much of the commentary that I did. But they were shakey. I don't know that they appeared to or sound to be worse off than what we saw with the Skylab III crew when they returned, if you can remember how they looked. I would imagine that this crew

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looks very - very similar. I'm delighted with the initial re - medical reports that we have from - from the command module. And I still reserve the right to answer the last question until we've had a chance to look at some of the cellular levels on the samples that we bring back.

QUERY Is this the first time that they have recovered the apex cone, if they did; and what use would you make of it?

SCHNEIDER I don't recall whether we recovered - we did get at least one apex cover in Apollo. We have no plans to make any use of it. We didn't need it; it's - was available and they recovered it. But we have no reason to believe there is anything wrong with it, obviously people will look at it.

QUERY Could you tell us some of the things that you have done on this flight that will be useful on the Space Shuttle. Some of the experiments that were planned to give you information, and were there any -

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QUERY Could you tell us some of the things that you have done on this flight that will be useful on the space shuttle? Some of the experiments that were planned to give you information, and were there any that you planned that would aid you on the ASTP?

SCHNEIDER Well we had a great deal of activity go into what we would call habitability, and that will provide a great storehouse of knowledge of how to best build a machine for the future, both shuttle and any space station that might come on beyond. And from a ASIP standpoint, why, we both use the command - the same command and service module. I do believe they will probably use some innovation of our flight planning practices, and we do have a materials processing experiment. Lee, you might add to that you can. We have a materials processing experiment that follows on with the one we had. I must confess if I'm a little vague about ASTP, it's because I haven't been looking at what they've been doing for the past year.

BELEW Well, there is an experiment on ASTP that follows the Skylab materials experiment. Actually there's two. And we do feel that that will - especially one of them will be a step toward proving some technology that's needed. It's - before we go all out for something on say shuttle. To elaborate a little bit on your overall question; what we really did gain in an overall system sense out of Skylab, that will to apply to say, the shuttle, is the systems that we functioned, the attitude control systems, power systems, and the life support systems, and the coolant systems, especially for experiments. They do span the spectrum that I feel proves without a doubt the operability of it over a long duration, that will be a direct feed in to shuttle, and shuttle payloads. It's eliminated I think a great deal of concern that one might have had we not had the Skylab-type mission.

QUERY How about a rundown on the post or the unmanned testing of Skylab. The CMG 1, and so forth.

BELEW Well, on the post Skylab testing, the tests that have been conducted that give us some results to date are those that were run at the very end of the manned mission. That's on some battery tests. On our battery systems, we have two major systems. One on the ATM and one on the airlock. And those tests showed a very favorable trend in the batteries that are in the airlock. The battery's life looks extremely good. Better than we'd hoped for. And the ATM, they looked as we had expected. We handled those two systems somewhat differently as far as what they received before we sent them up. For instance, the batteries in the airlock were new. The ones in the ATM, we had used through

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a great deal of our test program. And that two - having two types results there gives us a great deal of information on this type of system. The other engineering tests are just under way. The one that we have a bit of information on is the spinup of our CMG number 1. It began looking like it might be following the right curve as far as the current that one would have. We have the footprint of the first startup and we plot it, we were tracing the results of this one. It looked pretty good for an hour, but it now looks like it's kind of not acting just right, so I wouldn't predict too much on that one. The other engineering tests are just underway.

PAO

Mary.

QUERY

I have a question for Admiral Shepard. Since you were the man that started this whole thing off, and you had a, I believe the time was something in the order of 15 minutes in space, could you give your thoughts on did you think this day would come that you would have an 85-day mission? And what you think the astronauts per se, not technology, I don't mean that, but the men themselves have accomplished during this span of time?

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QUERY - - nauts per se, not the technology, I don't mean that, but the men themselves have accomplished during this span of time.

SHEPARD Well I think, certainly Mary that you partially answered your first question in that back in '59 and '60 when there was a great deal of cynicism about men in space, that we found it difficult to believe that we would have made the strides that we've made in this short period of time. I think that we've accomplished certainly much more than even the most optimistic of us would have predicted at that particular time. And I think that certainly along those lines, we have reached a sense of maturity which is heartening to us in some degree that we have been able to do this. In the short space of time that we've been able to demonstrate already, some of the spin-off and fall out that has started to effect the social structure of the country. But at the same time, it's disturbing that since we have reached this sense of maturity that its becomes so blase that we didn't even cover the last landing of this fantastic Skylab program live on television. With respect to these accomplishments, I think that certainly the majority of them have been accomplished by the fact that man has been the factor in the loop. Not only the crews in the spacecraft but also the crews on the ground have been able to bring their exercising judgment - exercise their judgment in engineering to bear on the problems that have occurred. I don't think that we would have been able to make the progress that we had that we now have the imaginative and the flexible element of man with us all the way through during this time period.

QUERY How much of a problem - how much of a worry was this propellant leak this morning? And since something similiar occurred on the second mission, does this give you any thoughts about this system in general that you're thinking about make any changes?

SHAPFER The first part was a leak in the command module RCS system which is a system that provides attitude control during reentry sequence. That system is completely redundant, so the first concern is the loss of redundancy and the sensitivity to a subsequent failure in the other system. The second level of concern is that fact that those propellants are toxic. And we had some special procedures that we wanted to relay to the crew to protect them from the toxicity as much as we could. One of the things that was new this time that we didn't have for the two previous missions was ARIA spacecraft - the ARIA airplane off Japan that covered the deorbit maneuver. And that vehicle came in very handy because it allowed us to relay that information to the crew prior to entry. I don't think we

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know yet, what the actual leak was. Whether it was the helium which is used to pressurize or whether it was actually one of the propellants. But that system is contained in the vehicle that we have recovered. So it will be able to find out specifically what the failure was. Alan do you have something you want to say.

SHEPARD That was what I was going to say, Phil, exactly.

SHAPPER

Okay.

QUERY For anyone who would like to take a crack at it, I would like to know what's left for man in space? Decoupling budgetary and political things from it but just some on - on pure basis, what is there - what is there left now for man to do in space?

SCHNEIDER I'll take a crack at that. That's what I meant when I said it's only rational resolve. We have shown that no man or machine limitation on whatever we want to do in space. I believe our Royce is a little more conservative than I. But I think eliminating budget problems, I think we have shown in Skylab that man can work in space. He does useful work in space, and there is useful work to be done up there. And we've shown that there's no man restriction on shuttle or space station or anything that we want to do beyond that.

QUERY I know there's no money in the fiscal '75 budget for another series of Skylab missions, but is this being considered at all since you have most of the hardware you need?

SCHNEIDER

No sir.

QUERY Think it will be opened for consideration now that this series was completed so successfully -

END OF TAPE

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QUERY - - being considered at all since you have most of the hardware you need?

SCHNEIDER No, sir.

QUERY Think it will be open for consideration now that this series was completed so successful.

SCHNEIDER No, sir, I do not. The equipments that we have been using in Skylab will gradually be phasing into the ASTP and Shuttle Programs and once that begins to happen, why, we will have essentially no capability to reactivate. We are holding to things until June. That's - because that's when they begin being needed for the Shuttle, and after that, there will be no equipment available.

QUERY Even though the men now have left Skylab, and even though the tests have been complete, the mission in a sense is still going on. I think people would be interested in knowing the future of the workshop, roughly how long it will be expected to stay up. How long it will function, and how valuable its function will be?

SCHNEIDER We have, as you heard earlier, a series of engineering tests that are planned for the next 22 hours, I believe, or something on that order, which are designed to bring back to us as much engineering data as we can out of Skylab as it remains. At the end of that, we will put it in to what we call a gravity gradient mode, and we will turn off the lights and turn off the switches and turn off the CMGs and let Skylab drift. It's anticipated that it will remain in orbit about 10 or 11 years.

QUERY Related to that, I heard several references the last couple of days about a possible revisit to Skylab with a time capsule being left in it - that sort of thing. What do you have in mind?

SCHNEIDER Well, we've just left it such that if, in the event the Shuttle comes along and we go up there and we can redock and revisit if ASTP has an alternate mission, why it too can go up and dock and revisit. We do not think that there is a high probability that if you tried to turn the systems on, they would turn on, but we think you can very easily, very probably be able to dock and reenter. And that's why we left the package, the materials they have to bring back to see what long term exposure in space is. Currently I'd have to say there are no active plans that I know of by anybody to visit Skylab.

QUERY Mr. Schneider, since many of us feel that we have ended an era in certainly dynamic exploration, where we've had progress in manned space flight year after year, and now we only have the ASTP, which is a brief mission and shuttle. How soon do you think that we will be able to get underway with an equally dynamic manned exploration program, in which we have things above and beyond what we've done and equally dynamic with the past, say, 13 or 14 years?

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SCHNEIDER Mary, you'll forgive me if I don't know the dates on the Shuttle, because I really don't. But I'll say I don't look upon this as the end of an era, but as the beginning of an era. I think we've shown in Skylab that what we've been saying on Shuttle is true. We are going to make space into another dimension that man is going to use profitably. He's going to live and work up there. And with Shuttle, we're going to make that easier than it was on Skylab.

QUERY Has there been a ballpark figure on the numbers of Earth photographs you have.

SCHNEIDER I've seen those numbers. Many, many. If you'll excuse me just a minute. Is this it? Let me - ATM, it says we have 182,842 frames. I hope they're all good, too. EREP, it says we have 40,286 in 190A, and 190B has 5,860, and we've got a great deal more film than that that's coming down, so that's just a beginning. Now, also, interestingly enough, we have 238,600 feet of tape, which, off of the EREP. So there's a great deal data that will be coming down. That's what I mean when I say this is the beginning of the scientific phase. It will take the scientists a great deal of - -

END OF TAPE

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SCHNEIDER - - will be coming down. That's what I mean when I say this is the beginning of the scientific phase. It will take the scientist a great deal of time to look at that data and to bring out of it all - all that it's worth.

QUERY Those were total Skylab. Not just this past mission?

SCHNEIDER

I'm sorry, yes.

QUERY Dr. Hawkins, now that the mission's over and keeping in mind that there were a few very evident problems at the beginning and lack of training on certain medical things, and all that kind of thing. To what now would you attribute the dramatic changes in both the mood of the astronauts and the efficiency of the astronauts, and the seemingly greater difficulty in adjusting to weightlessness compared to other crews.

HAWKINS

Well, Mary, I don't - I don't know as we've really saw any greater difficulty adjusting. When you look at the levels of performance in all - and compare those they have looked very very similar to what we have seen in the past. There is a learning curve that they - they must go through. It is - is a new environment and they've got to learn how to move and coordinate themselves in this new environment. Even though they have had extensive training on the medical equipment that they used in flight - preflight. There is still a new learning curve that they have got to follow. I think you see individual difference, certainly! but that's - that's to be expected. But I think this crew has - did have some experiments and some tasks and all which they were - were asked to start immediately off on, in the early phases of the mission which the previous crew did not begin to encounter until way beyond halfway of the mission, when they had already gone through that initial just sheer learning curve of adjusting in weightlessness. So, I - I think the performance is very outstanding in the way that they have wrapped up this program and the data that they have given us not only medical area but all of the scientific areas of endeavor here, I think just speak for itself really.

SPEAKER

Don't forget none of these three guys have been there before, this is the first time for all three. They haven't been anywhere before except listen to the sea stories at the bar. (Laughter)

SPEAKER

We were talking to the ATM PI's this morning, and they had a very very glowing report for the conduct of the ATM experiments by this crew. In fact they said some of there very best data on - on was gained by this crew. So - so that sort of witnesses that they really did -

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did perform quite well.

QUERY For Alan Shepard and Dr. Hawkins, do you see any objections to sending another rookie - entirely rookie crew up in space?

HAWKINS Well, I'm sure Admiral Shepard doesn't and I certainly don't as long as they've had the benefit of pre-flight training which they must have or any crew must have.

SHEPPARD Yeah, I think that's correct. That bears out the - the fact that our training program is essentially correct for these three fellows. The comment I made earlier had to do with the fact they were not only there for the first time., but there had been, as Royce said, some last minute changes in procedures particularly in the medical experiments, which they really hadn't had a chance to become too familiar. So I don't see any problems at all. And certainly that is one of the plans as you look forward to shuttle is to put rookies up there. Particularly in the area of the payload specialist as we call them. This will be the first time for them, so we've got a very good data point on how to handle it.

SPEAKER I might add that certainly this crew did everything that they were called on to do, and they did it well. No one can question the - the way in which they did anything.

QUERY Do you think it's safe now that the mission completed that man could stay up in a long mission for a year or two using the same physical training that was used on Skylab?

HAWKINS I think it will go a long way to keeping him there, sure. We're going to have to look at what we've learned here in these three missions. And certainly in the duration that we've just flown does give us a lot of hope and promise for what man can really do, how long he can stay there. I'm optimistic about it. I didn't mean to sound pes - -

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HAWKINS - - does give us a lot of hope and promise for what man can really do and how well he can stay there. I'm optimistic about it. I didn't mean to sound pessimistic earlier in response to the first question. There are - there are a lot of things that have to be learned, which we do not know at this particular point. But what we have seen in performance does lead us to believe that certainly we can - we can work around any limitations that man has in order to be able to keep in there in help him do a job.

QUERY To follow up possible on what Al was saying, that's sounds to me as though somebody has been thinking about maybe getting new astronauts from somewhere down the road closer to the shuttle. And I just wonder if you could share some of that thinking with us as to when you might be in position to bring some new ones on board and whether they will be women involved and the requirements for these new people and so forth.

SHEPARD My name is - if we're going to talk about ladies in space - my name is Deke Slayton. We have as you know all kinds of plans for shuttle, the crew's in Shuttle training programs. But just generally speaking, the plans right now for staffing the missions appear to be that we will use the current astronauts that we have here at the space center, in the areas of piloting requirements, in the areas certainly the initial medical and the initial scientific experiments. But beyond that after a year or so of conducting these experiments, the thought currently is that we will be bringing in people who are familiar with a specific experiment, and will be conducting it, but not necessarily have any previous training at all in space flight. That's the general plan and certainly if you want to say that an experiment includes writing a poem in space, maybe you'd take a poet up there. I see no reason why you wouldn't expand it to that degree.

QUERY What you're saying is that after a year or so, what you're looking at is taking just ordinary people along.

SHEPARD We've been putting in ordinary people in space for 12 years now - 13 years. You won't believe it but we have.

QUERY I'd like to know about what information from Skylab is going to have a bearing on the future training of the astronauts for these shuttle programs?

SHEPARD That's a big question. I think certainly we will - we will use almost all of the training, the types of training equipment - the same types of training in procedures that we've used in the past. We've found them very successful, which has, of course, - to maybe break

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it down a little further, which means you'll have some people training to be pilots and some training to be the scientist that and specialists that go along with it. But I really haven't seen generally speaking anything in our previous training programs that - which we will not use in training people further right from the general familiarization training right all the way down to the specific experiment type training. We've had a lot of experience to count on.

QUERY For those of us who followed this thing every day for 84 days and especially in the last few weeks, whatever happened to CMG number 2? Is it still alive? I know it's still alive and if it were to collapse now after - during this period, how long - what would be the orbital lifetime of the - ? S

SCHNEIDER Well, CMG number 2, as we left the control center a moment ago, looked like it was in what we call stable 1, that's where we started. We - we sought a new plateau you know, during these last 6 or 8 weeks. And found another stable point and it's been vacillating between the two. Of course, if you lost this CMG, you would really lose the ability to keep it pointed to the solar attitude that's necessary over these next 20 so - 20 odd hours to do some of the data gathering we're doing. Sort of academic as to what happens thereafter because you will call on that system not to where, it'll be shut off.

KLFINKNECHT Whether that's operating or not doesn't effect the lifetime of the vehicle that's up there.

END OF TAPE

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KLEINKNECHT - - Whether that's operating or not doesn't effect the lifetime of the vehicle that's up there.

QUERY Dr. Hawkins, did you get any actual measurements in talking with the ship on what the blood pressure and pulse readings of the various men were? And if not, they obviously didn't, then if not, how soon could we expect to get that?

HAWKINS Mary. We didn't, as I was shaking my head. No, the only figures we did get was reported by the crew, one of the crewmen earlier from the spacecraft of the heart rates in a supine position, which were 70, 80, and 80, which are certainly very, very nominal readings. I would estimate that possibly, maybe 2 hours before we'll really have the initial quick-look report that'll give us any solid figures to work with. It'll be very late this afternoon, early part of the evening before we get the final R plus zero data.

PAO

More questions. Thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SKYLAB IV - Change of Shift Briefing
Johnson Space Center
February 7, 1974
12:45 p.m. CDT

Participants:

Neil Hutchinson - Flight Director
Gatha Cotte - PAO

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Time: 12:45 CDT
2/7/74

PAO Change-of-shift with Neil Hutchinson.
This could be the last one, couldn't it, Neil.

HUTCHINSON Yes, I guess it is.

PAO Of the entire program. - -

HUTCHINSON Yes.

PAO The End. Okay. You want to start.

HUTCHINSON Okay. I - I haven't got a lot to say. We had again a quiet day, an awfully quiet day today, De - Today was our day to begin turning off all the workshop systems and we have proceeded through about 8 hours of that; really about 5 hours of work on the systems today without any problems at all. The crew has already finished all their work for today and they're getting ready to go to bed. In fact they'll be asleep here in about 15 minutes. And we didn't have any problems. We just went right down the time line, and there was very little conversation between the crew and the ground. The major systems that we turned off today, we turned off - well first off we got all the fecal material transferred to the CSM except for whatever is defecated today and it'll be brought up tomorrow morning. That was the last of the big bunches of stuff to go into the CSM except for the urine stuff in the morning. We've got the water system off, we've got the CSM fully powered up now except for turning on a couple of ECS things which get turned on tomorrow morning. Said we turned off the water in the workshop, turned off the O2 and N2 systems in the workshop, the waste processors are all closed out. The wardroom has been deactivated. They're now using water that they have pre-stored in drink containers, the water system is shut down. That's about it; and we - we just had a pretty quiet day and I think they're - the crew feels organized. We got all the pads up for entry tomorrow. That's it.

PAO Any questions. Mary.

QUERY Now one thought occurred to me. Before this mission they were all worried about, you know having enough food to eat and they took the high-energy bars and all that. Has anybody any clue as to, for example, how many - how much is still in the freezer, and the refrigerator and, you know, dehydrate that kind of stuff and also maybe how much clothing they have left because they kept running out of socks before and things like that.

HUTCHINSON Yes, we know exact on on both those items we know exactly how much is left. I don't have have the numbers I've - right down to the - - You know we've kept a very close - I really don't know. The - the food of course is, you know, there's a - there's the 10-day rescue supply, which is still available, plus some odd free food

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items, and I've - I really don't know how much cause I haven't kept real close track of that in the last few days, but we have kept a very close food inventory here on the ground. And the crew has regularly done an inventory for us and told us what - where everything is and how much of it's left, mainly for the purpose of us being able to budget them extra goodies as the mission progressed on here that free calorie items, free food items that they could consume, which we have done and they have done. As far as the clothes go, again they report daily everything they wear. Really they report what they discard. So we a - also have track of that, and both those things ought to be readily available if somebody wants to call over there, get the data.

PAO

We'll chase that down for them. Bruce.

QUERY

Neil, what - what food has gone in the

CSM or will go in CSM for return day?

HUTCHINSON

Well, there's - -

QUERY

Other than - -

HUTCHINSON

You mean for them to consume?

QUERY

- for them to consume. Not - not for

the - the samples.

HUTCHINSON

Right. I see. I - umm, I haven't got my deact checklist with me. Let me - first off, well, two meals. And it hasn't gone in the CSM. One meal has - there's really only one meal in the CSM, lunch tomorrow. Tomorrow's a standard three-meal day. As you know, of course, they're kept on - on the uniform restricted intake or controlled intake diet system for sometime afterwards. After the mission the - the food that we're eating today, this day was a high food bar day.

END OF TAPE

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HUTCHINSON After the mission the food that we're eating today - this day was a high food bar day, because we only had two meals today. They only had a short - they had a short day today, they were only up 9 hours. And tomorrow there will be - they've already reconstituted the food for tomorrow before they shut the water system down. And there are basically two meals: 1, breakfast, which will be eaten down in the workshop prior to getting their suits on, and then lunch, which has been reconstituted and then has been taken up to the CSM.

PAO Gentleman over here.

HUTCHINSON And it's a pretty standard lunch, Bruce.

QUERY Are you willing to project a little bit what goes on in the future for this very beautiful laboratory that's being left up there?

HUTCHINSON It's going to be very quiet.

QUERY How about a future rendezvous or an island in the sky type of thing?

HUTCHINSON Well, that subject has been - been pretty well discussed Doctor. Basically the position that we have taken on that is that the vehicle has been passivated completely. It is not habitable as an entity to support anything, in other words there - it's not being left in a - in a fashion that a man could go in there in his shirt sleeves and live like we've been in there. It is being left in a condition such that we could revisit the area, it could be entered suited. And of course the possibilities for such a - such a venture exist in the terms of an alternate mission for ASTP which we certainly hope we wouldn't be involved in, and of course the Shuttle. We also boosted the orbit up a tad here, as much as we could afford to do to extend the lifetime as far and as long as we could.

QUERY Would it be possible to carry enough stuff up from Earth to - to make it habitable again?

HUTCHINSON Well, it's possible, however, really the way - the condition we've left the vehicle in - I'd guess I'd have to say logically you probably couldn't habitate it, because we haven't cleaned it up very well this time. Most of the major systems of course when they're shut down - you probably after a period of time couldn't start them up again, like the refrigeration system for example and something like that that you'd have to have to be able to operate in there.

PAO Anything else? Well, thank you - wait a minute, Mary.

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QUERY Have you any final words on your friendly gyro?

HUTCHINSON On whom?

QUPRY On your friendly gyro. CMG.

HUTCHINSON Oh, CMG 2. Well, you're not going to believe this. I guess I'm the guy that probably a month ago said I didn't think it'd last another week. And you probably all wrote that down and ran away with a big story and here it is still cooking. Today it has - the last 24 hours it has been completely out of distress. The gyro has -
(Laughter)

HUTCHINSON - That's probably a fitting way to - to end it. Seriously the last - well, since I left yesterday, which really wasn't 24 hours ago but on the last shift that I was on over there before this one, the thing came out of distress and it has not been back in. It's running just about - what I would call normal with wheel speeds up around 8900 and the currents down around 1.02 and perking along.

QUERY And you don't know why? No maneuvers?

HUTCHINSON There are a lot to theories. You know people are saying the bearing fell back in the race and the bearing fell out of the race and it - We should have been keeping it cool instead of keeping it hot and you know, on and on and on and probably never know. We did by the way today turn on the heaters on CMG 1 preping to turn that on tomorrow after the crew leaves.

PAO Jacque.

QUERY Was the crew given any medication today to be able to go back to sleep?

HUTCHINSON Yeah, they were given - they were told that they could t - and I believe they reported they were going to take - I believe they took medication last night because yesterday was a short day for them. And of course - or today was a short day for them. They went to bed early last night and today was a short day, that combination. In other words they're going to bed early again tonight. And I suspect they'll all take Seconal.

PAO Mary.

QUERY Two quick ones. When - when - when do we have the battle to try to pack the ice cube trays. And also by any chance, we forgot to ask Dr. Buchanan, they were talking about recumbent ergometry when they get down. What is recumbent ergometry?

HUTCHINSON I - I can't answer that. I know they run -

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QUERY - - They were talking about recumbent ergometry when they get down. What is recumbent ergometry?
HUTCHINSON I can't answer that. I know they run full medical medical protocols on them on the ergometer. Maybe it's some particular posture they use. It is upside down, is that right, Bruce?

QUERY That's - that's a new one.

HUTCHINSON That's a new one this time. They're going - and are almost completely upside down.

QUERY I thought maybe it was lying down and, you know, just pedaling in the air, or something?

HUTCHINSON I don't know. I couldn't answer that. As far as the question on the urine trays, that happens very early in the morning. The crew - I keep speaking early in the morning, it happens tonight about 10 o'clock. The crew'll be back up at 9:00. And that's one of the first things we get after after we get up is the urine stowage and transfer.

PAO Bruce, did you have another one?

QUERY No.

PAO Neil, thank you.

HUTCHINSON Yes, sir.

QUERY Thank you, gentlemen, ladies.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-1V - Change of Shift Briefing
Johnson Space Center
February 6, 1974
6:00 pm CDT

Participants:

Neil B. Hutchinson, Flight Director
Milt Reim, PAO

SL-IV PC126A/1
Time: 18:02 CDT
2/6/74

PAO Okay, we have Flight Director Neil Hutchinson here for the evening change-of-shift briefing. I'll turn it over to Neil.

HUTCHINSON Okay, today, had a nice - what I guess I describe as a quiet day. The crew stayed busy - reasonably busy throughout the day today. We didn't have a lot of conversation, in fact, about the only conversation we had, we had right here at the end - end of the shift this evening, and that was concerning our friendly urine return container which we knew - found out yesterday afternoon has kind of a tight fit getting the urine in it - the urine trays in it. We did a lot of work today on the ground until we got a chance to talk to the SPT this afternoon concerning various ways we might be able to alleviate the problem. The problem is we've got this stowage box that's about the size of a small suitcase, and it's a highly insulated container that's used to transport the frozen urine and - and blood samples from Skylab down to the ground into the recovery operation - or through the recovery operation. The samples, of course, are frozen solid on board, and then they are immediately transferred into this thermally efficient container. And from there they aren't - the containers not opened again until we open it post recovery, and they're still frozen at that time. The samples are not put into this container until the last morning when we - when we leave. And the SPT yesterday afternoon late - or last evening really decided that he'd fit checked the - the samples in the container. Now the samples are in four what we call drawers, which is just what the name implies. They're four other containers that are about this wide by about that deep by about that high. And they fit in this one big thermally spiffy over - overboard. Now we've been sticking the urine in these drawers, if you will, in the freezer as we've gone through the 85 days. And all the urine and all these things are compartmented. It's a little compartment thing very much like an ice cube tray thing, and we just put the urine in there in bags in a systematic fashion, and the blood, and it freezes. Some of the bags - I got the impression after the conversation this afternoon, maybe two or three in each one of the four trays are protruding above the top level surface of the tray. That could be for several reasons. They weren't snugly fit down when they were first put in the freezer and then they froze and froze into that position, or there might be a little bit more air in the bag than we normally expect. We don't pretend to understand completely how liquids freeze in zero g, so all those combination - freeze, I mean, relative to the position of the liquid in the little urine return container.

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One of these sample containers, well a half sample - a full sample container's about like this. It's a little square plastic bag - sack, about like that, inch and a half or inch and three quarters on the side. This afternoon, we did another fit check - the SPT did another fit check at the ground's freezer. And very carefully he got all the trays out of the freezer and very carefully arranged them so that he took advantage of where one stuck up, another one had a - a depression, so to speak, in terms of the level surface of all the bags and the tray. And he did get - he got two of them into the - into the big over - overcan, if you will, the - the thermally protected one, and then he got the other two in all but about - about that far out of about that far. And indicated that he didn't feel he'd have any trouble completing the operation. And in the process, we did break the integrity of a couple of the sample bags, however, the urine is frozen. This has happened before. On SL-III when we got them back and took them apart on the carrier, we had a couple of bags that were broken, but they weren't contaminated. Of course, the thing is completely sterile and everything, and the urine is still just a frozen cube -

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HUTCHINSON - - took them apart on the carrier. We had a couple of bags that were broken, but they weren't contaminated. Of course, the thing was completely sterile and everything. The urine is still just a frozen cube when we get it out on the carrier, so we don't think that presents any problem. We did - we are going to have them use the technique of kind of shoe horning it in. We're going to take a piece of Teflon, probably off the treadmill, and use it across the lip that these drawers have to clear as a slide, so to speak, so that the tops of the bags don't catch on anything as they're being - as they're being put back in there. But I think that subject's closed. I don't think we're going to have any more trouble with it. And I think we'll be able to put it together. Of course, we took them out of the thing and put them back in the freezer this afternoon, and we don't get them out again until entry day, entry morning. And I don't expect we'll have any problem with it entry morning. The only systems thing that I know of that went on today, which really wasn't probably discussed, or you didn't hear very much about, we haven't done any heater cycles on CMG 2 in the last 24 hours. And the reason is that the bearing is hot enough that it's keeping it's own heat right at a constant level, around 74, 75 degrees without any input from the heaters. And this has been going on - off and on for quite a while, but not for a - as sustained a period as we've seen it this time. The CMC isn't in any further distress than it's been except the fact that it's showing a rather constant heat output out of the bearing. And if it will hang on just a day and a half more, we've made the grade. We did our last major medicals today, two of them. The biomed gear is all secured except for the ergometer which is still left powered up in case they want to use it, and we get that on the last day. We closed out all the biomed experiments, M133, the last of the - By closing out the biomed experiments, I mean the biomed experiment hardware. Of course, we're still gathering data on urine and feces and water intake and all that stuff - all the mineral balance work. The M144 sleep unit was deactivated today, and the tapes were put in the CSM. So we've about finished all the medical deactivation except turning off a couple of circuit breakers, which we get the very last day. We did a trim burn today. And it was just like I told you yesterday, for the purpose we discussed yesterday, and it went off completely nominal. We left the G&N, the guidance system in the CSM up post trim burn, and it will remain up right on through now, the computer and the platform. And as far as deactivation went today, we did quite a few things. Quiescent panel checks in the CSM all went well. This is

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an exercise just to go through and make sure after all this time that every switch is in exactly the right position in the whole CSM. And that all went well. We got the oxygen packs all configured for storage. Command module center couch has been put in. The rate gyro 6-pack fan has been installed. You remember, the fan that we have that blows on the 6-pack is going to be installed and left, and that was done. The CSM, as far as I'm concerned is packed except for a few minor items like a couple of reels of film and stuff, and, of course, the refrigerable items, which come the last day. And the crew is going to bed a couple of hours early. As you know, they'll be going to bed here in about an hour, and wake up tomorrow morning is early. This is our circadian shift night, and that's about all. Everything's hunky-dory.

PAO Questions? Tom.

QUERY This is something that's been very important to this crew, Neil, is having enough time to do everything. Excuse me. Do they feel they've had enough time from everything that you've gathered?

HUTCHINSON I think so. It's kind of hard to judge, but I - the reason I - I think they have, Tom, is that we have not had any comments from them that indicate they're harried in any fashion. They've been very quiet and seemingly very organized and frankly I think the stowage of the command module was - if I recall SL-III, we had a lot more
co - -

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HUTCHINSON - very quiet and seemingly very organized and frankly, I think the stowage of the command module was - If I recall SL III, we had a lot more conversation with the SL-III crew about stowage of the command module than we've had with these folks. And, so I'd have to say that I think the time lines that we've put together here for these last two or three days have been - have been open enough and we've allowed enough leeway where we thought they needed it, particularly in the stowage areas to allow them to get it done without a lot of hassle.

QUERY You know you certainly can't tell it from what they're not saying. But is there any indication - do you have any indication or any feeling about the way they feel about coming home? Do they seem excited or -

HUTCHINSON Yeah. I think they're - I think you can - I think you can - I - Did you hear them this morning when they woke up and the chatter that went back and forth this morning. I think they're kind of like we are, they're probably kind of nostalgic that it's over but they're really kind of happy to - to - and feel fairly comfortable with the tremendous accomplishments they've just done that - I think they're - I think they're attitude is - they're glad to be coming home.

QUERY I have several question as usual. Have any clues as to what they're going to put in the ditty bag? The time capsule? We've got, you know, the list of things that were supposed to go in. But say for the food items, I know there's a choice, but have they said anything about whether they're going to pack in the tuna fish salad and do you have any idea why they don't like it?

HUTCHINSON No, I don't know why they're going to leave the tuna fish salad for somebody. I - I - Mary, I don't know what they're going to put in that thing other than the list of stuff. I'm sure there will be a few things, and of course we did leave it up to they're option as to what they put in there in terms of a couple of three things like food and we ask them to put in a flight data file sample which, by the way, today turned out to be a bad deal because the flight data file sample they picked we had to use it today and they had to go back in there and dig around and get it out. But, other than the items that are listed on there we do have some photographs of the configuration of the bag and probably the contents and where it's - where it's secured in the - in the MDA and I'd suspect that they'll probably provide us a pretty complete list when they get back. I'm not - other than that I - I have no clue and - and wouldn't intend to ask them what was in it.

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QUERY

Also - also I'd like to know what was the orbit you achieved? Is it exactly right on the button on what they (garble)?

HUTCHINSON

We don't know yet, that'll be a while. But as far as we can tell, the burn went off exactly on time with exactly the right attitude and so and so forth, so we have to assume we got what we wanted. And it'll probably be a couple of shifts, I don't know - I - probably 10, 12 hours of good geometry before we get a feel for exactly what we got. I suspect that - that thing is pretty insensitive to - to errors because the mass is so large and the thrust is so small and even though you're applying it over a long period of time, and there are some minor attitude deviations, I suspect we came very close.

QUERY

And - and, I'm just fascinated with their ice cube problem. I have several questions on that. Is part of it you do - do you think due to fact that maybe they were a little over generous in filling these things up or in -

HUTCHINSON

No, theoretically you couldn't be too over generous if you could get as much in there as you - as it would allow and then freeze it. It should - it should clear the top of the - the of the tray. Although it appears that some of them are, for what ever reason, sticking up a bit. Now it could be that we didn't get - when we put them in there, didn't get the little plastic bag all the way down in the slot that it goes in, you know the ice cube slot, and therefore when it froze, of course, now it won't even move in the slot, he said - we asked him if he could get them out - if he could get the little frozen bags out and he said no he didn't think but maybe one of two or maybe three at the most would be loose in a given drawer. So you know they could have not been placed rather than when they - I mean froze in the container, it could be that when the little plastic rather than the way the ice - the urine froze inside the little plastic bag, it could be the way the little plastic bag adhered to the wall of the - of the container when it froze and they are stuck in there fairly solid.

QUERY

Does weightlessness make sort of globular forms?

HUTCHINSON

Well, the liquid - if the thing - yeah, if the - if the container is not full and in some cases they aren't, of course, if it isn't full the liquid can distribute itself inside there when it freezes in any manner.

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HUTCHINSON - container is not full, and in some cases they aren't, of course. If it isn't full, the liquid can distribute itself inside there when it freezes in any manner. The - it wouldn't be all in the bottom, it - well, it will be like - like - probably like - I don't know, like ice cubes with air pockets in it.

QUERY Do doctors object to having a fractured ice cuber two?

HUTCHINSON Oh, no, no, no detraction from the - from the data. And like I said, the ones that - where they thought the structural integrity had been damaged by - and the crew - Ed did indicate that maybe the tops - they had been torn, those little plastic bags in a couple of cases. This has happened before, and we didn't have any problem processing the samples because they were still frozen solid when we got them on the carrier and took them out of there. This is like the -

QUERY How many do they have, one - one a day per man is it?

HUTCHINSON No, well, no, some days it - co - yes, essentially. Some days are half samples and some days are full samples. Well, we did - what we did - there is not one a day per man. Some of the pools by one a day, I'm sure you're heard of one every 24 hour period. We took a container that was meant to house the urine for 56 day mission and made it house urine for an 85 day mission. And we did that by several means. One way - one thing we did was sometimes we do what we called - we take what we call a half sample, which is exactly half the amount of - the volume of one of these little plastic urine sample boxes, which means it squeezes to half the size. Some days we did what we called a double - a extended pool where we sampled in the morning of one day and the evening of the next day which gives you a 36 hour pool instead of a 24. So, there's not - and I can't tell you off the top of my head exactly how many are in there. There is not one sample per man per day, per 24 hour day, in there. So there is something less than 250 of them. Probably, a couple hundred, I'd guess in the four drawers.

QUERY Neil, was this latest trim burn, what do you now figure the life of the station before it deorbites?
HUTCHINSON Somewhere between 5 and 8 years.
FAO Abby?

QUERY How many of these misfitting cubes are involved, and how - how high do they stick up?
HUTCHINSON They stick up about a quarter of an inch above the top of the tray cl - clearance wise. And - he said there were a couple three in each one of the four drawers.

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QUERY Ther - n - Crippen just said a few minutes ago that he - he - he said - he had prefaced it by saying it depends on who you ask, or it's 6 to 10 years for the orbital lifetime. So I guess it does depend on who you ask.

HUTCHINSON Depends on who you ask. You guys asked me, I said 5 to 8. It is - it's really - it's really a buzzer. And that - you know, that depends on - I told you last night, it depends on what drag module used and what atmosphere - what drag module used and what orientation the thing finally stabilizes out at. And you know, if you use a complete pessimistic thing, you would say to yourself, well I'm going to have the largest surface area facing forward all the time. And obviously, you're going to get the most drag in that configuration, and it'll come down sooner. Or you could assume it goes like a bullet around, which it's not going to do, or it'll probably tumble some way and nobody will know. It's pretty unpredictable, because it is a large - fairly large surface area.

PAO Okay, Mary.

QUERY One more on the urine. What are you going to do if they can't shove these things all in there on the day they're packing? Are you just going to wrap them up as best you can?

HUTCHINSON Oh, no, we - we - we've exercised this thing fairly well. The - I - the what if I sincerely hope would not occur. And -

QUERY Well, he never got them all in there today.

HUTCHINSON Yeah, but - but remember the circumstances that I described to you. He had two of the four in there. The other two were in there about 80 percent of the way. He said that the resistance to him getting those last two in was even all the way in. The only reason that he didn't push the others two all -

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HUTCHINSON - - 80 percent of the way. He said that the resistance to him getting those last two in was even all the way in. The only reason that he didn't push the other two all the way in was that he didn't want - the drawers, as you push them in, they have a strap. It's a cloth strap and it's bonded to the front of the drawer, and he didn't want to take a chance on getting a hold of that strap pulling on it and having it not come back out then have a urine drawer out of the freezer. So he left himself a nice piece of tray he could grab onto and pull back out, in case he had a problem getting it back out. And I don't - I really just don't think we're going to have any problem at all putting them in. I think the problem was kind of a - we have a tendency sometimes, when we hear about these things, before we ask a lot of questions of the crew to overwork them on the ground. And we probably overworked this one. Well, it turns out really they did, because if they hadn't had some interference, they wouldn't broken the top off the - for example, on Skylab-III, we had a couple of them that were damaged when we got them back, and that means that they had interference when they pushed the drawers in, but they probably just gave it a little muscle and said, "Ah, well, that thing fits tight."

PAO And speaking of urine samples, I've just been told that when they splash we will have 230 total. Steve Young.

QUERY Do I understand correctly that you power down everything roughly 2 days after departure? And if there is no useful data accumulated after that point, why was the burn done to prolong the life of the space station?

HUTCHINSON Well, to answer your first question it's - the answer is yes, but it's about 1 day after. And the burn was done to put the station in a configuration where we would maximize our chances for the potential of having it there if we chose to go look at it with either the ASTP or the Shuttle.

QUERY Just one other question. With all the systems powered down, how long before you see serious deterioration? And of what sort?

HUTCHINSON Well, that's kind - the deterioration, of course, is exposure to a long-term space environment. Period. You know, tremendous thermal pressures and everything else that's up there, micrometeoroids and whatever else the - I mean it's - the fact of the matter is, that the vehicle was designed to maintain a particular attitude and it was thermally designed to maintain a particular attitude, and we certainly demonstrated what kind of troubles you can get into as far as temperatures and stresses and so on and so forth, if you don't have the right kind of thermal protection. When, in the attitude that we're going to leave it, it is not in a good

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attitude for thermal protection and it will be heated on one side and cold soaked on the other, and if it tumbles, no telling what it will do. So it's going to have a lot of thermal stressing, and that's the - probably the big one, and the kind of deterioration you get from that is pretty much an unknown over this period of time, like 5 years or what-ever. I don't think it going to - it's not going to fall apart. But as far as going back in 5 years and saying that the thing would have pressure integrity, you know, that's probably a big question. And there are no plans to ever try and repressurize it as a habitable volume.

QUERY Did you ever find out what we asked yesterday? When it does come back through the atmosphere, whether we are going to have chunks falling on cows and things or whatever?

HUTCHINSON No, but I did ask a question of one of the guys over there, and I guess there are volumes and volumes of material written on this particular subject. And the answer I got was that the probability of debris and I can't quote the probability relative to exactly what context it's put in, whether it's falling on land or falling on a populated area or whatever, but the probabilities involved with debris from the Skylab as opposed to debris from the Apollo program are exactly the same. I didn't get any numbers, Mary. I don't have any numbers. But the point I'm trying to make is when I asked the question, the point that was made to me was that the probabilities are - we aren't taking any more risks with this thing than we did with the hardware that we used in Apollo that reentered and that we left in Earth orbit.

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HUTCHINSON - probabilities are - we aren't taking anymore risk with this thing then we did with the - the hardware that we used in Apollo that reentered and that we left in Earth orbit and so on.

QUERY But seriously, we have had chunks of debris, there was one instance that really never got reported until years later of a whole bunch of stuff raining on a ship one time from a - of course this was from a rocket, you know it had gone in orbit and then came back through or something. And you know the famous cow in Cuba and all that. But there have been chunks that have landed and whole stages and things like that and this is a pretty damn big thing. And I would sort of like to do if you can find out for me what the chances are of seeing, you know, say a foot square chunk or what ever size they think it is of coming back and you know hitting either land of sea or wherever?

HUTCHINSON Okay, I - I'd kind of - I defer that to these folks. There ought to be something - there ought to be some standard quotable data that would say there's one chance in 10 trillion that a one foot piece would make it back to the atmosphere or something. I - and that's not a quotable number but I don't know - I'm sure there are numbers like that. And I don't have them.

PAO

We'll get you something, Mary.

PAO

Any more questions? You got another one?

QUERY

Just basically what are they going to do tomorrow? I know it's basically deactivation but -

HUTCHINSON Turn off the workshop. Everything except the - the lights and air conditioning so to speak. All the food systems will be deactivated, the water system, everything that you can turn off and still sleep down there one more night. I could read you off a list of hardware if you're that interested. But it's basically, it's everything you can do and still sleep down there, and to sleep you got to have lights and air.

QUERY

You have water don't you?

HUTCHINSON

Nope, no m'am. The water system is turned off. They're using a - the waste management system's all closed out. They're urinating in a - in a - a - in Skylab bags but using a roll on cuff procedure as opposed to the big fancy separator blower arrangement that we use. No water, all the food that is needed for the last day has been recon - already been reconstituted, it'll be done tomorrow afternoon. The water systems will all be closed out, can't even wash your hands anymore.

PAO

Mary, we've got a response here on your question. We expect parts of the shroud, the S-II stage, and

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the workshop itself each to reenter at different times. This would mean that the total surviving material would be on the same order as that for the Gemini and Apollo programs. Since the beginning of the U.S. space program in 1958, orbital debris has never resulted in physical injury or property damage.

QUERY That isn't what I asked. (laughter)

PAO You want to know how big the pieces will be? We don't know since so few pieces have ever been recovered after reentry.

QUERY I think it would be interesting if a piece fell in my front yard regardless of whether - -

HUTCHINSON Just think what a keen souvenir you'd have, if it didn't bury itself very deep in the ground or something.

QUERY That would be great.

PAO No more questions. We have a briefing scheduled in here at 10:00 a.m. in the morning, a recovery medical briefing. We'll have Dr. Paul Buchanan and Doc Donald Stullken in here to talk about recovery. Thank you.

END OF TAPE

**SKYLAB NEWS CENTER
Houston, Texas**

**SL-IV - Change of Shift Briefing
Johnson Space Center
February 5, 1974
4:33 pm CDT**

Participants:

**Neil B. Hutchinson, Flight Director
Ed Hodgkins, Stowage Officer
Dave Garrett, PAO**

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Time: 16:23 CDT
2/5/74

GARRETT And we're ready to get started with this afternoons change-of-shift briefing. We have with us the off-going Flight Director Neil Hutchinson and also with him today is Ed Hodgkins who is a stowage expert. And Neil.

HUTCHINSON Okay, we've had a very calm quiet day today. This stowage business is kind of like moving out of your house but not taking everything with you. And it's kind - it's like - also you're moving out and all all you've got is a Volkswagon and you probably have a trucks load worth of stuff you got to get in it. Frankly, I'm kind of surprised that we aren't getting more questions than we're getting from the crew. They were fairly quiet all day and seem to be progressing through the checklist and with a fair amount of speed and fairly calmly and collectively and I just - I just think the stowage is, even though we have had a few things that they have called down haven't been able to find here. Most of the things have - we've either been able to find a substitute or we've found the actual thing. And there are things like packing and a bag for this and a pad for that. I think the stowage is going along just great. And, of course, today was our big CSM stowage day. Tomorrow, we get some more of it but the real buzzer was today and it's still going on. We've got - we've got several more hours of it to go but I think it's going fairly well. We started into the deactivation checklist today, just some very basic stuff, most of it having to do with a game of stowage like items that we're going to take across during deactivation. There's some photographic work connected with deactivation being done today, very little bit of deactivation. We had a major medical which was still in progress when I left over there. And that's about it for today's flight plan, no anomalies. We've charged, let's see, a couple of things - we charged up the batteries, one of the batteries in the CSM, we're working on the second one. As you know, yesterday a procedure was employed to clear the faulty circuit breaker that we had in the CSM and we now think that problem is no longer with us. In fact, we know the problem is no longer with us and we're planning on using normal procedures for the entry as far as what battery goes on what BUS. Tomorrow we have a trim burn. It'll occur at about 20:45 Zulu or thereabouts. It's a 180-second burn, 12 feet per second designed to raise apogee about 7 miles and it's specifically for the purpose of increasing the life time of the work shop after the crew leaves. And depending on whose drag model you believe or maybe a better way to say it, on how the thing is going to end up orienting itself, we probably added one to two years to the life time

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with this maneuver. We're continuing battery testing on workshop. We've done two more CBRMs last night. We did the first PCG today, PCG6 and it's the only one of the airlock module power sp - airlock module batteries that we will test manned; the rest of them will be done unmanned. And it turned out to be a pretty super battery, it had about 30 amp-hours in it. And as you know we've been protecting a number like about 20 amp-hours on these EREPs. However, don't be fooled by the fact that one of them turned out high because if you've looked at the results from the CBRM batteries, they're pretty much scattered all around, 4 or 5 amp-hours difference, 30 or 40 percent difference can exist between batteries. Let's see, we've finished up the last of our experiments except for the medical, M479, and we ended up getting 30 out of 37 samples finished of the M479. The crew was given the option if they got time to complete that experiment today, but I really don't think they're going to find the time, I think they're going to pretty much have to spend most of their day doing the - doing the - the CSM stowing. And everything's progressing along fairly well. I guess that's all I have. This is Ed Hodgkins, by the way. And if you have any questions about where all that's stuff's going, ask him.

QUERY First for Neil. Okay, we've - this trim burn is going to extend the life 1 to 2 years.

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HUTCHINSON - - I guess that's all I had. This is Ed Hodgkins by the way and if you have any questions about where all that stuff's going, you can ask him.

PAO Questions, Bruce.

QUERY First, for Neil, you - okay we've - this trim burn is going to extend the life 1 to 2 years, now what are they saying the lifetime of the workshop's going to be?

HUTCHINSON I'd say that if you add that - you know the number that was quoted or was being quoted at least the one that I've heard is somewhere between 4 - before this trim - before this trim burn was discussed between 4 to 6 years - before the trim burn. And again that depends upon whose drag model you believe and whether the thing is stabilized itself like we hope it's going to or not. You know, because the cross-sectional area that's going through whatever rarified atmosphere up there is of course the thing is going to end up determining how long it really stays. You know, if we knew what attitude it was going to remain at we could predict it fairly well. Now if you add one to two years to that, I guess, that gives you a span of somewhere between 5 to 8 years. I realize that's an awful wide spread, but I - I suspect that that's probably about as good as you're going to hear.

QUERY Okay, a couple of more then. How long after the crew leaves are you going to keep the network up and keep working and playing with the station?

HUTCHINSON About 24 hours. We hope to be all finished I'd say about 2 or 3 o'clock on Saturday, I guess it's more like 30 hours or so - 2 or 3 'o clock local here. And we will commence testing shortly before the crew is down after we're sure they're leaving there. We essentially started after the shaping burn.

QUERY Okay, and for Ed, are they bringing home the moss. I - I don't recall.

HODCKINS Yes - yes they are.

HUTCHINSON As a matter of fact, we're bringing them home chilled, no less.

PAO Tom Low will take a question on that.

QUERY Yes, I'm Vic (garble) for the New York Times. I wanted to ask a couple of ill informed questions. Why is it desired to have it remain aloft so long? And well - maybe we can address that one.

HUTCHINSON Okay.

QUERY You want to keep track of some things on it and so I - I just don't know why you wanted to have such a long lifetime.

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HUTCHINSON No, Vic that's not the reason that - that trim burn is being done. A trim burn is being done to maximize the lifetime for the purpose of having the vehicle in the air in the time frame of the through the ASPC and possibly through the early shuttle. And that's not saying that NASA's gonna go back and visit it but it's at least going to - we hope be in the air doing something, tumbling or sitting there but it's not going to be on there's - we - Saturday afternoon about 3 o'clock is the last command is to be sent to the vehicle and it will be dead from then on, forever.

QUERY It'll not be revisitable?

HUTCHINSON Oh yes, it is revisitable, but as far as being habitable with it's own or under the auspices of it's own system, it is not.

QUERY Will you vent it?

HUTCHINSON Yes sir, we'll be venting it to half a psi and it will bleed the vacuum over a period of month or two.

PAO Abby.

QUERY Since this is going to be sort of a historic moment when you say - kill the workshop, can you go through those sort of last few commands in other words, when you really make it a ghost ship?

HUTCHINSON Yeah, it's pretty simple, you turn off the lights and turn off the telemetry, it's about as simple as that. The last commands that are being sent, basically are - you know we're going through this series of testing and we're going to turn off the ATM power system first. I'm wrong, we're going to turn off the airlock - here I go, not knowing which one we're going to turn off first. I believe we're going to turn off the - in fact I know, we're going to turn off the airlock power system first, and then we'll turn off the ATM power system. And when I say turn off I mean disconnect all the batteries from the BUSES. And before we do that - before we disconnect the power system from the BUSES, the BUSES will be completely unloaded as far as we can unload, which means everything except telemetry transmitters and command receivers. We can not take the command receiver off the electrical power system. They're hardwired onto the electric - you can look at it that way. But we can turn off the telemetry. So after we unhook all the batteries from the BUSES, the only thing will be left on are the command receivers and the telemetry transmitters.

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HUTCHINSON They're hardwired onto the electric; you can look at that way. But we can turn off the telemetry. So after we unhook all the batteries from the BUSES, the only thing that will be left on are the command receivers and the telemetry transmitters. And the last command to be sent will be telem - TM, OFF. So, basically you go down and you turn down all the systems, one at a time, everything in the vehicle. All the cooling systems, all the ASCP, you know, the thing will already have been put in this gravity gradient attitude. We'll have turned off the TACS and turned off the TACS BUSES, so it can't fire any jets. Then we're going to turn off the computer, and so on. And you just go through and power down all the systems and after you have all the systems off, then you start taking off the power sources. ATM first, and then after you have all the power sources off, then the last thing you do is turn off the telemetry.

PAO

QUERY

Any other questions?

Do - Kind of use your imagination and pretend you're either on the ASTP crew or in the shuttle flight or whatever, and you go there. What are you going to find? First of all, do you think it's going to be tumbling like mad? And then if you dock, what's the inside going to be like?

HUTCHINSON Very smelly. They won't be able to smell it though, because if we do manage to dock with it and go in, they'll be going in hard-suit. I really don't know whether it's going to be tumbling or not. If I had to - just from what I know about the vehicle and the CG and everything I'd have to say I'd expect it to be tumbling slowly, because I don't - some people think it's going to stabilize gravity gradient down - it's a function of the drag model and whatever little tiny momentum and whatever impulses it gets, and so on and so forth. And you know, it's not a symmetrical body like a dumbbell, like you'd like to have that would stabilize very well, one end down towards the Earth. We are putting it in an attitude. You can basically think of it just the way it's sitting there, with the back end, the radiator end, the part that's on the - the part that's sitting on the table here, pointed towards the Earth. That's the way we'd like to see it stay.

QUERY

It - it - Do you think it's possible to dock with a vehicle that's tumbling slightly?

HUTCHINSON

Oh, yes. All you do is get up there and set up a rate that's exactly - you just match it's rate. And it's a - it's probably not the easiest thing in the world, but it's certainly not out of context. It's something that's possible.

QUERY

Neil, what is to prevent, say, a year from

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now, if somebody went up there. Couldn't conceivably, if everything were working - of course, you have no way of knowing that. Couldn't you turn everything on again? That's HUTCHINSON Well, the first problem with that. I'd say probably not. Mainly because of electrical power - The batteries will be run down before we take them off line. I mean, they'll be discharged right down to their knees before we take them off line. And then, they'll - you know what little residual power is left in there, of course, without the solar panel seeing the Sun, and with the batteries, even if the solar panels did see the Sun, the batteries are disconnected from the solar panels. Now it's conceivable that you might get the thing in an attitude sometime over a ground station where the solar panels are in the Sun and you had energy, and if you had energy, you can send a command and turn - start turning things back on, but of course, whether they'd stay there or whether they'd come on or any- think like that is pretty dubious, because the vehicle probably does - even if it is in a stable latitude, is not in an attitude that has the Sun on the panels. And with the batteries all off, and with them all discharged, there's no way to get electrical energy to the things that need it to run.

QUERY

HUTCHINSON

Then you couldn't turn everything back on? It's conceivable. There are certainly are no plans to do anything like that however.

QUERY

Is this thing so designed that thermal expansion over a long period of time will not force pressure valves to vent, you know, pop valves to vent?

QUERY

HUTCHINSON

And thereby give us a DELTA-P? That's a - That's a very hard question to answer, Paul. For example, if it happened to stabilize, well even in the attitude we have it in, the Sun is able to get down under the curtain to the nitrogen bottles. Well there's a curtain over them, but over long periods of time that thermal curtain could degrade, you know. The - We feel like that all the high pressure gas systems - in fact, we're positive that the high pressure gas systems are not in any posture - -

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HUTCHINSON

- we feel like - that all the high pressure gas systems, in fact, were positive. That the high pressure gas systems are not in any posture where we could ever get enough heat in them. The factor of safety in all those tanks and systems is such that we would not put ourselves in a posture where it would be dangerous, you know, that the tank would blow up or anything. As far as things relieving, there are some things that might relieve, like maybe the - the SOP's, you know, the oxygen packs are being left on board. Some of them have some oxygen left in them, and if they happen to get right in a hot spot, they do have relief valves that might relieve some oxygen in there. As far as relief - general relief of the cluster - over anything in the cluster overboard that would give us a torque, you know, that might start it tumbling or something else. I really don't know of any.

QUERY

Does that mean it won't happen, or in - in - in - is that the way I understand you? I mean -

HUTCHINSON

Yeah, I mean like - for example, nitrogen - the nitrogen system is designed to take the kind of increased pressures that we can get involved in if the Sun were shining directly on the tank. And nothing's going to blow up. And of course, if any relief takes place, well, generally, you would get a relief in - relief inside the vehicle. For example, if you - if you cracked a relief valve in the vehicle, and the overboard vents out of the vehicle which are closed, or are being left, you know, which were used in the bleed the vehicle down are non-proposolve, theoretically. And they have been, I mean, we - we've bled the vehicle down several times, and, of course, in a program, and it's - it's proven to be that way.

QUERY

As long as we have a stowage expert present and since we're going to hear about nothing but stowage for the next couple days, perhaps he would like to tell us what the worse problems are. And presumably, this is planned for in advance that now - now here we are at the end. We have the actuality of - are we really running into any trouble putting it all away?

HODGKINS

As he was saying, it went very smooth today, but the big problem with this mission is the quantity of items that we're returning. It's much greater. The stowage density is higher on this mission than previous missions. The crew handling the many film magazines and all the things that they're retrieving today, essentially all the data from the mission is coming into the command module. Biggest problem is just quantity and details. The procedures have gone very well, I think, and we have made number of changes since we launched, since the pre-mission plan. Mostly in increasing

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and increasing our density in just the quantity of items, I guess, is the biggest problem.

HUTCHINSON To amplify Ed's remarks about today, for example, the kind of problems that we're running into today, we had a locker that had a bunch of magnetic tapes from EREP in it and they - they wouldn't fit. And we had marked it up on the ground and thought they would, and they didn't, and the crew fooled around with it until they finally got the lid to shut on the locker. It's kind of like filling your suitcase with too many clothes, you know, and having to sit on the lid. And the fact of the matter is, that in most instances in the CSM, the stuff - the packing density is so high, that if you get one thing out of place, or out of the - out of whack the way it's supposed to go in there, the rest of it probably won't fit. So it's just a very tedious job. And I told you when I started out, I'm surprised that we haven't had more questions, and more trouble particularly with finding things and with getting things, you know questions coming down here, I can't get this and this locker or was I supposed to slip this in that locker? It seems to be going fairly well, but there's another 4 or 5 hours of it here this afternoon.

PAO Abby?

QUERY A couple questions. First, a quick one, are they going to bring back those plants, in other words, the rice seeds that have grown?

HODGKINS No.

QUERY No?

HODGKINS Those are not being returned.

QUERY The plants are not - -

HODGKINS They're not being returned.

QUERY And a second thing, and this is for you, Neil. Again, to imagine, say that in 5 years you're a scavenger in orbit, and you - if you went to Skylab, what would be some really good things that still should be working that would be nice to have?

HUTCHINSON I don't know. Probably not a darn thing. I don't - I - you - you know the kinds of things that - that would be of interest to engineering value that you could think of are just, for example, the discoloration on the solar panels would be an interesting - technically interesting thing. As far as things working, I - I say again that there are - I don't think there'd be anything working, Abby, and we wouldn't try and turn anything on. You know, we built this little bag of goodies, a kind of time capsule kind of thing that's being stashed in the MDA for somebody to pick up if they were to -

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HUTCHINSON - been working heavy. And we won't try and turn anything on. You know we built this little bag of goodies, kind of a time capsule type of things that's being stashed in the MDA for somebody to pick up if they were to go back and it has a representative set of hardware and tapes and film and so on and so forth that you'd like to get data on long-term exposure to vacuum and radiation and et cetera, et cetera, et cetera. If you could call that working things, you know, I'm sure that if we did a revisit that bag would be returned, but as far as going in there and turning anything on, I really doubt it.

QUERY I was not thinking so much of that but again in a certainly imaginative situation but going in and saying, well this is a nice medical kit. I need a bone saw. You know, would all those sort of things - are those going to be left there and just found?

HUTCHINSON Yes, they're all being left there. And, you know if you wanted to go in and find a bone saw, I - there's no reason why you couldn't go in and get one. There would be tools in there that - that might be usable, and ropes and bags and stuff like that.

QUERY Neil, why do discharge the batteries and turn everything off? Wouldn't it be conceivable to leave everything go and even use the ATM?

HUTCHINSON Yes. And I guess when we decided to leave the vehicle in a - in a posture - programmatically decided to leave the vehicle in a posture that we're putting it in, namely, a completely passive mode that was "safe for a revisit". And that decision was based primarily - as you mentioned you could run ATM - it's based primarily on the tremendous cost to keep the control center and the network and everything up. You know, the program is over. And - when we chose not to do that, the reason the batteries are being discharged is safety. And long-term storage of batteries with energy in them under uncontrolled conditions is - has a tendency to not be a well understood physical phenomenon, namely, they might blow up. And, so we're putting them in as safe a posture as we know how and that's to take all the energy out of them. That's why the batteries are being discharged.

QUERY Neil, I'm - I'm not sure you know the answer, but I'll ask anyway. In the pool copy that's coming off the ship there is mentioned from Hordinsky about the guys being in better condition because they're short and compactly built. Have you heard - and this intrigues me. And they point to the fact that Lousma and Kerwin who were taller were ill. Have you heard any talk along these

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lines, or have you any theories as to why short and compactly built men would be in better shape?

HUTCHINSON No. But it would stand to reason that - that - I guess that a person who mass was not distributed over such a large volume maybe not - would not be effected structurally by gravity so much. Obviously if the mass is the same, you got the same pull on him, but if it's distributed over a longer frame you might - I really don't know, Mary, I'm out of - way out of my element. And I hadn't heard that by the way. Of course, it is - it is common knowledge that this crew is in better physical shape than the last two crews. I think everybody feels that way. That their overall physical condition is - is better than the last two; which, of course, SL-III was a lot better than SL-II.

QUERY Neil, in that far-off distant land when Skylab returns to Earth, have you modeled it out so that you know catagorically and beyond doubt that when that last chunk of whatever it is hits gound it's going to be vapor so that there's no possibility of any chunks raining down on us or anything like that?

HUTCHINSON You know, I really don't - I really don't know what the debris studies look like, Paul. I've never - I've never even addressed that question. I can't answer it: I don't know. I honestly don't know what - what kind of breakup analysis has been conducted. I don't know; that's a fair question though. And somebody ought to find him out the answer. I don't what the - what the reentry folks are - are calling for in terms of breakup of the vehicle or burn - up or whatever.

QUERY Okay, you were talking about the uncertainty of an explosion from these live batteries. What would be the danger of that? Are you worried about explosion in case -

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HUTCHINSON - - breakup of the vehicle or burnup or whatever.

QUERY Okay, you were talking about the uncertainty of an explosion from these live batteries. What would be the danger that? Are you worried about explosion in case in - if there is a reentry attempt or I mean a reboarding attempt, is that what you were talking about?

HUTCHINSON Yes it just, you would like that to happen period and - well, for example, suppose it might - it might - could damage a docking hatch - I don't know I - but the point is that the vehicle was - was - we were trying, Paul to get the thing in what we considered a safe configuration. Now back to the gases - you asked a question about the gases. We were considering at one time venting all the gas out of everything. And then we looked at each individual piece of gear and said, you know, 5 years from now or 2 years from now or whenever, after that things been exposed to heaven only knows what kind of thermal environment, is it still going to be a pressure - we still have pressure integrity in the vessel and the answer came back yes, the factor safety on that bottle is so high that you know you can heat it for a thousand years and it would never break, even with the amount of gas that's in there. And when that same question was asked about the batteries the answer was there is a possibility that with energy in the batteries you could get yourself into an explosive chemical situation. And with any kind of a chance of a - of a revisit by anything, ASTP or Shuttle or whatever you want to consider, the - you wouldn't want to go up to a landmine and disarm it. So that you know, I guess no - nobody is saying that there is anything going to blow up but you did - it was - done in the context that we were trying to make the vehicle as safe as possible - as dormant as possible, would be another word probably.

PAO Mary.

QUERY Neil, what are the last things that are going to be stowed in the Apollo before they come home?

HUTCHINSON You mean the very last?

QUERY Yeah.

HUTCHINSON Three guys. I don't know. What's the last gear we bring in, Ed?

HODGKINS Well, the last items, I believe, is film. We do some closeout photography and I think stowing the Nikon cameras in the MDA and coming into the command module with the last roll of film which has the closeout photography on it.

QUERY That would be done on the last day.

HODGKINS That's one of the last actions, I don't

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know, yes it's one of the last action. One of the last suited crewmen coming into the command module.

HUTCHINSON The last really big experiment stuff is done that morning and it's the refrigerated stuff. All the urine, blood and micro-biological samples. All that stuff is hauled in that last morning. The day we come down.

PAO
thank you.

Are there any further questions? None,

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
February 4, 1974
3:29 pm C.D.T.

Participants:

Milton Windler, Flight Director
Charles Redmond, PAO

SL-IV PC-123A/1
Time: 15:29 CDT
2/4/74

PAO

We're ready now with the change-of-shift press briefing with Flight Director Milt Windler. As advertised today, the - the day was basically a - a medical type day. The other experiments have primarily basically been put together and packed up and getting ready for the transfers. The medical runs today so far are going quite well. The one other experiment area that's still going is in the corollaries and that is a - a materials investigation that has to do with trying to ignite some different material samples, we have 37 of these, and see how they - flame propagates and how they burn in weightlessness. And at the present - last check we had from the crew which has been awhile ago they had completed 10 of the samples. I think it's pretty obvious that we're not going to get all the way through. And we'll do as many as we can within the time allotted but we would not be able to extend the time to any significant amount because the crew needs to continue with their deactivation and close out activities. And the reason for this being scheduled at - late in the mission is that it does introduce some contamination as the materials is - is burned and as it's then vented out to the outside and the contaminants are drifting around in the - in the area and there was concern that some of the optical instruments might be contaminated so we didn't want to do it until after the experiments were closed out. The hardware has been performing well. The CMGs continue to - to go up and down. We did see some of the highest currents that we've seen last night with - with readings of up to a 1.1 in amps and we haven't seen any of those today and I think we're still in the same posture of - of watching them and - and if they go out why we have adequate TACS margin and of course command module RCS capability to - to go from where we are now to the end of the mission. So, since EVA is now behind us and we did very well at the TACS usage on that why we're not very concerned about having to do without another CMG. The flight plan for tomorrow - oh, excuse me, we did accomplished today entry checklist review with the crew - the crew did that, we - the ground did not participate in that but the time was provided for them to do that. And we we're able to get some extra pictures with the ATM today. There's a new instrument at (garble), Arizona that - that has some higher resolution than we seen before and it's just in the last few days come on the line, and we're getting some XUV pictures from the spacecraft to - to compare with what this instrument is seeing at (garble). Tomorrow is - is basically a - a

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deactivation day; we do transfers. People have been interested in the details of the transfers and I don't have the exact items that are being transferred other than in general terms that - of course we're transferring all the - the data back across the - the film that we've taken over the past 80 days. Now we - now we - we didn't save all this up to be transferred all at one time we - from every four or five days or so we - we move some of it back across to the CSM. So we're really not looking at but perhaps say a week's supply of data here. But as you can imagine or - at the very last bit we were finishing up rolls of film here and finishing up pieces of tape there and so we - we have those odds and ends to - to get back across plus some of the equipment we want to bring back that we were using during the experiments, so of course that's another quantity. And if somebody wants more detail on that, why we can - we can get a detail list but it's a fairly bulky list that perhaps is more detailed than - than you're interested in. And we still have another medical run tomorrow with the SPT as the subject on the M092.

PAO Okay, thank you, Milt. That concludes today's change-of-shift press briefing.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Change of Shift Briefing
Johnson Space Center
February 3, 1974
16:30 CDT

Participants:

Milton Windler, Flight Director
Dave Garrett, PAO

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TIME: 16:26 CDT
2/3/74

QUERY That ought to be interesting. I'd like to have heard that.

SPEAKER What I saw on film of the press conference and it - it was kind of amusing, you know, from our standpoint. The fact that none of the reporters as accurate reporters asked any questions. And then he made a statement and then everybody's walking - -

WINDLER Well, they were rushing to the phone to file their reports.

QUERY They weren't even doing that last night.

WINDLER Well, you know. I mean - -

PAO Okay, we're ready to get started with this afternoon's change-of-shift briefing. We have with us the off-going Flight Director Milton Windler.

WINDLER Okay, well the EVA day went very well. The TACS cost was less than we expected, it was around a thousand pound seconds, and it's almost a new low record for EVAs in fact it really is. We did all the things that we were set up to do. The time of the EVA, I guess has already been announced as 5 hours and 19 minutes. I would like to make one point, I thought that the crew sounded a little bit confused at the beginning of the EVA and the reason that they were was primarily the ground's fault in the sense that we had talk for two or three weeks around here about the EVA and the procedures and the philosophy and there's a section in the checklist that has the overall plan. You've probably even seen that yourself, it's got about 7 or 8 or 9 things like that we're going to do in the total time of 4 hours and 35 minutes that was programmed for it. And we didn't send that to the crew and we never briefed them on the overall philosophy and the big picture and I thought that that was unfortunate, because and it was primarily like I said the ground's fault. We should have done that and it's very clear in retrospect and it - it made them ask some questions and do some things that were confusing to them because we didn't take the time to brief them on it so, in your mind, you ought to log that as a failure on the ground's part rather than the crew. We had a few problems today and turned out that none of them were very significant. We did have another water leak on Gibson's connector, LCU-PCU connectors. And probably that was just another one of these seal problems. We don't know about it yet. In fact, we asked him to leave it connected until we think up all the right questions and plan to ask those later on. Probably a fair amount of the 8 pound reservoir was leaked out but he had seemed to be pretty comfortable operating in more or less in a gas-cool mode. We

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were primarily concerned about the cooling for the PLT inside since he doesn't have the gas flow benefit and he's relying, essential totally on the water cooling so we needed to protect his cooling capability. Probably, I guess that's the main thing. We did give them some extra camera frames to use up since we found ourselves with one magazine that was a little bit too small to use later on or too few frames remaining. So we planned to change that out after we got back inside and this allowed them to have more film to use on the exterior part of the EVA which they did and sound like they had a big time doing it. The workloads were relative low, and it all-and-all was a pretty straightforward EVA, I think. And from here on in, of course, we'll be just doing our clean up work; getting everything ready to be transferred back into the command module and that sort of stuff. Well, we're ready for questions whenever y'all are?

QUERY What - What's tomorrow look like, Milt, on the Flight Plan?

WINDLER It's primarily a day of getting ready for transfers. We have about an hour and a half set up for the Entry Checklist update and I guess that's - they probably already made most of those entries but what they'll want to do, I'm sure, is to sit down together and talk over the procedures that they're going to use, refresh their memories on all the - all the CSM activities; Get ready for that. We have medical runs. Really, the only other thing we've got going is finishing up the medical activities. We do that one - one comet photograph and the - we'll be running some unattended ATM on one instruments and EREPs basically done except for just getting some of the gear transferred of course. So mostly it's just - medical is all that's left and it's pack up and get transferred. There's another light flash experiment set up tomorrow. The data from the first one was interesting enough that it was felt desirable to try to do that again, so we're doing that - correlating that to the - the South Atlantic - Atlantic anomaly and the things that are supposedly influence, all these particles hitting the Earth.

QUERY The other day Jerry was just a little -

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Time: 16:26 CDT
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WINDLER The things that are supposedly influence all these particals hitting the Earth.
QUERY The other day Jerry was expressing little concern about maybe not having enough time to do all the deactivation and wanted to do some it early. How does it - how does it shape up right now, look like they're going to have plenty of time to do it all without hurrying or rushing at the last minute?

WINDLER Yes, we still have a sizeable amount of what we call regroup time in the - in the checklist that we're trying to - I mean in the flight plan that we're trying to really keep in there at all cost and that's intended to give him, you know, some - some time to settle down and pickup loose ends and do what ever he things needs to be done. In addition to that, we - we think we're well ahead, we've - he's been several days now that he's had the deactivation checklist on board and it looks like that he's - he's pretty well got things under control. We hope so unless we get any more surprises of things that he can't - can't find that we're not aware of yet.

QUERY Milt, could you discuss for a little bit maybe how you view the - the packing up and stowing period that's ahead for the - for the crew now and - I'm curious as to whether you would regard it as equal to or easier or more difficult than the unpacking to begin the mission.

WINDLER Well, I guess it's hard to - to really say very much about that. I would think that it would be easier. Now, the crew hasn't said that I know of - I say that it would be easier because most of this equipment they've been responsible for they've - they've run experiments and taken the data and they have put it in places that they're familiar with. I think certain part of their problems earlier in the mission when they were unpacking of course concerned trying to stow it in places that - that they were not necessarily familiar with and in finding perhaps some other gear there that they weren't expecting. And in some cases I'm sure they found - they didn't find stuff in - in areas that they expected to find it. So, now they've pretty well probably been all through it and - and know what's there and what's not there and we'll still I'm sure have surprises on that. But, the only problem is it's psychologically any-way, it's - you got something making you a little more apprehensive of it in the sense that you're working against a deadline, whereas unpacking, if you miss a day well, okay, you start your experiments a day later. Whereas, certainly we could, you know enter on another day. There's nothing keeping us from doing that but we don't want to do that. And - and that - that deadline does I think influence you mentally and - and this leads us into this extra time so that

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they - they'll - will feel well prepared. I know historically the flight crew have always done whatever they had to do to - to be ready well ahead of time. Coming back from the Moon, you know they always had everything stowed up well ahead of entry and the other crews likewise. Now we, of course we're constrained from packing some of the equipment because we want to keep it cold until the last minute or whatever. Some of it we're still using.

QUERY The other thing I'm curious about is any personal reflections you may have on this - does appear to be last EVA for quite some time. And I just wondered what your view might be on that?

WINDLER Well, it's - I think I mentioned on the loop which you'll - I don't know whether y'all were listening or even can listen to. But it was kind of fitting, I guess, that the - that the EVA sort of ended on this - this communications anomaly that we had where we had the loud noise in the background and difficulty in getting all the switches in the right configuration. That's been a frequent bugaboo I guess of EVAs and - and whenever you've had good communications, you're always able to do one and when you don't have good comm then it's a problem no matter how well things or going otherwise. I guess I personally have mixed emotions about the Skylab being done, not only just the EVAs but the other part. Of course, we've been working it pretty hard since January a year ago counting the simulations and all the missions and personally I'm ready for a sort of change of pace and getting away from the control center. However, having been in the operations building - business for quite a while, it's going to be a certain loss in not having a - an active mission to look forward to in the - in the immediate future. I expect to personally get involved in the Shuttle and so I won't be working on the ASTP probably and - and that makes it e -

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WINDLER - certain loss in not having an active mission to look forward to in the - in the immediate future. I expect to personally get involved in the Shuttle, so I won't be working on ATP probably, and that makes it even perhaps further downstream, although, I hope to get to work on the horizontal flight test area of Shuttle, which in itself comes a little bit earlier. But I'm sure all of us will, after a week or two off, why we'll - we'll be lonesome for the control center. But we'll take a pill or something and maybe it'll go away - an aspirin, or - go down the street.

PAO Tom?

QUERY Milt, these EVAs especially on SL-IV and throughout Skylab have gone very smoothly for the most part. And especially as you came to a close here, there's just - they become almost - they become uneventful from a - from an anomaly standpoint. Is there anything you can explain -

WINDLER I guess that's - I don't really look upon them as being uneventful. In fact, the one - the two before this had to do with the maneuvers and the comet I thought were kind of wild, because of our control system problems. This one was fairly straightforward, I guess. We did have the water leak and we had some other things going. But, certainly, we've all come to understand the hardware better. I think we appreciate better some of the limitations that the crew has in moving around, and - and - and the restraint systems - and - leave something to be desired in some cases. And - and - probably in itself helped to make it better. We've always had the - the same group of crew procedures people working on the EVA timeline and checklists as well as for the most part the guys in the hardware. So the learning curve there has been very good, and I think that - that as things get smoother, it's a direct result of the people on the ground, and I'm not referring to myself, I'm talking about the Scott Milligans and the Bob Kanes, and all the people that have worked with the crews in the water tank at Marshall, and that sort of thing. Apparently we have a very good simulator. If you heard the crew today, they were commenting as to certain operations as part of their transfer was going to be - was always difficult in the water tank, and lo and behold, it was difficult in space too. So - except the tank is not as quite as deep as the Skylab orbit-wise, pretty close I guess.

PAO Okay, further questions?

WINDLER All right.

PAO Okay, thank you, Milt.

QUERY Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
February 2, 1974
16:31 CDT

Participants:

Phil Shaffer, Flight Director
Bill Mayes, PAO

SL-IV NC121A/1
TIME: 16:31 CDT
2/2/74

PAO Okay gentlemen, we have with us Flight Director Phil Shaffer. He'll give us a statement and then from there we'll take your questions.

SHAFFER Okay. When I left at the control center, the EVA preps had begun. In fact they were a little bit ahead of themselves by probably 30 to 45 minutes. But the way we got there is - got ahead is not fair if you will. During the CSM checks this morning, we spent an extra hour and a half doing that checks, because a circuit breaker wouldn't make. And that circuit breaker is the one that ties one of the entry batteries of which there are three. to one of the BATTERY BUS of which there are two. It was a very curious set of sequences when he first tried to hook it up, the BATTERY BUS showed no power. So he cycled some switches around and then it showed the right voltage level but about a third the right current level and then it went away again, all in a very quick sequence. And it didn't make a heck of a lot of sense at all. So we checked out the BUS by putting the battery charger on it and if the BUS had shorted then the battery charger goes off scale high, you get a full grade from the charger; your off scale high flow but the BUS was all right. We checked the battery and the battery was all right which leaves the breaker. We cycled the breaker a bunch of times and that didn't do any good so we pushed on the breaker firmly. And we could get an intermittent contact so it's obviously the breaker. It took us an extra hour to get all that squared away. It's - it's not a big thing because we have the three entry batteries, and we have the two Pyro batteries that are interchangeable with the entry batteries and et cetera. I got a little blurb I'm going to read you here in a minute just to turn you on about nomenclature and sequence of events to see if you can follow it, okay? Other than that single problem, the CSM's clean. It looks like it did when - on rendezvous day. Same level of performance errors in the guidance and navigation systems and the control system, all of the electrical continuity checks went just fine. The SPS swings around with great cleve et cetera. So that the birds in good shape. Tomorrow's EVA and that's all there is to tomorrow. There's no need to go into any detail on that. The - one of the problems that we have with these vehicles is that we have some many different power sources and some many different electrical busses and so many different ways to tie them together that if you don't take very good notes over there in the control center, you get it all mixed up. And we did, it took us probably 20 minutes of replaying the tape of what Jerry read down to us to understand exactly what -

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what had happened and in what system. But it goes something like this, BAT BUS A to BAT A circuit breaker would not make a contact, okay. So we put the battery charger on BATTERY A and we undid the BATTERY BUS B from BAT B and the result of the above caused several C&Ws because the BAT RELAY BUS was not powered, by either BAT Bus A or B and it also showed that the BAT BUS A was okay. You with me so far. So what we did then was put BAT Charlie on Bat BUS A to finish the G&N checks. And by that time we were absolutely convinced that it was a circuit breaker problem so we cycled BATTERY BUS A, BAT BUS A - BATTERY BUS A, BAT A 20 times to try to clean the contacts and was no joy et cetera. So our current plan is to put POWER BAT A on BAT BUS A and ENTRY BAT A on BAT BUS A and BAT C on BAT BUS A and B and BAT B on BAT BUS B and put the power loops where they belong.

QUERY He pulled this out on the EVA (garble)
SHAFFER I wasn't reading it then but when I saw
the look on your face is when I decided to scare these guys.
Okay one of the -

END OF TAPE

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SHAFFER (Laughter) But I - but I wasn't reading the then but when I saw the look on your face is when I decided to try for these guys. Okay. One of the things we're toying with now is to load the - the BATTERY BUS and make the contact under a load to see if we can clean the contacts with arcs that naturally result from that. And - at this point, we're not willing to do that until we understand the ramifications of that kind of an action. But that's one - one potential to - to clean it off. Questions?

QUERY All that's needed for re-entry, as I remember, is one bat and one bus, is that right?

SHAFFER Yeah. But let me tell you what kind of entry that is. One BUS is all you need, that's right. One BATTERY BUS and one PYRO BUS and one MAIN BUS, but you've got to be able to hook the ones you've got together. It doesn't do any good to have BUSES that can't be hooked together. If you - if you a one battery entry, it's a minimum activation time. You don't really close out the workshop, you pull down - you stay on workshop power as long as you can and pull the umbilical in the process of undocking. Okay. You spend just a very few minutes getting clear and then you do a big single impulse SPS whenever you need to turn everything off; like all the comm gear and all of the blowers and fans, and all that stuff so you'll have enough power. You can do it, but you won't like it.

QUERY Well, that raises a question. Have you lost use of anything except MAIN BUS A to BATTERY A?

SHAFFER No, all we have lost is BATTERY A.

QUERY Okay, you can't go from MAIN BUS B to BATTERY A?

SHAFFER Huh,uh. BAT A only hooks to BAT BUS A.

QUERY Okay, but you - you can - C goes to either one?

SHAFFER Yes.

QUERY And B only goes to B?

SHAFFER That's affirmative. BAT B only goes to

BAT BUS B.

QUERY Okay, so as you stand now, you've got two good buses and two good batteries.

SHAFFER No, I got two good buses and four good batteries.

QUERY Counting the pyros?

SHAFFER Yes, they're completely interchangeable.

QUERY Oh, okay.

SHAFFER I can hook the pyros to the battery buses.

QUERY Okay, but in your nominal system of what you would normally use on re-entry of the -

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SHAFFER Normally, I would have BATs Alfa and Charlie on BAT BUS A, Baker and Charlie on BAT BUS B. PYRO BAT A on PYRO BUS A, PYRO BAT B on PYRO BUS B. The new configuration is all the same except I have PYRO A hooked to BAT BUS A and BAT A, ENTRY BAT A not connected at all.

QUERY Okay, so you've got - you've -

SHAFFER I'm going to try. I'm going to close that breaker you know, because, it doesn't hurt anything, you know, but -

QUERY Yeah.

SHAFFER - but I'm not -

QUERY And you may get an intermittent signal at best, or it may clear itself up. Is that the reason for keeping it closed then?

SHAFFER Well, of course, it's conservative, too. And one of the things you can do is build yourself a little lever. Okay, get one of the tools or something out. Take down one end of it and put a fulcrum thing so you can put it across the breaker and shove on it and hold it in should you need it. We're also considering that, but it's not obvious that we need it yet.

QUERY Okay, what - the other thing you were talking about doing to try to use the arc to clean it off is throwing a heavy load on it?

SHAFFER No, just a load

QUERY Just a load.

SHAFFER If you've got it powered and you can make - make it contact, then when you break the contact then you have a arc.

QUERY Okay, but there's no sense in doing that at this point, is there? I mean is there -

SHAFFER Well, it saves you a bunch of checklist changes. Okay. And it provides you - your complete redundancy on the battery - on all of the buses. So, that then I would a whole lot rather fly a three battery entry with a full-up nominal configuration all the way than I would a two battery entry, which will require some management to fly the nominal end of mission sequence the five hour beauty.

QUERY What do you mean management, in what way? You going to turn everything off and everything?

SHAFFER Well, I'll have to turn some things off.

QUERY Like what - what kind of things?

SHAFFER Like the power amplifier for the transmitters onboard. Like I'll probably have to manage the SCS ATTITUDE CONTROL sys; I'll have to leave that off. I'll end up managing the heaters to keep them off as much as I can.

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QURRY Would the amplifier - won't that effect
you on the last of the re-entry phase comm?
SHAPPER It rende - increases the signal to noise
ratio.

END OF TAPE

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SHAFFER - - so I'll have to leave that off. I'll
end up managing heaters to keep them off as much as I can.
QUERY Would the amplifier - won't that effect
you on the last of the re-entry phase comm?
SHAFFER It tends - increases the signal to noise
ratio.

QUERY Repeat that.
SHAFFER Garble - garbles it a little -
QUERY Okay.
SHAFFER Maybe. I don't - we - we're talking fast
to each other and I'm trying not to avoid you. I'm tr -
I'm trying to answer them as you ask them. Don't let me
slip one over you. Okay.

PAO I think we have a comment in the back.
QUERY Yeah. But even if you can't get BAT A
back on the line, the re-entry with four BATS is - is nominal
in effect.

SHAFFER That's affirmative.
QUERY Yeah. All you're losing is your one
battery redundancy.

SHAFFER That's right.
QUERY Yeah. And all these batteries appear
to be normal and - by the way they're -
SHAFFER No they are - you know with this -
QUERY - that with this - Yeah.
SHAFFER - - housekeeping CM7 that you see on the

Flight Plan which was done 3 days ago, I think, the batteries
were all checked and were all all right and the breaker
worked then so it's probably a piece of floating contamination.
QUERY You mean like a piece of solder or some-
thing like that?

SHAFFER Well, or a piece of fiber or it may be some
kind of film that's build; that's slowly built up, you know.
QUERY Some nonconductor.
SHAFFER Obviously, a nonconductor, that's right.
QUERY Okay, I want to kind of - in the event that
we have another problem if you lost one - the use of the
other, say battery BC, would you still bring in one of the
other Pyros to replace that - that loss when you connected
in, is that correct.

SHAFFER Yeah, with Pyros -
QUERY And you can still fly with a -
SHAFFER Okay, but now I'm getting in the point
that when I come to places where I need good voltage levels
for events like separations where pyros have to be fired
and all of that, then I will have to have some power down
accomplished when I get to that to keep the voltage levels

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high enough to be damn sure we get those functions. Okay the point is that one more battery puts us in a - in a management situation, two more batteries puts us in a worse management situation. Three more batteries puts us into business, it - we were talking about earlier and I'm not sure we'd fly that way because if you got four out of five batteries cratered, you'd better start - in fact, at three out of five, you'd better start thinking about a generic problem. But we're a long ways away from that.

QUERY But - but the odds on losing one or two more are what?

SHAFFER Well, I don't have BAT A at this point.

QUERY Right, but it's it's not the BAT (garble)

SHAFFER Well, but you have a generic problem in circuit breakers. Yeah?

QUERY are you lost as a way to get to it?
Are you lost at a way to get to that BAT A usable, right?

SHAFFER Well, we're also toying with - there are some ways to take some panels off and strips some wires and hook them up around the breakers. What you give up in that case is the protection that the breakers gave you. We're a long ways from that, I'll tell you. One heck of a long ways. But at some points you end up trading that for rescue when there's a trade between those. Thank you.

QUERY Well if you start doing that and you do have some kind of a generic problem would you - seem to me the only reason you'd want to go in and strip and do some electrical rewiring is if you had a genetic problem in circuit breakers and you're losing more, and then you'd run the chance of blowing your whole system out after you've undocked. I mean - is it really all that realistic of a -

SHAFFER Sure. The circuit breakers are failing to open. Big difference. I got to have in addition to all these problems, we're postulating here in this scenario I've now got to have another problem that cause me to need the protection at the circuit breakers.

QUERY Right.

SHAFFER We kind of get - I guarantee you that if you pick your failures in the right sequence and the right relationship, we can get in one hell of a heap of trouble and it's always been that way. Yeah. And three more circuit breakers - three more specific circuit breakers - very specific circuit breakers, you're in some trouble. Just probably two more circuit breakers in that other system that will get me in this much trouble.

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QUZRY
your problem.

SHAFFER
nuisance level thing there.

QUERY

Well the best thing is you're not tricking

Yeah, we never do. Yeah. It's a

Losing - losing say -

END OF TAPE

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QUERY Well, the best thing is you're not picking your problems.

SHAFFER Yes, we never are. Yes. It's a nuisance level thing there.

QUERY Losing - losing say use of another battery or - or something would force you into a (garble) position which makes it more difficult on reentry day. Or would you have to set everything up in advance or - -

SHAFFER Set it up.

QUERY The kind of thing you'd have to be doing almost step by step.

SHAFFER Set it up in advance. You just - you mod the entry sequence, turn things on and off to preserve the thing. But that - that's still an easier management problem than Skylab II before we got the solar array up. And that was a wooly bugger, let me tell you that was something else. Where every single 100 watt light bulb was - not even 100 watts - or 12 watt bulbs were significant.

QUERY Is it easier than SL-III with some of the quads down on reentry?

SHAFFER Yeah.

QUERY So on a scale from 1 to 10 this would rate very low then.

SHAFFER Yeah, as a management problem. The - the thing with the quads on SL-III was a dynamic problem. Yeah, electrical systems are passive they just set there and do their thing. But the quads are the things that make the vehicle move. And it's 6 degrees of motion. And it wasn't a matter of - of I just use it but I had to mod procedures and mod techniques, and mod computers and et cetera to get that 6-degree capability. And then the electrical system I just turned stuff on and off to maintain an energy level. It's - it's a different kind of problem.

PAO Is that all the questions gentlemen?

Paul.

SHAFFER Oops.

QUERY Continuing our tradition of exploring trivia, and continuing the tradition started yesterday of making our trivia questions personal -

SHAFFER That was not a tradition that was started yesterday.

QUERY Well, this is philosophical one. If you had your druthers would you be up there with them or down here doing what you're doing?

SHAFFER Oh, I'd be up there.

QUERY Are you a frustrated astronaut?

SHAFFER No not necessarily, but I - I just haven't every done that. I think that be - I think that would

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be a lot of fun. And I think hey've got a whole lot better view than I've got. Okay and with my 20 some stone I think I would appreciate zero g.

QUERY If you were up there how do you think you confidence would be toward the guys doing your job?

SHAFFER Well, I - I think that as entities where an entity is a team that they were highly confident. Okay? Because we got a heck of a bunch of good people, we got a lot of good people backing us up in places around. And we're like any large group of people we have individuals who are not as strong. Okay? But - but the specific answer to your question is that - all the confidence in the world. The - the one thing that - while we're being philosophical - the one thing that - that we some times have crews have trouble getting the crews to understand and we not had it with these guys - is that we don't move as quickly in this kind of an environment as you do in the launch rendezvous or an entry kind of sequence. And I get to feeling that there is some kind of frustrated occasionally because of that inertia that the that the system has. Yeah, and at least I'd have that going for me. I would know that there aren't very many instant answers, where there is not an instant problem. We optimize.

QUERY

That's a function of conservatism.

SHAFFER Well, there is some, but I think there's more optimization than there is conservatism as - as a driver for the inertia, do it right - super right.

QUERY

Reluctance to certain options.

SHAFFER

Huh?

QUERY

A reluctance to certain options.

SHAFFER

Yeah.

PAO

Okay, gentlemen if that's all thanks for coming, we'll close the philosophy class.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
February 1, 1974
4:31 p.m. CDT

Participants:

Phil Shaffer, Flight Director
Dave Garrett, PAO

SL-IV PC120A/1
TIME: 16:31 CDT
2/1/74

PAO We're ready to get started with this afternoon's change-of-shift briefing. We have with us the off-going Flight Director Phil Shaffer. Phil.

SHAPPER For the last full blown science day, we had at it. For - started off today with a JOP 13 and immediately got behind the power curve like we're want to do on occasion. It took Ed a little longer to get Canopus positioned in the TV, we were using Canopus for a guide star. We were doing the bulk of the maneuver from solar inertial to Canopus and removing all the errors there with Canopus and then going on to Gamma Valorum. The technique for doing that was to do the initial maneuver from solar inertial which was to put Canopus behind the occulting disk in S052 then maneuver out to see where it showed up in the - on a grid that we play similar to the way we're doing the 18 Deltas with the comet and then compute the exact maneuver to put it precisely in the center of the field of view and then go after Gamma Valorum. And that took a little longer than it was supposed to and then when we got ready to go from Canopus to Gamma Valorum we made an out of sequence set of entries into the control system and had to start over and that cost us a few more minutes. Specifically what we did was enter the attitude maneuvers to do before we switch to the control modes. And the computer couldn't cope with that. You got to do it in the right sequence. And then something happened that convinces me that Ed Gibson's hunted quail before. On account he caught Gamma Valorum coming into the scope. It was supposed to go to behind the occulting disk and then he would do the same trick moving out if he could see it. Gamma Valorum is a lot dimmer than Canopus and then move it back but he caught it coming in. So he stopped the maneuver with Gamma Valorum still in view outside the occulting disk and computed the precise maneuver to move it back and that saved us quite a bit of time there instead of having to go in and out and then back in. He just stopped it and recomputed his maneuver and went on. That's a whole lot like shooting quail because - the thing's only about so big you know and it's (garble) across but anyhow we think we got it this time. And he did see it obviously so that he was able to stop. The CMG was out of distress, it went out of distress late yesterday and stayed out all night and went back into distress during the JOP 13 work, classic-no-nothing new on the distress level, it just went back in. The mib count, we had predicted 76, we used 75 for the JOP 13 exercise and that's about 300 pound-seconds - no 375 isn't it? EREP 50, weather was beautiful for that down across the western part of the U.S., across Mexico and across South America. Unfortunately

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it's most probable that S191 cratered, that's the spectrometer they - what they call their viewfinders tracking system as part of the optics that they look around with. And the failure mechanism is that the cooler didn't cool. And it was quite a bit warmer than it was suppose to be and then loss associated with that is that we were trying to get some thermal data via the S191 instrument from some volcanoes in Central America or somewhere, I've forgotten where now. And that data will be severely degraded if - if not lost. And also the calibration that we did on that instrument after the EREPs will be degraded also because on all -

END OF TAPE

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SHAFFER - - calibration that we did on that instrument after the EREPs will be degraded. Also because all of the spectrums are somewhat degraded by the high - high temperatures. The normal temperature for that cooler is around 34 degrees the part that we measured is a lot colder inside. And it was running like 70, so it was considerably warmer than it was suppose to be. We had predicted zero mibs for EREP 50 and it took 4. The lunar cal exercise went textbook as most of them have. We don't really have any problem with those. And we had predicted 84 mibs for it and we were still firing an occasional deset mib when I left so the count's probably up around 90 on that. Point is we predicted somewhere around 750 pound-seconds we ought to come real close to that, which is very good to come that close with that kind of exercise. Major medicals - the second major medicals were just beginning when I left those are M092/171s. EREP's over; JOP 13's over. This evening we'll do the last Kohoutek work with the 201 instrument. We will also be taking a starfield with that. And that's the last one of those. Tomorrow starts out with systems checks on the CSM early, 07:00 local is when that begins. It runs for about 3-1/2 hours. The EREP equipment is secured tomorrow and it's - that's the end of that. It's put away into a - a stowage condition. An EVA prep takes up the bulk of the afternoon. It's kind of interesting the - the EVA checklist changes went up last night, and probably about 15 feet long per copy. We sent three copies. The deactivation checklist changes went up last night. They're 15 feet, sent two copies. The JOP 13 pads, the EREP pads, the ATM pads, the Flight Plans, and all of that. Tell you what Jerry said, he could get from the teleprinter to the wardroom. And we think that's an understatement, we think he could have got there and back cause there was probably about 90 feet of paper hanging out of the teleprinter when he got up this morning. Should have really been a spaghetti bowl. Oh, the CMG went back out off distress during EREP. And when I left it was looking normal - nominal not normal. Normal has changed it's meaning now, it looked nominal. (Laughter) I guess I don't have anything else to say specifically, how about some questions?

QUERY Are there any more Kohoutek next week?
SHAFFER The S233 they had - the cameras out the windows will go on for another day or 2 and then that's it.
QUERY What about - what other type of corollary experiments can be look for next week?
SHAFFER None.
QUERY Just - -
SHAFFER I'm sorry. M479, which is the materials

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burning. The experiment that has to go on after the EVA, after we've gotten everything closed down because the ashes from the burning are vented outside. And they'll get all over everything most likely, so it - that is still - there's a full day of that. It must be occurring on day 81, the day after the EVA.

QUERY What about - how many more medicals have we got?

SHAFFER Everyday.

QUERY Everyday?

SHAFFER Yeah, one - at least one a day.

QUERY What about EVA day? Have we got any?

SHAFFER Well, we did two today. And we'll be doing one tomorrow. Of course not on EVA day, and I think we have two on day 82, with the day after EVA we have two again. The - it average is one a day.

QUERY When does those cut off all together?

SHAFFER 83, I guess. Th - the last one may be day 82 but I suspect it's day 83, cause you obviously want to get the latest data you can within reason.

END OF TAPE

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SHAFFER The last one may be day 82 but I suspect it's day 83. Because you obviously want to get the latest data you can within reason.

PAO Howard.

QUERY In your observation of the CSM do you see any problems at all with it from - from the ground.

SHAFFER The only problem's you know the quad Bravo has a propellant isolation valve that won't close. And we've know that since we've - since like the first week. And all that means is that you've got to be careful with any of the failure modes when you try to isolate stuff. So that - if a quad starts leaking you don't want to dump the PSM through it. So we had to go through and be sure that when - when propellant tanks from the quad door itself are open to the thruster that the PSM is not. And vice versa so that we don't get a problem with the thrust and lose both of those. But there's - there really aren't any other problems. We're going to be sure there aren't with the - -

QUERY What - what - -

SHAFFER - - systems.

QUERY Is it strictly a systems check tomorrow, or are they familiarizing themselves with some of the - -

SHAFFER Well it - it obviously -

QUERY - - systems and things.

SHAFFER - - serves both purposes. You know we do this - this thing you see in calcomms. It's called HKCM7 and those happen once a week. What happens there is that they go in and check battery voltages and run the coolant loops and look the vehicle over and et cetera. And the stuff that is "active now" if you will. The stuff that is - that is been quiescent like the G and N, the optics, the SCS control system, the EMS, the wires that go between the control system to the thrusters and the SPS (garble) drives. And all of those things will get exercised tomorrow to be sure that they're still working okay. And you do these I might point out just as a reminder that we do them at this point entry minus 5, entry minus 6. So that if we find anything we can respond to it in time to get the checklist updated and do any required analysis and et cetera before it's time to commit to the entry.

QUERY Is this the same thing like last night referred to as a button touching or -

SHAFFER No you're talking about Skylab II. We have done the entry checks every mission. On Skylab II we also tried to do what amounted to a sim if you will, involving the ground and the crew both as a refresher where the ground would go through their exercise. The things that they normally do in a normal kind of a time line. And the

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crew would go through the entry sequence switch/touch exercise. That turned out to be about an hour and a half or two hours of Pete cooling his heels being nice to us. Because he thought we were getting something out of it and us cooling our heels thinking he was getting something out of it. And I finally asked Pete where he was because I didn't think he was in the command module anymore. He said he was down doing something, and I said yeah, I thought so. Why don't we knock all this off. So we haven't done that anymore. And last - yesterday afternoon the guys spent quite a bit of time and - where "quite a bit's" measured in hours, like 2 or so. Going over CSM refamiliarizing themselves, looking over the checklist and et cetera. And we have some more time of that scheduled. But a regimented time sequence simulation in that kind of environment just doesn't work.

QUERY La - last night I caught the tail end of the conversation. Did they have some problem with the shower vacuum that may them - that prevented them from taking their showers yesterday.

SHAFFER Yes, they wouldn't pull the water.

QUERY It what?

SHAFFER It wouldn't pull the water. The fan that pulls the air through that catches the water that et cetera, et cetera didn't work. And it's - the fan itself is full of water, it won't run.

QUERY No more showers then.

SHAFFER Well, they've had their last day off.

QUERY Okay.

SHAFFER They're going to come home dirty.

I've got to stop calling that thing a boat - ship.

PAO Any further questions? Bruce.

QUERY Yeah. Well, the S191 cratered today on the last EREP and the shower cratered on the last day off. Is the

bird just starting to fall apart as they finish with it. Is that -

SHAFFER The bird is not just starting to fall apart.

QUERY Well, I - I don't - I know that.

SHAFFER Well it didn't start until 57 seconds after liftoff. And if you want to plot it at the average is fairly constant -

END OF TAPE

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QUERY (Garble)
SHAFFER The bird is not just starting to fall apart.
QUERY Well, I don't know that.
SHAFFER I mean it didn't start until 57 seconds
after liftoff. And if you want to plot it, the average is
fairly constant.
QUERY (Laughter) Yes, I think you're right.
QUERY What about the -
SPEAKER The guarantee was up on day 240, by the way.
(Laughter)
QUERY How do you bring it home to turn it back
in though, Phil?
QUERY What, with the end of the science - bulk
of the science work, what's the kind of feelings over there?
Was this mission as much of a science success as hoped to
begin with -?
SHAFFER Oh, my goodness, yes. Oh, for goodness
sakes yes. You know, they - when we built the Mercury, started
flying the Mercury program, no two vehicles were ever alike.
We learned and improved, and et cetera. The same was true for
Gemini, and it was obviously true for Apollo in both of the
vehicles. And the first vehicle has always been pretty grim,
but - each new type of vehicle, but because you just can't test
it for that environment down here. And the odds were not great by
any chance that we'd ever even get to Skylab IV, without
something cratering to the point that we couldn't fly the full
duration. The fact that we've flown three missions, flown the
last two longer than was intended in the face of the problems
that we started with tells us that that's really pretty damn
good first of a kind vehicle. It's fairly forgiven. We carried
an awful lot more consumables in the way of film and tape and
etc. on Skylab III and Skylab IV. That's stuff's all been
used. And the fact that the mission's - you know, it's like
we got an extra Skylab II out of it in terms of duration. So
that the answer to your question has to be a resounding yes.
We got more than we started after.
PAO Any further questions? Thank you.
SHAFFER No - no innoculus questions. I'm upset.
You have really done me in. (Laughter)
QUERY I was going to ask him how much he weighted.
QUERY Call him the Santa Claus of the mission - of
the flight directors.
QUERY That's an idea.
SHAFFER You really want to know, don't you? About
24 stone.
(Laughter) (Whistles)
PAO Thank you, Bill.

END OF TAPE

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Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 31, 1974
4:30 p.m. CDT

Participants:

Phil Shaffer, Flight Director
Gatha Cottee, PA

SL-IV PC-110A/1
Time: 16:30 CDT
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PAO Ready to start the briefing. Change-of-shift briefing with Phil Shaffer Flight Director. Aside: I've already cut it off. Phil you want to give us a rundown, please.

SHAFFER Okay. I guess you guys know that today was the crew day off. They jumped out of the sack early this morning and - early, hour and a half late instead of 2 hours late like they normally do on the day off. And did EREP track 49 which was a 360-degree pass. The data takes started just east of Brazil and ended in the southeast part of Brazil. - the reason there was a - a full orbit of data take. - to use the S193 altimeter all the way around while some of our C-band stations skin tracked the vehicle. The intent of the - of the data take was in support of a satellite named GEOS-C - that's G-e-o-s-C And as I understand that that's a Geoid survey and it's a third of a series, thus the "C." But what that beauty is trying to do is study the - the basic shape of the Earth and magnetic field and et cetera. And by using our instrument the 193A over a full circuit of the Earth and when the GEOS flies over with its altimeter then we got some empirical data both from the altimeter on the Skylab and from the C-band tracking stations that - that (garble) the vehicle around. The EREP pass was predicted to take 24 mibs - 20 mibs it used 24. S190 worked with no problems which is the one that cratered on us a couple of days ago for no good reason that we know of yet. 193 apparently had a - a bias in the antenna and since we had to pin it during an EVA early in Skylab IV we rolled the vehicle - we biased the vehicle attitude 1-1/2 degrees to compensate for that. And my EREP officer told me the 193 altimeter worked nominal today, that everything he saw was per the advertisements. So obviously the 1-1/2 degree bias helped. The press conference followed the EREP - of course you guys have access to all that so you know who did what to who and et cetera. After the A - the first ATM pass today that Ed had, the guys retired to the command module to begin refreshing and boning up CSM systems and CSM management and Entry Checklists. Two days ago we updated the checklists - I'm sorry, night before last really and sent the other new AOS-LOS times, the new sunrise, sunset and changes to the operations. The bulk of the changes were changes in film magazines and - and that sort of thing. One profile difference that we'll have for the end of mission vice what we had prelaunch-the end of mission was based on a 70-day mission and we had flyaround that was a full 360 degrees around the vehicle taking pictures and observing. And that starts at sunrise terminator. And the Earth-Sun San Diego relationship is all changed enough now that there's not enough time to go

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all the way around the vehicle so we just - we're going to go
halfway around now from the front to the back over the top
photographing and observing on the Sun side. Aside: What
do you want me to do with that? Yeah, okay. When I left
the control center the crew was still in the CSM reviewing.
One of the things we did a few days ago that hasn't worked out
at all is the-what they call the al -

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SHAPPER - - the crew was still in the CSM reviewing. One of the things we did a few days ago that hasn't worked out at all is the - what they call the ALC, and I've forgotten what the thing stands for. But it was a mod to the communications systems to try to help the crew get rid of that 6 cycle noise we got going for us. And that hasn't worked out at all. And what it has done is degrade the recording - voice recording to point that it's almost unusable. So, sometime today we'll be removing that modification. I believe it's called ALC bypass cable. Which will put us back to the configuration we were 4 or 5 days ago where they got the 6 cycle noise in the background while they're recording. And when they don't want the noise they can pull a circuit breaker that shuts the noise off. And also, precludes recording. Tomorrow is a hopping banger as far as TACS consumption is concerned, we have another JOP 13 on Alfa Valorum - Gamma Valorum. First rattle out of the box in the morning, that's followed about 2 hours later - 3 hours later by an EREP track 50 which will be the last EREP of Skylab IV. We do a lunar cal behind the EREP, back to back with it. And then in the evening we're going to go look at the comet with S201. That's going to run 7 to 800 pound-seconds of TACS to accomplish all of that in 1 day. But it's in the truest of sense the last big science day of Skylab IV. Day 79 has got EREP closeout, it's got the CSM system checks and EVA prep. And that's - that's going to be about the size of it. Two major medicals tomorrow with Ed and Bill as the subjects. By the time we get all of that done that'll about wipe out the day. How about some questions?

PAO Tom?

QUERY Phil, apparently you - you've - everyone feels real good about TACS now still and got - have a lots and lots of TACS left?

SHAFFER Well, the GNS - the guidance, you know, the Harry Clancys and Jack Kammins and Terry Watsons, Ron Lerdals those - Ron Brickfed I'm sorry, have done what you've got to call an outstanding job of studying the momentum managing problem and adjusting things so that we can minimize the usage of TACS. And these guys have been well backed up by the people in Huntsville in the Stat/Host environment, because those guys have - have run one for one with our guys here. And those people have just done an outstanding job. You know we - we - after the CMG failed and we reviewed the redlines and - and redid the rules and all, we were setting where we could use about 350 pound-seconds per day, and still maintain the margins that we required. And we got hit in the eye 2 or 3 times by inadvertently errors and by problems during the EVA and at

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cetera. The fact of the matter is these guys that got all of that back force and on days when we could spend 150 they spent 50, and et cetera. Now we di - we flatly haven't used a hell of a lot of TACS since we got back into the business after the last EVA. And I don't have the exact number but it's - I'd have to guess we're setting around 14 - 15,000 pounds-seconds. So, the point is we got - we got TACS.

PAO Paul?

QUERY Phil, continuing our program of investigating trivia - -

SHAFFER (Laughter) I can tell you guys can hardly wait for me to get back over here.

QUERY I noticed several of the Flight Plans starting with Saturday would have - literally hours where labeled regroup. Now, what specifically is the purpose of this - this period is regroup? And does this involve the ground or is it just regrouping among the crew or what?

SHAFFER If I - if we had labeled that time as pad would it have helped? We - the boys felt rushed - -

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SHAFFER

We - we've always felt rushed powered down before. And we fully expect that there are going to be some things come up that are not anticipated. And we want to keep our options open. We don't want to have to start scrubbing things to get out of there, we want some expansion room. If things aren't going very well I want to sit back and talk about them, take new directions, i.e., re-group that's where the name comes from. But we don't, we ought to leave that beauty for a while. And as you know the agency's position is that we want to leave it in a posture to be revisited, not reactivated - revisited. And you start trying to punch out of there in a hurry - that you take a chance of jeopardizing. That - we're out of consumables. So you know that ATM is about out, and EREP is about out and et cetera and et cetera. I want to keep those days loose, as loose as we can.

PAO

Paul.

QUERY

There was some confusing - confusion among my troops and elsewhere about the length of that news conference today. There were a number of questions that didn't get - get unanswered - or that went unanswered. And I was wondering was there some reason why it was - it was cut to just the stateside pass and we lost the Vanguard?

SHAFFER

Yeah, that was all the time that was scheduled. In fact but - but let me - let me expand on that a little bit. The - you know that was the only time we get TV is across the States, okay. And there was a - the gap between stateside and the Vanguard and the guys be out of it. I fully did not expect it to take as long as it did. I didn't expect the guys to talk as long about the given topics as they did. And the Flight Plan that I had this morning. You've got to understand I just came back on after a couple of days off - had Texas and MILA scheduled for the press conference, and had the guys going to eat after that. And I stopped it because that's what the schedule was and that's where the TV was. And it's nothing more sophisticated than that.

PAO

Paul.

QUERY

When is the last final look at Kohoutek?

SHAFFER

I think - wait a minute hang on. No that's not entirely true - now that - The last - I think the last look with the super sophisticated gear like the instruments that go into the SALis tomorrow. But the handheld photos, what they call the S233 will continue for a while. But I believe tomorrow at the end of the day the S201 ops is the - is the last shot. You know the guys can't see it anymore. It is so far away now and so dim that it - that

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they can't see it and we're providing guide stars. Now we're telling them to take a picture of star "whatever" because that's the camera field to be used - big enough to include Kohoutek in that.

PAO

Paul.

QUERY

On this partial flyaround are - do they have instructions or anything or - do you hope that they will look for anything in particular. Any particular problem or anything like that they are looking for. Or is this just an engineering assessment or what?

SHAPPER

The we haven't seen the sunshade. Okay. And that's probably the primary reason for doing the flyaround. We need to know from an engineering standpoint what that thing looks like since the crew did have trouble laying it out and it "Has some accordion folds in it." And we'd like to understand the temperature response that we got out of the vehicle after we put it out. Which means we need to know how much the vehicle is covered by it and what the degradation has been and et cetera. And if you remember when Jerry and the guys got there they reported browns and reds and greens, and lots of different colors that were obviously radiation degradation or solar degra - -

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SHAFFER - the guys got there they reported browns and reds and greens and lots of different colors that were obviously radiation degradation of a - solar degradation of the coatings on the vehicle in the different areas and we want to see what another three months has done to that.

QUERY Speaking of that sunshading and related to that - The Skylab was originally designed with that - with this infamous micrometeoroid shield based on mathematical probability of it getting pierced by - by some debris flying around out there. And they said the other day the things has been remarkably tight, no leaks or anything like that which would indicate it hasn't - has in fact not been pierced by anything. Does this give you new data and new confidence to fly a long term space station without a shield or did this really add anything to that?

SHAFFER Well no matter how I answer that I'm in trouble. (Laughter) The - I don't remember what - what the statistics were on the thing. But if you say the probability of getting dinged was 5 out of a thousand for instance, that is characteristically a high enough probability to take some positive action for - i.e., a meteoroid shield to dissipate the energy. And the fact that we didn't get hit doesn't mean I wouldn't have got hit twice the day after deorbit statistically. As long as the predictions produce those kind of numbers we'll do something about it. Now whether or not the statisticians will update their predictions or not I don't know, I can't answer that. But I - I personally don't consider that the data to date has invalidated the predictions. Like I say I'm probably in trouble for having said that.

QUERY I wonder who we're going to have tomorrow?

(Laughter)

SHAFFER You - you got me for two more days, unfortunately. No I understand. Two more days.

PAO Is that it? I guess we can wrap it up.
Thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Inflight Press Conference
Johnson Space Center
January 31, 1974
12:36 p.m. CDT

Participants:

Dick Truly, CAP COMM
Gerald Carr, CDR
Edward Gibson, SPT
William Pogue, PLT

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PAO Skylab Control, Greenwich mean time 17 hours 36 minutes. Acquisition coming through Goldstone in 1 minute for the press conference, the last and final press conference in the Skylab program with the crew from inflight, questions submitted to Mission Control Center by representatives of the news media. We'll bring the line up for this stateside pass. Reading the questions to the crew will be CAP COMM Dick Truly.

CC Skylab, Houston. Hello stateside for 15 minutes. We do have TV. How do you hear me?

CDR Read you loud and clear, Dick. How me?

CC Loud and clear. I have a number of questions here to pass on to you guys so I'll just read them verbatim here, and we'll get on with it if you're ready.

CDR Okay.

PLT Let's get a comm check on each one of the crewmen. PLT; How do you read?

CC Bill, I read you loud and clear. How me?

PLT Fine.

SPT Okay, Dick. How do you read me?

CC Ed, I read you loud and clear also. How me?

SPT Very good. Thank you.

CDR Let her rip.

CC Roger. The first question, Jerry, is for you, for Commander Carr. What do you feel have been the major accomplishments of this mission, and have you proven that man can pretty much do as he wants to in space considering working, living and repairs?

CDR I think the major accomplishments in this particular mission are - are several. I think the biggest major accomplishment is the - the tenure, the - the length of the stay. We've shown that man can do what we thought he could do and that is come up here and set up housekeeping in space, that he can adjust to his new environment and I think from a medical standpoint the medical experiments have already shown so far that we right now appear to be in better physical condition than when we left, and I think the other accomplishments are in particular - Ed'll probably get an opportunity to talk about it, but in the solar area I think the fact that we managed to catch the full rise of a solar flare is a significant event. The fact that we caught the brightest coronal transient that's been seen from up here I think is significant. In the area of Earth resources we have done nearly 45 Earth resources passes around the Earth. We've gathered a heck of a lot of data and I think that is indeed significant. And last but not least is we took the time before we left to do some study on how to do Earth

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observations from out the window and do handheld photography, and it's our impression that we have really covered a lot of ground as far as getting photography from handheld cameras and we feel real good about that and I think that's that's been a very significant input from this mission.

SPT Dick, if you'll allow me, let me add a couple of things on there. We also had, I think, quite an extensive comet observing program, and although the brightness of the comet was not what we predicted I think the all-out effort which people all around the world put on it and particularly up here where we were able to make a large number of attitude excursions of the vehicle and point at the comet learned something of its spectra which is going to tell us of what it's composed, I think is a very significant achievement. And I think one that speaks well for all of Skylab, just ours, but that is that in spite of some fairly major hardware problems, we've been able to pull off all three missions and extend ours beyond what we originally anticipated. We put a sunshade up to take care of a problem we had with thermal micro - micrometeoroid shield coming off. We've had rate gyro problems and had to fix those. On EVA that was - both were done on Skylab I and Skylab II, and we've lost a control moment gyro and have been able to do the most extensive maneuvering yet of any of the missions on two CMGs. So we're all pretty proud of not just our mission but the whole series.

CC Roger, guys. Appreciate the answer, and we certainly agree with you. This next question is for Bill Pogue. Now that your mission is almost over, do you feel disappointed about any aspect of your flight?

PLT Well, I don't think so really. I think that we feel like w - as we - as has already been said. We feel like that we've done very well in spite of some of adverse circumstances. Looking back, it's in a couple of things we mentioned in particular was the repair on the primary coolant loop, which was conducted and completed early in our flight, carrying on from what Ed said from the earlier flight, so that was a major repair job and represented a task that had not been done before. We also have worked outside EVA and made major mods or repairs, sort of a combination of the two, on one of the radar antennas which was a part of the Earth resources package and also on the Apollo telescope mount, one of those telescopes was malfunctioning, so by and large I think that we have - although we would have liked to maybe have had everything working 100 percent, in view of the fact that it wasn't we've done very well in spite of that fact and we feel like we'll be bringing

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back the best data possible for the situation that existed when we got here.

CC Roger, Bill. Thank you very much. This one's for Ed Gibson. You're the last American crew that will fly for at least 18 months. How do you feel about the long gaps between flights in the next 6 to 8 years and what do you feel is man's long-term future in space?

SPT Of course, Dick, I think everybody associated with the program would like to see us have more flights in the coming years; however, I think what we're building up to, that's the ability to get man in and out of orbit with a lot of flexibility, cheaply and easily so that we can fly the most competent people for the given mission to be performed, I think we're all happy to see that coming down the road and we're going to have to pay the price of not having a few missions continuing on here in order to get that capability but it's going to be well worth it. And let's hear the second part of that question again, please, Dick.

CC I think you kind of answered it. It was how do you feel about the long gaps in the next few years and what do you feel is man's long-term future in space?

SPT Okay. Long-term future: I think that we're going to be going in two directions again. One is exploration and the other is utilization. Now we've done both on Skylab. We've been able to explore some new frontiers and we've been able to utilize. Earth resources certainly is one of utilization of a capability to get up here and use the space station. We're going to be building space stations eventually in the future and extending the various types of activities we just started here, and we're going to be exploring. There's no doubt in my mind we're going to be visiting other planets. When that is, I can't say. It's when the American people chose to - to make that effort. Those are two directions which are inevitable. How fast they come is really up to the desires of the people.

CC Okay, Ed. Thank you very much, and back to Jerry Carr. You guys have been in space longer than anyone before. What psychological and mental problems do you foresee for space travelers on very long flights to, say, Mars?

CDR I think probably the psychological problems that you would probably face on a mission that long would be the same kind of psychological problems you get up north in the winter when you're locked in the cabin for months or on an island, island fever, cabin fever, that sort of thing. That is the - the lack of the ability to get away.

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You're stuck with the surroundings and there's not a whole heck of a lot you can do about changing your surroundings, and so what you need to design in a future spacecraft that are going to do things like go to Mars, is you're going to have to design lots of - of ways to divert yourself, rec - recreation, reading, things like that. You got - you got to be able to as we say in the flying game, you got to be able to close the hangar doors when you go home, and when you're on a year or 2-year mission you're going to have to have a place that you can call home and you're going to have to be able to go to that and be by yourself or - and do what what you want to do, and I think that's probably the major psychological problem we're going to have to work out. I think the submariners understand this too. The guys who spent 30 to 60 days underwater most certainly do understand this problem too, and they're working it as well as we are.

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CC - - dark. You guys have been in space longer than anyone before. What psychological and mental problems do you foresee for space travelers on very long flights to, say, Mars?

CDR I think probably the psychological problem that you would probably face on a mission that long would be the same kind of psychological problems you get up north in the winter, when you're locked in the the cabin for months, or on an island. Island fever, cabin fever, that sort of thing. That is the lack of the ability to get away. You're stuck with a surrounding and there's not a whole heck of a lot you can do about changing your surroundings. And so, what you need to design in the future spacecraft if you're going to do things like go to Mars, is you're going to have to design lots of - of ways to divert yourself; recreation, reading, things like that. You've got to - you've got to be able to - as we say in the flying game, you've got to be able to close the hangar doors when you go home. And when you're on a year or 2-year mission, you're going to have to have a place that you can call home. And you're going to have to be able to go to that and be by yourself or - and do what you want to do. And, I think, that's probably the major psychological problem we're going to have to work out. I think the submariners understand this too. The guys who spend 30 - 60 days under water, most certainly do understand this problem, too. And they're working it as well as we are.

CC Roger, Jerry. Thank you very much. This one's for Ed Gibson. Based on your medical studies, what do you predict your physical condition will be after splash down?

SPT Okay, Dick. As Jerry already pointed out, we're in better condition than when we left in the sense that cardiovascular, that is the ability to perform work with using - using oxygen. And - Especially your ability to utilize oxygen. In that respect we're ahead. We, of course, have not had any one-g stimulus to our inner ear. We don't know exactly how that's going to affect us in terms of dizziness. We're going to try to make the best of that one. Go at it slow, not try to rush into it when we get down on the ground. And I'm sure there's some muscles in our bodies which we have not used. And even though we have exercised quite rigorously in many ways, the 1 gravity down there tended to use different muscles and we're going to find that we're going to be a little sore, probably. But, all and all, I think, we're going to come out pretty well. And I think if we're in a kind of situation which requires us to use our physical capabilities when we first got down, I would have no fear of it.

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CC Roger, Ed. Thank you very much. Back to Jerry Carr. There's been a marked lack of public interest in your flight. What do you think causes this, and does it bother you?

CDR Well, I think, people just get use to things. Think about about 10 or 12 or 15 years ago when the space program was first getting going, there was a decided interest in it then. Lots of action, lots of interesting things. But I think people get use to these things. People except them into their lives, and when you except something into your life, you begin to - to kind of take it for granted. And I must say it does kind of disturb me, because, I don't think anybody likes to see his work taken for granted. Nobody does, but this is a human - a human thing. It's a human - sort of a characteristic. And I guess, as long as things stay rather routine in the space program as it has been lately, I think, what we consolidate, essentially, what we gained in space exploration, I think probably the public interest will stay pretty low. But when the spectacular's come off, people will be interested.

CC Okay, Jerry. Thank you very much. We've got about 4 minutes left here and I still have a number of questions. This one's for Bill Pogue. Do you feel your time in space has been well spent and what rewards has the American public reaped from the expense?

PLT Well, I think our time has been well spent, of course. I thought that before we came and I still think it. And as far as the rewards are concerned, I feel that most of the reward will be sometime in making full provision. Now some of our activities have already benefited certain areas (garble) already, some of our visual opera - observations. Observations out the window by eye have revealed certain things around the world. For instance, a new current the coast - the northern coast of the island of New Zealand. This was not known to exist. And when we first reported that, we had quite a few questions come back on that. (Garble) we checked it out again and it's there and we've documented it with photographs over a period of time. It's also, of course, possible that some of the other visual observations we've made on ice - ice movement would be of immediate benefit. Weather observations will also be immediate of benefit. But, I think, a lot of the things, for instance, the good that will come out of some of the solar observations - observations with the Apollo telescope mount, will be years in reaching full formation. Some of the results will probably manifest themselves in new theories and new ideas almost immediately. Others will take a long time before they will actually go through the full process of moving through basic theories into applications. And so - It's

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hard to, 10 years from now, say, hey look, we went back on Skylab 1, 2, and 3. We developed - we brought back data that led to this development. And at that time it's not going to be exciting at all, because at that time it will be ancient history. But I feel that those are the kind of benefits which will probably be more dramatic in historical perspective and some of the things which more or less excite the imagination right now. I mean, of course, those are important and we're very excited about them ourselves, because we can see something coming of it. The Earth resources is another area which you may take some time to (garble) photographic data. The photographic and visual imagery will provide immediate useful data in many cases in which might find applications in various parts of the world. We've not just photographed the continental United States. We have done considerable work in the continent of South America and also in Africa. The - These photographs, of course, will be available to these governments and they will use them immediately. Now some of the other data requires much more subtle processing and consider - and long term consideration. It's going to be a long time, I think - not maybe as long as - it sort of depends on just how basic a theory you're working with. But, I think it will be perhaps some time before all the Earth resources data will reach application stage. And it's going - we're going to have to more or less, I think, sell the idea that we did this, and when I say we, I mean the National Aeronautics and Space Administration, working in conjunction with several other governmental agencies in foreign continents that we - we in this period of time, did collect this data, which is now being over several years and will continue to find applications.

CC Roger, Bill. Thank you very much. We're about 30 seconds to LOS. Vanguard comes up at 18:03. See you there. Real quickly - Well I'm not sure we have time to get an answer on this, but I'll ask it anyway. And Ed, you can pass it down - -

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CC Bill, thank you very much. We're about 30 seconds to LOS. Vanguard comes up at 18:03, see you there. Real quickly, I'm not sure we have time to get an answer on this one. I'll ask it anyway, and Ed, you can pass it down after some thought. The other day you recorded the birth, life, and death of a solar flare. Briefly what will this data tell scientists about the Sun and its relationship to Earth. We're going over the hill here, but you might think about that one and pass your answer down when you get a chance.

SPT In short, learning to predict. We don't understand why a flare occurs and how to be able to predict exactly when it does. Be able to understand that and predict much better and it will be a benefit not only to people on Earth but also future space travel.

CC Okay, Ed, I got it. Thank you very much.
PAO Skylab Control, Greenwich mean time 17 hours 53 minutes. Loss of signal through Texas tracking station. Next acquisition in 8 minutes and 50 seconds will be Vanguard where the press conference will be picked up again. 18 minutes devoted to Q&A session with the crew on this the final mission in Skylab, and the final press conference in space for the Skylab program. We have a 10-minute pass through Vanguard in 8 minutes and 30 seconds. We'll bring the line back up at that time. This is Skylab Control at Greenwich mean time 17 hours 54 minutes.

PAO Skylab Control, Greenwich mean time 17 hours 56 minutes. Correction that the press conference has been concluded. It will not be continued through Vanguard. Vanguard acquisition in 6 minutes and 15 seconds. At Greenwich mean time 17 hours 56 minutes, this is Skylab Control.

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PAO Skylab Control, Greenwich mean time
18 hours 2 minutes. Acquisition coming through Vanguard in
45 seconds, a 10-minute pass.

CC Skylab, Houston. Hello at the Vanguard
for 11 minutes.

CDR Hello, Dick.

CC I got two, three things here. For one
thing, the VTR is clean, and except for the scheduled ATM
TV after a while it's all yours for the rest of the day.
Also, I'd like to get somebody to help me out with a reg bus
adjust if I could.

CDR Okay. Ed's, on his way up.

CC Okay. While, he's going up there, one
reminder here. In the TV-27 pad that we sent you to secure
from the press conference we just had, it lists in there the
panel 200 buffer amps 1 circuit breaker to OPEN. Of course,
that's now being handled by you guys. As long as it gets
closed when you want to do voice recording you can handle it
either way you want.

CDR Okay. We're going to leave it closed.

CC Okay.

SPT Go ahead, Dick.

CC Ed, we'd like to go back to where we
were, which - the original setting prior to the adjust
we made a while ago which is 45 degrees counterclockwise
from where you are now.

SPT You got it.

CC Thank you very much, Ed. We'll take a
look at it, and one more item, Jerry. Do you happen to have
written down the EREP tape measurement I asked you about a
while ago?

CDR Yes sir. 3 centimeters.

CC Okay, Jerry. Thank you very much. You
guys have already done a full day's work, so welcome to your
day off. If we - if we can help you down here give us a
holler.

CDR Okay, Dick. Right after lunch we're all
three going to the command module. We're going to review
some checklists for a little while. We'll be about an hour.

CC Okay, Jerry. That'll be fine.

CDR Actually, it's going to be right after
Ed's ATM pass.

CC Okay. And the reg bus adjust looks real
good. We sure appreciate it.

SPT Thank you, Dick. Hey Dick, let me
throw a couple more sentences onto that last question if I
could.

SL-IV MC-2716/2

Time: 13:01 CDT 77:18:01 GMT

1/31/74

CC

Okay.

SPT

Okay. Really, not just ability to predict is going to come out of this thing, but a flare essentially is a way of storing energy and the energy is all that - is stored in the atmosphere of the Sun and now all of a sudden released very rapidly and in large quantities, and that mechanism of release is something we don't understand and I think it's a basic problem, basic physical problem, astrophysics if you will, and once we understand that we may have application for it elsewhere in addition to just understanding the Sun and other astrophysical objects. So it's a energy conversion basic problem and out comes basic knowledge which is application.

CC

Okay. Ed. Thank you very much for your extra words. And SPT, Houston. In preparation for your starting a little bit of ATM today I've got a little update on the Sun. Active region 39 rapidly emerged. It gave one small flare and is now declining. Also, prominence 92 is quiet, quiescent returning feature near 30/1.0.

SPT

Thank you, Dick.

CC

Roger.

CC

Skylab, Houston. We're a minute to LOS.

Tananarive at 18:31.

PAO

Skylab Control, Greenwich mean time 18 hours 14 minutes. Loss of signal through Vanguard. Next acquisition in 16 hours 45 seconds will be Tananarive tracking station for a 4-minute-45-second pass. We'll bring the line back up at that time. This is Skylab Control at Greenwich mean time 18 hours 45 - 18 hours 14 minutes.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Change of Shift Briefing
Johnson Space Center
January 30, 1974
5:27 p.m. CDT

Participants:

Don Puddy, Flight Director
Richard H. Koos, EREP Officer
Dave Garrett, PAO

SL-IV PC-117A/1
Time: 17:27 CDT
1/30/74

PAO We're ready to get started with our change-of-shift briefing this afternoon. We have with us Don Puddy our offgoing Flight Director, and also Dick Koos of the EREP department. Don.

PUDDY Okay, let me start off by talking just about a couple of items that we had on yesterday's Flight Plan that occurred after I briefed you. As best we can tell right now, we think we may have missed Gamma Valorum at least as far as the S05 - S055 instrument is concerned. The SPT reported he did not see it. Whether or not we were able to pick it up in 52 we're not sure right now. But the S055 instrument has only got a 5 arc minute field of view. So, it's kind of like hunting for a needle in a haystack. And we - as I showed you a picture the other day. We do have a couple of burnt spots on the vidicon tube. And as a result of that it is possible that it was behind one of those and we did actually catch it. We just don't know for sure. We are hopefully going to - it's being planned right now anyway, day after tomorrow, try to run that again. One change in the plan that we're going to follow is we're going to actually maneuver over to Canopus, which is some 18 degrees away from Gamma Valorum. It has a magnitude of about minus 1, where Gamma Valorum's got a magnitude of somewhere around plus 1.9. Doing this we think we may be able to take out any minute errors that crop in. We're also penalized a little bit just due to the lack of station coverage on this one that we ran last night, in that we did have a - had calculated that we'd have about a .7 degree nuZ error. And as it turned out we ended up with an error that was essentially zero. And without the station coverage we weren't able to actually go ahead and give the crew an updated maneuver. But we won't know until we get the data back as to whether or not we actually did obtain it. One thing that was very interesting last night while we were in the JOP 13 attitude, it just happens to be one where we heat the CMG where the EREP maneuvers are just the opposite. They're ones where we actually do a little bit of cold soaking. Normally you wouldn't expect this to have any appreciable effect at all because of course we do use the heaters on the CMG. However, CMG recovered beautifully during the JOP 13 data take period. Actually the rprs got up right around 8900 and the currents dropped back to 1.01 region, and everything looked great. However, since coming out of JOP 13 attitude and moving along with time the CMG has returned back to the previously established new plateau, the values of which I've given you before. Had no significant glitches of any kind on it today, and so no reason again to believe that's not going to hang on in there with us. Shortly, before the crew

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went to bed last night, on the ATM COOLANT LOOP PUMP C which we were running on, it dropped to zero. Pressure in the loop dropped - flow rate in the loop dropped to zero. We did go ahead and bring on PUMP B. Ran through the night with it with no problems. Today we could see no reason why there should have been any problem with - with the third pump - or PUMP C. So we brought it back on line. When I left the control center, it was again running fine. So, no real explanation on it. And as I briefed you several times before there's no problem even if we should lose all three pumps. But just to play super safe we're going to manage those pumps for remainder of the mission. Probably turning them off at night just so we don't have - put a pump in a stall condition and not have the capability of turning it off. Today was a very busy day as far as the crew is concerned. When I left the control center we'd already run a 92/93 run on the commander, already had an EREP pass on track 48. M131 on the science pilot. Had done some work on TV-87. I'm not sure the crew has quite finished up with that yet. And had accomplished two ATM passes. As far as the EREP pass is concerned, we had three mandatory sites, that we were looking at today. One was in the north - -

END OF TAPE

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PUDDY As far as the EREP pass is concerned, we had three mandatory sites that we were looking at today. One was in the north Pacific, where we were using radar, radio-meter and photographic data to get the high seas state and wind conditions. We also had another site off of the Gulf of Mexico and Caribbean where we were looking at low wind and smooth seas. And of course, these - our object here is to try to prove the wind field and sea state forecasting models. And another one in the Colorado River Basin where we're primarily trying to get some regional geological mapping for minerals, petroleum, and the ground water resources, and also some data on drainage. Hopefully, maybe it will benefit some of the people in Texas if we can get enough information there to prevent some of the flooding conditions we had this last June in and around the hill country. We're pretty sure we got the north Pacific site and the Colorado River Basin based on the available weather we had. We had one other site we were going after which was in Colombia, South America. It's part of the world-wide United Nations research - or resource survey of crops and forests, insects and disease infestation of the crops. The weather over that particular site today wasn't - wasn't too good, and we're just going to have to wait on the verified weather in order to determine whether or not we did pick up that - that particular site. As far as the S190A, we did run a malfunction procedure on that this morning. And I still would be untruthful if I told you we knew exactly what was wrong with it. But as been typical of spacecrafts in the past and this one, such menial things as cycling circuit breakers restored the operation of the camera, and there were three of those circuit breakers that were recycled, exactly which one or whether it took all three of them to actually get the camera in operation, I'm not sure. But anyway, the 190A cameras worked perfectly throughout the entire pass today. And I guess in addition to gathering the data for us today, they relieved our minds from the standpoint that we were able to get the film that we got of the HATS area out of there without any damage to it. The S193 ALTIMETER and SCATTEROMETER has been worked on quite extensively throughout the day, and I'm going to let Dick Koos go ahead and give you a few words on that area. Dick?

KOOS Well, I guess we put - we - we gave the crew some additional ALTIMETER mode real time today at the end of the pass. And it was located just off the coast of Argentina. It was in the - over the water, and it looked to us, in reviewing the voice tapes and everything that we had an ALTIMETER READY light and we also had an ALTIMETER LOCK, and we lost lock about the time he went into solar inertial attitude. And it was, I think, something under just under a

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minute that - that we had a valid ALTIMETER working. So we're pretty sure we can use it tomorrow and with some success. We did get readings in the ALTIMETER mode of the antenna position, and it looked to us like it did the day before yesterday. It was about ROLL - was minus ROLL of 1.4 degrees today, and the day before yesterday was about 1.3 degrees. That's reading of the fine - the fine meter. The coarse meter kind of substantiated that and it was reading 51 percent - actually 50 percent zero degrees on it. We were - that - verified that yesterday when we put the reset values back in for the antenna position that that was accomplished successfully yesterday at the end of the pass. So, we're going to use the ALTIMETER tomorrow.

PUDDY Okay, and I - I think the one thing that we're working on right now and I think we'll probably do is - as Dick has - -

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SL-IV PC117C/1
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KOOS - we're going to use the ALTIMETER tomorrow.
PUDDY Okay and I think the one thing that we're working on right now, and I think we probably do is that as Dick has mentioned we do have a bias there. And we will be biasing our Z-LV attitude to - to account for that. Because as I mentioned to you last night this 360 degree pass that we hope to run tomorrow is primarily centered around operation of that particular instrument. Although let me emphasize that even if that instrument should not work we are also obtaining some normal EREP data with all the instruments over track 62. Give you be a few facts on the 360 tomorrow. We are maneuvering out of solar inertial attitude at 14:42 Z. We have a 9 minute tower maneuver time so we'll arrive into Z-LV attitude at 14:51 Z. We'll be taking data almost continuously from that point in time through 16:31 Z. Coming back to solar inertial at 16:40. I just made a real rough calculation, I wouldn't swear to this but I think our data take is about 98 minutes long. In which case that will give us in excess of 23,520 mile data take. I think the longest data take we've had to date is somewhere in the order of 12,000 miles and I think that one was split. So this is by far the longest EREP pass that we've had in the Skylab program. As far as the rationale for this particular pass it's fairly straight forward, we're making a long-arc geoid measurement. Primarily to gather some additional data to establishing the relationship between spacecraft perturbations and the geoid variances (?) are caused by the gravitational fields. The data that we gather here can be used to help us design an altimeter that we are building at the present time for a GOC satellite. I don't know exactly when that's going to be launched, but I do know that right now they are thinking about an instrument very similar that which we're flying on Skylab. Course you also are going to be able to use it to more accurately determine the shape of the geoid along the ground track than your able to do with just taking short-track solutions. And I'm sure that the scientists who are familiar with the geoid are going to be hunting for new features which heretofore they have not been able to gather just because they haven't been able to obtain data over anything but just spot areas or very short arcs. And the existing gravity model that we have is - is primarily just been developed by these satellites. So I - I feel fairly certain that having a pass on a global basis is going to be very beneficial. This very interesting today also as far as the laser was concerned. We kind of performed a little spot check to see how we could do from a distance standpoint.

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We were running at the 1-watt level with the yellow. The crew was able to obtain visual observations out to a thousand miles, and with binoculars out to around 1500 miles. And I think they probably would have been able to do even better, except just at those slant ranges you are just running into an atmospheric haze problem. Tomorrow is the crew day off. If you can call it that. We have about 11 man hours worth - over 11 man hours worth of science scheduled. Primarily this is the 360 ALTIMETER pass plus track 62 which we call EREP 49. In addition to that we have some S0 - S063 observation.

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PUDDY - - 49. In addition to that we have some S06 - S063 observations which we're running with conjunction with that EREP pass, a S233 comet observation. And of course the standard showers, checklist update time, and their standard day off medical-type protocol. As far as the day after that, just - I usually quite don't go this far but I think it's going to be a very interesting day. The next day as it stands right now is still in the planning stages. But we are planning on doing a JOP 13 first thing in the morning, followed immediately by a combination of an EREP pass and a lunar cal, and followed immediately thereafter with M092/M171 major medical on both the science pilot and pilot. Followed immediately by a 201 comet maneuver. And this is one of the last corollary observations that we are going to have on - on the comet. And of course as you're probably well aware that the 201 is one of the more sensitive instruments, to date we've tried - in the last couple of days we've tried a couple of the S233 observations and haven't actually been able to visually pick up the comet. And we have another one scheduled tonight which we hopefully will be able to. Had a little information here for you, if I can find where I put it, as far as some more detail times if you'd like to have them on entry day. Our plan is that we would undock at 10:34 Z, probably end the fly around somewhere around 10:56, separation around 11:00 that'll be a 5-foot-per-second maneuver as presently planned. Shaping at around 11:32:45, 279-foot-per-second maneuver. Retrofire at 14:35:50, 185-foot-per-second maneuver. Entry interface, we ought to hit that at 15:00:55, half g point at 15:03:21. Going into blackout at 15:03:43, end blackout somewhere around 15:07:11. Drogues at 15:11:20. Mains at 15:12:07, with a splash at 15:16:57, which I rounded off for you last night at 15:17. We are going to roll right we expect to splash somewhere around 31 degrees 19 minutes north, 119 degrees, 45 minutes west. This is approximately 150 nautical miles west-southwest of San Diego. This will enable us to fly the necessary data in via choppers. Also if we have rough seas it will enable us to make a slower trip and still be able to get all the biomedical samples and things of that nature. And in our - our normal time frame. The crew presently plans, of course, to spend the night on the carrier. And I guess being that close to San Diego and the fuel conservation mode, we can also save a little carrier fuel. That's about all I have as far as Skylab activities. I would like to say, since this is my last press conference, that I have indeed enjoyed the opportunity of - of being able to come over and talk with you during the times I was on the

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execute shift. I've found both professionally and personally y'all to be a - a very amenable group. And I think you've done an excellent job as far as reporting the activities on Skylab. And hope that this type of thing can continue on future space programs. And again would just like to say enjoyed it and thank you a lot. Any questions?

PAO

Art?

QUERY

While we're looking here, we'll ask you the same question we asked Neil. Can you briefly kind of sum up the - -

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PUDDY - like to say I enjoyed it and thank you a lot. Any questions?

PAO (Garble)

QUERY Well, we're looking here - we'll ask you the same question we asked Neil. Can you briefly sum up the - your - your feelings about the Skylab program and what it's done for manned space flight?

PUDDY Boy, that's a loaded question. Well, I guess you could go through all the classic things, I think. Skylab has - has certainly proved the benefit of man in space. I say this because if you'll remember back to the Skylab I mission, there were a lot of us that indeed were very queasy about just exactly what the fate of the program was shortly after launch. I think when you look back over the program and you see the fact that we not only have accomplished the pre-planned mission objectives, but in addition to that have actually moved the third mission from somewhere around 56 - 59 day mission into an 84-day mission. You certainly got to appreciate the fact that without man there, that could not have been done. I think, also, the future space programs that we're planning, i.e., the Shuttle for the same type thing that can happen on Skylab, it's merit can certainly be emphasized primarily because there's - there's nothing that man builds that you can say is perfect from a design and a workability standpoint. And no matter how much money, or how much time you spend on it, you're going to at times have quality defects, and it certainly is beneficial to have a - a repair capability. I think the Shuttle, when it becomes operational, will definitely offer a capability of - of using man in a vehicle to recover satellites whose components have given some problem, and yet at the same time, will enable us to be able to launch very-long-duration Earth resources weather, various types of satellites that are - are being launched today, be able to recover those, repair them, and return them to orbit, at a considerable decreased cost. As far as the benefits from the standpoint of Earth observations, the solar viewing, biomedical, the tremendous variety of experiments that we have performed in the corollary fields, such as metals melting and items of that nature. I think it's going to be pretty hard to - to realize the true benefit of those for many years to come. But in my own mind anyway, I just have to feel that seeing what has evolved from the Gemini and the Apollo programs with their shorter duration flights and with their limited instrumentation capability as far as Earth observations are concerned - Earth and solar observations are concerned, that we have to reap a tremendous benefit over the next few years from that. But

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just the knowledge of the ad - adaptation of the human body in zero g. I think is going to keep the medical people going for quite some period of time. The fact that we've been able to be out of the atmosphere for such a long period of time and observe not only the - the quiet Sun, but the active Sun, and the fact that we've been able to catch a flare on the rise all the way - all the way solar flare on the rise and - and follow it all the way to its death, so to speak, is significant. I could go on and on on that. But I - I - just in summary I just cannot help but believe that - that Skylab for the amount of money that the American people have put into the program will return many times that to them in benefits in the future. And I just don't think today we can sit here and realize those, but I do feel like they will come through the results of scientific work on the data gathered in the years to come.

PAO

Bob?

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PUDDY - - they will come through the results of scientific work on the data gathered in the - in the years to come.

PAO Tom?

QUERY What are - what else are you going to be on that 360 degree EREP besides the ALTIMETER? Anything else?

PUDDY Like I say, we will be running the - running 193A and 191 more or less continuously around the pass. And then for the track 62 portion of that 360 degree revolution, we'll be running other instruments in a - in a normal EREP fashion. Dick, you want to cover the - -

KOOS Across the U.S., let's see track 62 comes across northwest and across the Gulf coast. And, let's see, I think in western Florida. No, maybe not that far east, I can - I'm trying to think where 62 crosses. They will cross the - the southwest corner of Alabama and then cross the Gulf coast. And then out across the Gulf. And - -

PUDDY From that standpoint it will be a standard EREP p EREP pass.

QUERY What sort of thing are you going to be looking for on that one - on that part of the - of the pass?

KOOS I didn't look at the particular sites. I know that there's that site in Mississippi that we'll cross again. And then Al - Alabama there's a certain stretch that will be interested in getting again. And we'll be interested in - if it's reasonably clear we'll be interested in calm water in the Gulf, I'm pretty sure. And 62 crosses some sites on the northern coast of South America again that we'll be interested in.

PUDDY Put that somewhat in perspective - as of yesterday - well, actually it was day before yesterday - we had completed the rerun of all of those sites that we lost due to the 190A filters not being installed. We had completed all of the mandatory sites for which we had any remaining tracks left. We left two of those, I believe that we did not obtain any data on. So, our objectives on the remaining EREP passes other than getting this around-the-world ALTIMETER data are primarily to go ahead and - and add to data that we have already covered over a - sites. So we're not - there's nothing absolutely unique on this particular pass.

QUERY That 23,520 miles you mentioned. Is that statute or nautical?

PUDDY I believe that's nautical miles.

QUERY And, tomorrow is supposed to be the GO

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NO GO decision for the final week of the mission. Can you see any reason why they can't get a GO to complete it?

PUDDY Well, that's not really my decision to make but certainly at this particular point in time, based on what I heard from the crew today and the way everything is going from the standpoint of the spacecraft, right now I can't foresee any reason why we would not be a GO for the last 7 days of the mission.

PAO Are there any further questions. If not, thank you.

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Sky Lab IV

Science Briefing

Vol. I

COLOR CHART

ATM-----GREEN

COROLLARY---CLEAR

KNEP-----RED

MEDICAL---BLUE

PROGRAM---Pink

SCIENCE DEMONSTRATIONS - YELLOW

**SKYLAB NEWS CENTER
Houston, Texas**

**SL-IV - Medical Review
Johnson Space Center
February 1, 1974
10:30 a.m. CDT**

PARTICIPANTS:

**Dr. W. Royce Hawkins - Deputy Director, Medical Operations
Dr. Robert L. Johnson - PI, M092 experiment
Ed Michel - PI, M171 experiment
Dr. Jerry L. Homick, Ph.D., Cognizant Scientist M171 experiment**

SL-IV PC119A/1
Time: 10:37 CDT
2/1/74

PAO Okay, ladies and gentlemen. We have with us Dr. Royce Hawkins, and to his right, Dr. Robert Johnson, M092 principle investigator, Dr. Jerry Nomick, principle conscience and scientist for M131, and Ed Michel, Principle Investigator for M171. We'll have Dr. Hawkins start on mission day 78 -

HAWKINS Well, I - I think the significant thing right now is that we have a crew that is in good health. That are still performing the medical experiments and other tasks, other scientific studies and all to the best of our expectations and I'm happy to report that from a dietary standpoint, the crew is eating well. Their fluid intake is good, their weights are stable and I think that we're - we're going to find them in very good condition when return to one g conditions. I'd like to have Dr. Johnson briefly recap for you the M092 results and what we've seen there.

JOHNSON The M092 experiment has been performed 20 times now on each crewman. The pilot and science pilot will receive their 21st run today and the commander, his 21st run tomorrow morning prior to the EVA on Sunday. In general, they've been doing quite similar to what we saw in Skylab - in the second Skylab mission after 40 days. In other words, the tendency apparently to develop the more stable reaction to the stress of lower body negative pressure. The exception to this may be the scientist pilot has had to discontinue two runs early. One of these was on mission day 61, I should've said two recent runs early. On mission day 61, he had symptoms at the very end of the - of the run. These symptoms were the usual type that precede loss of consciousness. His was in a very early stage. He only had mild dizziness. This was the first day that he had a run when the temperature was high in the spacecraft and probably that was one factor in this type of reaction. Right after that, he started sleeping in the MDA where it was cooler and was able to rest better. So we think that the heat in the workshop plus the fact that he was not sleeping well because of the heat where his quarters are accounted, at least in part, for this. On mission day 71, he had a early termination again. The heart rate was higher than usual. There were no - no residual effects; he went on with his usual activities afterwards which are the M171 experiments. And since that time, he's been doing very well. In the last 10 days, they've all looked good with respect to the 92 performance. We've seen very little change in their leg circumferences in the past 3 to 4 weeks. I have the figures here somewhere. But at any rate, they're all down between 5 and 6 percent at this time 5 or 6 percent decrease since their preflight measurements. This is not as great as we saw in the Skylab-III crew at 58 days and the logical explanation whether it's correct or not is that the type of exercise and the amount of exercise they're doing, is affecting this particular measurement.

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JOHNSON But at any rate, they are all down between 5 and 6 percent at this time, 5 or 6 percent decrease since their preflight measurements. This is not as great as we saw in the Skylab 3 crew at 58 days. And the logical explanation, whether it's correct or not is that the type of exercise and the amount of exercise they're doing is affecting this particular measurement. And I think that's essentially the salient points about M092.

SPEAKER Do you want to use those figures or not? These are - what these are - in (garble).

JOHNSON Yes, okay. They're - -

SPEAKER Or is that inches?

SPEAKER I can't see (garble). It is - in each case it's the reduction is around 3/4 of an inch to around 1 inch, however.

PAO Okay, let's go on at - and introduce, get right down to the right. Dr. Homick will cover the results now which we've seen with the vestibular studies.

HOMICK On the oculogyral illusion or OGI portion of the M131 experiment, we haven't seen anything very surprising relative to previous missions. The commander is performing very well on that part of the experiment. His ability to perceive the illusion is actually a bit better than it was preflight suggesting that he's slightly more sensitive to the illusion in zero g than he had been on the ground. The SPT and the PLT are performing a little bit more erratically. By that I mean that they're showing more variability in their performance from run to run. Particularly the PLT, who on a couple of occasions commented that he was unable to even perceive the illusion, which is rather interesting. This was even at higher rates of acceleration where the illusion should be fairly apparent. He was reporting that he was unable to see it. We don't really regard this as a very significant finding, but it is something is a first as far as this part of the experiment is concerned. We have one more run on each of the crewmen on mission day 81 on the OGI test, and that will wrap it up for us. On the motion sensitivity portion of the experiment, that is the part that is designed to look at susceptibility to motion sickness. Again, the results have been very consistent with previous missions. And by that I mean that the crewmen have become virtually immune to developing any symptomatology of motion sickness while riding in the rotating chair. We sort of curtailed the motion sickness testing after mission day 27 to 28 and did not conduct any tests with the rotating chair partly because we felt we weren't going to see very much with those tests. And then, after giving some thought to developing a technique that we might implement that would give us a more

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in depth look at what is going on, we did conduct on each of the crewmen a special motion sensitivity test early this week in which they were rotated in one direction and developed no symptoms as a result of that, and then immediately rotated in the opposite direction. The reason that this was done, what it was based on, a considerable amount of ground-based laboratory studies where it has been demonstrated that this procedure of reversing the direction of rotation proved to be fairly stressful, that you can precipitate symptoms in most individuals by doing this. We wanted to see if this might happen with the crew in flight and it didn't. And that to us represents some valuable information about what may be going on with this sensory system in flight. The spatial localization portion of the experiment is complete. All of the runs have been accomplished. Much of the data has not yet been analyzed, so all I can say about that is that we are seeing some slight changes inflight relative to preflight, but they don't appear to be consistent changes yet. No overall trends have developed. I might make some very brief mention about planned postflight activities. We'll follow pretty much the same schedule that we did postflight for Skylab 3. We will conduct - -

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HOMICK - - wants represent some valuable information about what may be going on with this sensory system in flight.

HOMICK The spacial localization portion of the experiment is complete. All of the runs have been accomplished; much of the data has not yet been analyzed. So, all I can say about that is that we are seeing some slight changes in flight relative to preflight, but they don't appear to be consistent changes yet; no overall trends developed. I might make some very brief mention about planned postflight activities. We'll follow pretty much the same scheduling that we did postflight for Skylab III. We will conduct tests on the ship of susceptibility to motion sickness using the rotating chair. We'll be measuring the crew's postural stability utilizing the special rails test that I believe I described in the past. And we'll be measuring for the presence of any mistagness. That is, unusual eye movements during certain types of procedures. That summarizes things on 131.

PAO Okay, Jerry, thank you. Let's move on into Mr. Michel on the results of our 171.

MICHEL To date we have 10 tests on each of the crewmen. All the tests are essentially nominal. We've completed all these tests in their entirety, and all the physiological parameters are within their preflight baseline range. In essence, we have not seen any direct decrement in the crew's response to exercise.

PAO Okay, Jim.

QUERY Dr. Hawkins, would you agree with the commander's assessment that the crew is in better physical condition than before they were launched?

HAWKINS Well, I guess you got to look at it in - in what - what way are you talking about physical condition, Jim.

SPEAKER This is just something he volunteered. I don't know what he meant.

HAWKINS I think the - I think for the most part that the - the performance which we have seen indicates that - that they have reached a very stable level in the - certainly in the latter half of this mission. And I think that the exercise and all which are programs which they've been performing have - have definitely tended to maintain them in the physical condition which they started out. Now I can't say that they're really better off. Now, I don't know whether Ed feels that the results that he's seen with the exercise performance and max exercise levels indicates anything different from this or not. What do you think, Ed?

MICHEL I'd say they - they are slightly improved.

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In fact, the commander's last run we obtained the lowest heart rate in his third level exercise that we've seen in flight. It was like 7 or 8 beats lower than we have seen previously.

HAWKINS They've gone through a pretty - pretty sophisticated exercise program during this mission that, of course, was designed to - to give them the best opportunity of maintaining their - their physical status. And I believe it has proven to do so. And I think the subjective response or subjective feeling of the - expressed by the commander is important and no doubt gave us to use some greater insight into - into their state. So, yeah, I think our data supports what he's saying really.

PAO Howard.

QUERY A couple of questions on recovery day. I understand they're moving the splash point about a hundred miles closer to shore now. Is that going to have any affect on - on their coming back here? And also, will they be allowed to walk from the command module to the SML when they get out, or will the forklift truck carry them over?

SPEAKER The plans and all for postflight activities are really very, very much the identical to the Skylab-III plans. In other words, we're still going to handle them in the same manner with the - with the lift and assistance and all just as we did for Skylab-III. They will return on, as right now, as scheduled. I think you - you have access to that schedule for return - -

END OF TAPE

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SPEAKER - - (garble) for postflight activities are really very, very much identical to the Skylab III plans. In other words, we're still going to handle them in the same manner, with the lift and assistance and all, just as we did for Skylab III. They will return on - as right now as scheduled. I think you have access to that schedule for return and I have not heard of any deviations from that at all. I don't think that we could shorten it in any way.

QUERY For Dr. Homick, who was the astronaut who was spun around in the reverse directions and what rpm were they going and how does this information of value to you in trying to figure out why they've developed this immunity?

HOMICK All three crewmen were subjects for this special test and the rpm was 30, max rpm on the chair. The reason why we feel the information is of value, is because laboratory studies have demonstrated what we call short term direction-specific adaptation effects. In other words, when you rotate in one direction and then suddenly go in the opposite direction, the reason why you tend to develop symptoms more rapidly, is that you develop a direction-specific adaptation to the first direction of rotation. And this, this direction specificity, this type that - excuse me - adaptation is indicative of dynamic processes. Adaptation processes are going on in the vestibular system and the associated central nervous system mechanisms. The fact that this direction specificity did not manifest itself in flight, is somewhat of an indication that these types of dynamic processes weren't at work in the crewmen during this special test. I would hesitate to say that the - the vestibular receptors in this respect were almost dead, unresponsive, but certainly the kinds of processes that occur on the ground were apparently not at work in flight.

QUERY Based on what you've seen so far, would you have any hesitancy about recommending a flight for a year?

HOMICK Jim, I think we can say from what we've seen here with the - certainly these last two missions and this one, that man can extend the time that he - that we've been in space. I don't know yet that I'm willing to commit ourselves to a year, although I'm very optimistic about it. I would before seeing or trying to pin it to any specific time, I would rather wait until we see what the results of our laboratory studies postflight shows us because we haven't yet had a chance really to look at all of the - at the cellular levels the hormonal levels, to understand whether if there're any continuing nuing changes here that could dictate otherwise about extensions in time. But we certainly feel very optimistic about it.

SL-IV PC119D/2
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QUERY These men have been in space longer than any other people. Is there any plan to observe them, say for months or for years afterward? Maybe bring them back once a year or something like that for an extended period?

HOMICK Oh, yes. We do this with all the crews - all the crewmen who have flown. They - the ones who have all ready left the corps, still come back for an annual physical and examinations.

PAO We have a few here submitted from our friends at the Cape. First one from Mary Bubb, the first of six from Mary Bubb, as a matter of fact. What changes have you seen in the crew since they reached the plateau earlier in the mission, and what do the changes mean?

SPEAKER What changes have we seen in the crew? - Well,

SPEAKER I don't -

SPEAKER I think the -

SPEAKER Huh? I'm not sure what she - what specifically Mary's asking for there, really. The - since about midpoint of the mission, certainly about day - somewhere day 40, I think the - we have - we have seen a plateauing of the crew's performance and with the exception for the changes which Dr. Johnson mentioned there - -

END OF TAPE

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SPEAKER

I don't - -

HAWKINS

I think the - Huh? I'm not su - I not sure which what she, - what specifically Mary's asking for, really. Since about midpoint of the mission, certainly about day - somewhere day 40, I think the - we have seen a plateauing of the crew's performance and - with the exception for the changes which Dr. Johnson mentioned there. The response to two specific runs on the 92. The crew has really shown, I think what would be considered continuing improvement in - in every way. And I guess that was is change in itself. So, maybe that's what she's asking for.

PAO

Her other two questions you've already answered. It says since the crew is not expected to clean up the workshop with germicide, before leaving, do you expect germs to grow in the station? In the workshop.

HAWKINS

Well, the space - the workshop is going to be down to a vacuum or maybe a half a psi. It's - I think that there - this in itself would retard some growth although it's possible that there may definitely continue to be some - some growth of organisms that are left there. But, I don't foresee that this would be something of a monumental type of growth that would affect any revisit capability.

PAO

Her next question. Why do you think the crew always seems to be hungry and why do you think they require more seasoning in their food.

HAWKINS

Well I - I think the crew is eating at a very acceptable level and I really don't - I really don't agree with her statement there that the crew is always hungry. I think there might be some desire for some more variation in their diets which is only natural, but I don't think that they're going hungry at all. They're eating well and I think the weights and everything shows this.

PAO

Her next question bears generally on that. She says, are they still having problems with intestinal gas?

HAWKINS

I think that this is continuing as we've seen in every - every mission. I haven't had any recent comments about it that I recall the crew's commenting on it. So, I would certainly interpret this that this is certainly no problem for them.

PAO

Tom.

QUERY

Dr. Homick, about half way through the mission or somewhere like that, the PLT and the CDR, both, expressed the opinion that they weren't sure motion sickness was behind the problems they had at the first of the mission, that they thought it was something else. Have you - There been any more thinking on that?

SL-IVPC-119E/2
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MOMICK

We've - We've all done a lot of thinking on that subject. And I'm not sure that we have any better answers now than we had after the crew made those comments. I guess something that I tried to point out the last time I was here, was that, maybe the term motion sickness is not the best term to use to describe the types of symptoms they experienced when they first hit 0 g. It might be a much more complex phenomenon than we're used to dealing with in 1 g. But, yes, we are doing a lot of thinking about it. Studies are being designed to try and look at this whole problem, from several different points of view to see how fluid shifts, for example, may influence what we're seeing. To see how interaction between the semicircular canals and otolith organs, particularly, in the absence of gravity, may influence this whole problem. It's a difficult task, there's no doubt about that. And something we're going to have to take a good hard look at it for future space flights.

PAO

Oh, okay.

PAO

Jim, did you have another one? Howard?

QUERY

We have two more submitted. What factor - physical factors may we - may you expect for the extra week, if any?

HAWKINS

I don't understand what he's asking.

PAO

What additional physical factors may develop in the next week that we have not already experienced, physical changes?

HAWKINS

Oh, in the condition of the crew? I

don't expect any.

PAO

I see. (Garble).

PAO

This next question is related to one of the questions submitted yesterday by the students - about missing the female companionship. And Mr. Dave Crane asks could the lack of female companionship result in physical or mental problems on a long-duration mission?

END OF TAPE

SL-IV PC-1197/1
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PAO - - may develop in the next week, that we have not already experienced, physical changes?

HAWKINS Oh, in the - the condition of the crew?
I don't expect any.

PAO This next question is related to one of the questions submitted yesterday by the students, about missing the female companionship. And Mr. Dave Crane asks, Could the lack of female companionship result in physical or mental problems on a long duration mission?

HAWKINS Well, I guess that's an individual thing, too. (Laughter) So I don't know what the answer to that one is.

PAO Nick?

QUERY Have they been using that shower much?

HAWKINS Yes. They have been using it.

SPEAKER They used it yesterday.

HAWKINS Yes, I don't know that they've missed any.
Have they? Bob do you - -

JOHNSON The crew was asked last week, they thought they missed one and - See, they don't report that down. And they can tell by the water consumption. And they did ask the crew, last week, if they all took showers and they said yes, they had.

HAWKINS They might have missed - Seems like I do recall somewhere that somebody missed a day. Bill Pogue missed a - -

JOHNSON Yeah. Missed one.

HAWKINS They've been using it right along.

JOHNSON They've had 9 - 9 days off?

PAO Okay, ladies, gentlemen, if that's all,
thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Liquid Floating Zone Briefing
Johnson Space Center
January 14, 1974
2:15 p.m. CDT

Participants:

Dr. John Carruthers, Principal Investigator for TV-101 - Bell Labs
Bill Pomeroy, PAO

SL-IV PC98-A/1
Time: 14:15 GDT
1/14/74

PAO

Okay. At this time, we'll have a briefing on the TV-101 science demonstration, and we have with us this afternoon Dr. John R. Carruthers, who is the Principal Investigator in this experiment or science demonstration. He is from Bell Laboratories and we'll hear now from Dr. Carruthers.

CARRUTHERS Thank you, Mr. Pomeroy. Over this week-end onboard Skylab, a very unique series of experiments was completed in fluid dynamics and as the title suggests in float - liquid floating zones. These experiments were performed by Dr. Ed Gibson, and we anticipate that the results of the experiments will have a major impact on our ability to prepare crystals for the electronics communications and computer industries. These are crystals used for things such as transistors, integrated circuits, and for optical (?) electronic and optic applications. In addition to some of the things we've learned from what Dr. Gibson has done, we are also looking at this technique as one which certainly now with the present results in, is one which can be developed further to use on the space shuttle which will be going up in the late 1970's. In these experiments, we deployed a cylinder of liquid between two circular disks and then we studied the response of the liquid cylinder to various conditions of rotation and vibration. And the experimental setup consisted of a rather unique lashup of onboard equipment and I'm not going to describe too much more of that because we're going to show a video tape replay of some segments of the experiment and perhaps afterwards if there are any points that are not clear, we can go into them at further length then. The - we did see some basic phenomena involving the stability of this liquid cylinder as well as the internal flow patterns which have never been seen before and were not anticipated as a matter of fact. On the other hand, there does exist some theory with regard to the stability of these zones and the certain portions of the experiment where there was - which could be analyzed theoretically with existing theory, there was excellent agreement. So we - in essence, have the best of both worlds here in the unexpected and the expected and we're rather excited about these results and I think as you see the video tape replay, I think you'll see why. Well, without any further preamble on my part, we'll show the video tape replay and then I'll summarize afterwards with a few comments. The video tape will last approximately 10 minutes. I'll get up and use the - - SPT Welcome to Skylab III. Today, let's talk about what some of these objects I have have in common. Screw driver, pair of scissors, recorder for that matter, this TV camera. Each one of those, has a quality and their

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quality. is dependent upon the materials of which they're made. That's true for most things that we work with. Up here in Skylab, we plan to study a little bit the techniques which things are made particular solids and how they cool, how they're formed from a liquid, and how they actually become a solid. It's in this phase, of going from a liquid to a solid, in which the quality of the material is determined to a large degree. Particular, if we look at - let's say - silicon crystals, which transistors are made from, which are the heart of this TV camera and the electronics industry, we find that as they cool, the gravity which we have down there on Earth, and which every transistor so far has been - -

END OF TAPE

SL-IV PC-98B/1
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SPT

- - (garble) going from a liquid to a solid in which the quality of the material is determined to a large degree. Particular, if we look at - let's say silicone crystals, which transistors are made from which are the heart of this TV camera and the electronics industry. We find that as they cool the gravity which we have down there on Earth, and which every transistor so far has been made in the presence of, we find that the gravity tends to make the warmer, or the hotter material move to the surface as it's cooling. Same thing happens in your home. If you notice your second story's always a little bit warmer than your first. All heat is up the ceiling. Same thing happens in a solid whether it be a metal or a crystal. Now this convection tends to create very small nonuniformities in the material. Nonuniformities can change the properties that usually degrade it. Also, we find that contamination can come from a container which you cool a solid in. For example, if you have a vat of metal you cool it, you find that the contamination from the side, from the walls, from the floor will change the properties of the material. Now, in zero g we don't have that problem. We're able to essentially create a mass of liquid, hot let it cool, with no contamination from the side, and no convection to change its properties. We're going to be studying a little bit in the next couple of days one particular way of forming crystals which Dr. John Carruthers, one of the people working in the field right now, feels is a - a very promising way in which to grow crystals with exceptionally pure uniform properties. This will enable us to create much smaller crystals or much smaller transistors if you will, for smaller circuitry and we think may be improvement in the electronics industry. However, what we're going to be doing has application in many fields. Just plain study of fluid mechanics in zero g. I think you'll - you'll see is going to be fun and it's also got some very basic applications. The way we're going to be doing is - is with this homemade device here that we have taken and use four mounts: 1, 2, 3, and 4, and these mounts are pretty much the same as hold up the TV camera, line them up, take some of our tools, which are extension shafts for some of the bits that we have, and mounted them in here so that they're free to turn. We'll be placing a fluid in between the two here which you'll be able to get a closeup view on this camera, and then we're going to turn it. We're going to turn both of them simultaneously using this string and rod pulling it up. We can change the speed, we can rotate them in opposite directions, and we can also move the distance apart. We'll be placing colored fluids in here, hopefully so that you're better able to visualize what's happening.

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The reason we've chosen this particular scheme here is that for growing crystals you need to heat the - material which you're working with, to get it to be a fluid, and this is a unique and promising way to do it. Put the material in here and have a furnace around the outside and slowly rotate it, very slowly, so that you get very uniform heating, another consideration, is get uniform heating. Then as it cools, you can also allow it to cool very slowly by changing the amount of heat that it gets in to allow it to cool off - cool uniformly, you need to slowly rotate it because you cannot build a perfectly uniform heater. So the situation we're faced with is a fluid in here which will be rotating. Let's see what happens. Okay. We're back here with the granddaddy of them all. This is the biggie.

SPEAKER

He's at the two ends of the socket wrench extensions now. You can keep his voice up -

SPT

- - CC's of water on each side, and first we'll just take a look at a few oscillations although I will go rather gingerly on these - -

CARRUTHERS

This is colored, I think he was using grape Kool-aid that day. This is just a normal water drop. On the other you cannot see it, but it's on the opposing disk.

END OF TAPE

SL-IV PC-98C/1
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SPT - - Okay, we're back here with the
granddaddy of them all. This is the biggie. - -
CARRUTHERS He's at the two ends of the socket wrench
extensions now. You can keep this for yourself (garble)
SPT We're working here with a gap of two
inches 10 cc's of water on each side and first we'll
just take a look at a few oscillations although I will go
rather gingerly on these.
CARRUTHERS This is colored. I think he was using
grape Koolaid that day. This is just a normal water drop,
on the other you cannot see it, but it's on the opposing disk.
These oscillatory modes are also of interest to us by the way
(garble)
SPT Okay, and we can see the natural frequency
there which I could certainly amplified, but I choose not to.
Now you see I can get out of phase with it and - -
CARRUTHERS He's going to join these two (garble)
SPT - - cause interference which, well,
there we go I set up a harmonic. But, I wish not to play
with this too much right now. Instead, we'll press on with
the experiment. We will first rotate in the same direction.
You'll notice in the clear bubble that there is a small
air bubble inclusion. The angle I can see in the bubble,
it makes a very good lens, ampli - or - makes the - there
we go. That was the only way I could get it over there.
CARRUTHERS Now notice this bubble has stayed pretty
much in the center of the field here. Now this is the liquid
cylinder to which we were referring. In crystal growth, this
would be molten and this would be - -
SPT Okay, we're going to go here - -
CARRUTHERS - - on solid liquid interface; the other
one would be over here. And, the crystal growth would occur
by solidifying either one of these interfaces and holding
the other.
SPT - - at a rate a little bit lower than
the specified rate of 16 which is every 10 seconds for pulling
up the rod. After watching the last one with a gap of only
1 and 3/8 inches, I'm sure it's obvious that speed would be
disastrous. Okay, here we go. That really - hold on, let
me back you off. I got a good view, but you don't. Let me
center you up. There we go. Okay, now you have only one -
one angle on that. The angle I can see is at the light -
darker color fluid. The violet has gone all the way around
on the outside but the clear fluid has penetrated up the
axis. Okay, here we go. Well, look at that. Now, I can
get the other, the standard mode of oscillation. Ooooooh; hang
in there.
CARRUTHERS (Laughter) Okay, we measured the rotation
rate by, of course, measuring the number of rotations per unit

SL-IV PC-98C/2
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times either socket wrench extension modes - -
SPT Okay, let's see if we can get this back together and I've stretched it out to an extent anyway.

CARRUTHERS We're very interested in the form of the rotational instability because, of course, if we have a liquid at 2,000 degrees centigrade there we don't want it to come flipping out of there. And the other thing is that we're quite interested in these oscillations because they represent perturbation during the nominal crystal growth process. And therefore, they're undesirable.

SPT There we go. We still have a little rotation left. There's the interesting oscillation. Okay any faster and you see that I do get the - the one major instability which is just what you see in front of you, the C-shape which rotates.

SPEAKER Zero gravity is a new world.

END OF TAPE

SI-IV PC-98D/1
Time: 14:15 CDT
1/14/74

SPT Just - just what you see in front of you, the C shaped which rotates.

CARRUTHERS Zero gravity is a new world. Okay - well, those represent short clips and I want to perhaps emphasize a couple of points here. One of them is that this is a technique presently used in the semiconductor industry to grow silicone crystals and approximately 1/3 of the single crystal in silicone material is prepared by this technique. And one of the major problems with the technique is that the material so produced is not uniform in composition and the primary reason for that are these unexplained flow patterns, some of which you've seen here. So that certainly one of the major results of the work we've done this week - and is to elucidate some of these basic flow patterns and this conceivably could result in many many millions of dollars saving in the semiconductor crystal growth in electronics business. Looking ahead just a little bit, of course, you can see, I think, that the technique will lend itself to development for a space shuttle laboratory and we're certainly going to go full steam ahead on that one with this basic information at hand. I would like to conclude by saying that these experiments were only possible through a rather unique combination of talents. The - including, of course the astronauts, in particular Dr. Gibson, the people here at Mission Control who took a very zealous interest in the work and the people at Marshall Space Flight Center, including Jack Waite here, and Tommy Bannister, who actually cleared the way to get things going, and the people from Martin Marietta who knew very much about the equipment on board with which the set up was lashed here. And I think you can see that this is a good example of the performance of science in space as perhaps opposed to the primary mission of Skylab which is the performance of science of space. And materials processing, the preparation of materials in zero gravity environment is something that has tremendous potential. And we're only just beginning to tap it by understanding how to operate, live and perform in a zero gravity environment. I think experiments of this type are certainly an excellent demonstration that we are going to open up in the future some of these areas to quite a large extent. So that's all I have to say formally. I'd be very glad to respond to any questions.

QUERY Could you explain a little bit more about why you said this will save a great deal of money in the - in the - let me say that - save a lot of money in the semiconductor -

CARRUTHERS Right.

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QUERY

that?

- industry? Could you elaborate on

CARRUTHERS Yes, right. When we grow semiconductor crystals, we intentionally put impurities, if you will, back into them to give them the properties, the electrical properties that they must have. And the trick, of course, is to put them back into the growing crystal in the way that they are desired. And the most common way is that you want them to be there uniformly throughout - spatially uniformly throughout the solid. And the fact is, of course, that in reality they're - the composition is not uniform throughout the solid. So that it means that they have to cut out that portion of the crystal which is usable and the rest is essentially scrap. So what we're talking about is utilizing more of the grown crystal for a particular application. And it's a very serious problem in the semiconductor business, especially as the requirements on the solid state devices such as integrated circuits have become very much tighter. And were - the major reason for these nonuniformities are the convective flow patterns that exist while the crystal is growing. So we're trying to identify them and control them in some way. And zero gravity environment, of course, represents an excellent way of eliminating many of the adverse effects of convection that we see on Earth. Okay - yeah, go ahead.

QUERY

When you say space shuttle laboratory, what - what are you talking -

END OF TAPE

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QUERY When you say space shuttle laboratory, what - what are you talking about? The shuttle itself or a - or a station that the shuttle was to go and come from?

CARRUTHERS Right, okay. I'm no expert on - in this, but the space shuttle is going to operate in a number of modes. One of the modes is that there will be sorte laboratories which are essentially plugged into the space shuttle vehicle itself, so that some of the missions of the space shuttle will actually be scientific missions where laboratories - whole laboratories are plugged into the space shuttle. They orbit the Earth under zero gravity conditions, experiments are performed and then everything is returned. So - what we're talking about now is a sorte laboratory devoted to one or other of a primary scientific mission, which will be orbited by the space shuttle vehicle.

QUERY What size of a facility would you have to have in orbit to make it economically feasible?

CARRUTHERS Well, that's a very difficult question to answer. I think because of the complexity of the various different types of things that are - would be done in such a laboratory. I - I - I think economic feasibility is something that perhaps depends very much on the instantaneous needs of the times. One cannot anticipate them, but I know in the electronics business, I think most of us believe that we should cover all - almost all of the bets that we can. And then when and if any one of them should become important, then we will be in a position to utilize this information we have. And I think - I - I - I can't speak for the other areas of the space shuttle because I work for Bell Laboratories not NASA, but I - I think that there are some things that may in fact, afterwards prove to be economically feasible which we may not have realized before. And we must keep our eyes open for that possibility, so -

QUERY Will, then you're talking about something pretty far down the line aren't you? Couple of decades or something?

CARRUTHERS Well, things move awfully fast in these times. The space shuttle will tentatively be ready to fly in 1978. And although the - the laboratories that we're talking about will not be ready to fly until some time in the earlier mid-1980s. But things do move very quickly, and times change and demands change, supply and demand markets change a lot of things. And it's certainly possible that - by that time, we may have a - a rather critical needs defined, which may change some of these things, but I think will be picked up by NASA as missions for their space shuttle. That's - you know - you can't - you can't say in 1974 that - what's going to happen in 1984. I think it would be foolish to do that. But on the other hand, I think you can try and define areas that you might

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anticipate might be important. And then try and develop a base upon which you can build if the need suddenly escalate in those areas. And I think most of us are operating this way.

QUERY Can you use unmanned spacecraft for your work?

CARRUTHERS No, not for this. The process is not - it is - most economically bascially - it's not feasible to automate a process like this. Either here on Earth or - in my opinion - on a space vehicle.

QUERY Do you see private industry picking this up in a way similar - say COMSAT did on the communication satellite?

CARRUTHERS Yes, that is a good question. Of course, communication satellites is a - a very well defined area and one in which, I think, almost major electronics industry had an interest. And therefore, in order to avoid - I know, of course - point of view of my own employer Bell Laboratories and ATT that we were most anxious to continue on after Telstar in this area. But I we would have dominated it unfairly so, in terms of competition. So, that was a well defined area which I think the things - the sort of things that we're talking about right now are not yet but could be in the future.

QUERY When - when these kinds of laboratories are reached the point, say the Telstar did, would you see then that private industry just in a consortium type of way or -

CARRUTHERS Definitely.

END OF TAPE

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QUERY - - types of laboratories or - or
reach the point say that Telestar did, would you see then
that private industry just-in a consortium type of way or - -

CARRUTHERS Definitely.

QUERY taking over and -

CARRUTHERS Yes, it would absolutely have to be based
on a con - (garble) or prototype of some type and the lessons -
their, their - their trials and tribulations

COMSAT is going through right now are probably going to
be very valuable for things like this later on. If it turns
out that relevance and - and needs become very important
for one particular area of space shuttle. But again, I -
I'm not an expert on space shuttle so, you know, I would
defer some of these questions perhaps to Jack Waite from
Marshall Space Flight Center.

PAO Okay, no further questions. Thank you
very much.

CARRUTHERS Thank you very much.

END OF TAPE

SKYLAB FEWS CENTER
Houston, Texas

Skylab IV - Solar Prominence Briefing
Johnson Space Center
January 18, 1974
11:32 GMT

PARTICIPANTS:

Dr. Robert MacQueen, PI 5052
Dr. J. Gosling, Co-PI 5052
Joseph Hirman, NOAA
Bill Pomeroy, PAO

SL-IV PC103A/1
Time: 13:32 CDT
1/18/74

PAO Okay, at this time, ladies and gentlemen, we're going to have a briefing based on the unusual solar prominence that was seen yesterday. And with us at the panel to my immediate right is Dr. Robert MacQueen of the High Altitude Observatory and principal investigator on S052. Next to him is Joseph Hirman of NOAA in the ATM support room, and beyond him Dr. Jack Gosling, co-investigator on S052, also from the High Altitude Observatory. We'll have some remarks from Dr. MacQueen and Joe Hirman and from Jack. And then Dr. MacQueen will show us from down in front here the - some pictures and show us just what we are talking about. We'll start off with Dr. MacQueen.

MACQUEEN I want to make just a couple of points in prefatory to Joe Hirman and Jack Gosling telling you more about the specific events that went on yesterday. The first, the point I want to make is that this of course is not the first coronal transient that we've observed on Skylab. It is a unique event in the sense that it is probably the best observed coronal transient that we have on any of the Skylab III missions, due to several fortuitous circumstances and several circumstances that were the result of good planning both by the people on the ground and Ed Gibson on the panel. The event is of some interest to us as all the coronal transients are because of their implications with regards the coronal structure and inter-planetary events. But this particular event yesterday came at a very nice time. Those of you may be - you may be aware that Ed Gibson has several times during the course of SL-IV queried the ground as to what was the reason that he had not seen any of the white light coronal transients that for example the SL-III crew, the so called solar bubbles that Al Bean, Owen Garriot, and Jack Lousma all saw on SL-III as a result of activity on the Sun. And in response to this NOAA and the HAO people made a survey of the activity that had gone on and came to the basic conclusion that the Sun was just not that active during SL-IV and therefore the frequency of events was much less. Well, this clearly I think, in my opinion, this clearly worried Ed Gibson that he hadn't been able to make any observations of these phenomena especially since his premission training considerable emphasis had been placed on this after we had seen this spectacular events of both SL-II and III. So I think quite frankly the happiest person to observe this event is Ed Gibson. Not to say that we are not completely happy with it too. We have by far the most complete and thorough observations with the coronagraph of this transient in the corona

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than any of the others on Skylab. It works out that because we're at extremely high beta angle the inclination of the orbit is so high that the amount of sunlight per orbit, that is the amount of time you spend above the grazing height of the atmosphere is very long. In fact this means that you have more sunlight time to observe the Sun per cycle. And that was the circumstance that permitted him to only to miss only the night time part of the orbit for something like 20 minutes or so. I think without any further comment along those lines why don't I turn this over to Joe Hirman of NOAA. Let him tell you a little bit about some of the ground event - ground recorded events and then Jack Gosling will describe to you the events that were seen both by the S052 coronagraph and in the XUV monitor of the Naval Research Lab. And I guess since Neil Sheeley of the Naval Research Laboratory could not attend I should point out that this is by far their best observed eruptive pictures of erupted material and that Ed was ab -

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SPEAKER - - of the orbit for something like 20 minutes or so. I think without any further comments along those lines, why don't I turn this over to Joe Hirman of NOAA and let him tell you a little bit about some of the ground events of the ground recorded events and then Jack Gosling will describe to you the events that were seen both by the S052 coronagraph and in the XUV monitor of the Naval Research Lab. And I guess since Neil Sheely of the Naval Research Laboratory could not attend, I should point out that this is by far their best observed eruptive pictures of eruptive material and that Ed was able to get a number of good exposures for the Naval Research Lab - spectroheligraph on the event.

HIRMAN Okay, the first indication we have of any significant activity was the alarm that came over our teletype network which was an automatic response from some of the classified Air Force monitoring satellites. We do not know exactly what this means as far as what monitor it was or what triggered the alarm however that was the first indication we had in the sign that something was going on about it. About 2 or 3 minutes later we begin to receive calls on our telephone system that connects to several observatories, one of which was Ramey in Puerto Rico. They at 1925 saw a piece of material off the west limb of the Sun around north 07, which was bright and apparently moving out from the surface of the Sun. And at that time it around 1926 or so, it was out to about 0.22 solar radii. This was from an area that did not expect any activity, and - and it was at this time we also received reports from Boulder indicating that there was a radio event occurring at the same time in - in addition to this was also notification from Mauna Loa Observatory that they were also seeing in this event on the limb of the Sun. All this together was, I think, sufficient enough to warrant some rapid response in the science room in the - as I was notified, and this information was uplinked to the crew who, at that point, I think began operations on the - the limb event. As to the source of the event, there's some debate as to what produced it and just what it is. Our best guess right now is it came from a region that was about a day and a half behind the west limb of the Sun, active region 14 which the day before produced a, this seemed a similar type event. However, active region 14 was not expected when it was on the surface of the Sun to produce much of any activity. It seemed to have grown as it transited the west limb. And the only indication we have that it was perhaps from this region is that the geometry of the event was close to where active region 14 should be on the back side of the Sun.

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And it - the definition of the event is also up for question. We called it an eruptive prominence, however, an eruptive prominence you'd like to have a prominence in position to erupt before this happens, and we can't seem to find one. So, therefore we think maybe it's ejected material from a flare out of active region 14 on the back side of the Sun. And I'll pass that from that to Jack.

GOSLING Okay, like Bob and Joe have described the event and a little bit of our enthusiasm about what the way the crew has responded to catching it. Before going further, I'd like to make a point about this particular event, and that is its most unusual feature as seen by the coronagraph experiment is the extreme brightness of very concentrated knots of material coming out from the Sun. I think it's quite fair to say that these are by far the brightest that we have seen. And overlying these knots are a weaker looplike structure which I want to discuss in a little more detail as well as some of the implications. But the - certainly the unusual feature of this event is the extreme brightness of these knots as seen in our coronagraph experiment. Once the crew was alerted it was some 8 minutes after the event had been reported on the ground that the crew was notified. Ed spent a little time first pointing to it, and then going Sun center. By the time he got to Sun center there was already material out at two solar radii, yet the observations at the Earth had been reported out to point - about 0.3 solar radii. So, we're another solar - another - -

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SC Once the crew was alerted, it was some 8 minutes after the event had been reported on the ground and the crew was notified. Ed spent a little time first pointing to it and going Sun center. By the time he got to Sun center, there was already material out at two solar radii. Yet, the observations at the Earth had been reported out to point - about 0.3 solar radii. So we're another solar - another solar radius out, or should I say, 7/10 of solar radius out, beyond where it was last reported on the ground. And it's not clear that what we first see in the coronagraph picture that we shall see, is indeed that same material which they saw earlier or whether it's another manifestation of the same event. Further, out beyond this bright knot that you'll see, you'll see weaker loops that are out about 3 solar radius. In other words, they're another - by when I those distances, I mean from the center of the Sun. So 3 solar radiuses from the center, it's two solar radiuses out from the limb. And this is just a few minutes after they have recorded only several tenths of a radius above the limb. So we - I want you to I concentrate on that when we actually get to the pictures. It's also - I think, the first time we've ever seen a transient event like this in the XUV monitor. When we see - I think the first thing we have is the XUV monitor which was taken I believe shortly after the event occurred, so if I can have the XUV monitor on the screen, I'll try to describe that. If you noticed on the western limb there, that's the limb on the very far right, there's a - I can't see it well from here, but I think you can see - perhaps see it, if you get a closer view. Maybe we should have the lights out.

SPEAKER (Garble)

SPEAKER Okay. It's the very faint ray-like structure emitting from the west limb. This is undoubtedly prominence ejecta as seen in emission probably or predominantly in the helium 304 line. Now the NRL 82A experiment take pictures which are very similar to this picture but instead of being - seeing it in many lines like you do in the XUV monitor here, they look at the emission from this ejecta material in selected wavelengths. They will get pictures of the Sun and the ejected prominence material in the isolated wavelengths in which it primarily emits and that is primarily in the XUV region in the helium 304 line, I believe it is. They undoubtedly have a beautiful sequence of pictures of this material expanding out into the corona and hopefully and we think probably overlapping that region in the corona where the white light coronagraph is able to observe. Again as Dr. MacQueen pointed out, these are probably the best temporal sequence pictures we have, with the 82A experiment

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of such phenomena although they do have some beautiful pictures on some of the previous Skylab missions of such events, but no where near the good temporal coverage. One of the real questions we're trying to answer now, relating to events like this, is the intimate relationship between the material that you've seen in emission, that material that is ejected from the Sun, from the solar surface proper and the material that we see in the coronagraph pictures at 1 AU. At this time it's not completely clear that these big magnetic loops that you see, that these are really the material that is ejected itself or if this is material that was overlying the region where the eject occurred. If I may now, turn to white light coronagraph, we can see what this looked like in the coronagraph yesterday as taken by Ed Gibson. The bright knot there in the center is the ejected material that's at about two solar radius at that point, please note the overlying and surrounding diffuse loops connected with it. Dr. Gibson spent most of his time describing - describing and discussing the very bright knot in the center and certainly that's the brightest feature we have ever seen in the corona, I think it's fair to say, with the white light coronagraph experiment. That bright knot, the reason it's probably so bright is that it's probably emission line from elements that are not completely ionized. The surrounding material is quite likely primarily scattered light, although - too may be emission also. And one of the crucial questions we're trying to answer is what is that surrounding material? Is that coronal material originally or is that chromospheric material? And, indeed what is that bright knot? Can we correlate that bright knot specifically with the - -

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GOSLING (garble) The reason it's probably so bright is that it's probably emission line from elements that are not completely ionized. The surrounding material is quite likely primarily scattered-like, although it too, may be emission, also. One of the crucial questions we're trying to answer is what is that surrounding material? Is that coronal material originally, or is that chromospheric material? And, indeed, what is that bright knot? Can we correlate that bright knot, specifically with the NRL, 82A exposures of the prominence erupting? Those are some of the questions that we hope we might be able to answer with this. During the sequence that followed this we were able to observe for six consecutive orbits, the progress of this event as it moved out through the corona and its evolution, the magnetic evolution. It's very difficult to say from the few downlinks that we have of exactly what it did look like. But we do have Ed's words as they came down. And we do have some knowledge about similar events to this from previous experiments. It appears that this event moved out at a velocity of approximately 700 - 650 kilometers per second. That is - That is the velocity that we might associate with that bright knot in the center. However, it's not apparent to me that the outward loops above that are not moving faster than that. In fact, this particular picture here was taken, I believe, within 15 minutes to a half hour after the eruption was first noted at the limb. And you'll note that the outer diffuse area there stretches out to about 3 or 3-1/2 solar radii. So it's possible that that material is moving much faster than the knot itself. Also, following behind this bright knot later, there apparently were other surges of material and they have different velocities. Well, some questions that we might be interested in asking in events such as this, I think the first thing is, when we see something like this in the coronagraph, what is the cause of it? What is the source of it? That is, we know that a material was thrown out, but why was that material thrown out, was it a flare, was it a rearrangement of material, was it perhaps a difference in the pressure caused in the atmosphere that caused this? What caused this? Also when we're seeing here - when we're seeing this diffused material ahead of the bright knot, what is the cause of that and what is the effect? It's not true which is the horse leading the cart or whether the horse is pushing the cart? Some other questions, I think, that are interesting to ponder from this event and others like it, and I think this event possibly will help us answer these questions is - Let me comment first of all, that the speed that we observe here, like 650 kilometers per second, in laymen's terms, if we go non-metric, that corresponds to like 1-12 million miles per hour. So they are pretty fast.

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But, are they that much faster than what we'd normally observe streaming out from the Sun? Well it's difficult for us to see materials streaming away from the Sun, although, we know from the stretched out appearance of the streamers that are certainly doing that. But, we know from observations at 1-AU that it's not unusual at all to see the solar wind blowing by us at speeds 500, 600, 700 kilometers per second, very comparable to this. So the speeds here associated with these events are high, but they're not that unusual. What is unusual about these events is their density, their temperature, and the magnetic structure that we see associated with them. Some questions we might be interested in answering are these: Do these things all move out into interplanetary space, or do they eventually fall back into the Sun? Is the Sun's gravity strong enough to hold them in, or do they eventually just move out through the solar system? We think the answer is that they, by and large, are moving out. We have yet to have good strong evidence that any of these - this material ever really falls back into the Sun. Also, since we see such strong structuring associated with these events, what special effects do these cause? Well, there are several things that they might cause. Since there are strong magnetic fields there, we might expect that they'll contain particles, energetic particles that might eject from the Sun behind these, the so-called solar cosmic ray events, that we might expect these big loops like that would help to contain the ejecta of such particle. And they serve to modulate. Matter of fact, it's my personal opinion that such structures like these are responsible in a great way for the modulation of the energetic particle increases that we see. By that, I'm talking about particles in the range 20- to 30-million electron volts. They - -

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SPEAKER - - ese cause. Well, there's several things they might cause. Since there are strong magnetic fields there, we might expect that they'll contain particles energetic particles, that might eject from the Sun behind these, the so called solar cosmic ray events. We might expect these big loops like that would help to contain the ejecta of such particles and they serve to modulate. As a matter of fact, it's my personal opinion that such structures like these are responsible in great way for the modulation of the energetic particle increases that we see. By that I'm talking about particles in the range 20- to 30-million electron volts. They probably also have an effect on modulating the cosmic rays that arrive at the Earth. A well known modulation is known as the Forbush decrease of cosmic ray intensity, where for a period of two days at the Earth you may see a modulation of cosmic rays received at the ground by perhaps a 10 percent effect. My own personal opinion is that structures like this have a strong effect in producing that sort of modulation. Further, if we're sitting with solar wind satellites out at 1 astronomical unit, and I might add that Pioneer 6 and 7 are ideally located to observe possible interplanetary effects of this event which apparently came from behind the Sun, if they are operating hopefully we might see the interplanetary signature associated with this particular event. Question arises is how do we see such an event at 1 AU, if we're looking at it, let's say solar wind detectors. It's undoubtedly true that some of these cause interplanetary shock waves, this one seems fast enough. It's moving at about 650 or 700 kilometers per second, that's faster than the normal solar wind speed of like 400 kilometers per second, it's supersonic in that sense. We expect a shock wave to form at the end, at the front end of that and they'll probably be a shock wave associated with that event. And all the attended effects associated with shock waves in the solar wind. However, it's surprising that when one looks at 1 AU that the net effect on this will probably be reasonably small in terms of the total energies of the solar wind flow that we see coming past 1 AU. One might ask how important is this in terms of mass loss from the Sun. The question to that is - the answer to that is the mass loss is negligible, the impressive points about this is the amount of energy released and, of course, the dimensions and the time into which this energy is released. And, I think I'll tie it up with that and ready to answer any questions that we might have.

SPEAKER Jack, before you do that, I'm told that filament 81 has lifted off and - -

SPEAKER (Laughter) Wonderful. (Laughter)

SPEAKER - - and Ed Gibson is doing another JOP 8 which is coronal transient, joint observing programs, the same

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thing he did yesterday. I think Ed is going to be very happy about all this. That's in progress now, apparently.

PAO Okay, at this time, we'll take your questions.

QUERY On this filament 51. Is this similar to this event, which is - that we're looking at now.

GOSLING Yeah, I think it's filament 81.

SPEAKER Filament 81.

GOSLING It may be similar to this event. In the past missions we have seen coronal transients of this - this character, not precisely this - this type, but this character as a result of filaments and that's just the word for a prominence, when a prominence is on the disk. A filament is a prominence.

QUERY Would - would 51 also be in active region 14?

SPEAKER No, it's all the way over on the other side of the Sun. In fact, on the northeast side of the Sun.

SPEAKER It's right about in the middle today.

GOSLING About in the middle today. All right.

QUERY Could you describe for us just what - how do you class a coronal transient. Just what is that?

GOSLING (Laughter) That's a tough question. And, I don't - we don't have - I don't have a pat answer for you, except to say a coronal - we class a coronal transient as any event that occurs in the corona that is someth - on a time scale of minutes to hours. Now, that's a very poor and loose definition, because one of the things we've certainly found in the analysis, the preliminary analysis of SL-II and SL-III results, is that the corona is changing form and shape visually at least, over time scales of hours to days, but that's a coronal transient and I guess the best definition I can give you is, there is one. Anything like that we call a coronal transient.

QUERY Well, just one more question here. I know in our past discussions, one of the things we've talked about is - you're trying to learn how energy is transferred - up - from one place to another in the Sun. Will this give you information about that?

SPEAKER Jack, you want to - -

GOSLING I'm not quite sure what the energy transfer you're associated with. Certainly there's a transfer of energy here from the solar surface out in through the interplanetary medium - -

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SPEAKER - - I can give you as - there's one.
Anything like that we call a coronal transient.

QUERY What - just one more question. I know
in our past discussions one of the things we talked about
is you're trying to learn how energy is transferred from
place to another in the Sun. Will this give you information
about that?

SPEAKER Jack, you want to - -
GOSLING I'm not quite sure what the energy transfer
you're associated with. Certainly there's a transfer of
energy here from the solar surface out into the interplanetary
medium. There's undoubtedly associated with these events
a rearrangement of the coronal structures which require
a certain amount of energy. I think there's definitely
associated with an eruption of material a - that's an energy
loss right there. And the energy loss with an eruption like
this is comparable to that expended in the radiation associated
with flares. So we have a comparable amount of energy released
here as released in a major flare. Does that answer your
question?

QUERY Yeah.

QUERY That - Jack, that leads into another one.
Is this as important to your studies as a - as a flare? And
when you - when you track one like Ed did yesterday, do you
learn as much about energy transfers et cetera of the Sun
as you do if you catch a flare from - from the moment it starts?

SPEAKER Beauty is in the eye of the beholder.

(Laughter).
GOSLING I - I think that's true to a certain
extent. The - I think one of the things we found on Skylab
is that we - the number of times this event has occurred has
surpassed what I think we expected. And certainly this type
of event that we've seen here we've seen more frequently than
we've seen large flares. And since the energy released in
these events is comparable to that, certainly we're talking
about a - an event which has a frequency as frequent as large
flares and with a comparable amount of energy. Like you say,
I'm primarily an interplanetary type who's interested in the
corona and the energy transfer through the interplanetary
medium and its effects upon the Earth. And for those type
of studies in the solar wind. In particular this is the -
the fruit of one's life. Solar flares where the emission -
when the emission is in the electromagnetic part of the
spectrum has a very small effect, per say, on the interplanetary
medium.

QUERY Did I understand you to say that you don't
know where this material is going, even if it's going to
fall back into the Sun or - -

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GOSLING I think we know the answer to that pretty well. I think the answer is that most of the material does not fall back into the Sun, and most of the material gets dissipated out through the solar system and eventually ends up in interstellar space.

QUERY Well, is it - is it headed towards Earth?

GOSLING This particular event was from the back side of the Sun and - we think. And it's very unlikely that this would cause any effect at all upon the Earth at this particular event. Events such as this that were emitted from the central meridian, like perhaps this one that occurred today, we certainly expect such an event to impact upon the Earth's magnetosphere to cause such things as Sun (garble) geomagnetic storms, and auroras and the like. And that's when - and it's then when you would see the modulation of cosmic ray intensity and the modulation of solar protons, energetic protons and what not.

QUERY Well, as you digest this fruit here, (laughter), what's it going to tell you about as it dissipates out into the solar system, what's it going to tell you?

SPEAKER What's going to happen as it dissipates?

QUERY No, what's it going to tell you that's important to you?

SPEAKER This particular event as this particular one dissipates out in terms of our effects on Earth here I think are negligible; that one particular there. But what we would like to understand is, I think some of these questions that I ask. What caused such events in the first place. How does the Sun conspire to release such an enormous amount of energy in the form of a concentrated partial emission like we observe here? Two, what's the effects of the ambient corona above it, and the magnetic fields that are associated with it? What are the dynamics of this event? This is one of the few places where we have a plasma of astrophysical significance that we can study directly to understand plasma dynamics in stellar atmosphere. It's just the Sun is the only - -

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SPEAKER In the form of a concentrated part of the mission, like we observe here. Two, what's the effect of the ambient corona above it and the magnetic field associated with it. What are the dynamics of this event? This is one of the few places where we have a plasma of astrophysical significance that we can study directly to understand plasma dynamics in stellar atmosphere, since the Sun is the only star that we have a close enough at hand to understand astrophysical plasmas. We can't produce this type of plasma in the laboratory. If they could produce this type of plasma in the laboratory and contain it, then we'd probably have nuclear fusion well in hand. However, I doubt that our understanding of the dynamics of this particular event will contribute directly towards understanding of nuclear fusion. But, it's the only place that we have in the physical universe where we can study plasmas like this. And, just from the pure scientific standpoint they're fascinating creatures. They're like pulsars or pulsars or quasars or beast of that category for the scientist.

QUERY Bob, I know you're starting to get low on film, as most of the guys are, this late in the mission. But if you had another event similar to this today, what would that do to you as far as your film budget and so forth?

SPEAKER Well, we - we sent a message up to the crew this morning, as part of the science conferences - we scabbled around last night and this morning working up our film budget and we gave the explicit go ahead to the crew that if they see another similar event such as this then we would appreciate all the operations they can get. And what it means is that if they really get a superb set of observations again then we will have to further parse out the remaining frames in our camera to cover from now to the end of mission. Indeed we're getting to the state where we have to be very careful about what - just how we operate the instrument. It's a very pleasant situation to be in.

QUERY I have one question - oh, go ahead, Bob. I'd like to know, how would you compare the data you're getting on this one, say with the S-III data where you had quite a bit of activity. Are you disappointed in what you're getting this time?

SPEAKER No, I think not. We've - let me speak from a personal viewpoint now, from S052, the coronagraph. We have some awfully nice sequences of observations oh, with temporal resolutions that we found difficult to get on SL-III because of all the activity. This is not to say that the corona has not been somewhat active. Ed reported approximately what was it Jack, a week or 10 days ago - -

SPEAKER 10 days ago.

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SPEAKER - - when we were running something we call JOP 19, Alfvén wave program, that we couldn't have picked a better time. It was purely fortuitous; I wish I could claim otherwise. We couldn't have picked a better time to observe the corona because he could see it changing on an orbit by orbit basis, so indeed we haven't had the flare activity this mission that we've had on SL-III, but I think that at least from the various voice comments that we heard from Ed and from this event and the like we will have a rather significant amount of short-term changes in the corona. And no, I wouldn't say at all that we're disappointed with the operations of this mission because we've been able to do a number of programs in conjunction with other experiments especially which were designed after we had seen SL-II and SL-III film. We've been indeed able to run those specific programs this mission and so what we're doing some new things and that's always very exciting. We don't really know what's going to be on the film as we examine these new programs, which for us are various temporal sequences and various correlative observations with the Harvard experiment and the like.

SPEAKER I'd like to add a little bit to that. What we'd really like is to run this coronagraph for a whole solar cycle, where we can watch the long term evolution of the corona and we consider every month closer to that 11 years well worth the effort that was put into them.

SPEAKER I'm glad to hear you say that Jack. I'll know who that we'll want to have down here for Mission Operations for that experiment. (Laughter)

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GOSLING - - add a little bit to that. What we'd really like is to run this coronagraph for a whole solar cycle, where we can watch the long term evolution of the corona and we consider every month closer to that 11 years, well worth the effort that was put into them.

SPEAKER I - I'm glad to hear you say that Jack, I'll know who that we'll want to have down here for Mission Operations for that experiment. (Laughter)

PAO Okay, - oh -

QUERY Speaking about the future. I understand either today or tomorrow you're having a meeting - uh - talking about applying ATM that you're learning from this to the Shuttle program. Or am I incorrect? I thought I heard someplace along the line this meeting was going to come up.

SPEAKER I'm not aware of a specific meeting with regard to that. We have certainly had discussions over the past several months, among ourselves and with various other people about applications of the ATM for future space flights and I think it represents one of many options that NASA could take for future space instrumentation. For example, it could be considered as one of the options for a solar package in the Shuttle era. The fact that the prototype, that is the other flight qualified ATM, the whole bloody package, is over in a clean room at Huntsville now and is of course is a totally flight qualified unit. So, I guess, I don't know of a specific meeting. We have been discussing this and we're - we the ATM principal investigators are interested in the possibility but there's a many a slip twixt the cup and the lip and the Shuttle's a long way away, so I guess we'd really can't say what's going to happen.

QUERY How would you characterize Ed Gibson's enthusiasm on the ATM as far as helping you in your studies?

SPEAKER Well, I'd characterize it as extremely high. Ed, as you know, Ed and Owen Garriott were, if you will, the solar specialists among the Skylab crew members, and Ed and Owen both participated in the formulation of the joint observing program in the - participated in the refinements of the design of the hardware on all these experiments, 6, 7 years ago, Ed was right in the thick of it, with us on the best way to make these instruments. I - I'm - I have to point out that Ed Gibson, personally, was very much responsible for our coronagraph having a television system in it, that such that we can get that picture over there. We originally had not designed the instrument with a television system and it was very much at the insistence and urging of Ed that we installed the television system which has allowed him to respond to these coronal transients. So, historically, Ed's been one of the more enthusiastic of the entire astronaut crew, in terms of solar

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physics. And, I think that the fact that you heard him, you heard Jerry Carr, over the last several weeks making the specific request for more solar time as long as the activity was - these active regions were on the disk is an indication of how enthusiastic he is and how much he wants to get for example, most notably, preflare observations. And as you're aware from looking at the schedule in the last several days especially day before yesterday, and the day before that, he is now being scheduled in for many cycles per day, at his own request on the ATM panel. He's - I think he's spending more consecutive cycles than anybody in all of the Skylab have spent at the console. So, personally, he is extremely enthusiastic and I know he's - when things like this happen that prove his role in operating the instruments it makes him awfully happy.

MACQUEEN - - He's a little less bubbly about what he sees as some of the others. He likes to keep his cool professional manner when reporting down. I don't think that any reflection at all upon enthusiasm.

QUERY Just from what you've seen the first two missions. Can you speculate whether you can answer any of the questions that you posed? If so, which ones?

SPEAKER Can we speculate that what?

QUERY That you can answer any of the questions that you posed?

SPEAKER Yes, as a matter of fact, I hope that our data will have significant impact on answering most or all of those questions. I think the one that's going to be the toughest is what - -

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MACQUEEN - - probably about what he sees is some of the others. But he likes to keep his cool, professional manner when reporting down. I don't think that - any reflection at all upon enthusiasm.

QUERY Just from what you've seen the first two missions. Can you speculate whether you can answer any of the questions that you posed? And, if so, which ones?

MAC QUEEN Can we speculate that what?

QUERY That you can answer any of the questions that you posed?

MAC QUEEN Yes. As a matter of fact, I hope that our data will have significant impact on answering most or all of those questions. I think the one that's going to be the toughest is what causes them to go in the first place.

QUERY One other thing on this Shuttle business. Is the ATM of a size that it could be carried in the Shuttle?

MAC QUEEN Yes. It gives you a good feeling for the size of the Shuttle. (Garble)

QUERY (Garble) would it be man operated under the plan that you're talking about?

MAC QUEEN Yes. It would be - we would hope and I think that the various committees that have been studying the kinds of operations for the Shuttle era over the last year or two have been fairly uniform in their recommendation that the instruments should be capable of twofold operation. One complete operation by the man on board and, equally importantly, complete flexibility from the ground. And that is, it would be a considerable extension of our ability now to operate the ATM from the ground. As you know we each - a number of - not each, but a number of the experiments can operate limited modes from the ground. I think the Shuttle era with the proposed shorter duration missions, that are being talked, it's - it's - I hate to use the word, it's cost effective to operate the telescopes every minute that you possibly can at the most optimum rate. So, it's very important that one has complete ground flexibility with Shuttle instrumentation, at least in the solar class, where the instrumentation is extremely complex.

PAO I have a question that was phoned in. Addressed to anybody on the panel. It says "During this SL-IV mission. Has anything new been found in the Sun?"

SPEAKER Like to field that one, Bob? (Laughter)

MAC QUEEN Well, there are - there is quite a long list of - of good observations and interesting new observations that have come out of SL-IV. I won't even pretend to begin to go down those. For ex - I'll give you an example. For one, the Harvard College instrument, 3 or 4 days ago, I forget how many days ago, I guess it was when active region 14 was close

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to the limb, has some marvelous observations of a surge at the limb. Both time sequence and detail spectra of that, and that's the first time that they've been able to be looking right at the limb when material squirts out in a surge, and they have just simply beautiful observations of that. That's an entirely new observation that we haven't been able to get. And earlier I alluded to the fact that we have a number of new joint observing programs built on knowledge of SL-III and SL-II. We've run virtually all of those programs at least once and in some cases a number of times. They're new observations and whether or not they're going to tell us anything new about the Sun, we've got to develop some film first before we can even begin to answer that.

QUERY Any idea how many pictures have been taken of the Sun so far on this mission? With all the instruments?

MAC QUEEN Oh, boy. With all the instruments. I'll have to do a little rapid arithmetic. We are currently - we ourselves are at 14,000, approximately. Right?

SPEAKER You mean this mission?

MAC QUEEN Two cameras.

SPEAKER At this mission, that's right.

MAC QUEEN This mission. So we have 14,000 pictures of the corona. A - Marshall has 6,000 in their cameras and they're down to 2,000, so they have 10,000 pictures. American Science and Engineering has 7,000 per magazine - 8,000 per magazine, and I think they have about 2500 to go, so they have something like 13,000 plus. The 82B runs 1600 exposures per magazine, and they've got about 200 to go on this, so they have made 6200 - -

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SPEAKER A - Marshall has 6000 in their cameras and they're down to 2 th - so they have 10,000 pictures. American Science and Engineering has 7000 per magazine - 8000 per magazine, and I think they have about 2500 to go, so they have something like 13,000 plus. The 82B runs 1600 exposures per magazine, and they've got about 200 to go on this. So, they have made 6200. And 82A has 160 frames, is it, per magazine and they've got about 50, I think, to go; 50 or 70 to go. They're getting ready to do a heavy sequence in the next day, so they have 300 and so, and the Harvard College Experiment which doesn't take film continues to bang away every day all day. So, I - now you'll have to do the addition of those numbers. (Laughter)

QUERY Some of that has been the comet, hasn't it Bob?

SPEAKER Indeed. Some of that film was directed at the comet. In our particular - in the coronagraph case when you take the comet when it was close to the Sun you were also getting the Sun, so it's dual purpose. That's a lot of film.

PAO

Okay, thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

S/L IV Press Briefing
Johnson Space Center
December 18, 1973
4:31 pm CST

Participants:

Dr. George Withbroe, Co-Investigator S055, Harvard College
Observatory, Cambridge, Mass.
Joseph Hirman, NOAA
Dave Garrett, PAO

SL-IV PC60A/1
TIME: 16:31 CST
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PAO We're ready to get started with today's briefing, as you're aware our Flight Director, off-going Flight Director was not able to be with us today but we do have Doctor George Withbroe who's a co-investigator on the S055 experiment from the Harvard College Observatory at Cambridge, Mass. Doctor Withbroe.

WITHBROE Okay, I've been - I've been asked to talk about the ATM today and the two probably most important things that have been going on in the ATM world are that tomorrow for the first time ATM is going to look at the comet and I'll describe that in a little more detail later - what we're going to do there. And the second thing there is a huge prominence on the Sun today, in fact it was on the Sun yesterday. It's been on for several days now, and it's the biggest prominence we've seen in roughly 20 years and we're waiting for this - we're hoping it'll erupt so we can catch a big eruption. And if it does erupt it'll be the biggest one since I believe it's since 1946 or 47. Yeah, June 1946 and so we'd dearly like to see this thing erupt and catch it like a prominence has never erupted before. So if you want I can go first of all into the comet observations, the - what we're going to do tomorrow is maneuver out, we are going to spend two orbits looking at the comet. The first orbit, we're going to look at the comet with the experiment S052, which is the coronagraph and this will take pictures of the comet and of it's tail in white light. It'll be similar to pictures one obtains on the ground and we'll spend roughly half an orbit doing this and then the other half of the orbit the astronaut will be spent trying to find the star Alpha Scorpius and the reason for this is he can see the star in his field of view. He has a TV display and we've become concerned from the last test we ran that we don't know how to point precisely, point ATM precisely at something like a star or the comet so the purpose of the second half of the first orbit is for the astronaut to try to put the star at different places in his field of view to make sure that he can point precisely where he wants to. And then we wait through the darkness period. The on the next daylight side, the experiments S082B and S055 will be pointed at the comet. And they'll be pointed for roughly a half hour at the comet and the primary goal there will be - for the 55 will be to measure the - get measurements on the hydrogen cloud that's coming off the comet. Comets - in some theories they say comets are made up - have a lot of ice in them and when this ice dissociates you get a lot of hydrogen come off the nucleus of the comet, and this makes a great big huge hydrogen cloud around the comet,

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and so what we'll be trying to do with 55 is make measurements on this hydrogen cloud and then the 82B experiment will be observing the spectrorange from roughly 1200 angstroms to 4000 angstroms. And one of the things they will also be looking for is Lyman-alpha emission, they can actually measure the profile of the line and then they'll be looking for molecules. Turns out the spectrorange from 1200 to 4000 is a particularly good place to look for molecular spectra and so they'll be looking for a whole variety of molecules. And I believe between 1200 and 2000 angstroms, we've never obtained comet spectra before, so these will be new and unique observations. First of all any questions on the comet before we move on to the prominence?

PAO Okay, Howard.

QUERY Yeah, what - what will the picture on the tape TV look like, will it be coming down live from the coronagraph and what will it look like?

WITHBROE My understanding is that there will be - they will be sending down a TV picture but one can't expect to see a lot other than maybe the nucleus, is that right? Just be a bright dot but you won't see a nice glorious comet picture like you - this will appear on the film but it won't appear on the TV display is not as sensitive as the film itself. The major - the data being taken will be on the film, he's just using the TV display to figure out where he's pointing it.

PAO Any other questions on the comet? Howard.

QUERY Yeah, is this the first of many ATM observations of the comet, you'd probably do a daily thing with this from now on or what?

WITHBROE Okay, I didn't bring the program with me but we have a series from roughly 10 days before perihelion - comet perihelion till 10 days afterwards. We're going to be observing it with increasing frequency, like I think we're observing the -

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WITHBROE - - before perihelion, comet perihelion until 10 days afterwards. We're going to be observing with increasing frequency, like I think we're observing it on day 10 - 10 day minus 10 days before perihelion 8 days, 5 days and 4, 3, 2, 1, 1, 2, 3, 4, 5, 7, 9 something like that. It will be everyday - when we get within about 5 days of perihelion, we'll observe it every day. And then the crucial thing for ATM will particularly be the times when it's very close to the Sun, when - at called minimum elongation, when it appears closest to the Sun as seen from the Earth. Then we'll be shooting - we hope to shoot very rapidly, particularly with the coronagraph, to get - watch the comet as it passes through the outer corona of the Sun and really catch the interaction between the comet material and the corona - solar corona and the interaction with the solar wind. Should be a very spectacular set of observations if all goes well.

PAO

Jim?

QUERY It would appear that these are probably the most significant observations ever made of a comet, is that true?

WITHBROE

Well, I hate to get on a limb like that. There are number of other experiments in Skylab which are also observing the comet, in fact, have been for a number of days now. And the total package from Skylab, I imagine, is making data is - that has never been equaled before. But all - is also being studied very extensive from the ground too. So the collection of ground plus Skylab, probably will make one of the this the best studied comet in history. And the thing that's unique about Skylab is comets in the past occasionally one could obtain spectra from rockets and so on. But with Skylab we can study it every day over a period of days and obtain spectra that you can't obtain from the ground, in the ultraviolet. So that's the unique thing about Skylab.

PAO

Tom?

QUERY So far you've found methyl cyanide is that right?

WITHBROE

I'm not a comet expert, (laughter), I'm a solar - solar man. And I - I don't know what all molecules have been found.

QUERY

I was going to ask what other molecules are you looking for.

WITHBROE

The - well we can see things in - for the ATM - I can only really tell you what's the ATM experiments will look for. The ATM will be looking - will be looking for the hydrogen which we know we'll see. The - we should see molecular oxygen. We also see - hope to see maybe carbon and oxygen, carbon and oxygen and nitrogen in a molecular state, excuse me in the atomic state. And also we'll be looking for molecules like molecular oxygen, OH, CN, CO, those are the only ones I

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can think of off - off the top of my head. But the spectrum between roughly 1200 and 2,000 there are an awful lot of molecules in that range. Oh, another one we're looking for is molecular hydrogen, which you can only observe from space. I imagine OAO probably looking for that also, the unmanned satellite.

PAO

Further questions? Okay, proceed.

WITHBROE

Okay, then the other sort of in - new thing that's going on ATM that - that's unique in the past day or two is this - this big prominence which I don't know if you've you seen pictures of it. It goes out roughly at - right now I believe it's out at .13 solar radii. And which means it's out about 13 diameters of the Earth, but it's a huge prominence. It's the biggest one of this cycle. And because - the interesting thing is the fact that we've got such a nice huge prominence when we had Skylab up there. And so we've been studying it intensively last night, and we'll be studying it intensively again during the day - we've been studying it last night unattended, during the day today with the crew. We'll be studying it again tonight with the experiments going to be run by command from the ground. And then tomorrow again we'll be looking at it. And one of the things we're hoping for is that the prominence will erupt and blow off. And if it does it should be, as I say, the most spectacular phenomena since - the most spectacular eruptive prominence since 1946. In fact, there's a picture - picture of it here - this one in '46 in Ed Gibson's book, which most of you probably heard of. He wrote a book The Quiet Sun before he went up. On page 66 in his book he has a picture of this "grandpa", they call it, prominence. And so it'll be very nice if he could get a shot at this one going up, you know if it wau - -

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WITBROE - 66 in his book, he has a picture of this "grandpa", they call it, prominence. So it would be very nice if he could get a shot at this one that's going up, you know, if it would go now. There's - trouble with these kind of prominences, it's ha - it's hard to predict whether or not they will go, because if this one's been around it - we saw it go over the west limb. In fact, we have some pictures of it here. And now it's come around again on the east limb. And there are people that say - hope it will erupt, but whether it will or not, we can't say. And if it does go, the most likely thing we will do is o - try to observe it with the coronagraph. And - what this will enable us to do is follow the prominence as it erupts. It'll form a huge cloud moving off from the Sun, usually several hundred kilometers a second. And we would hope to follow it from the - where the coronagraph starts seeing the Sun, namely, about 1-1/2 solar radii out to 6 solar radii. And if this would happen, it would be a truly unique event, because you can not do this from the ground, observe the corona that far out. So, we - as I say, we'd dearly love to do this, but whether or not it will happen, we don't know. It's a matter of it going off at the right time. And that - that ATM will be able - be able to be run. Oh, and I also might mention that sitting over this prominence is a very bright helmet streamer which - well we don't know until we get the film back, but on the basis of what the crew has said, and the t - TV pictures, it is one of the brightest, if not the brightest helmet streamer that we've seen during the mission. And the helmet streamer is - where it get's its name - get's its name is it looks like one of these old World War I helmets - sort of like that. And these helmet streamers - the arching part at the bottom - what you're doing is holding in the solar wind at that point. And so if this prominent erupts - what it will do is break that, and this material will shoot out into the solar wind. And so, it would be a very spectacular thing if it went.

QUERY Well, is it - is it inevitable that this thing is going to erupt sometime and - if it happens in the middle of the night, would you consider waking up Gibson and sending him up to the ATM?

WITBROE If the ground rules say we can't wake up the crew for something like this, we can run the coronagraph unless we're really bad as far as ground station coverage, we can run from the ground. So, it's a matter of where the ground station coverage is. We can actually tell it to start - tell the coronagraph to start taking pictures. And it takes long enough that we will be sure to catch it, at some time during its eruption. But it - as I say, it is

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it's a very iffy thing whether it will go or not.

QUERY Why did you say - -

WITHBROE Knowing Mother Nature, it'll - will probably go in the coolant and Earth resources pass or when we're looking at the comet or something like that. That's - -

QUERY Do you think it will erupt - does it have to erupt - does it - or can it - -?

WITHBROE It doesn't have to erupt. No, it - it's like predicting the weather. Pred - predicting what's going to happen on the Sun is very similar to what is going to happen on Earth. And there are some people crawl - crawl up on a limb and saying it will erupt, but it may just sit there and stick around for another solar rotation. We don't really know.

QUERY Well, uh - what - if it does erupt, and you get a lot of good data on it, what - what could this tell you?

WITHBROE One of the - one of the reasons that we study the Sun is because the Sun - the Sun has quite a bit of impact on the Earth, particularly in the Earth's upper atmosphere. And the solar wind, in fact, the solar wind and the Sun - Sun - the radiation from the Sun strongly condition - control conditions in the upper atmosphere on the Earth. This is roughly a hundred kilometers up. And when you get that huge eruption on the Sun, this cloud of material, when it comes off and hits the Earth will cause things like - what's commonly called a geomagnetic storm, which you measure with sensitive magnetic instruments. And also you get things like increased aurora displays over the northern and southern poles. And so one - one of the things that we're hoping in Skylab is get a better understanding of just how events happening on the Sun influence the Earth's upper atmosphere. And there are some indications that there're even - even long range weather - the interaction the solar wind with the Earth upper atmosphere does have influence on it in long range - long range - forecasts, storms in the northern hemisphere.

PAO

QUEE

PAO

questions

QUEE

it's all right.

That's the same thing? Any further

when you -

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WITHBROE With the Earth's upper atmosphere does have influence on the long - long range weather forecast, storms in the northern hemisphere and so on.

PAO Jeff.

QUERY No, that's what I wanted.

PAO Oh, that was the same thing. Any further questions?

QUERY When you mention this prominence erupting, is that the same thing as a flair?

WITHBROE Sometimes a flair can touch off an - It can be a cause and effect relation sometimes since you get a flair then a prominence will go. But a prominence, I - my background is not terribly strong in this whole area. But, I think they just sometimes go, and I don't think people really know why they go: they just erupt. And they just, the reason they can say now this one may erupt is they watch it, and if it's swirling around a lot, and they've got different indications that it may go.

QUERY Well, how will it compare - compare to say with an M class flair, are something like that if it did go? Would it be a bigger explosion or bigger eruption?

WITHBROE You can ask Joe Hermit. I just can't (Laughter)

QUERY Well, we were just curious on this solar prominence if it did erupt, how would it compare with the flair? Let's say an N class flair or a X class flair.

HERMIT In energy I would imagine it would be perhaps comparable to a M class flair. There's of course much more material that would be ejected if this thing erupted. And the speed would be a little bit different than an X-ray flair. In a flair things happen much more faster. This thing, I don't know of - I guess you probably explained much of the structure of the prominence. But it extends almost one-quarter of the circumference of the Sun. And if the Earth just happened to be in that line and it did erupt, it would perhaps would cause the same thing as in X-ray flair, aurora, magnetic disturbance, even power failures I mean power changes. Does that answer your question?

QUERY Yes. (Laughter)

QUERY We're supposedly at the end of the quite period of the Sun.

WITHBROE We're - we're just approaching the quite period.

QUERY Just approaching the quite period.

WITHBROE Yeah, we're - if you consider solar maximum

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winter, we're in late spring. Summer would be the quite period in the Sun.

QUERY Of - of the 11 year cycle though are - are we not this year, has it not been toward the end of the quite end of the spectrum.

WITHBROE We're - we're coming down. The peak was in - let's see, can't think of the year now, 67 - 68 something like that, that was the peak activity. And we're sliding down towards solar minimum. Joe would you know when the solar minimum is predicted to be?

HERMIT We should

PAO Wait for the mike.

HERMIT Okay. We should have had solar minimum if you'll extrapolate it from the peak in 67 - 68. There was a large bump in August of 72 which kind of brought things back up to nearly solar maximum, and then it started going down again. And during SL-III we had another huge excursion from the normal decay of the Sun spot cycle. So we - we really should be in the quite period if you extrapolate it from the curve that we started during this solar cycle. Does that - that answer your?

QUERY Yes, that - that leads me to another question. Are you developing better theories with what you've seen and - and what you know from Skylab on the solar cycles? And with the prediction had been that - that this were going to be in solar minimum this year more or less, do you know more about how the Sun - Sun's cycles operate?

WITHBROE Well, let's say we don't know any more yet. Because we haven't really had a, we're so busy getting the data we - we really had a chance to look at the data. But the very nice, the Sun has been extremely cooperative to Skylab. In that as you've probably heard from other conferences the Sun appears to have two faces. One side which is very quite, with hardly any activity on it at all, which we had about a week ago. And then the other side of the Sun is very active. And so we get sort of a taste of the very active Sun, and a taste of the very quite Sun. And I would suspect that particularly since Skylab gets pictures of the corona with the coronagraph, which gives the outer atmosphere of the Sun from about 1-1/2 solar radii to 6 solar radii - And then coronal pictures we get from the X-ray experiments and extreme ultraviolet experiments where we can see the magnetic structure of the corona. You can see all these magnificent loops if you've seen any of the X-ray pictures. You can see all these mag - mag - magnificent loops going from active regions to active region. The whole key to the solar cycle is -

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WITHBROE - - see all these mag - mag - mag - magnificent loops going from active region to active region the whole key to the solar cycle is what happens in the magnetic field. It's really - the solar cycle is really a magnetic cycle, a 22 year magnetic cycle. And I would bet that from the pictures we've got of the corona, particularly from the X-ray pictures and the - the pictures from the coronagraph that we can get a far better understanding of what is happening in the magnetic field in the outer atmosphere of the Sun. And then from that we can get a better guess what's happening in the interior of the Sun, below the surface where we can't see it. And so, I personally am very hopeful that we get a much better understanding of the solar cycle, whether we'll be able to explain it or not, I don't know. There are theories now, but they're all pretty much hand waving. Hopefully we can get it from the hand waving stage into something a little bit more firm af - on the basis of the Skylab data. Has been particularly nice to - be able to study it for a number of months for 8 or 9 months now.

PAO (Garble)

QUERY Was the data that you got on the last Skylab mission with all the activity more valuable than the quiet Sun activity you're generally getting on this - on this flight?

WITHBROE In order to study - to really understand the Sun, you really have to be able to understand both the quiet Sun and the active Sun. If you saw nothing but activity, then you wouldn't really - you wouldn't have a comparison. And as I say - to understand the solar cycle, the ideal thing to understand the solar cycle would be to observe the Sun with something like Skylab for you know 11 years, through an entire cycle. As I said the beauty of - what's happened during Skylab is the fact, that we get this very quiet Sun so you can see what the quiet Sun looks like, for one - where you can see one whole side of the Sun will be very quiet if you've seen any of the pictures, with hardly any activity on it at all, no Sun spots, or any - anything in the way of active regions, then the other side is very active.

HERMIT I should point out that the active side of the Sun, that was seen during SL-III, is the same active side that we - we're having now. This prominence is really part of that same complex of regions we had during SL-III. It's the same longitudes on the Sun, so the Sun has been very good at returning to the same active side.

WITHBROE What I was saying, this quiet versus active, the thing we will be doing after we get all the data and we get back to our home bases, is we'll be trying to build models of the solar atmosphere. In order - the first

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thing we always start off with cause it's usually the simplest and easiest thing to do, is you build a model for the quiet Sun. Then once you have that nice and secure, then you try to build a model for the active Sun. So - so it's essential - really essential to have both types of data, so you can see what makes the active Sun different from the quiet Sun. (Garble) really understand the activity you want to know what is the magnetic field - you know why did it - why did it appear active? Why isn't the Sun always quiet? You see the best way to do that is - to have a comparison between the two.

PAO

Any further questions? Howard?

QUERY

I got one on the comet. Why is the comet getting so difficult to see from Earth now?

WITHBROE

I'm not really a good expert on that. I - I - best I understand is the comet is re as - is dimmer than one would - would have expected at this time. And it's also getting close to the Sun.

QUERY

We're also plagued with the Moon. The Moon just happens to be going where - where the comet is - is coming up and so you're getting some moonlight and in addition you're getting the comet closer to the Sun. And you have a lot of scattered light, especially in Houston, you have to look at it within an hour of sunrise and you get a lot of fog and pollution or whatever else coming up.

WITHBROE

The best person to ask is someone like Karl Henize on that for what - what - Bill Snoddy over in the comet - Bill Snoddy over in the comet office, Building 30. He can give you all the latest on why we - what - is it up to predictions, or is it not up to predictions? I've only gone more by hearsay.

PAO

Tom?

QUERY

Could - could I get a - a precise layman's definition of a - of a prominence? It - it's probably been done before, and maybe everybody else understands it, but can you give me, in some layman's terms?

WITHBROE

Oh, I can try. I don't know if I can give you a pro - preface - precise professional one, but the basically the prominence is a cloud of gas up on the corona. Now the corona, you know when you look at the visible edge of the Sun, the corona is the part that sticks up above that. It's a very thin atmosphere and it's about 2 million degrees Kelvin. The prominence, - -

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WITHBROE - - sticks up above that. It's a very thin atmosphere and it's about 2 million degrees Kelvin. The prominence, by some mechanism which we don't really understand yet, is a cloud of cool material of about 10,000 degrees Kelvin, which is sitting up in the middle of this 2 million degree gas. And the prominence is much denser than the corona that's surrounding it. And so the interesting thing about a prominence is how can you have coexisting in same area of space this cool dense 10,000 degree gas surrounded by this 2 million degree thin gas. And so one of the major things we're trying to do is just understand how is this possible. What happens right at the boundary between the 10,000 degree and the 2 - 2 million degree material? How sharp is this boundary? Does it go instantly from 10,000 degree up to 2 million or is it a gradual thing? And so it's a problem of understanding basically a plasma. There're purely magnetic fields in the prominences and what is the relationship this cool gas, the hot gas, and the magnetic fields? Just how do you get this thing to happen?

PAO Do we have any further questions - if not, thank you Dr. Withbroe.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - S183 Briefing
Johnson Space Center
December 5, 1973
14:33 p.m. CST

Participants:

George Courtes, S183 Principal Investigator
Terry White, PAO

SL IV PC-42A/1
Time: 14:33 CST
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PAO Okay. We have with us, this afternoon, the Principal Investigator for the S183 Ultraviolet panorama experiment aboard Skylab, Dr. George Courtes. He's the Director of the Laboratory of Space Astronomy in Marseille, France. Dr. Courtes, why don't you run down how your experiment's doing and what the foreseeable results might be.

DR. COURTES Our experiment has been designed for the study of the very bright blue stars in the Milky Way. And those are to observe some (garble) results and this instrument is, in fact, a camera with 3 boundaries, that means that it works in 3 different wavelengths. One is 1800 angstrom, the one 1300 angstrom and the last one 2500 angstrom. You know that from the ground we are observing only the visible part of the spectrum, and we used to observe or saw through different filters. One of the most famous way to observe the (garble) stars is the (garble) system with (garble) U, B, and V. And it is in this kind of work that we are doing in the space UV.

PAO Okay, Are you ready for questions now?

DR. COURTES No. I can explain fine sensor what we've obtained up to now. We have been observing several stars in the Milky Way. And also, we have obtained several pictures of our nearest galaxies, especially the (garble). You know that (garble) are the nearest galaxies are belonging to the (garble) group of galaxies. They are situated about 200,000 light years from Earth. And they are very interesting objects because they are close enough to see details. And then you can check the difference between the different part of the structure (garble) galaxies are (garble) and it doesn't appear (garble) the general structure, but there's something funny in UV and it appears also in the gas structure. In fact, it is not so irregular that it should be suppose. And there are some disposition like a chain of gaseous nebulae in the bright stars, which are significative of some continuous (garble).

PAO Questions now. Unless you have something else to add.

DR. COURTES Yeah we can show a picture. Of course we have some more objective. We obtained a very beautiful picture of the (garble) which is one of the brightest nebulae in the sky and especially the dust scattering of this nebulae and also we obtained a picture of the crest of (garble) which is the crest of bright blue stars. But surrounded by a heavy dust cloud which is illuminated by the stars.

QUERY Do these pictures suggest any conclusions that you can draw about these distant - these near galaxies? Things that you haven't seen before?

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DR. COURTES Yes. There's something of use - it is very interesting comparison between our results and the results obtained by Dr. George Kohouta in (garble) fly on the Moon. When you compare the picture obtained with (garble) camera of Dr. Kohouta. This picture was obtained in the range of 15 (garble) much further in UV. The structure is looking very similar. That means we are observing only the blue stars which have a continuum spectrum from the far UV to the near UV. The factor using far or near UV doesn't change very much the disposition of the stars there partition of the stars. And that is interesting because anyway assume you get 2500 angstrom, you can't (garble) practically all the latest stars, the stars with the yellow colors like Sun light repartition. And that's the most important because you know the rest is population two stars and population one. Population one is the one that we are lookg for. It is the one which is constantly created by the (garble) matter. And (garble) population is visible in the visible light. And it is interesting to select both of them. That is difficult to do --

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COURTES And though the one, the whole population is visible - is in visible light, and it is interesting to select both of them. That is difficult to do from the ground.

QUERY - - more do you know about the structure though, of these stars from the pictures?

COURTES I mean - when I mean the structure I don't mean structure of the star.

QUERY No, I mean - -

COURTES The structure of the partition of the stars, you know. Then, of course, it would be more interesting, I hope that we will get during the next mission, this present mission some - some photograph of spiral galaxies. Because on the spiral galaxies the structure is more of use because you have a hock of stars. But in this irregular galaxies there are something right too. It is not absolutely irregular. It looks irregular in visible light but not in UV. And that is a very interesting result.

QUERY I guess I'm the only one with questions.

PAO You're the only one with questions.

QUERY What is your camera going to do on comet Kohoutek?

COURTES Ah, in comet Kohoutek we have a wave length which is exactly right in the middle on the peak of band width 3000 angstrom. And the OH bands which are the - usually the brightest bands in the molecular spectrum of the comet, are at 3000 angstroms. There are three bands at approximately 3000 angstroms. And we are exactly in the middle of our band width. And then we will obtain the intensity and the diameter of the OH glow. That is interesting for this main reason, you know that during one of the OSO satellite fly, it has been obtained the Lyman-alpha glow around the comet Bennett by the Professor Plameau. And this observation shows that there is a cloud, a spherical cloud of hydrogen of about 9 degrees in diameter around comet Bennett, and maybe it will be something like that in the Kohoutek comet. And we expect it to explain the dissociation of water, and the OH. And to look at the ratio of the diameter of the OH glows, the hydrogen glow and the OH glow. It is a reason why there are many scientists during this mission are looking for the diameter of the OH glow. Another point is a new observation recently made in the United States by Nancy Kener of Smithsonian, and she has obtained a very good spectrum of the comet Kohoutek showing the scattering of the comet dust, the scattering of the sunlight. And that is of use because one sees very well the strong absorbing lines of the solar spectrum during

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the spectrum of the comets. Then it is the real proof that this comet is very rich in dust and has a sort of cloud of dust around the head. And assume it is still so dusty, it is ve - sort of a very beautiful experiment to see how behaves the scattering of the dust in different position of the Sunlight in the direction of Earth. Then you - one can have a good evaluation of nature of the dust which are very similar to any planet dust. It - it is sort of an experiment in which you can see - you can change the condition of the illumination. It is - you are, in fact, - it is - it is simpler to make an experiment. Fortunately, the comet is doing the experiment for us and changes the situation of the dust in the respect of the position of the Sun and Earth.

PAO

Tom?

QUERY

Does your experiment, in - in - in getting very - very good - better look at the stars than has ever been gotten before have any - any application other than knowledge for it's own sake of - of the Milky Way? Do - does your experiment have any other applications?

END OF TAPE

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DR. COURTES - - take of a - of the Milky Way.
QUERY Does your experiment have any other
applications? More - you know - practical applications,
something that - -

DR. COURTES You mean outside the astronomy?

QUERY Right. Outside astronomy.

DR. COURTES I could say that we emphasize an application
of this same optical design for the Earth resource survey and also
for some planetary survey because we can select the 7 times
every band width, but only the optical design. This optical
design could be used for this kind of application. And the
experience that we have obtained this time maybe will help us
to design a new instrument for this kind of application. I'm
confident in the fact that all progressing uptakes are always
with application, especially in astronomy. You have not to
forget that all high ratio camera have been designed first
for astronomy because astronomer is always very exigently diff-
icult about the sensitivity. And maybe progressing in the
photograph lens will not turn away to the needs of the astro-
nomers.

PAO Any further questions? Abby.

QUERY How does your experiment compliment the
far UV camera? Are you looking for the OH cloud while it
looks for the hydrogen cloud?

DR. COURTES No. Only - we - we are looking for the
OH cloud. In fact, if we have thought that there should be
maybe a comet, we would then forsee another band width in
Lyman-alpha. Our instrumentation could be sensitive to
Lyman-alpha but we have a systematical take because you know
that there is a very strong Lyman-alpha airglow on the Earth,
the geocorona in airglow. The geocorona in Lyman-alpha then
is so bright that it should fog our plates then we'll cancel
it systematically for the study of stars. But, the cloud of
the comet is certainly much brighter than the sky background.
Then with short exposure, I think, that the camera without the
cover there will obtain the result in spite of the Earth's
corona.

QUERY But how large do you expect the OH cloud
to be and the hydrogen cloud to be around the comet?

DR. COURTES It is a matter of maybe 30 minutes some-
thing 20 - 30 minutes. It may be difficult to say the ratio
is not - is not very well evaluated on the theoretical side.
And anyway we - we have not any check up to now of the hydrogen
glow.

QUERY And what basic questions about the comet
does this information answer?

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DR. COURTES The basic question is to know if OH and H are coming from disassociation of water. For instance if the nucleus of the comet is a case of water, ice, maybe dirty ice if it is dusty; and this ice is dissociated by the same radiation and it could give the oxide OH and the H. The fact is to try to understand if it is the reason of the dissociation. Then this should prove that the water is - is in the comets.

PAO Any further questions? Yes Dr. Courtes has some photos up here. If there are no further questions why don't we just turn off the transcribing and then you can come up and look at his photos. You can come down to the table here perhaps.

END OF TAPE

SKYLAB NEWS CENTER
Houston Texas

Skylab IV - Science Demonstration
Johnson Space Center
November 30, 1973

PARTICIPANTS:

Tom Bannister, Marshall Space Flight Center
Curtis Hunt, PAO

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PAO Okay, I think we can get the press briefing underway. This morning we have with us Mr. Tommy Bannister of Marshall Center, who is going to give us a little background, a briefing on the science demonstrations, and then we'll have some questions. We also have Jack Waite, also of Marshall, in charge of corollary experiments, in case you want to ask him some questions a little later. Now we'll start out with Mr. Bannister.

BANNISTER Good morning. I'd like to explain, first of all, how we got into the business of these science demonstrations and then briefly cover the ones that we've gotten approved so far, and then tell you at the end of this discussion about the one that's scheduled to be run at 23:23 Greenwich meridian (sic) time, today. Back before Labor Day, in about mid-August, Owen Garriott on SL III called down, I guess, 10, 12 times asking for additional tasks. And, at that point in time, virtually everybody in the Skylab Program just knew that we had the crew activities filled up to the maximum. But I guess the one thing that changed it a little bit was the crew's learning curve enabled them to do more proficient job as time went along. So during the middle of the SL III mission, they did have some time. So we were turned on at Marshall and I was asked to pull together a set of demonstrations, which are sort like experiments, but not quite as sophisticated. We had to go around and make use of what onboard equipment existed. We had to define what was meaningful and what was not. We finally decided that we had to define meaningful fill-in science demonstrations for the crew that would demonstrate a scientific principle that could be used in classrooms for educational purposes or would give us another point on the curve or for some interesting things that we hope to do on shuttle that would contribute to space knowledge all the way around. And we had to work with what was available on board. The people working in Skylab have been tremendously helpful. A lot of the material that we use, for example, comes out of the medical area. These guys really worked with us here at Houston, in using the onboard syringes and things like this to demonstrate scientific principle. As a matter of fact, informally, one of the doctors told me that he was glad to see this, because this type of thing, where there wasn't much training involved, and where it's truly a lab-bench type of thing, where they gather materials and from the checklist that we sent up, they do work. This really provides a sort of change of pace for the crew. As I said, many of the things that we do can be useful for educational activities. My particular background is in fluid mechanics, and this is one area where it's possible to do a lot of science with onboard equipment.

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Owen Garriott did two long TV runs on SL III, including mechanics, and we've had a tremendous response from fluid mechanists all over, for example, John Carruthers at Bell Laboratories, who is interested in the fluid behavior part of growing these electronic crystals is - was very intrigued when he saw some of the things that Owen did with fluids on SL III. Also, Simon Austratch of Case Western Reserve University and Stu Churchill of University of Pennsylvania and many others have been real interested in it. Not all of the demonstrations are in the fluid mechanics area. But that is one of the more - The one we have the most demonstrations in. Now we - We worked on it and we originally had, I guess, around 25 or 30 proposals and we had to - from various people at Marshall and with their contacts. And I understand we were all working to beat a time schedule and there was no real formal program, there was no funding, and what we're getting - the science we're getting out of this is just a bonus. We haven't spent any money, just our time. So we came up with 18 additional ones. And they're - I don't know if you want me to read the titles of them off. I guess I could. There's a Liquid Floating Zone, - -

END OF TAPE

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BANNISTER We haven't spent any money, just our time. So we came up with 18 additional ones and they're, I don't know if you want me to read the titles of them off, I guess I could. There a Liquid Floating Zone, The Immiscible Liquids, Liquid Films, Gyroscopes, Rochelle Salt Growth, Deposition of Silver Crystals, Fluid Mechanics Series, Neutron Environment, Orbital Mechanics, Ice Melting, Ice Formation, Effervescent, Acoustic Positioning, Diffusion in Liquids, Lens Formation, Charge Particle Mobility, Cloud Formation; and those are the ones that we added. Now many of these are going to be important to us in our manufacturing in space program. I know most of you probably heard Dr. Gatos's remarks on the manufacturing space program back on SL-III. Well, it turns out from a fluid and mechanics viewpoint, one of the key problems in manufacturing in space is the handling of fluids in space. And we feel that many of these demonstrations, which demonstrate fluid mechanics principles per se will be important in the manufacturing in space program. And Dr. Carruthers from Bell Labs, for example, is working real closely with us and is the proposer, you might say, on the liquid floating zone. Liquid floating zone is a technique in which they grow silicon crystals, and we're going to simulate that with water in two metal rods in zero g. Actually in the making of silicon, they have a long rod and they pass a coiled heater down the rod real slowly and it melts a little band in the rod. It's melting on one side and freezing on the other side as the coil goes down. And then the rod is rotated to obtain symmetry while it's melted. And one thing, if the rod's too big, then gravity is going to cause the little melted zone to spill over. You have to have the rod small enough for surface tension and capillary forces to hold the zone in place. Well, in space we could maybe do it with a bigger rod. The other thing is that when you're rotating it and have gravity, and part of it's hot and part of it's cool, we all know that hotter liquids are lighter, and the hotter liquids trying to float to the top and the heavy ones going to the bottom. This is a very complex situation fluid mechanically in that melted zone. And this complex situation really effects the homogeneity of the silicon crystals. So we're going to put dye in this zone and rotate it in zero g and try to determine the fluid flows in space and we're going to get fluid flows because we're rotating, but we think they'll be much more symmetric. And this is a typical example of a science demonstration. And I brought two pieces of hardware to show you. One is a very simple thing - -

PAO

Excuse me, Tommy, let me interrupt just a moment. I just have an announcement I got over the phone. If anything happens during the maneuver, to prepare for EREP, they will interrupt us. And the EREP pass starts in about

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20 minutes. So we need to, if you can, - -

BANNISTER Okay. I'll speed it up. Okay. We have a total of 18 that we've gotten approved. We're working on, as a contingency, some 30 additional ones that toward the end of the mission, if time is available, we'll probably send those up. I would like to mention that there were eight demonstrations that were on the SL-III list that are also on SL-IV list, that most of those involve the astronauts doing some kind of a momentum-type thing where he's rotating, spinning like an ice skater, things like this. So what I'm talking about this morning, is the ones that we've added. Now, one of the simpler ones that we've added is a gyroscope, where Ed Gibson could take just a simple gyro and get a flywheel going and then let it be free suspended in space and show precession and angular momentum and stability.

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BANNISTER - - doing some kind of momentum type thing where he's rotating, spinning like an ice skater and things like this. So what I'm talking about this morning is the ones that we've added. Now, one of the simpler ones that we've added is the gyroscope, where Ed Gibson could take just a simple gyro and get a flywheel going and then let it be free suspending in space and show precession and angular momentum and stability. And also could demonstrate to the audience the basic principle behind the gyro control system. This is one of them. Now, another example - incidentally this is a - a child's toy that we got out of a store - retail store and we took the paint off and coated it with Teflon. And - as a matter of fact, the one that flew I paid for it right out of my pocket. It cost \$1.39 or something like that. The other - the second illustration that I'd like to talk about is the Rochelle Salt. This is a typical 4-inch food can. We took the food can and we put water and Rochelle salt in it. And by putting it in the food tray and heating it up to the temperature of the food the roshell salt will dissolve in the water. Then by taking it out and stowing it in the - one of the lockers while it - when it cools off, the Rochelle salt will come back out of solution because of the temperature curve of the solubility. And then Ed can open the food can, bring out the crystal and show it. And this is not as a sophisticated experiment as the M518 crystal growing experiments, but it's visible. It's one that you can demonstrate to classrooms how crystal's grown and so forth. And he could very easily take this crystal and show it on one of the TV downlinks later on. Now the last one that I'd like to talk about is the one we're going to do today, is the charge particle mobility. And if I could have the first viewgraph, please. Put the viewgraph - I might be right in the way. This is a charge particle mobility. This is an actual (garble) about 3 inches by 4 inches, and this is the onboard timer. This thing weighs about a half a pound, 6 ounces. These two plexiglass tubes were fabricated for us at no cost by the University of Arizona. And then at Marshall we fabricated this holder plate and put on these two switches so we can activate cell 1 and cell 2. Now the object here is to apply an electric field along this tube and then open a gate valve, which is this red thing here, and we will photograph the travel of blood down through a buffer solution. Now the buffer solution provides a host medium for the blood. It doesn't chemically interact with the blood, and it also is sort of an electrolyte which produces a charge on the blood cells, and the blood travels

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down this tube. Now, the other cell, cell 2, back behind this gate valve we have two protein solutions. When we turn on the voltage the protein solutions travel down the - I'm sorry. Could you hear me when I was explaining the two tubes? The objective of this is just to determine how materials like this will flow down these tubes under zero g; how fast will they go; how smooth will the interface be; will there be any fingers sticking out in front of the solution. And over here we're interested in the separation of the two proteins. Now, this is a first step sort of thing toward later on doing a more sophisticated set of experiments on shuttle to purify things - this - of this nature. Could I have the next viewgraph, please?

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BANNISTER Here're some proteins that have been separated at the University of Arizona, Dr. Biers, Principal Investigator showing, after applying an electric field to the solutions with the proteins in it, now some of the proteins obtain a different electrical charge, therefore move faster and then separate from the other proteins. This is various stages. On Earth these have to be done in a jelly solution because these particles have large molecular weights and they settle to the bottom, convection causes the fluid to stir around and get mixed. And what we're trying to do in space is do the same thing without the gel. The gel introduces impurities and other problems. If we could do this task in space without the gel, then we would be way steps ahead in terms of handling these proteins and separating them. And the light at the end of the tunnel on this experiment is - this demonstration is that if we can develop the handling, the fluid handling techniques now, with these demonstrations of how to do this, later on we could do this with important materials, DNA material, for example, or viruses. And we could - If we can develop the technology, in the future sometime, we could purify to a higher resolution in space these important biological materials that could be returned and used for research and other things. So I guess it's time for questions.

QUERY Tom, what are you talking about, the purifying of viruses or proteins and mixing it out. The science demonstrations were added very late. What was in the early part of Skylab planning, what types of demonstrations like these were put in early and then maybe later maybe taken out of the planning or, I mean, whether they were ever in hard or not? Was there good consideration for these types of demonstrations?

BANNISTER There was a consideration, as I said previously. Most of the ones that were already there, involved astronaut participation and maneuvers. As a matter of fact, there was a list of things that was sort of informal in the beginning. You know, Owen was - discussed some of the things he did with some fluid mechanicians and if you remember, those two discussions on TV that he did, these were crudely considered science demonstrations at that point, although it was on a more informal basis at that time. The - Some of the ones that they did, they had a slinky. They wanted to demonstrate angular momentum of the spacecraft. You remember, Owen demonstrated with a drink bottle the - when you spin a long thin object, if it has any energy consuming components in it the angular momentum stays the change - stays the same, but it's changing its mode of spin from a spin to a tumble head over heels. These were all demonstrations and they were approximately 10 of them, the Wilberforce pendulum and - There was some electromagnetic, electrostatic type of things that were planned and there was one

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planned where they had some black and white balls to shake them up in a box and show in a truly random situation how the balls would land without gravity to bias the distribution of the black and white balls, things like this.

QUERY How many of these science demonstrations are you really learning things on or are you just proving what you really are sure of?

BANNISTER I'd say approximately 50 percent of them we're demonstrating known principles that we already know, but we feel like, would be a tremendous asset to the educational community to use to demonstrate principles; and the other 50 percent we are learning something that is going to do us a lot of good in the future, particularly in the fluid mechanics area.

PAO Thank you. Do I have any other questions? Okay. Thank you, gentlemen.

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SKYLAB NEWS CENTER
Houston, Texas

S/L IV - Earth Observation Aircraft Program Briefing
Johnson Space Center
November 19, 1973
12:30 pm CST

PARTICIPANTS:

Charlie Harlan, Chief, Aircraft Applications Branch, JSC
Jerry Elliott, Aircraft Applications Branch, ERP
Charles Redmon, PAO

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PAO

QUERY

What do you want to see?
I'd like to see something that's correlated with some kind of specific results like the corridors of insect infestation in Mexico.

SPEAKER

I think we can probably do that after this briefing.

ELLIOTT

Okay, I guess we can start it. I'm Jerry Elliott, I'm with the Aircraft Applications Branch in the Earth Resources Program. First of all, thank you very much for attending. This is going to be real brief. It's going to be over by 1:00. We have a bus right outside Building 1 here to take everyone in a group or you can drive your private car if you like to Ellington. And we're having a tour of the aircraft at Ellington Air Force Base at 1:00. It roughly lasts about an hour. And I think I've given each of you a handout press kit. The press kit has quite a lot of information, a lot more than we're going to get into today, so I hope you read it. It has the role of the aircraft in Skylab IV. And then it has a write up on the aircraft program itself. There is also an information sheet in regards to the use of the data. And we have some pictures of the aircraft. And more examples of what we do with the data than applications of the data. If you have any questions, please feel free to ask us. I'd like to introduce now Mr. Charlie Harlan who is chief of the Aircraft Applications Branch. And Mr. Harlan is going to give you a real brief overview of the aircraft program, and we'll be here to answer any questions that you have. So I'm going to turn it over to Charlie Harlan.

HARLAN

Okay, thank you, Jerry. We originally set out to make the aircraft available today for a kind of a static display, a short tour so that members of the media could see the JSC aircraft that support the Earth Resources program here. And then it somehow grew into giving you a little briefing here, but our purpose is really to give you just a quick overview and show you the airplanes, and then give you kind of an invitation to talk to anybody you'd like to here on the Center that is involved in this program. If you want to do any followup in any kind of detail. We just don't have the time today, and we'd like to have made our program longer except that we're tied to the schedule of supporting the Skylab mission and Monday was the best day to have our static display because we'll have the airplanes moving in fairly soon. So the primary emphasis today is to just get a brief overview, and an idea of the scope of the aircraft program here. And then find out who it is you can go see if you want to find out more about it. At the aircraft we'll have the Pilots and some of the crew members available that can talk in detail about the aircraft per se and they can also talk in detail about the sensors, and can tell you something

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about the missions. So I guess there is another thing too, we can make some of these people from the aircraft branch available to ride out on the bus that you can chat with or you can ask questions of when you leave here and go out to Ellington Air Force Base. And I would like to introduce a couple of guys here that will be available to questions. In the back I have Dale Moore who is the head of our Project Engineering Section, and you can buttonhole him for questions. And then we have Frank Newman sitting beside him who is the Head of the Mission Management section. Frank you want to stand up again? Somebody didn't see you here. And he can talk about any of the mission-related activities and the project kind of things we get into. And Bill Molnar who is head of Data Management Section, he is our resident expert here on handling the data and that kind of thing. I would like to make it clear that we're just one small organization here, the people you see today at JSC that are involved in the aircraft program. There's the Earth Resources Program Office that manages it. There's us, who are in the operations business. We're going out to Ellington and you'll get to see some of the pilots and the aircraft operation out there. They have a big role to play. And then we have something called the Earth Observations Division in the Science and Applications Directorate. And those people really have all the details and the smarts on the scientific applications of the data. So, if you want to pursue anything in detail, we can certainly route you to the right person once we leave here. We currently have four large aircraft in our inventory. We have a P-3 which is a Navy version of an Electra. We have C130B, and we have two WB-57F's, and we also have a helicopter. This program began in about in 1965 with one Convair 240 and it's grown in scope considerably over the last few years. And the reason of course, is the tremendous demand for this kind of activity. Right now, our primary support is in three basic areas. We support the ERTS program, which many of you know is a Goddard Earth Resources satellite. And that has been the major part of our activity over the past year. And the work we do for the ERTS kind of satellite activity, is much like what we're doing for Skylab here. I'll get into the Skylab support a little bit more to kind of give you a brief overview of what we're doing in Skylab. The one thing that people want to ask is why we go around flying airplanes under a satellite that's possibly doing the same thing? They're taking pictures, the spacecraft's taking pictures and we're taking pictures. They're taking electronic data and we're taking electronic data. And there are several reasons. And one is, is that the use of these kinds of sensors from a spacecraft

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standpoint, is a new field. Now the aircraft field has been around for several years. The data we get from the aircraft is by and large a known kind of quantity and can be put in many cases to known utilizations. The spacecraft is a research kind of field at this point and they are learning how to use spacecraft data for Earth Resources kinds of applications. We fly airplanes underneath the spacecraft to provide something called, "Truth data," which is to take aircraft data that is known and to be able to correlate it to a spacecraft, say image or picture that's of lesser resolution. We use it for the space - the aircraft data for the development of the interpretation or the data interpretation techniques and the same sort of thing. The aircraft data is known, the spacecraft is not known as well, and you need a baseline or a reference point or a point of departure to go from something you know to an unknown data source. We provide more - we provide data that's in a larger scale for location of spacecraft data. We provide - we have higher spatial resolution with our sensors and it enables someone to take and locate a specific area more readily by using, say an aircraft mosaic built up that's of a larger scale. And they also try to correlate signatures of specific ground events or ground activities to the spacecraft signatures. Now in EREP, our aircraft support is similar to what we've been doing in ERTS except that in many cases, it's more dynamic. As you all know, the Skylab spacecraft has a problem of accomplishing a number of scientific kinds of programs and the Earth Resources is just one of them. So we compete for time on the spacecraft with a lot of other scientific investigations. So, we never know for sure exactly what ground-track the spacecraft's going to fly. As it's based on - since they have a limited number of groundtracks they can fly due to their flight plan competition with other science that it becomes more of a real-time planning operation. I think you can see that a spacecraft can go across the country pretty fast but it takes a relatively long time to move a group of airplanes around to get them under the spacecraft. So with with the Skylab support, it becomes a Mission Control kind of thing and we in the aircraft program work very closely with the spacecraft people. We have a man in the Control Center that does this schedule coordination between the spacecraft and the airplanes.

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SPEAKER - - the spacecraft. So, with the Skylab support it becomes a Mission Control kind of thing. And, we in the aircraft program work very closely with the spacecraft people. We have a man in the Control Center that does this schedule coordination between the spacecraft and the airplanes. Could I have that first viewgraph and I'll just show a couple of pictures here that will attempt to show - Can we turn these lights down? I don't think you can see this too well from where your sitting but the point I want to make on this is that this is an ERTS image taken from the ERTS satellite and this is the given aircraft image that was taken over part of this area here. And you can see that the detail is much greater and that this data here can be used to extrapolate over this wide broad area that is taken by the ERTS spacecraft. I got another one that shows some of the same thing. I'll just hold it cause I'm gonna sit down in a minute. Okay, this red frame of data here was taken with an ERTS satellite at about 500 statute miles in altitude. This is a Skylab frame of data taken at 270 miles. This is the S190A photography. And this is one of our - it's a mosaic made up of some of our photographs taken at 60,000 feet. You can't really see much due to this poor projection here, but the point is that a very small detail in the spacecraft imagery shows up as a very large equivalent in the aircraft imagery. And so you can use this as a baseline to make determinations from the spacecraft data. Okay, you can turn the lights on now. Okay, the other part of our program, beside the spacecraft projects that we fly, is something that NASA has called Supporting Research in Technology, and these are aircraft-only kinds of investigations and we fly a number of these for government agencies, universities and so forth. And in some cases they're very complex projects and in other cases we fly data collection for other agencies that are gonna do the analysis. Okay, I'd like to have the next chart, please. Okay, this - this is just an example of how aircraft data can be used to identify damage from a natural disaster. This is Hurricane Camille and it shows the devastation of a shopping center. And we've done - or accomplished a number of flights over the years in this SPT program for damage assessment. Could I have the next chart, please? Okay, over the past year, I had this chart already made up and to show the distribution of kinds of work that we do in the aircraft program, we support the ERTS and last year we had a total of 58 projects and in EREP we had 64 and SRT is 51, so the GSC program, by and large is - the bulk of the work is towards supporting the spacecraft kinds of programs. Could we have the next chart, please? This is the same activity

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broken down on a flight basis and for ERTS we had 154 flights required. We actually flew 120. In EREP we had 80 required and we flew 58 and in the SRT program, we had 122 with 103 accomplished. So you see by the flight magnitude that again the bulk of our flight loading has been toward the spacecraft support. Although the SR in T program, it did require over a hundred flights in that year. Okay. Next chart, please. I just put this up to show the kinds of locations we fly. Geographical locations. This is - where you see the dots, including Alaska there is the test sites that we flew in fiscal year 73 just for the ERTS spacecraft program and you can see that we have some fairly diverse kinds of test sites around the country. Next chart, please. Okay. This shows the EREP test sites we flew and that was through the first of January, 1973. And again you can see the scattered test sites. Those were actual - actually test sites that we actually flew. Next chart, please. And this is the SR in T flight program. Showing again the diverse locations. We - we base our airplanes here, primarily at Ellington Field, except that to get to these widely scattered sites we have to stage the airplanes from various sites around the country. We normally use military bases or other NASA bases, wherever we can, in order to get a better break on fuel cost and that sort of thing, get maintenance that's available to government airplanes. As far as the last fiscal year, to talk about the magnitude of the program, we flew 618,594 data miles. That's an aircraft over a site somewhere taking data for a mile. That was 618,594 data miles. We took 201,000 original feet of film, which is quite a bit of film. And as far as electronic data processing goes, it required some 3500 computer processing hours back here at the site from the data that we've collected. Could I have the next chart, please? This is our P3 aircraft and you'll see that when you get out to Ellington. And, as I said before, it's the Navy version - an earlier Navy version of the Lockheed Electra; it's a little bit shorter than a standard Electra. That's the site in the background, JSC. Next chart, please. I'm not going into details on this particular chart because you can see the insides of the airplane when you get a chance to walk through it at Ellington; but this shows that we have a number of sensors installed in the airplane and number of operator stations and it's a fairly complex kind of installation. You'll get a chance to walk through. Next chart, please. This is our C130B, and again, it is full of sensors, full of consoles and - Could I have the next chart? This will show an isometric view which shows the racks of equipment in the airplane and operator positions and you'll get a chance to

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go through the airplane. Now, the P3 airplane is - is - well I'll get into the sensors in a lit - an overview of the sensors in a little bit. Could I have the next chart? This is - it just shows the two airplanes flying in formation. And, if you'll notice the way their painted, the P3 is called Earth Survey 1, and C130 is called Earth Survey 2. Those are NASA designations for the airplanes. Next slide, please. This is one of our WB57 airplanes. This particular - uh - the way the markings are on there, for the United States Air Force, we were more or less leasing or had an agreement with the Air Force to provide us the high altitude flight services the B57s. That required some funding of their own and they got out of the program so we took possession of two of the WB57F airplanes and have configured those airplanes to meet the needs of the Earth Resources Program here. These airplanes fly at 60,000 feet and are used to simulate in many cases spacecraft kind of data; we can get over about 93% of the atmosphere with these airplanes. And we also get a smaller scale photography we've - photography in the order of 120,000 to 1. Next slide, please. Okay. This shows one of our B57 airplanes and you can see in the center it has a large instrumentation pallet. And I'm hoping that you get to see that today because they had to take the pallet down from the airplane to take a sensor out and I think maybe the pallet will be available for you to look at. But you can see the whole belly of the airplane is one palletized instrumentation system and it drops down for maintenance and access to the sensors. Next chart. We chose to go a different way on our second - no this shows the pallet, right here. And this is kind of prespective view and you can see it's full of instruments. And that pallet will weigh somewhere in the order of 4,000 pounds. Next chart, please. We chose to go a different way with our second B57 and go to something we call the mini-pallet. Which we have, instead of one large pallet containing all the sensors we build - we're building several small pallets that we can hang in the belly of the airplane. Although this one's - we call it a minipallet, it's not so small, it has two RC8 cameras and it has a long focal length camera, if we ever get it installed in the S190A camera system that's on Skylab

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HARLAN - - which we have instead of one large pallet containing all the sensors we've build - we're building several small pallets that we can hang in the belly of the airplane. Although this one's - we call it a mini-pallet. It's not so small; it has 2 RCA cameras and it has a long focal length camera, if we ever get it installed, and then the S190A camera system that's on the Skylab. Next chart, please. This shows a little helicopter that we use with one particular instrumentation configuration. We don't use this instrumentation anymore on the helicopter, but this is an airplane that's been used for - or has been used in Apollo for Astronaut training, and we converted it to use for remote-sensing purposes. Next chart please. And this is a view of the same helicopter. It's rigged out somewhat differently. You see there's a pallet on either side of the airplane there, hanging out over the side, and this is the Skylab S191 system that we use. Next chart. Okay. This is just kind of an overview of the airplanes that - P3's is a turboprop airplane and we can fly it from 150 to the neighborhood of 300 knots up to close to 30,000 feet and it's very similar in performance to the 130. The B57 we fly normally around 60,000 feet. As a matter of fact, most of our flight requirements are for 60,000 feet for this airplane. The P1's are trying to get over the atmosphere and they're trying to get a wider, more synoptic view. And the time at altitude is 78 and in the case of B57 we figure, one way about 5 hours, we can be up taking data. It takes an hour to climb and an hour to let down, somewhere in that time frame - Next chart. Okay, I was going to get into the - just a little bit just a very gross overview of our sensors because I think you can get a lot more of that when you get out to Ellington and actually look at the sensors and look at the airplanes and talk to some of the people that know more about them than I do. But this shows the electromagnetic spectrum and we have sensors on the airplane that cover most of the electromagnetic spectrum, all the way from the UV through the microwave except for a couple of areas here. These airplanes - these sensors are split up on different airplanes. We have about 21 different electronic sensors and some 10 camera systems we use to cover this part of the electromagnetic spectrum. Have the next chart, please. Okay. Can you drop it down just - okay, this shows our aircraft sensor configuration and for the B50 - for the B57's - we have two B57's listed here. We have RCA metric cameras, these give a nice 9-inch film. We have a Zeiss camera with a 12-inch focal length and we have - on one of them we have a set of six Hasselblad cameras that are used for multispectral

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photography and we also have a bore site camera that's used for this electronic sensor here. We are currently installing an RS18, which is a thermal scanner instrument, which is in the lab right now. And I had just changed this chart to try to update it and we're going to put an older sensor back on, and that's why you'll see a pallet down on RS7, which is an earlier version of that. And then we have another set of instruments we put on that aircraft which are (garble) spectrometer and radiometer. Can you raise that up just a little bit now? There you go. Okay, for the other B57, it's configured much the same except that we have the Skylab S190A camera system used as a multispectral camera for that airplane. We also are installing one of these thermal scanners on it. RS18, which is a new sensor to us. For the P3 we have a full set of cameras. We have the RCA metric or mapping cameras. We have a set of four KA62 multiband cameras. We also have an S190A system on it. And we have another multiband kind of camera system we can use which is called "I squared S," and it gives four bands. And we have a set of scanners on the P3. We have the RS14 which is a thermal scanner, and we have something called a PMIS, which is Passive Microwave Imaging Scanner, and that's peculiar to that particular airplane, and it's used to fill in the microwave part of the spectrum. And we can talk a little bit more about these sensors, and I'll tell you the general purpose of this airplane. We used to have a SLR (?) on the airplane and that was supposed to be off of this chart, and it's been put in storage. We have a multifrequency Microwave Radiometer, which is a passive device. And we have a Scatterometer, and we have something called PRT5, which is a precision radiation thermometer device. And we have some environmental sensors, and their purpose is to try to get a feel for the environment between the - or the atmosphere between the airplane and the ground so we can what that atmosphere is doing to the radiated signals coming from the ground. And we have a Laser Profiler that we could use on either one of these two airplanes. Generally, the P3 is outfitted with the cameras and some microwave systems and it does have a Thermal Scanner, and it's generally used for Oceanography and soil moisture kinds of studies and that sort of thing. The C130 has the Hasselblads - 6 Hasselblads used for multispectral photography, two mapping cameras, and it also has this - it doesn't show on this chart - it also has this S190A Multispectral Camera System. And it has something we call the Multispectral Scanner, which is our 24 channel

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scanner that is similar to the S192 device that you hear talked about on the spacecraft. And we have a Rad/Scat, which is a Microwave Radiometer and Scatterometer and other similar sensors to the P3. So the general purpose of the NC130 is to provide data from the Multispectral kinds of devices, and its utilization is more towards Forestry, Agriculture, and those kinds of things versus the Oceanography and Soil Moisture kinds of study for the P3. And the helicopter we have this thing we call the Field Support Spectrometer, which is the S191 sensor used in Skylab. And it has a camera, a Vinton (?) Camera that's used to take pictures of where the electronic data is being taken. This is used to support the S191 kinds of investigations in Skylab. Okay, you want to turn that chart out please? No, just a minute let me finish this Jerry. You want to turn the light up. Somebody got the lights? Here he comes. Okay I went through all those sensors pretty fast. And in fact it was too fast to really talk about them, so if you want to really find out more about them, you're going to have to spend some time and ask some questions out at the airplane of the guys out there. That was - I was really kind of rushed for time and I went that very quickly, in fact too quickly for you to get much out of it. But for EREP - want to talk a little bit about Skylab. For Skylab we're flying with these airplanes for 69 different investigators. And this is both scientific kinds of missions and sensor performance kinds of missions. In fact most of our missions are for the scientific community. However, we do fly for some engineers here at the Johnson Space Center who are trying to determine how well the sensors are working on the spacecraft. And they are going to use our data as part of their basis for analysis. Skylab II we flew some 8,704 data miles for 51 data flights. In Skylab III we flew 20,190 data miles with 114 flights. So you can see the scope of the program is fairly large. And for Skylab IV our plans are, for the 38 projects that we are going to support in Skylab IV, we'll fly 64 test sites around the country - there will be 111 flights - data flights - 46 of these have to simultaneous with the spacecraft over flight coverage. In other words we have to be under - we have to over the test site at the same time the spacecraft is, 50 of them have to be within one hour, and another 21 of them during the same day. We'll be flying for 21 different government agencies, 15 universities, and 2 private concerns. And I can talk about some of the typical projects perhaps but we are running out of time. If somebody wants to ask some questions - I won't be able to answer all of your

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questions, but some of these guys here probably will be able to.

SPEAKER Okay, thank you very much. It's a hard subject to deal with in a very short period of time. We hope that you will come on out to Ellington with us. I have a bus standing by outside the door here, ready to take everyone, or if you have a car, and you'd like to drive, well that's fine. We will be back here, it'll last about a hour and we'll have the bus bring us back in about a hour. And I hope you will come with us on the bus cause it will give you an opportunity to ask more questions and of course out at the aircraft we can go into it. So thank you very much and our Foreign Visitors (garble). Okay.

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**SKYLAB NEWS CENTER
Houston, Texas**

Skylab-IV Multispectral Photography Briefing
Kennedy Space Center
November 15, 1973
11:00 a.m.

PARTICIPANTS:

Ron Anderka, Program Manager for Earth Surveys Program
Dave Wambaugh Optical Engineer of S190 A Camera

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PAO Now, we'll welcome you to ITEK briefing on Multispectral photography. This morning you'll be hearing from Ron Anderka who is our Program Manager for Earth Surveys Program and Dave Wambaugh Optical Engineer who is responsible for the Optical design of the S190A camera. And we'll get started with Ron.

ANDERKA Thank you. I think what we'll do probably is be looking at a lot of pretty color pictures over on the right hand screen so if you'll - some of you wanted to orient yourselves a little bit more towards that side it would be - it might be easier. Can I have the first slide, please? As many of you know ITEK is at this point probably the principle supplier of custom photographic systems to NASA. The Apollo win bay camera, and camera for the Viking lander of 1976 and the camera systems for both the Skylab or least the S190A system for Skylab and the aircraft under flight program. Our experience and our background in multispectral photography was gained up 14 or 13 years ago when we built the cameras for DOD which were for the detection of underground nuclear blast by multispectral photography of the surface of the ground which would indicate either vegetation changes or perhaps soil changes - soil moisture and soil disturbance. So, the camera systems the multispectral camera for - for Skylab being an EREP experiment is primarily tailored to the discipline of oceanography, hydrology, geology and agriculture. I'd like the next slide please. As you know the EREP experiments are all carried in the multiple docking adapter and the S190A is one of the package, the S190, 191, 92, 93, and 94. Next slide please. Could I have that focused a little bit please? These are pretty much the motherhood statements that NASA uses for most of their earth observations and earth resources program, however, I think what's important to use them again at this time after EREP's data has been gathered is to point out a number of the key ones which are actual programs where data has been taken and goals are being sought and information be sought in the hydrology of course, as - as most of you know the - one of the key activities resulting from the photography of SL-III is the identification of fresh water sources in Africa. The other thing that I'll be able to illustrate most of these to you it would - photography in a minute. Of course the fishing productivity some of the results of the photography in the - in the gulf of California resulting from some of the experiments have changed the fishing patterns - the fishing habits of the people in that area. Next slide please. Here again, I'll be illustrating with actual photography from the SL-II mission some of the

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illustration on the agricultural and geologic aspects of the program. Next slide, please. All of you probably got maps showing the coverage I think the only reason I - I like to remind people particularly in a briefing that the inclination is a 50 degree inclination orbit is quite often people will compare - try to compare EREP's to Earth as a system as you know the Canadian area and - and large portions of Asia are not covered by the EREP sensors. The other thing I'd like to point out is primarily on SL-II the coverage was primarily of the United States and of North America and South America. That - the most of the photography was confined to those regions. On SL-III, they took considerable more information they again covered North and South America with both the ascending and descending pass information and covered a lot of the European and African areas. On SL-IV the S190A camera has been boosted to carry 42 rolls of films they originally - the only carried 18 rolls of film on SL-II and they carried 24 rolls of film on SL-III. And on SL-IV they will be carrying 42 rolls of film. Each roll being well over - somewhat over 100 feet and there being approximately 360 pictures in every hundred foot roll. So this is where the number I believe mentioned in the EREP briefing yesterday of something like 30 expected to get something like 30,000 pictures out the S19A system. Next slide please. I'm going to sl - no I think we don't have to go to the Vugraph machine, I think this shows up fairly well it's a little bit detail but if somebody's interested in some of the details I have a nice Vugraph that shows that - I guess we're - we're somewhat fortunate that the Earth emits energy in - all throughout the electromagnetic spectrum and if the sensor is built to detect this energy then the in - well the information relative to various phenomenon about the surface of the Earth and under in some cases - under slightly under the surface of the Earth and certainly the atmosphere above the Earth can be detected and by proper correlation and analysis of the information conditions and state and general information can be derived and this is known of course as remote sensing and this has been a tool that has been used - using - certainly in military aircraft type operations and as a tool of geologist and foresters have used for decades.

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ANDERKA Conditions and state and general information can be derived and this is know of course as remote sensing. And this has been a tool that's been used - using certainly in the military aircraft type operations and is a tool that geologist and foresters has used have used for decades. The concept of remote sensing. Basically what it does is allow you to deal with a large area where you take information similar to an area which you have ground truth. There is no elimination of the man in this operation at least for the foreseeable future. There is - there are a chance of course to actually identify features and identify soil types and agricultural types. But in general - in general the the purpose is to have an experiment or have an operational program where ground truth is gathered. Sampling is done from various altitudes and of course dealing with satellite information. Now the goal is to expedite the analysis by I say a factor of ten. Because we currently of course are finding that our - our information needs about the surface of the earth both for survival and for management of our resources is far need is exceeding our ability to do so. Basically what we have here in the electric-magnetic spectrum is the phenomena elementary chemistry in the X-ray gamma rays. We get out into the ultra violet the visible infrared microwave. And basically the EREP sensors. The EREP package is intend to sample pretty much through out the electro magnetic spectrum with sensors like the visible sensors the near infrared, the far infrared S191, the scatterometer and finally out into the radar range of the system. Next slide please. Now, the photographic systems - can you see - are pretty much confined to the visible and near infrared. And this is not because optics are limited to this. It's because photographic materials generally are confined to - to this region to the emulsion. We can work in areas outside what we might call the visible. We can work in areas which are in the rear infrared and also in the blue which are generally not visible to the human eye. Films can be used in detection of these areas. Now traditionally we work with color films or panchromatic films and we have always dealt with with generally the shape size and positions of objects with multi spectral photography in its looses sense. Coloring - coloring infrared photography, filtered black and white photography. We can now start to discriminate information in the blue dealing with rocks and minerals. And we can start dealing in water penetration capability and finally out in the near infrared we can be dealing with plant identification and plant vigor information. Next slide please. This is the S190A. I think the model probably is - is gives you a pretty

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good idea - is the exact scale model of the one aboard the Sk-lab vehicle. Three more of these cameras exist in the aircraft program at the Johnson Space Center Aircraft Program. Next slide please. This shows the same camera with out the cassettes. Those cassettes that you saw are the ones that han- hold a 100 foot roll of film and those are what they are taking up 42 of this time. These little- could I go back one slide please. Basically these little round things here are what they take a bag of those up and the bag consist of 4200 - 42 of them on this next mission. These cassettes these entire magazines are removeable and the Astronauts load these and thread those through the magazine with one hand at operation. They have a velco padded table and they stick the magazine on to the table and hold them with one hand and thread them with the other. And they and they are very proficient at this - at this point. Next slide please. Basically you see the last element of the system of the optical system we'll be talking a little bit more about that later. But its basically a 70 millimeter or a 2-1/4 by 2-1/4 picture in its original sense with a 6 inch focal length lens. Next slide please. The unique feature about this is the fact that S190A is the fact multi spectral photography you've heard about before with aircraft programs and certainly the S065 experiment that NASA preformed fern Apollo 9. However this lens is the first time that anyone has attempted to design a lens specifically for multispectral photography. And I'll let Mr. Wamball explain just exactly what the optical challenges were there.

ANDERKA This is the front view of the actual flight unit with different filters, the infrared filters, the green red regions of the panchromatic film, the true color and the color infrared. Next slide please. As I mentioned EREP means experimental packages basically the experiments that was explained yesterday are being conducted by approximately 146 Principal Investigators. Their obligation is to provide the field experimental information and if its a foreign country to provide the aircraft under flight. In the United States the aircraft under flight are being performed both by the NASA Ames Aircraft, the U2, by the Johnson Aircraft, which consist of RB57, P3, and C130 and they charter various aircraft from University of Michigan etc. Basically it's a sampling process where you pick up a leaf and analyze it or look at the soil and do a chemical analysis and by its spectral characteristics you - you identify it. You can then extrapolate from that by using aircrafts and finally from spacecraft imagery. Next slide please. This shows

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you the - this shows you the films we have available to work with. Basically everyone wondered why this camera has to have 6 lenses. Why the S190B has only - there's only 1 camera and they use 2 films and they get their information. Well, there are completely different functions. There are 6 lenses in this camera because we divide that visible spectrum as you saw before into 6 discreet regions. This is one of the set of pictures taken with one of the S190A aircraft versions looking at Galveston Ship Channel. And it generally shows you what different spectral information you're picking up. In the Ship Channel itself and so forth. I just want to illustrate that the 4 film types that we have available -- in fact that anybody has available is a true color a color infrared with black and white infrared and a panchromatic film and you can divide these up into many different regions depending upon what specialties you are working on. But basically we have to work with those 4 films because those are the only ones manufactured. Next slide please. This just shows you one of those - one of those prints blown up to give you an idea of the capability of that camera. Most of you are very familiar with photography so I don't have to explain that if I take a 1 image within this and blow it up 53 times you can look at this after while if you like. The image holds for perfectly adequate analysis with as much as a 53 time enlargement. That's one of the reason why the camera was designed. Of course you are going to be taking pictures at 270 statute miles or 235 nautical miles and you want to be able to resolve information which is meaningful as far as earth resource data. Next slide please. Now we get to actual EREP or S190A results. This - can that be focused a little bit too. Should be a little bit better than that. Yeah, oh stop there. This is of course everybody's favorite test target for agriculture. You've seen this on ERTS and you've seen it on aircraft programs and you seen it on S065, Apollo etc. This is with the S0190A and the reason I'm giving this is to illustrate the agriculture aspect is because of course the dense agriculture patterns in that area. The total frame of each one of the S190A covers 8,500 square miles, each frame. There are 6 frames exposed simultaneously and like I mentioned on each cassette load there are approximately 360 frames set. This shows for your geographic interests shows the line between Mexico and the United States where water is taken out of the Colorado River over here by this canal, irrigation canal and you can see the intense irrigation activity and the results of it in the American side of the border verses the Mexican side of the border. And this of

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course is the Salton Sea. I'd like to call your attention to the sedimentation pattern which is caused by a drainage of this river here. Because I want to illustrate something a little bit later on. Next slide please.

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SPEAKER Of course the Salton Sea. I'd like to call you attention to the sedimentation pattern here, which is caused by a drainage of this river here because I want to illustrate something a little bit latter on. Next slide please. This is a 20 time enlargement of the S190A image. This is getting quite compatible with very high altitude aircraft photography with standard commercial optical systems. I have some print that you can look through afterwhile that you can get a idea of what it looks like. Here again PS190B if used over the same region would be getting about 3600 square miles would be getting closer to a 10 meter GRD 30 foot resolution. This is more on the order of 80 feet resolution. The specifications on this were about - to be about 29 meter GRD. You can see the intense agriculture and you can see the - pretty much the spacial information. Next slide please. Now we take the color infrared and I want to point something here, that the infrared photography from space, and you've seen a lot of illustrations of this and you've seen it on ERTS as well. - In many instances - first of all you're dealing with a tripack emulsion 3 over lapping layers where the discrimination is only has good has the individual layers will give you the information. There is no manipulation of the data to enhance to exaggerate. The other thing about standard infi-red film - a coloring for red film - it is at least on S190A the lowest resolution of all of the films. And so when I- next film please - take it up to 20 times you can see the deterioration of the image verses the 20 time enlargement of the color. Matter of fact I'd like to callp your attention to a couple fields here which have almost disappeared. Now why are we taking 6 lens up there? If we use black and white - the black and white channels which have now been attained through very nearly filtered regions and we take the green channel of panchromatic, the red channel of panchromatic, and one of the infrared black and white channels which we essentially get the same spectral information as we did get on this tri-pack film. And if I take the same area and I put these three together - next slide please - here I'm getting - now see here are those two fields - okay - now you're getting the same spectro definition except more enhanced and certainly at much higher quality than you would in the color infrared This again is a 20 times enlargement, as you know - as you notice in the infrared water absorbs the infrared energy reflectes very little of it, so therefore in the photographic realm of infrared you get very dark inagery. Now you start seeing different pinks deep reds, peach color and different

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and then of course you're starting to get blues and grays, and whites where there are no - where the ground is fallow where it has been harvested. But generally in the infrared the deeper the red the more vigorous the crop. The more chlorophyll the more moisture the more infrared reflectance. And of course in agricultural analysis the whole idea here is to estimate yields, estimate when to harvest, and certainly if there is a diseased crop it will indicate another spectral region and this can be detected. But this shows you where at least 5 of the 6 lens were employed to give you the greatest amount of information. Next slide please. If you're a purist when you deal with black and white in films you can do the same thing and come out with green instead of red whereas on the infrared film of course you - you do see your crop vigor as red signatures. But if you want to detect the vigor of the crop or the state of the crop by its greenness as you might visually - this has got the infrared response but is represented as green because we were able to do this when you do this with the black and white films. Next slide please. The other thing that - this is a - putting multispectral photography together is a rather high technology operation that requires very sophisticated color processing techniques and then just the ability to put things together to give you the greatest amount of information. Now you saw before on the color and color infrared of the Salton Sea, that you saw is pattern. Well this image here exaggerates and brings out more, now this is taken at exactly the same time from the same perspective station except on the black and white film. And this exercise was to enhance these water features. Now the water features may be depth they may be suspension, they may be pollution, in some cases they may be thermal. And what we have done here in this case there were 7 photographic steps that went in enhancing this. Next slide please. Here is almost the ultimate. There were 14 photographic steps that went in to this operation here. But you can see where now the features - the different characteristics - here's a thermal plume - here's a different feature. Now we, being in a photographic and optical end of it of course, are not going to tell you what these things are that's for a principal investigator to do. But the whole point here is that for a given situation at a static period in time the definition of water features and suspensions and what have you has been so called in time and now of course if this is typical of the Salton sea condition obviously I would sample here and I would sample here and here and here and here and I wouldn't have to do it in a sample analysis of the

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entire Salton Sea area to determine its water content. But that - that was strictly photographic - you will see - and quite often particularly in Earth's imagery they do this manipulation in the computer. This is done photographically so that no spatial information is lost and of course you parallel processing all this information. You're essentially dealing with an entire image at 8,500 square miles if you have the whole frame. And you're doing this in photographic steps. Next slide please. Here to illustrate some of the geological capability of this kind of photography both the A and B imagery. This happens to be Greybull Wyoming area, and here the very famous anticline which is kind of a classic geologic structure. Next slide please. Time Magazine - the is not a (garble) - Time Magazine has or Time Life has used this anticline in a number of journals The World We Live In among others. And we've pulled this picture to show you what that anticline looks like from high altitude aircraft photograph that was carried in one of the Time Life publications. Now this next slide please. This is a 20 time enlargement of the S190A image. That photograph that you saw - that Time Life took was from this area looking at this peak here. The interesting part about these features of course is being at the anticline is the erosion patterns and how the streams have cut right through this rather hard material that was pushed up out of the earth. But geological analysis on the EREP material is enhanced by not only the resolution and the true color rendition of the features but by the fact that there is some stereoscopic material about 50 or 60 percent of the photography was taken in stereo. In fact all most all of the land mass was in stereo versus the oceanographic material is pretty much all taken in a monostrophic mode for the correlation of the scatterometer radiometer information primarily. Next slide please. Here is a interesting feature in fact there is an illustration of this downstairs. Here is Mount Hood, here's Mount Adams, Mount St. Helens in the Cascade region. Here's the foot hills leading up to Mount Rainier. Mount Rainier would be just off the picture there. And here you see the (garble) National Forest in central Washington - south central Washington. The features in here that are predominant you'll notice are squares where timber has been clear cut which is somewhat of a controversial things these days. This is a national forest under management of the forest service and of course the forest service gives permission to timber - or to harvest their timber and clear cutting is a common technique. Next slide please. Now if you'll look

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at the infrared. Just the standard directly out of the camera - standard infrared product you'll notice most of these little square areas are now blue indicating no vegetation. Whereas the deeper forested are reds and deep purples. Remember pine trees having a very narrow having a not a broad leaf structure reflect a lot less infrared energy than deciduous trees and agricultural perhaps orchards here. So the redder image is probably broad leaf or deciduous trees or other forms of vegetation and the purples are for pine and fir trees. But these blue patches there one mile on a side are the clear cut areas. Now what we would like to do is illustrate here again using the black and white images how you can enhance or bring this out if you're doing a timber inventory of that area. And you certainly have a big area to deal with. Next slide please. Here is one level of enhancement, this is somewhat enlarged but here again you see Mt. Helens - Mt. St. Helens and that's Mt. Adams over there. But you can see now these were using black and whites trying to suppress background information and representing the clear cut areas as red patches. Now the next slide please. Here's one that is where we have taken almost all of the background information and suppressed it, all except the snow covered mountains.

END OF TAPE

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SPEAKER The next slide please. Here's one that is where we have taken almost all of the background information and suppressed it all except the snow covered mountains. But here you see those clear cut areas quite - you know - nicely enhanced - nicely illustrated and certainly will aid the annalist to expedite his job if he's doing a timber inventory. We've suppressed almost all information in here in the cultural area - in the red practically did away with all of that and it - you have more time and the images are processed in a proper manner to begin with you can practically suppress all information except the spectral region that you want. Next slide, please. Here's this gulf of California the mouth of the Colorado River and on S065 as I mentioned the sedimentation pattern showed up so nicely these long tongues of sedimentation, that this is where of course the - the tuna fishing - I believe it was tuna fishing was always known to be where those sedimentation patterns - except that charting them and knowing where they were was a very difficult process in aerial photograph would cover just a tiny little patch of this so here again on EREP, the - took pictures of the area foreign investigator and we in turn took the black and whites and tried to enhance the sedimentation patterns to bring them out a little bit better than this. That's the next slide, please. Here you start seeing quite further out into the water these - these tan - tongues of sedimentation (garble) - using the black and white multispectral imagery and manipulating the data. Next slide please. Well, here's the Salt Lake City. Here's Utah Lake, Provo Utah and the Bingham mine the world's largest man-made hole in the ground. And the reason I have this slide is that I guess in the EREP briefing yesterday there was some discussion as to the resolutions of these systems. This particular photograph again covers 8500 square miles and there's a shallow bay area here with an interstate highway going over it. Next slide please. Here's the intra-red. And you can see that most of it is non-forested or non-agricultural you can see the red areas that was - that shows the intense of agriculture, a couple of real bright spots. Next slide, please. This is now a twenty time enlargement of Utah Lake, and not only are you starting to see depths and sedimentation patterns but on the original photograph this - on the interstate highway you can see vehicles. I'm not sure whether they're twin (garble) trailers or what are they but basically you can be picking up vehicles and you can pick up aircraft on the runway. This is with a 6 inch lens, remember from 270 miles. Next slide please. Well, I - this slide introduces Mr. Wambull who's going to talk about the - the 6 lens - the six-pack

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as we call it. The S190A and Dave has the unique responsibility of designing a lens where these images would register to about 7 microns - 7 micrometers even though the light going into the lens and onto the film were to be taken in different spectral regions which normally focuses at a different distance so the whole idea was to design a lens where even though the scale or the focal length would be adjusted the picture scale would not be and I think that was one of the most critical as well as designing it with zero distortion and the register ability in the bore-sighting operation. So Dave is the designer of that system. It's the first time he's been down here and I thought perhaps to add a little bit more to the technology of this that it might be worthwhile having Dave talk about this and then you can ask him some questions on the program. Dave.

WA'INULL

Thank you Ron. I want to attempt to go into a great detail about the design aspect I'm not sure how interested you are. Be glad to talk with you later. I do have a few copies of a paper which we gave on the lens design aspect up in Iowa last year. Could I have the first slide, please? Here's a cross sectional view of the lens, there are 8 (garble) elements in the lens. Up front here we have a place for two filters, filters are changed in flight sometime by the astronauts. It does have a (garble) in the lens shutter mechanism in here. It has a (garble) in the back where the film is pressed up against the back for stability. The (garble) material was chosen for this lens so that you would match up with the (garble) of the glass. This is just a lens which you - does not change greatly with temperature changes. Here's some of the outstanding features of the lens up here. The lens does work over a large spectral region for refracture work from .4 to .9 micrometers, the six lens camera array which you see over here - four of the lenses work over the (garble) spectral region, 1000 anstroms each, these four are used primarily for the overlays which Ron was showing you previously. The other two is a (garble) color camera and a natural color camera, S0242. The next slide, please. Now earlier, as Ron mentioned there had been previous multri-band systems flown they were put together from off-the-shelf lenses. These lenses were fairly simple much like you use in your own camera what did come out of all of this - the S065 experiment, a few others, is that there was an indication of the feasibility of using multri-band photography in the study of earth resources. This camera here is the first attempt at designing a camera array specifically for doing this. Some of the shortcomings of just putting lens together off the shelf.

SPEAKER

We can't hear you, have to get it up.

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WAYBULL Okay. Thank you very much. Is that - there is a lack of match image registration between the spectral channels. Most lenses do have inherent design distortion which is in the design itself, another source of distortion is in fabrication of assembly of these objects. Now when you try to overlay as the pictures Ron had before two photographs which does have image distortion the image will not exactly superimpose. And this will give a smearing of the objects and hence take away from the contrast. Another shortcoming is the non-uniformity of image plane (garble) as a function of f number. Now these - okay thank you. Is that better? Now, this is an f/2.8 basic design lens however each of the film type is not exactly the same speed so therefore each camera works at a different f number. Now if you had non-uniformity of the image plane (garble) and you try to superimpose these then you start getting mis-matches, whereas the color is being super-imposed in the center is going to give you the exact same color tones out - out near the edges. Most of the off the shelf lens you get have (garble) four uniformity they drop down to somewhere in the order of 30 percent (garble) illumination at the edge. Which gives you all kinds of problems when you're trying to super-impose images. Another shortcoming is the lack of photogrametric accuracy. Even though you may have a well-designed lens, zero distortion when you start to assemble these lenses you have fabricatio errors, assembly errors, this gives the kind of fused type of distortion. So, these you cannot take out in processing from lens to lens this fused distortion will vary and again you have problems in super-imposing the images. Another one is that the off the shelf lenses will - most of them will vary - -

END OF TAPE

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SPEAKER Allowing that the off-the-shelf lenses will - most of them will (garble) with changes in temperature. Here in the S190 we did take pains to match up the cell material with the glide so that the image is held constant as temperature varies. Also the reason we're working primarily with the nyroband photography is .5 to .9. Again those lenses are designed just over the visible spectral regions which is like .5 to 17. You got to use the siting lens out form .8 to .9 for instance. You would find a lot of distortio and aberrations which are uncorrected. Next slide please. Here are some of the static resolution performance measured in the lab on the S190. The - here are the 6 cameras in our band .5 or .6. Our contrast 118 on the active, 111 (garble) which is average weighted resolution. Low contrast you can see is down by the factor os 2. The photography that we were seeing while ago was more in the order of 5 to 1 contrast. (garble) - high contrast (garble). Just to scale the thing a 100 lines (garble) per millimeter is equivalent to about 29 meters around 90 feet. The film types are given over the other - other side 3400 panachromatic are in two of the cameras. RI black and white 2424 is in two. We have IR color which is 3443 in one camera and S0242 which is a high resolution color film. Anybody else?

SPEAKER This mike. Yes, this microphone is working. I'd like to invite questions at this time. Also I would like to mention that this photography is available, would be available in print form through Mr. Brack who is in the back of the room right now. And he had quite a stack of pictures of the Grand Canyon and some of the Salton Sea area there of the agriculture, but I see they are all gone now. In the press kits there's some block and white - -

SPEAKER Is this on? In the press kit are some block and white pictures of the San Francisco area. But these color pictures are - would be available if you inquire from Mr. Brack. Any questions? Yes, sir.

SPEAKER Well, the 190B of course is the camera that was Apollo 14. It was a reconditioned Air Force recon-naissance camera that was on Apollo 14 and it was called the lunar topographic camera which then was fitted with a new lens system by the Actron Corporation and - and fixed for the scientific airlock modeul on the - on the Skylab. The - so that's kind of a difficult one because it went through a lot of iterations and it probably was inherited by NASA as a surplus military item in the first place. S190A was designed

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from scratch so to speak. And what did you ask about the relative costs - -

QUERY (garble)

SPEAKER Well, I would say that right now after building and mounting and using 30 of these lenses in the 5 cameras that were built, the one the Skylab A camera that's in there now, the backup unit, and the three aircraft units. That the cost of an individual lens system with shutters focal point is probably almost identical to commercial aerial camera lens which I would put in the area of 25000 to 30000 dollars.

QUERY The whole thing?

SPEAKER No, no. I said one of the lenses that's 6 cameras you remember. Okay that's 6 cameras right there. And all I'm saying is that you have a standard aerial high quality camera made by Zeiss or (garble of Switzerland or so forth. That aerial camera sells with film cassettes and everything else for around 50 - 50 thousand dollars or so. And if you took one of those individual channels and did the same thing with it it would be about the same price. So what I'm saying if you multiply that number by 6 you have the price of a repeat unit of what one of those would cost. Any other questions. Thank you very much.

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**SKYLAB NEWS CENTER
Houston, Texas**

**Skylab IV - Premission Science Briefing (T-2) and
Premission Earth Resources Briefing (T-2)
Kennedy Space Center
November 14, 1973
9:15 a.m. CST**

PARTICIPANTS:

**Dr. V. R. Wilmarth, Earth Resources Program Scientist, JSC
Dr. Valerie Milazzo, U.S. Geological Survey
Dr. James V. A. Trumbell, U.S. Geological Survey
Dr. Andrew Benson, University of California
Bill Pomeroy, PAO**

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PAO As soon as I report. At this time, we will start our Pre-Mission Science Briefings on Skylab IV and Skylab program at this time. Because of the uncertainties in the launch time we have had some impact on our schedules and we still have them. We will start off this morning as planned - an overview in introduction and Earth resources. And, after that we anticipate having a discussion of the student experiments and the Apollo telescope mount experiments. And, that will be the order of events we plan for this morning. We're gonna move right along and try to keep on a good schedule so we can take a break at noon for an hour and a half and resume at 01:30 with Dr. Stuhlinger. At this time I would like to introduce our panel here this morning. We have to my immediate right from NASA headquarters, Tom Hanes, the Director of Experiments with Skylab Program, and Dr. Vick Wilmarth from JSC, Earth Resources Program Scientist, Dr. Valerie Milazzo of the U.S. GS, is going to be here, but is not arrived as yet. Then we have V. Trumbell, U.S. GS and Andy Bensen of the University of California in Berkeley. At this time we'll hear from Tom Hanes.

Hanes Well, good morning. We're gonna try to talk to you about the results of the experiments that have taken place on the second manned mission Skylab. And we'll give you some of the results of the investigations that are being performed on the data on both the first and the second manned missions. If you look back at the second manned mission in perspective you begin to get a feeling that two things stand out. In the first place after a (garble) shakedown period. The crew got the Skylab into a condition of being a completely operable space station. They did two major repair jobs, if you will remember, they put on a large what we can consider permanent solar sail to protect the Skylab from the thermal contingement on the solar side and they put in what we call a six-pack of rate gyros that establish the stability of the spacecraft so that it's been in good shape every since. When they got the station operating and it has been going now in almost complete - without

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HANES - any major difficulties. They - they then found a (garble) to the zero-g and performing work. And the second thing that stands out is the scientific productivity of this - of this mission. You probably remember that we were asked in the middle of the mission by the crew to give them more work and we piled that on, and they asked for more work and we piled that on, and they have demonstrated to us that a little determination you can do much more than anyone thought you could ever get done in a facility of this sort. For example, we did about 50 percent more of the solar observations than we had anticipated. We're beginning to see evidence that we will have to revise our present thinking about the Sun in the respect to its structures and its mechanism. In the Earth Resources area we got about 50 percent more passes than we had planned. And I believe that you'll probably hear about some of the investigation results, it might be quite interesting to you, today. In the medical area, we did what was required to get the data that's was necessary to chart the time history of a man's adaptation to zero-g. And this, of course, is extended now to 60 days. In all of the other experiment areas we performed all of the experiments that were required of us except two, and still had some time so we moved the manufacturing in space experiment forward from the second - the third mission to the second mission. And we have some repeat samples with new protocol to go up on this spacecraft. Although we're going to do more in the material science area than we had ever anticipated. The two experiments that we didn't really do the way we would like to, the S071, 72 circadian rhythm experiments where, in the service module of the spacecraft and shortly after they got started, there was some kind of an electrical malfunction in the experiment package, so we lost the data on those two experiments. A - It turns out to be a - that experiment was put together to be self-contained and automated. It's a lovely little spacecraft of its own, and it's too heavy to carry on this other spacecraft, so we're not going to be able to repeat that one. The S073 gegenschein/zodiacal light experiment, photometer after a short period of observations jammed and we had to jettison it early in the mission. The investigator on that experiment can do part of his work by use of photography, and we have film aboard. We're going to help him get more of his data on the SL-IV mission. We have talked, and I said a few things here today about the quantity of data that we got on the SL-III mission, on the second manned mission. We did get more data, we did do more observing. We were all astonished by the

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quantity and the productivity of this mission. During the day today I think you should listen for the quality of the data and the investigations that are beginning to show up. Some of the - some of the things that are beginning to come to us from the - from the data of the first and second mission is beginning to get very exciting to us, and I think if you listen to it you'll be excited also. We - As you realize again we have to say the investigations take place over a period of many years, and the things that we can report on now are just the beginning. They're - they're sort of the top of the iceberg, I would say, and over a period of the next year as new things crop up, we'll try to feed them to the press in a way that will make it interesting to you and understandable where they can be. But in the long run the message of Skylab will probably never be put together in a - in a major sense because the message or the real product of Skylab is great quantities of data that can be investigated and worked with for many many years. And with that I think we should go on and start the Earth Resources.

POMEROY Okay, at this time we'll move ahead, and at the conclusion of all the presentations we'll take questions. Dr. Wilmarth.

WILMARTH Good morning. I'm going to do three things this morning - -

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WILMARTH I'm going to do three things this morning. To begin with, I'm going to recap a little bit of what we have, what EREP really means and what it is here for and what we expect to get out of it. And talk a little bit about what we have accomplished relative to SL-II and III. We're ready to go with SL-4, and what we think we can get done with SL-IV, and some of the highlights of some of this activity. And then I'm going to have two discussions by Dr. Jim Trumble, USGS, who is going to talk to you on some of the activities that he has been carrying on down in Puerto Rico relative to the EREP (garble) data. And then Andy Bensen will talk to you from the University of California, Berkeley on some of the activities that they have been doing on the EREP data in forestry and (garble), and realying activities. So if I can borrow one of these rolling mikes, I'll go down there and start. Can you hear me? Is this on?

WILMARTH

Can we have the lovier turned on?

WILMARTH

This winter season down here in Florida has given me a bad cold, so I hope I get through with this. Can we have the first slide please? EREP as I have said several times, is beginning to, was put onboard Skylab for three specific purposes as stated here in this slide. It is an experiment, people. We are not trying to do a total production type activity nor to do total Earth Resources application. But the differences between the ERTS and the EREP sensors will provide us with some very important information on how, what spectral resolution, what space resolutions will be needed on upcoming flight programs relative to the sensors for Earth survey activity. As you know, we have got onboard some microwave instruments, 193, the radiometer scatterometer with the altimeter, the 191 which is essentially an IR spectrometer, and also we have onboard the L band radiometer, which is a passive - the L band radiometer. Pardon me. Now these are the first times we have flown these., So therefore it is important for us to find out how useful such data are relative to the applications or to Earth survey programs. So from the data that we have got back from these sensors, have been put into the hands of the investigators, and we are now beginning to get some results back, which I will not report on toda, but hopefully, in order to give you a better feeling of the kinds of time frame we are talking about for data analysis, we have put out to the investigators now all of the 190A, which is the photographic multispectral camera, and the 190B data from SL-2. The SL-III data will be going out shortly, as far as photographic information is concerned. We have put in the hands of the investigators the 191 data, and the radiometer

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scatterometer, and altimeter data for most of the SL-2. We are processing the SL-III data and hopefully within a few weeks, we will put that into the hands of the investigators. As far as the 192 data, we have distributed part of the data requirements for the - to the PIs. And processing in response to their request additional data for the 192 scatter data analysis. We have not processed any of the 193 or 192 data from SL-III. Hopefully we are going to start that in a few weeks. The SL-IV data are already in the hands of the investigators. So we are looking ahead now to having a Science Conference at JSC, Houston some time in the early spring of next year, which will have the investigators come in and give us the preliminary results, some of which you are going to hear today. So we are looking forward to that and hopefully by that time the investigators will have both of their data, and we will have some rather interesting and startling results from the EREP analysis. So let's go on for a little bit, as far as the - -

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WILMARTH - - go on for a little bit. As far as the last item here. We are using the 192 scanner data, and the 191 infrared spectrometer to determine totally the effects of the atmosphere as you well know it contains the ozones and the oxygen as well as other particles. And these do affect the analysis, both on a photographic and an electronic basis. So, with that information, we will be able to have a better handle totally on the kinds of sensors we will be using in the future Earth survey program. Can we have the next one?

WILMARTH I want to recap for you, to let you know that we do have a rather large stable of investigators in our program. Again, these are statistics, but it shows you that we've got, essentially, 146 investigators in the total program representing the United States and 20 countries. And you can see here they represent the academics as well as the state institutions. We have 22 industrial organizations and of course very heavy organization - federal - federal units and agencies, both here and in foreign countries. Can we go on?

WILMARTH To give you a feeling of the distribution of some of these investigators. Here is the breakout which shows that we've got the U. S. Department of Interior, Department of Agriculture, NOAA, U.S. Corps of Engineers, and we have our own investigators, both at JSC, Marshall and Goddard. And then we have three investigators from the Navy. Turning briefly to the state-affiliated organizations, they are primarily interested in a broad regional state resource activity. They have their own individual agencies within their state governments that are directly involved in the total program of using EREP data in a resource or in inventory type land use studies. Can we go on?

WILMARTH Briefly. Here are the foreign countries and number of PIs that we have involved in the program. Now they're the designated PIs, but remember, associated with each of the individual investigators, there is a series of systems, of coinvestigators and totally if we added them all up, we'd probably have something on the order of about 600 investigators totally working on EREP data. So, as you can see here. Our neighbor to the South, Mexico, has eight PI's and they're working in the fields of mineral exploration, oil exploration, irrigation, vegetation pattern recognition and general land use. Again, certainly, the (garble) are working in their own areas as well as assisting in some of the work in Africa as well as down in South America. Primarily in some of the areas where they have a single

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PI, take for instance Mali, they are primarily interested in the use of the EREP data for the studies of the drought conditions and what can EREP do for them in designation of some of the areas where water potentially could be found where the green forage areas are currently. Well, I think that's about all I really wanted to show you, that we do have a rather broad program both here in the U.S. and across other countries and go on. Now, I have stated this before at briefings but it is important to restate here. That the only time that we take data as far as EREP is concerned is where there is a designated pass site. We have broken out here the areas where we have geology pass sites designated with individual PIs. We have the same thing for the ag forest range, for the oceans, and atmospheres and for the other remaining 9 total program elements. But, I wanted to call you attention to this, we have other slides showing the same thing but on a descending or ascending pass the sensors are turned on specifically to acquire data across that pass site for that specific individual investigator. Now, certainly with just geology we threw on all the rest of them you'd find that most of the U.S. is covered. But in foreign countries we only turn the data - the sensors on where there is a specific designated pass site and the individual PI. May we go on. Okay, let's turn now to what we have done relative to the EREP data tapes and statistics, because these are rather startling and as Tom said we do have a bunch of real good data. In SL-II, we had 11 Z-LV passes; we had one solar inertial pass, as compared to 39 Z-LV passes in SL-III. Totally then we have 50 Z-local-vertical passes with the sensors turned on over various parts of the world and I'll show you those in a minute. Now, on lunar calibrations, and I'll -

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SPEAKER - - Z local vertical passes with the sensors turned on over various parts of the world and I'll show you those in a minute. Now, on other calibrations, and I'll say this again, the important point in lunar calibrations is to determine how well the sensors are operating relative to specifications. In this we use the Moon because it's a rather unique, rather common total reflectivity which has given us a good data-take point. All right, the Earth (garble) experiment is looking at the upper atmosphere to determine what is the - the constituents in using the 190B and 191, and the 192 scanner to determine what are the upper - what are the real constituents of the - of the atmosphere and we included this here as the speciality because it is a rather unique experiment. All right, let's turn now to what we have accomplished relative to the 190AB and the 191 as well as the magnetic tape data. The magnetic tape is those that require excessors of the 194 and the 193, and the 191 and the 192. The numbers are at a start - totally we've got 131 thousand feet of magnetic tape, and somebody will obviously ask, "Are you going to process all of that?" Well, that's an awful big border to process. We're trying to process the data specifically for the individual investigators, as you well know, if you take the 192 there are 13 channels and we don't intend to process all of the channels for that specific PI requirement. We'll process the channels that he needs relative to his approved investigation. So, we will not process all of the 131 thousand, we're going to process relative to a specific PI requirement. Again we have essentially something on the order of about 20,000 frames of data taken over the U.S. and the 28 countries that we've already taken data over. So, if you take and add this whole number up together, the DAC film incidentally the frames are used for the orientation and location of the target site for the 191 as well as for other types of activities, but primarily using it to determine the orientation and location of the 191 target site. Now, lets - lets consider for a moment how long it's going to take to analyze all of the data. Well, I can't give you a good answer to that simply from the standpoint that if you take one 190B frame, which has something on the order of 3600 square miles, and you wanted to do solar separations and density slicing of such a data tape, you've got a real major data analysis problem. So, I can't tell you how long it's going to take to analyze all of that data as far as the photographic is concerned. But you can understand ratherly simple that it does take a considerably amount of time just to analyze one frame where

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you have 3600 square miles.

QUERY

Give us an example, 15 years, 20 years.

SPEAKER

Let me talk to you in terms of geologic investigations, give you a field first because that's my field and I have some idea of what this is going to take. To do a preliminary geologic analysis of an area that you have not worked in. Working at the scale of approximately one to a quarter million. It takes a good photo geologic technician to do a preliminary analysis of such an area approximately 5 to 6 months. And I can tell you this based on the area of photographic analysis. But if you take the Skylab data, essentially the 190B, or you can just take the 190A also, you could probably do the same kind of analysis certainly in the same time frame. So you can take that as a preliminary guide. You can do an analysis of 3600 square miles in approximately 2 to 3 months. If it's a real complex geologic area it's probably going to take you 5 months to do a preliminary geologic analysis.

QUERY

(Garble)

SPEAKER

One frame 3600 square miles of 190B. Geologic analysis of any one area. Okay?

QUERY

How many frames the average PI go?

SPEAKER

The average PI will probably get maybe 5 or 6 frames depending upon the size of his site. But that's about what he's going to get because you get 60 percent overlap to get (garble)

QUERY

You're saying 15 months?

SPEAKER

We will have real good analysis back from the PI, photo interpretation, in approximately 15 months. So that would give us some real good data early next year when we have our preliminary science conference that we're now planning. Okay?

QUERY

Dick you're 15 - -

SPEAKER

Okay, I've got to rush on. Can I go on to the next line? Alright now, here's what we did on - -

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SPEAKER

QUERY

SPEAKER

- - we're not planning. Okay?
Dick, you're 15 minutes - -
Okay, I've got a - press on. Can I
go on to the next line? Alright now, here's what we did on
- on SL-II as you can see the descending passes are down
through here and you'll see this again on the next slide.
Here's what we did on SL-III. The descending pass is down
through here, the ascending pass is across here, and there
are repeats because of cloud cover. Here are the passes
we took over the Christine hurricane both on initiation
growing and on the dying stage. These are general passes
that we can see that we've covered a fair amount of the -
of the - of that part of South America. Can we go on to the
next one? In addition we took the pass over Japan, pass
over Thailand, East Malasia, down across Australia, and as
the final pass of that SL-III down through here to pick up
this very important (garble) quadrangle area. These are the
two passes down over or ascending up over Mali area and into some of
the drought areas. Can we go on? Briefly SL-IV, what are
we going to have. This slide has been hard to keep up to date,
but with the launch here you can see where approximately
maybe 7 or 8 days prior to initiation of the workshop and
getting ready to take EREP data. We have the descending
passes across here and over descending in here into South
America. We were going to be losing some of the European passes
because of the - the descending tracks here. We will be
able to pick up some of our African passes. But as we get
farther over in here, here is the bad lighting conditions
throughout. We'll be getting more of the U.S. ascending
passes ascending across South America and Africa, so we
will be picking up again a good repeat coverage over descending
across U.S. early in the mission and ascending across U.S.
later in the mission.

QUERY

to get those in?

SPEAKER

I'm saying here the launch here is actually
here, and it takes about 10 days to - before we get into an
EREP pass, so that we're going to have this period of time
to get our descending passes across the U.S. and that should
provide us some interesting data for snow analysis, freeze-
fall line studies and certainly a different period or different
season for crop growing.

QUERY

(garble) time for Kohoutek?

SPEAKER

It - No, no, we have not lost pass time
for that because you can see here we will get good coverage

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here and extension on over in to here. This goes on over to an 85 day mission. See what I'm saying?

PAO Could we hold our questions until later so that we don't - - Some of the people won't know what the question is that's being answered.

SPEAKER No, let's not do that.

QUERY (garble) the questions until later until we forgot what the questions were about.

SPEAKER Right. Okay.

PAO Take a note.

QUERY Alright.

SPEAKER Okay, that's - that's about what I wanted to cover this morning. So, let's go on to Jim Trumbell and - -

QUERY Now wait a minute. Let me - may can we ask you a couple of questions? I want to know what those great big numbers, 131,000 - -

PAO All right. Could you wait until we get a mike to you? We'll take questions at this time if you want. Just a minute.

SPEAKER I think we can hear him.

PAO We want to record it.

SPEAKER Yeah.

PAO Okay.

QUERY For instance, you have a number here 131,000 feet of magnetic tape. Well, that's a very impressive number. How much of that is usable?

SPEAKER Well, we have not processed all 131,000 feet. So, what we do is we take - all data takes are geared to a GMT time. So we take the GMT data take and split it out and process only specifically what is the number of seconds, which essentially 4 miles per second traveling rate, so you can pick up the data at the same rate. So you see what we're doing is processing only a part of the 131,000 feet that are needed relative to a specific individual investigation. I can't give you a specific number of how much of the 131,000 we've actually processed and how much is going to be used. I - I could give you a - -

QUERY I was trying to get a (garble). Is the rest of it wasted or is the rest of it - -

SPEAKER No. It's just that when you turn on - -

QUERY - - the rest of it is not needed or is it possibly going to be used someday and stored in the computer or something like that.

SPEAKER Right. It is always usable. Now what I want to tell you is that in the 192 you have 13 channels

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of data take. Right? You can't split out one channel and turn it off; you take all 13 channels. But the investigator may need only 2 channels. So we'll process those specific two channels and yet you still get a data take of so many feet of tape.

QUERY But some other investigator might want some of the other channels.

SPEAKER Some other investigator may need the same data.

QUERY Is that 131,000 - is that feet of frames?

SPEAKER Magnetic tape.

QUERY Magnetic tape. Well, what about the 16,000 frames, the 3,000 frames, 30,000 frames you referred to? Is all that going to be used?

SPEAKER I would say that before the EREP - -

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SPEAKER

QUERY

16,000 frames or 3,000 frames, 30,000 frames you referred to?
Is all that going to be used?

SPEAKER

I would say that for the EREP investigators that probably 60 to 70 percent of it will be used.

QUERY

How about the rest of it?

SPEAKER

Some portion of it cloud covers -

SPEAKER

Right. Some portions is cloud cover,

remember.

QUERY

(Garble) photographed?

SPEAKER

Cloud cover is the people in (garble) in NOAA are using this kind of data for study of clouds anyhow. So, we do get that data for them.

QUERY

And I have one more question I want to get in here because now we've had two missions in which you've gotten a lot of passes. And this is either for Dr. Wilmarth or for Mr. Hanes. And I'd like to know right here whether you do - is there anyway for you to judge the relative merit of the relative benefits or the relative profits that you have received from ERTS and ERO - EN - EROS, yeah?

SPEAKER

Relative profits from ERTS and EREP?

SPEAKER

We just -

SPEAKER

Okay, well -

SPEAKER

EREP, rather. I'm sorry -

SPEAKER

I'm willing - I'm willing to try and feel that

one now and that's an interesting question. For starters you have to understand there's two reasons for flying ERTS Survey instruments today. One of them is to find out how best to build an operational satellite that will do this thing in and out. And in this respect, the ERTS and the EREP sensors are completely compatible in that we on EREP have sensors that do a lot of things that the ERTS sensors don't do. But ERTS does something that we don't do. ERTS is the Sun oriented satellite that covers the entire globe and it covers it with the same Sun angle at all times. So that the complimentary investigations aim at understanding the best way to build an operational satellite. Now, then, with all of the data channels that are available on EREP, investigators are able to pick those data channels that are most applicable to their particular investigation. Now, that's why we have the 24 - 14 channel scanner. Is to find out which channels really are the most applicable to which investigation and each PI is allowed to pick out those channels that he thinks is going to do the most for him. Now, we give them data and we'll give them whatever they want, but

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they're not going to all want all channels, that's - this is - this is where that goes. So of value to each investigator, I don't think that we can answer that question yet because we haven't - you mean the relative value, the ERTs investigator are delighted with their data. The EREP investigators haven't got their data long enough to be de - more than just interested in what they've seen so far. So, we can't answer that question. All I can answer is the question of relative value for the future and that question is that we're complementary. Okay.

QUERY

Just one problem. Do I detect from what you say now that one - a primary, if not the primary goal of EREP is to learn how to build an unmanned satellite in the future for Earth resources - technology.

SPEAKER

That's one primary goal, although we have a hundred and some investigators who have another goal entirely. In fact, each one of them has a different goal.

QUERY

I'm just curious about preliminary results from what EREP has found so far? Are there certain areas that PIs are now working on which they find of immediate importance to analyze, such as the drought areas in Africa? Can we expect results in those important areas sooner than this conference which is 15 months away?

SPEAKER

Certainly, well the investigator Norm McCloud, at American University has already found that the data that he has seen relative to the - what he has seen relative to the drought areas in EREP that they can identify specific areas where there are of interest to search for water and green forage. Which is important far as the life cycle is concerned. So, we do have some preliminary results on that already.

QUERY

Well, is that the only case? And, in addition, when can we, the press, expect to find what those results are? How soon can we know? How soon can the public know as a matter of fact?

SPEAKER

I think I did state that we are planning to have, next Spring, a full scale or comprehensive review of the data that has been accomplished for the new - results that have been accomplished to date, from EREP. So, next Spring, we will have a fairly comprehensive review of that subject.

SPEAKER

Yes.

QUERY

What I am getting at is this. There are I imagine, some areas such as the drought area in Africa that is crucial for the survival of those people now. And they can't wait 15 months for

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QUERY What I am getting at is this, there are I imagine some areas such as the drought area in Africa that is crucial to the survival of those people now. And they cannot wait 15 months for some scientists to sit around and come up with a conclusion. Aren't there some PIs hard at work on this now or will they shortly be, and will the results of those areas which we know to be crucial be given out much sooner than that 15 month conference?

SPEAKER Certainly, certainly. In the Mali area, yes. As those results become available, and they are important to those people over there and we can make them available through a press conference similar to this. Now just when those results are going to be available, I don't know because Norm is over there in Africa right now using some of the data that he has already accomplished on EREP. So when he gets back and gets all of the results, why, certainly that kind of data could be put out, isn't that right, Bill?

SPEAKER Right.

PAO We'll take one more question at this time.

QUERY Dick, you indicated that we are going to lose the European passes due to the late launch, and there were no further passes over Europe indicated on your chart. Does that mean that Europe is out from here on, or are you attempting to reschedule?

SPEAKER No, we're going to try to reschedule some of those. That chart is somewhat out of date, as you already know the launch is set. So we'll - they can update that as we go into it. We have not redone that one, so we will look at the - that certainly.

PAO Okay, at this time we will move ahead with Jim Trumbell of USGS.

TRUMBELL I want to show you some results of working the ocean on the west side of Puerto Rico. At the outset, I am a Marine geologist. I am mapping geology of underwater areas around Puerto Rico coastal areas. So, although I'm talking about oceans, I don't know anything about a lot of the work that is going on with oceans. There are scatterometers, which I don't happen to know what is, and all sorts of electromagnetic stuff going on by physical oceanographers measuring of currents and productivity, that sort of thing out at sea. What I am interested in and want to show you about is the relation between land and sea, and what we can see in the images. I am working in a small area, please keep in mind the point is to figure out what we can do and then apply it around the world to other areas. Could we have the first left-hand slide, please? The other one, okay. The big one

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instead of that one. So here is Puerto Rico up north is that way. I want to show you the different kinds of things we can see on these goodies. Eighty-eight nautical miles across on the south coast are all kinds of coral reefs, which show very nicely. And this line across here is down through, I think on the average of 120 to 160 feet of water, perhaps as much as 180. This is the symmetry, this is the shape of the bottom, well charted in this case, pretty well by the coast and geodetic survey but around the world, I expect the charting of depth is not done or way behind. The symmetry from these images I'm sure can be made into maps because on standard or rather special but standard low altitude area photography, the Coastal and geodetic survey is now on a production basis charting, and is important because ships have got to rely on the accuracy of the charts. They are charting the symmetry from aerial photographs underwater just as maps are made of land elevations by a machine from aerial photographs. So I think the (garble) symmetric situation is pretty straightforward. It's intricate to get the depths right, but maps can be made metrically and precisely from machines from this sort of imagery. We can get quite a bit of detail - I guess the house lights are - as low as they can get. In this area right here, there is a neat set of things called sand waves. Geologically they're pretty - could we look at the other projector, please? This screen over here will have 4000 foot - can we keep this one on, I'm sorry. This screen over here will have stuff I shot from a light plane on the day the satellite went over here. That's usually 4000 maybe six, maybe three, something like that, feet. These are sand waves the distance from land to land there I suppose is 2, 3 miles, something like that. Puerto Rico has used up, as a matter of fact, most of the sand and gravel it's got ashore - people are out robbing beaches at night to sell truckloads of sand to concrete companies. Here's a resource of sand that -

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SPEAKER

Well, Puerto Rico is used up as a matter of fact. Most of the sand and gravel that's got ashore people are out robbing beaches at night to sell truckloads of sand to concret companies. Here's a resource of sand that they desperately need offshore. We can't see this image particularly well and it's a pretty bright room. But that much information can be gotten off here. As I look at the stuff in the microscope I can see it just about as well as I can there as a matter of fact. So, that's the symmetry, a pretty clear matter. Other things we can see, I want you to look please, at this light colored pattern up there. If we can go to the - Well let me show you a couple of other pictures over there first. Can we have the next one of those on that screen? Good. Corals reefs down here and the veneer shore areas. This pattern is a mixture of looking at bottom shape through clear water and silt and also organic material is being swept along the coast by coastal current. Islands and reefs make their own silt patterns into the water. They're generating silt. It's being carried along, it will go out and make the sediments that's on the ocean bottom. The next slide over there, please. That's a point down - that point right there as a matter of fact, in detail on the (garble). We can see, I think, just about that kind of information from here. So we can see coastal currents, we can tell whether coral reefs themselves with mangroves on them are generating silt themselves, as that one appears to be doing. That kind of stuff we can get out of here over a tremendous area without having to go there. Would you kill that one and advance with this one please? Now, this was taken some 10 or 12 seconds before Puerto Rico again. This time we've got north still this way. We've got the east corner of the Dominican Republic, Mona Island, where Puerto Rico, incidentally is trying to build a super port. One real keen thing on here; this is a little island. It's built - it's built just like that. It's a little cone and it is showing awake as this surface sheet of apparently sediment-laden water is going past it. Can you see the little tails? Good, fine. There's a little tail running down there. That's neat. If nobody minds, can we leave those off? I think that's very slinky. This sediment out here - now the Sun angle is lined to it, I suppose. I think there's some reality in this. This is sediment in the water. I've been out there in a ship getting water samples but I don't have the answers yet to see how turbid this water is compared to this and this, for instance. But this is the high rainfall area of Puerto Rico on the north coast is causing the rivers

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to bring lots of silt to the water. It's coming this way and it is just a beautiful current indicator that's showing this other sheet of water going that way past the island; just a neat little goodie. Take a look here. Now, right in this area there are a whole bunch of things going on and let's go through them, please. That right there is a big river just discharging silt-laden water. Could we see the other projector, please? That's not that river, it's - that, as a matter of fact, is one that's off the picture over here. The next one over there, please. That is that river, as a matter of fact. Oh, the light plane is about here, looking out there, so - - What these intermittent pulses are, I don't know as a matter of fact, but I sure want to find out. That is a view of this area shot from here looking that way. Okay, 50 rivers wrping under the sea, so what? It's the mud gout (garble) the spouts of mud, label that water and we can tell which way its current's going rather easily. In that previous slide the current direction was obvious. In this slide we know that there's no long shore coastal current, so we've got a current measuring device just like that. And this is such a common characteristic. There's several in there, I can't see them on here, but I think maybe I can see them in there a little bit. There are none around here but there are a number of rivers back here. This goes on all over the world so you can very quickly say what the coastal current direction and perhaps velocity is if you've got repetitive coverage, although that's not Skylab's business. So, there is natural silt coming down the rivers. The next slide on the right, please. That's just plain pollution. That's a molasses plant. I think it's a rum factory, and that's thin molasses or something like that back down the coast over here, it was just a pretty picture. The next one over there, please. This has got at least 3 different kinds of pollution on it. This the harbor at Mayaguez. The town is that light-colored area right there. The docks are right there, and we're looking almost straight down on that area.

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SPEAKER - - this has got at least three different kinds of pollution on it. This is the harbor at Mayaquez. The town is that light-colored area right there. The docks are right there and we are looking almost straight down on that area. These are - I'm not sure if these are - as a matter of fact, but what this factory is a great big tuna canning plant. I think it may be the largest in the world and those are very probably members of the - they look like it - of the big world sweeping San Diego tuna fleet. Anyhow, I have no data, all I've done is look at these pictures and I can't say "Ah, that factory is throwing out lots of filth," but it's pretty dirty around there, anyhow. I think that these plants are kicking this stuff out into the water. I don't know what that is, but it's somebody's debris from somewhere. And that I think again is (garble) molasses, from a runback. I can't see each of those individual things in here. The resolution isn't great enough. And so - but in larger cases of manmade pollution, I think Skylab has got enough resolution to spot them pretty easily. May we look at the next one over there, please. Now, we're beginning to get into combinations of the several different things you can see on this imagery. That's what I think of as molasses. It looks like it, whatever it is. And this is river sediment mixed in this little area here. The next one over there, please. Now looking at the same area - the planes flying here were looking up the coast that way, that's that land on the right. Town of Mayaquez right over here. Here's rivers - end of my leash - here's river sediment from a small river coming through the town. Here's molasses, whatever it is and wherever it's coming from. Here's the stuff coming from the fish pack plant over there. There's the big river called the Anas. So there, putting out a big cloud of stuff. Elements of this are visible here, certainly the big river there. The small river there, I can see. I don't happen, as I said to be able to see that pollution, but, the big crazy thing in here is this blue area and at the outset I'll tell you I don't know what it is, but it doesn't belong there. We've seen bisymmetry - this - this by the way on this picture, that's a good piece of bisymmetry. We can differentiate it by taking the S190A, you know it's got 6 cameras, it's got straight color, infrared color, and four black and white presented slides, because it's got green, red and two infrareds I think. We can differentiate one thing from another. We can watch different colors separations, make this appear and disappear and so we can tell what is muddy water from what is bisymmetry. I think rather easily and neatly, although, I'm not very good at it yet. We've got a combination here of bisymmetry of muddy

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water, of what I think is a combination of both there and a great big dark blue mystery. May we look at the next slide, please. Here, again at the Rio Grande Anasco but we've got three kinds of things. Muddy water, molasses, and out here in the distance we're beginning to get into an explanation of this mysterious dark blue slick. That is differential sun light reflection, that land there looks - this isn't anything over here that I can tell. That may be a cloud shadow indeed but this over here is an avenue of break in this reflective layer. I think it was - a thin organic slick on the surface of the water. And that is what I think is causing this very unusual phenomenon here. Hit us again over there, will you please. Is that them?

SPEAKER Yes.

SPEAKER So, about this blue anomaly, that would ordinarily say clear deep water, well it's not, the water there is cruddy, it's rather shallow, and that's not just blue ocean water you're looking at. I have a hunch that what it is is perhaps man aided slick and organic film on the surface of the water maybe coming from the fish plant. Maybe it's fish oil, I don't know. After we get good enough at this I think we'll be able to look at something like that and say, "Okay, let's look at it at a few different frequencies" so will you change this one, please? Here's same area same picture in green light that piece of - I'll guarantee is good by symmetry down there in clear water, that clear water is sweeping up from the Caribbean this way so we can still see suet - through it here it's all gone muddy up here. The dark blue area is still there. I'll show you red lights, visible red, please the next slide. The -

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TRUMBELL - - sweeping up from the Caribbean this way, so we can still see through it here until it got muddy up here. The dark blue area is still there. I will show you red lights, visible red. Please the next slide. The blue area is still there. It is always there in every frequency as a matter of fact. That piece of bottom - I've forgotten whether it was there or there, that bottom asymmetry is gone now. And so we can say, okay, if it's on that other frequency, if it is not on this frequency, it's the symmetry. Some day I hope to be able to say if it's on everything, it's fish oil. Could we look at the next and last slide, please? I can't tell the same area. This is infrared, nonvisible red. I can't tell here that it's darker there than it is elsewhere, but under a microscope I can quite easily. So, thank you; you can kill the projector and come up on the lights. That is about all I had to say. I think this is an example of some of the things that (garble).

PAO The lights, please. All right, at this time we'll proceed to Andy Benson of the University of California, at Berkeley.

BENSEN Thank you. The data that we are getting from the EREP package we're analyzing with respect to the vegetation resources. Our organization, which is the center for remote sensing research, University of California, looks predominantly at three vegetation resources. May we have the first slide, and the lights?

PAO May we have the first slide, please.
BENSEN Anyone who is familiar with California, there may be Californians here, this is a portion - this is northern California. There is, there was - here we see Sacramento, Orville Lake. And here are three very important vegetation resources that we have in California and perhaps in the world. Of course the most obvious one is the very regular geometric pattern of agriculture. The Statistical Reporting Service of the Department of Agriculture spends 21 million dollars, at least that's what they were budgeted for in 1973, to inventory agriculture, this is throughout the United States. This 21 million dollars is matched with about 10 million from the state. The types of inventories are done by a sampling routine, and rely mostly on ground enumeration. The second resource I would like to talk about you see mostly now is under clouds, this is the forestry resource. The forestry service spends about 3 million dollars a year inventorying wood. Every 10 years they publish an estimate of our forest products that are available throughout the nation. However it takes them about 8 years to collect this kind of data, 2 more years to put it together. So by the time your 10 year report comes out, most of your

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data is probably pretty old. The third resource, and it is probably not very visible because this frame was taken on June 2 is the rangeland. And I would like to come up with some great figure on how much money people spend to inventory this, but they don't have it available, at least I can't find it. The point is at least in California half of your beef cows spend probably about half of their life on the range, a very vital resource. Well, I have spent a lot of time talking about how much money spent to inventory these particular products. And this is what we think, and we're pretty sure, is going to be the real cost benefit that you are going to get from any Earth orbiting satellite system. If you can get a satellite system looking at the Earth with the optimum sensors, then you can cut the cost of inventory and probably the accuracy of the inventory very markedly. Now the technique of what is called discriminate analysis and multistage sampling. I see, this is going to be very useful on this, is a combination of what is called discriminate analysis and multistage sampling. I know those are some pretty powerful words. There is nothing terribly original; statisticians have been using them for a long time, but until recently with the availability of satellite data have we really been able to apply satellite data as what we call driver for sampling. Now let me cover discriminate analysis first with the next slide, and this will probably - this really gets into what Dr. Wilmarth was talking about on data. Now I would say we need the optimum - -

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BENSEN - - (garble) satellite data is what we call a driver for sampling. Now, let me cover the (garble) with the next slide and this will probably - this really gets into what Dr. Wilmarth is talking about on data. I would say we need the optimum channel to get the best sampling sheet. Say we had one channel, we have poor vegetation type. This is a frequency of the safe intensity as appeared on one channel. Now, A, B, C (garble) looks like we can sure pull out vegetation type B with not much problem. But in A, B, and C, particularly C, you have a very difficult time separating it out from any other current or vegetation. Next slide. So what we do is infold another dimension. Well, let's look at the density in red, the density in green, so we start getting our islands. Well, B still hangs out really great. B and C are cer - still a lot of confusion (garble) occur here. And A and B, while we'll be probably 90 percent of the time (garble) we can separate the two, we're still going to have a lot of (garble) in there. So, the third - Next slide. Well, let's add another dimension. So here you see - now we're starting to get (garble) are really beginning to separate out. The - we've got a red, infrared and green. Now, this is just a very simple example. And in a lot of cases four channels will work fine. In agriculture sometimes we need to add an additional dimension, such as time. So say if you have a whole 13 channel of multispectral data from EREP, that might not even be enough to separate off particular crop dust because they look so similar. Throw in another dimension; throw in time. Look at it two months later and you can probably pick it out. But the point should be that you have to look at these individual channels very carefully to find out which ones are going to be best suited for your purpose. Right now with under Earth you only got 4 channels to look at. The main thing we haven't been able to look at is the thermal band/ And hopefully the thermal band will reveal - give us a lot of information as the identification of crops and vegetation for rangeland resource. Next slide. All right, now, under the second subject of multistage sampling. Here are the first stage of the multistage samples for any vegetation resource, and for that matter perhaps even water dense - water quality or anything using space imagery is what we call stratification. In other words, you take a human interpreter and sit down and draw lines around what we call homogeneous blobs. Very scientific isn't it. Well, okay here we have - this is S19A imagery of the area we saw before. And, okay, say we want to look at the forest

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resource; no problem at all. But if you look at this screen there's an awful lot of stuff we don't want to look at and we don't need to look at, and if you start looking at how much computer type cost, we probably can't afford to look at. So, the first step is, well, we look at forest resources we could probably draw a pretty good line, just right about down here and say well, we'll only look at that area up there. And maybe a point in passing right here: We've got these two different image type here, coloring infrared, and here is the Ektachrome. We have found for vegetation resource analysis color infrared there is generally more helpful than what is normally in higher resolution Ektachrome. This is our experience. Next slide. So this is a portion of that black infrared - color infrared slide, and we decided to go one step further. Remember, we were looking for forest resources and here we go, we're using - we want to sample the forest to find out how much timber we've got there. So, again we use this imagery as the driver tell us where to collect our samples. Now, - you can - most of you right can see there's some areas here we don't particular want to look at. There's no point in looking at Lake Almavore. Well we can't look at these areas, unfortunately because they're under cloud, but (garble) interpreter say well, all you see is (garble) red spots. Well, I see the indication of very large vegetation. This is probably a wet meadow. These areas particularly up here is (garble) in close proximity to (garble), while you're - 99 percent sure that is going to be a meadow land in a sense where in this example you're looking at timber resources, let's just take it out and not bother to look at it on the S192 data. But we do have a lot of (garble). Here we can - -

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BENSEN

- - and since we're, in this example, looking at timber resources let's just take it out and not bother to look at it on the S192 data. But, we do have a lot of (garble). Here we can probably classify this and say it looks pretty barren and in this case it's low-density timber and a person familiar with the area can do a very credible job of trying to find out these homogeneous (garble) and identify them as to what his primary interest is, whether it's timber, whether it's agriculture or whether it's range-lands. Next slide. Well, one of our people got a hold of that imagery and this is what he did with it. He - you can see a bunch of lines here, a bunch of grey symbols. I don't know how he ever came up with this. He was looking - he was mapping all vegetation there. But for the purpose of timber inventory he didn't find anything that has a B in it and a V, a B and a V. This indicates the presence of one type of camera. The other thing happens is the other extreme types of vegetations such as (garble) or meadowlin, and here again we (garble) the CX up there. Okay, that's right up there, that's water. But anyway - so the idea on these samples - on these multistate samples is now we'll digitize all of these areas that have B's in them in one form or another, and we will then digitize them and put them on computer tapes so when we in turn get our S192 data, which we've got (garble). Right now, you won't have to go through the entire area. We can pick up these specific areas in which to do our analysis. This is part of the point we've got now with our Skylab experiment for today. The - and right now as Dr. Wilmarth says, we're working on the analysis, this number (garble) on the S192 data to find out what's going to be the optimum channel in order to run this analysis. But I'd just like to give you an example on what - where we go from here means that this is what we have done with ERTS. We've done it very successful with ERTS but you've got to remember ERTS has very, very broad bands of sensitivity bands, and again the main one did not have for thermal. So, what - I'll show you what we've done with ERTS and think that we're going to do the same thing with (garble) chosen bands of Skylab and then we'd get a good comparison due to this specific narrow bands of data really help. Next slide. Oh, excuse me. Let me back up just a minute. Here this is a comparison of what the photo interpreter did on Skylab data. This is the same protical in which he had made about 6 months earlier under ERTS experiments to make a ground truth. Now,

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if he used the very small scale, 1 to 120,000 imagery was taken from an Army 57 aircraft. Now, as you can see there's a lot more detail here. If you really came up and looked you can see that not only did he have the letters down here, he also has numbers qualifying the relative density. While this is a great deal more detail it took him about 2 hours to do this; very, very quick. This he probably spent about 2 weeks on. The reason is the two weeks to cover this area which is - this is (garble) about 300 square miles, you're talking about a stack of photos that's about a foot thick. The - just a shuffle through that many photos is a very time-consuming job. So, while we're not - don't have the detail up here as we do down here for the purposes of multistage sampling combining it with multispectral scanner tape, this is more than adequate. Next slide. Now this is what we've done with ERTS and we'll do the same thing with Skylab, so we'll go through this very rapidly. Here is the center of a watershed that was delineated on - on an ERTS image and you can see these holidays, those black areas. Those are areas we're not interested in. These happen to be - we're one of the inventory in this case national forest land this has to be private holding. If you see areas that are orange those are nonforested areas. Areas we take out on the imagery, areas we will not have to look at on the scanner tape. So you can see we've really become very efficient when we start playing with the (garble). The - and if you look very closely, it's not evident really on the site, you can see different levels of green. So what the next step is - okay, we take this image and we're going to take a sample, a sample of the green area. Next slide. Here is the sample of this alleged green area. Well you notice we still have some orange in here which is nonforest area, we don't particularly want to look at that. You can see, if you've got good eyes, three levels of green. The three levels of green represent three different density levels of - .

END OF TAPE

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You can see, if you have good eyes, three levels of green. These three levels of green represent three different density levels of timber. These density levels were determined on high resolution aerial photography, and then used to train the scanner, train the computer to look at the scanner data and that was the final result (garble). So again we're looking for a driver. Okay, we want to sample this area again. We want to sample the area of course with the highest volume of timber is so the biggest chances of picking out the area that has a high probability of being sampled are only the very dark areas, which have higher timber. Next slide. Well, here is how we go with sample. We go fly down there in a small aircraft, and again you happen to be a stereo triplet (sic) I'm sorry you're not (garble) these photos. Okay, again we have a series of these, a photo interpreter, excavates relative to timber density, and then we sample again. Next slide. We get down even further on the deck and this gets pretty exciting on a small aircraft, let me tell you, to get these really large-scale photos. But you'll - here, now here we can really see individual trees very well, very well defined. We can with various measurement lenses make the relatively good volume estimates of individual trees by measuring their tree crown, crown size and their height. So, again this is the other stage of the samples, you see now we know individual trees, individual tree forms. We again select from a series of these photos individual trees to go down and measure. We are not as good as MR. Swap on (garble), we've got to get down there and measure the tree. So we will go down and measure the trees with a very precise measurement instrument. Well, this seems like an awful lot of work, but preliminary with ERTS let me get with that was with ERTS - We looked at 215,000 acres. The area we sampled was .001 percent of that. It took us about 2 manned weeks to select the data and go down and visit these individual trees, and this (garble), but the estimate was as good as and probably a little bit better than the ones the Forest Service has. Forest service has two three-man crews out there looking at the area all summer long. They do this every summer. We figured roughly that if you considered the space imagery, and I include imagery and data take at three, the cross status is about 100 to 1, comparing this multistate sampling system. If we are willing to pay, say 15 thousand dollars per image, the savings still come out to be about 50 to 1. So this is with ERTS. And I think if your discriminate analysis is better: # # We're getting about 90 percent accuracy on this, you see if you can get even better than the 90 percent accuracy. The number of visits that you are going to have to make to the field, and I think we have to emphasize, that is the expensive on part of this

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sort of thing, is getting people out into the woods and having them run around and look at trees. If you can get them up to, say if you can get your discriminate analysis up to 100 percent accurate why you have to have a man go out and look at one plot just to verify it. But your cost, your cost efficiency, I have no way to really estimate what that would be. So if you can choose your proper channels, and that is what we hope to get in Skylab, we're going to run through this same exercise, I'm going to be able to get a real good feel for this (garble) sensors for inventory. Notice we bring back the same technique, we used it here for trees. There is no reason why we can't do this to range land, no reason we can't use it for agriculture crop and crop production, and I don't think there is any particular inventory you could not do using a technique such as this. Thank you.

PAO

May we have the lights on please?
We are coming right on schedule, and Dr. Milazzo has not arrived yet. I think at this time before we start a Q and A, I would like to ask Dr. Wilmarth to discuss eyeball observations for the next Skylab (garble).

WILMARTH
One of the things that we initiated in SL-III was to try and determine the kinds of information the crew could observe various features of land, ocean, as well as the - -

END OF TAPE

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SPEAKER - - was to try and determine the kinds of information the crew could observe various features of land ocean as well as the atmosphere. And we up-link to the crew a series of questions to observe various types of phenomenon As a result of some of the results - the results on Comet by the SL-III crew, we initiated a training series by experts for the SL-IV crew. We have given them approximately 20 hours of training in diverse subjects such as volcanoes, ocean currents, cloud features, geologic features, vegetation patterns, cultural patterns and the life. And as a result of that, we have put on board a book, which will be available for use of the press in Houston. Here is a copy of the book. The book is approximately that thick. It has the features to be observed, kinds of photography, the kinds of observations the crew should be doing on SL-IV. The photograph or an illustration of the feature of the area for the crew to be able to look at and to study up on a up-link or a planning session on the night before. So, somebody will ask, "Well, why are we doing all of this." And it's real simple. We are trying to determine for use in any future means, manned spaceflight program, how much the crew can observe, what kind of data they can obtain and other words what's the envelope of their visual observations. What can they obtain in the way of scientific information, factual data, serving as a screener, a discriminator for taking obser - taking handheld photography. Then as we get into some of these other manned missions, farther on down the pike, we will be able to identify the kinds of photography, the kinds of observations that the crew can be making. So, it's a experiment, we hope to have the crew as they come back from SL-IV to work with the individual investigators, which are not all EREP. There're certainly a few of the EREP investigators involved in it, but primarily to be working with the on-going science programs, such as those in geology, such as those in vegetation patterns, agricultural inventory and things like that. So, the book will be available in Houston, for use by the Press to see the kinds of features that we hope to have the crew observe, photograph and describe.

PAO Okay, if you'll wait till we can get the microphone to you. We'll take your questions. While we're doing that I'll make mention that we have in our audience today a couple of people I'd like to identify. One is Jack Waite from Marshal Space Flight Center. He is the manager of the Experiments in the Skylab Project Office there. And we have Scientist Astronaut Bob Parker, the Chief Scientist for the Skylab program, who is also with us here in the audience. Okay.

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QUERY

Dr. Wilmarth, those eye-ball observations have to be pretty gross. Don't they, because of the speed -
WILMARTH Certainly. But one of the things that we
You're perfectly right on that, but one of the things that we
will have of course, is repetitive overflights every five
days, come back and look again and do the same kind of
observations depending upon the cloud cover and things like
that, but as I say an experiment to determine how good the
crew can observe and what kind of data they can obtain.

QUERY

For Dr. Bensen. Now, do you foresee a time
when the computer is going to be able to interrogate it's
own tape, make its on discreets and eliminate the on-foot or
whatever human verification you have to go through. Is it
possible to get it fine tuned that well, where you simple
ask it over a given area how much white sine is there and you
don't have to go down and look?

BENSEN

Well - -

QUERY

I have a second part to that, too.

BENSEN

I don't foresee (garble)

SPEAKER

I'll give you this other mike

BENSEN

I don't think you ever going to be able to
eliminate the man on the ground. Maybe I'm being narrow
sighted, but I think you can sure cut down the number of
visitshe has to make on the ground and more efficiently allocate
directions where he should be going. This is probably the
greater thing that aerial photography in general you see has done.
Just tell them where to go look. And so the higher, and
higher (phone ringing) you get and the better your analysis
gets the more efficient use you can use of it.

QUERY

You mention the money savings or at least
the potential spending the 21 million the USDA has for it's
inventor - -

END OF TAPE

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BENSON

- - that you can use on them.

QUERY

You mentioned the money savings at least of the potential spending the 21 million the USDA has for the its inventory, another 10 million from the U.S. Forest Service.

BENSON

Excuse me. The Statistical Reporting Service was funded - was budgeted for 21 million dollars. This is matched by 10 million dollars by the state. This is just for agricultural.

QUERY

As a political practical matic (sic), do you really believe those agencies are going to give up that money in their budget and fire Smokey the Bear, and give it all to NASA for stuff like this, really?

BENSON

I don't know if I really want to answer that question. Yes, okay. I think if we can prove the real utility of this, particularly with the Forest Service who's had - hasn't been able to hire as many men as they need, and their increase and need for knowledge with this, what would you call it, is what we can call a logical ecological awareness. If they are not going to get any more people to do the job, they have got to still get the job done plus additional work, I think this is going to be the only way they're going to be able do it. And they are going to almost be forced to come around to it. I don't - i'm really not aware of the political ramifications of this. We do all of this work in a nice irory tower, and then with the exception of the work that we have done with the Forest Service, and some of the work with California crop and livestock people. A lot of people in the Forest Service are very very receptive to this particular technique, but I don't know what goes on back in Washington. Maybe I don't even want to.

WILMARTH

Let me tee off on this just a second. You're right, you know the history of technologic inovation the nation is, that when you learn to do something more efficiently, you keep right on doing that. The agencies don't give us their money, they put them into something else. We've never had a wholesale reduction in the cost of government yet. But we are not worried. We personally are not trying to reduce the overall cost of the government. We're trying to find a way of doing useful things more efficiently. And each guy tries to do his job more efficiently and we turn off the lights when we can, why, it ends up to the better of the whole business. If you want to cut down the cost of government, you have to (garble) the pot. The people who aren't doing an efficient job, and get them out of there. How about that. Is that a good Washington answer?

QUERY

Dr. Wilmarth, that eyeball experiment sounds very much like an input from the DOD. Is that true?

WILMARTH

No, it is not.

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QUERY They have no interest in it at all?
WILMARTH I won't say that they don't have any
interest, but it was not a DOD generated experiment at all.

QUERY Have they jumped on board?

WILMARTH Not to my knowledge, they have not.

SPEAKER We haven't looked at volcanos you know.

QUERY Going back to a line of questioning in
the last Q and A period, except for this eyeball experiment,
have you found a reason to have men operating these experiments?
You said that this is an evaluation program, ERTS versus EREP
with different kinds of channels. I haven't discerned anything
in all of this discussion that says you have to have a man
turning on all of those switches.

SPEAKER That is a complex question. As you well
know, in 191, the man does operate the infrared spectrometer
for a specific signature definition of targets so that the
man does operate that. I think that as we look at SL-IV,
we're going to try to use the man to determine the - when such
instruments such as the optical are to be turned on, because
we have found that if we go on weather forecast that sometimes
we do not have an up date - up to the minute type forecast
when we do our flight planning. So we are going to be looking
to the crew to - in their roll to tell us, or actually, to
be able to turn on or turn off some of the sensors within a
given time frame in order to obtain better or less pictures
of clouds. Let's put it that way. So we will be using the man
in the crew in that sense. That is a specific that I can refer to.

QUERY When you get all of the Skylab data in
obviously you are getting good - -

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SPEAKER

- - specific that I can refer. (garble)

QUERY

Okay, when you get all the Skylab data in and obviously you're getting good data and is very useful, plus the ERTS data; how is the evaluation going to be made as to how you go in the direction of Earth Resources surveys? It - surely Johnson's Space Center is not going to make that decision.

SPEAKER

Certainly you're right, Johnson Space Center will not be making that decision but we will have a responsibility to define the utility of the EREP sensors and how they have performed in different environments and for specific proved tasks and therefore to give an input onto the utility of the sensor with the 13 channel, a 4 channel and which specific channels, and how good is the film returned for color IR or color versus black and white. And the utility of that kind of sensor will be an input as we learn from the results of the U.S. data analysis. That will be a definitive input on any future spacecraft sensor compliments.

QUERY

Another thing is that there's a fairly high level committee that's in Washington that consists of people that are essentially under secretary level and all of the interested departments of the government. And this committee will probably be the one that gets the guide lines to many operational satellites that takes place. Now, you recognize that NASA does not have operational satellites. As NASA does experimental work at least through operational satellite and just as in the communications business. We - some other agency runs the operational satellite. Someday you could expect that several agencies will have ERTS survey satellites in orbit doing their particular thing and tailored to their particular thing. Although, at the present time, as far as I know there's only one preliminary operational satellite in the overall 5-year plan; I guess the 10 year plan.

QUERY

To follow up John's question again just a little bit; would you have learned more with the EREP sensors if you had had them in a very sophisticated unmanned satellite in polar orbit Sun-synchronized?

SPEAKER

Might have; might have. But right now we don't have - didn't have the boost capability to put an unmanned satellite into - into that orbit of that size. You know, having a Saturn-V rocket handy helped us put the microwave sensors up and then legislated out how to put (garble) on a (garble).

QUERY

Well, I think the thrust of all of this is leading us to asking you the question that seems to be

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obvious out of this discussion. Are you saying that these types of investigations will not be applicable to permanent space stations in the future that we should just consider manned out of the picture as far as this is concerned. We should stop thinking about man as a - as a part of this type system.

SPEAKER Now I really don't think that's true. And I - everytime we have a discussion we always talk about the manned versus the unmanned. And I believe that there is a pattern beginning to arise right now that, among other things, is a secondary product from Skylab. And that is that there is a way of getting great productivity out of a space station type of device. It's quite obvious that you don't put a space station up to do a simple job like looking at the weather every day or every 5 hours. And the productivity - now, we talk a lot about Skylab being an experimental space station as wanting to find about space stations and various kinds of investigations, that the productivity of it has begin to show us that this is a facility that can this type facility can do an awful lot of things for an awful lot of different areas of investigation. And there's no doubt that there is a place for both manned and unmanned. I think NASA has got themselves into a position where we all firmly believe that each has a place and it isn't a contest anymore. I don't know that everybody believes that, NASA believes it.

QUERY I want to turn to a technical and a political question. The resolution of the photography and data coming from EREP, I've - -

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SPEAKER - - the resolution of the photography and data coming from EREP - I've heard various figures that the closest resolution is 100 feet across and according to an astronaut interview I read recently down here at the Cape or Coco Beach, 6 inches across, and I wanted to know. Exactly what is the finest resolution of EREP senses can come up with then on the political side, well that would seem to have great political implication to me. Especially since the data goes to PIs in certain countries (garble).

SPEAKER Well, of course, let me correct one thing. Six inches is not correct. I think that we can identify, certainly with the 190B, the high resolution EREP terrain, or the Earth Terrain Camera. Objects and those photographs that are in the neighborhood of 20-30 feet in a dimension we can identify. You can take a look at the photograph over the - downstairs and you can identify, look for yourself, the kinds of objects you can see in that, just a blow up of standard color 190B frame. So, we can identify things that are in a range of 20-30 feet, if they are high compress. But, not six inches, man, that's a real fine camera (laughter). I agree. We don't have that one.

QUERY How many camera do -

SPEAKER Well, I will pass that question to (laughter) somebody else. But politically I don't know what you're talking about except that those are the kinds of things that we have seen.

SPEAKER Okay, in relation to the victims, I'm glad that's cleared up because that shocked me when I heard the thing.

SPEAKER You're not gonna sit on that (loud noise) (laughter).

SPEAKER But, as to the political side, since the data goes to PIs in a number of countries as well as the U.S. and when it's public releas - publically released, it's available at the same time to all sorts of industries, whoever wants the information to use it. What I'm getting at is the political implications of how it might be used. Now, let's say PI in another country would link up to well some major industry that has an interest in another country for example just hypothetically speaking. One country interested in oil coming from an area of Saudia Arabia and their company finds before Saudia Arabia finds it another let's say oil location they send their people out to buy that land or something. What sort of ramifications could this have, right now we're just talking about well insect manifestation and improved agriculture, but what about the politics of it? Discuss this

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or is there a -

SPEAKER

Oh, yeah. -

SPEAKER

- - review coming up?

SPEAKER

Well, all right. It's obvious you can invent political ramifications and so can we Ed, you recognize that we put all of our images in the public domain, before we give them the principal investigator. All images are in the public domain so that it's available to anyone. That's the first thing, that's the most - that's the primary thing to do to get around the political question. The question of one country finding out about resources in another country has been taken up in the UN and it's still under debate and it probably will be for years. However, there's no restriction on the way NASA is operating with its sensors in taking pictures where we have people who want the pictures and putting them all in the public domain and let the chips fall right there.

SPEAKER

We'll take one more question at this

time.

QUERY

I have a series of three parts to this question. I'll address the first to the last speaker and the third one to Dr. Wilmarth. During your brief you threw up a slide that showed a map that was made of a forestry area from the infrared region and some of these

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QUERY Some of these areas had, oh, maybe a four letter designation such as BB, BK. And I was wondering were these differentiated on a basis of several - three dimensional analysis as you showed in the previous flight as opposed to just a frequency distribution? Were these overlapping frequency distributions?

SPEAKER This was - that's the - those initials were just a - the relative present of particular vegetation types just on the photographs, just by appearance only and by the photo interpreter's experience with the area.

QUERY He could identify the infrared, the four types.

SPEAKER Three or four types.

QUERY They were clearly visible then?

SPEAKER Yeah. Well, - I think we should say they were clearly visible to him.

QUERY To him I should say.

SPEAKER Yeah, because the fellow is very - you know, he's interpreted the area on high flight. He had done it on - he's looked at the same stuff on Earth so he does it on this. You think this might be cheating or something and giving you a false idea of just how good the imagery is. The way we look at it if you're going to use a system - a system of this sort of sampling, the person going to be doing the interpretation is going to be someone who is pretty familiar with the Earth.

QUERY Do these, for instance, in that one particular block, do these four types of vegetation occur frequently in association with each other?

SPEAKER Yeah. This is another thing.

QUERY So if you find one you're -

SPEAKER Yeah.

QUERY Yeah.

SPEAKER And he also had available to him you see, you know, get all kinds of things available like if you've got a map with elevation, well, you know, if the area you're in is over 6,000 feet you're pretty sure that stuff up there is maybe red fur and it's probably not conversed inclined. So you could - we shouldn't say that the interpreter just looks at the image, he looks at any of the stuff that's available really to give him this best estimate of what is there.

QUERY Okay, now, there's one question that pops up to my mind and surprise me but; it seems - it's my general impression that perhaps the Skylab in Earth's imagery is redundant when used in conjunction with aerial imagery. Because - I would think both would be mutually

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exclusive. You wouldn't have to get - to put a man in the field or fly over a particular area even for a random sample analysis.

SPEAKER Sure you - for a random sample you wouldn't. But if we have time for about a four hour short course on statistics we could probably show you that random sampling is not very efficient. If we random sample we're going to throw a bunch of samples that might be out in a meadow. And to be real true and honest we still have to go out there and say right there's no trees out here. What we do with the space imagery though is we use the space imagery as a driver. We will go to that resource of highest value that we're looking at. We will make sure that it has a highest probability of being sampled. This is what we mean by using space imagery to drive the samples, and it comes out giving you unbiased estimates and very good estimates and really reducing the number of field visits that you have to make. If you just want the random sample, there's no reason at all why you even need aerial photos to take a map out there and throw down your dock. But you're going to have to throw a heck of a lot of dock to get any kind of near the same accuracy level.

QUERY This question is directed to Dr. Wilmarth. I'm not real familiar with this particular aspect of geology but it seems that the main thrust of this imagery has been directed toward environmental geology, and I was wondering if it was - which is a fairly new field. I was wondering if it's been able to refine other fields of geology. For instance, structural geology, have we been able to more clearly understand some of these enigmatic cryptoexplosion structures we find across the Earth.

SPEAKER Certainly we have used some of the EREP imagery to look at such things as cryptovolcanoes, some of the rain structures, calderas and things like that. And we have identified several of them that have previously not been identified or located. So we have used this in a screening method, but we have not gone out and actually done mapping relative to newly identified circular or caldera type structures. So, yeah, we have done it. And as we get more and more familiar with this kind of information and this kind of synoptic photography we're going to be using it a lot more because it has a very definite advantage to - over aerial photography certainly.

PAO Okay, at this time we'll move along to our next item on the agenda. Because some of our Apollo telescope members are not here, at this time we're going to have a discussion of the status of the student experiments

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on Skylab by Charles Cothran of the Marshall Space Flight
Center, the Student Science Advisor at Marshall.

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**SKYLAB NEWS CENTER
Houston, Texas**

**SL IV - Press Briefing
Johnson Space Center
December 20, 1973
10:08 a.m. CST**

Participants.

**Dr. Dennis Morrison, Principal Investigator for Gypsy Experiment
Bob Gordon, PAO**

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PAO We have with us - boy, got a lot of awful hum in there, Art, check your clothing when you leave out for moths. Okay, we have - We'll run this TV from yesterday of the gypsy moth exper - -

SPEAKER Will we have the (garble)?

SPEAKER No, we're going to turn it.

PAO Okay, here we go. We'll let Dr. Dennis Morrison describe the TV and answer any of your questions on the gypsy moth experiment.

MORRISON Is this the entire sequence?

SPEAKER Yes.

MORRISON Okay. This particular video coverage was done actually in three segments. One segment was began (sic) and the TV recording did not occur properly and it was reran. This is the second portion, then it was broken off part way through and the crew had to - had an expedient test to take care of and they came back later and went ahead and finished it up. And basically now this is the narrative that came down.

SPT - - of gypsy moths, one is tamed and one is wild. That means laboratory produced and one for the wild. The objective of having these along us is to see if we can prematurely induce by having them in zero g, a production of a moth or diapause hatching on the egg.

MORRISON That's in breaking diapause, actually, is what he's referring to as hibernation phase.

SPT The normal hatching of these fellows that I'm holding right here on the ground - -

MORRISON You'll notice that he's taking the vials out of the little baggie that we had them in. And they screw caps on there and the (garble) plugs we have in there keep the moth eggs from getting out.

SPT We have in the wild essentially five to six moths which are visible and perhaps an equal number of partially hatched or partial emersions from the eggs. Now if we can find a way such as use of zero g for prematurely inducing the hatching then this opens up a way of - of producing them in large numbers and understanding just what some of the mechanisms may be. It will greatly aid the laboratory rearing of these animals, or moths if you will, and enable people to introduce large quantities of sterile moths which can be used to decrease the moth population where they turn out to be a great nuisance. What I'd like to do now is move in a little closer and give you a closeup view as close as we can of the eggs and some of the moths. These eggs turn out to be about the size of poppy seeds. And even with your eye right next to the vial they're pretty hard to see. But we'll put a closeup lens of TV and give it a try.

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SPT (Garble) the closeup view, and they're (garble) on our 85 day flight. It's not much but it's all we got. On the top of the screen is a vial containing the same (?) moths or larva, those which are bred in the laboratory, and then the regular ones which are wild. The ones on the right are the - excuse me, it's - it's on your bottom. The one on the top is tame, and the one on the bottom is the wild. The ones on the bottoms are the ones which have hatched. A relatively small percentage of them have hatched, but still a significant quantity. There is about five or six which have fully hatched and have been out crawling around or have ceased to a crawl, and the other five or six are partial emerging. That is, they've come part way out and that's as far as they got.

MORRISON There was no provisions for food here, so that we didn't expect the larva to continue. And they only last a couple of days without food.

SPT The large aggregate right now is right behind the tape. We're trying to get it to the bottom there. Now on the bottom of the tube, and you see this is in contrast to the ones in the vial which have not hatched at all. They're spread pretty much uniformly like you'd expect poppy seeds to spread out. The aggregate comes from - -

END OF TAPE

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SPT Try and get it to the bottom there. Now on the bottom of the tube, you can see this thing contrast to the ones in the vial which have not hatched at all. They're spread pretty much uniformly, as you would expect poppy seeds to spread out. The aggregate comes from those which have hatched and are crawling over their potential brethren and those who are just partially hatched. They all tend to stick together, even in a world of moths.

MORRISON The reason for that is that the little moth larvae secretes a silken like thread. In fact, it's distributed in nature through work by winds that way, riding the silk thread much the same way as spiders do. And in this case, the silken thread is going together and forming an aggregate of the eggs.

SPT And I'll have to be fairly meticulous here about trying to give you a reasonable focus. So just bear with me until I get all the way zoomed in here. And we'll try to move this so we can get you a reasonable picture. Okay, at the right side of your picture is the top of the container and we've got some cotton down in there. Now there's one which is on the cotton, but I'll have to rotate the vial for you to see it. So bear with me and I'll have it right back for you.

MORRISON Larvae in the egg shells are fully developed embryonic larvae and when they come out they uncurl, so to speak, and therefore about twice the size of the egg they were in.

SPT Bit bit the dust about 2 days ago, or ' the cotton, if you will. I guess, to me, with the resolution I have on my monitor it looks just like two eggs stuck together. But it really is a moth which has emerged. And now maybe I can give you a little better view of it. I think we had some eggs which were right in front of it. And it's right in the center of your screen. Unfortunately the little guy is right in the edge of the vial there where the light transmission is distorted. And we'll just go right on down the vial and see if we can pick up that aggregate and I hope your resolution of your monitor is better than mine. I'll just leave it on here for a while and - They're in that aggregate. Maybe you'll be able to see a few.

MORRISON We do have 35-millimeter close-up photographs to bring back, at least, and we shall have some of those here. And it really doesn't effect them, agitation, vibrations, things like that. At least they've tried that in the laboratory to try and get them to - Actually they tried many things and nothing has worked. So we really aren't too alarmed. They're terribly (garble)

END OF TAPE

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SPT This certainly has provided a little bit of derision for us. Done an awful lot of good Earth resources recently, solar observations. Learned a lot about ourselves medically, and in general.

SPEAKER If you look closely you can see at one point there you can see one or two of the little white collars.

SPT And doing a lot of maneuvering all on 2 CMGs. So life has been interesting in this has just been one - one additional feature. Hope you've enjoyed seeing it. Will keep you posted on what happens. So long for now.

SPEAKER Are there any questions?

QUERY Yes, several. First of all the only ones that - that are reported hatched are in the wild container.

SPEAKER That's correct.

QUERY Now since they were collected, I guess in natural surroundings, what's to tell you that those five or six or 11, even counting the partially hatched and all, weren't, say, laid early, or - or say in a time period early enough that it's just their timing or is their incubation period erratic enough to allow, say, 10 or 11 to hatch much earlier than the others?

QUERY Okay. There's two considerations here, and number one, we have, of course, at best guess at when this diapause phase actually began. And indeed the wild ones are probably about 6 weeks into the diapause phase farther than the tame ones. We know exactly when the - the laboratory reared ones began their diapause. We feel that that diapause phase probably began somewhere around the first of September. Normally in the wild conditions you would not expect more than 1 or 2 percent to hatch out over the entire 5- to 6- month diapause phase. And actually that 1 or 2 percent would probably happen closer to the end of the 5 or 6 month. Here we have hatching that is essentially 3 months into the game. The second consideration is that there is a possibility of inducing an effect and - by simply bringing the wild eggs into the laboratory. Usually what happens then is some 3 or 4 months into the game you do get a small amount of hatching over about a 6 week period, maybe 2, maybe 5 percent hatch out over a 6 week period. But none of the rest of them ever hatch out. So that the bringing them in does alter them. You don't see this burst of activity like we've seen of at least some 2 percent now within just a few days. None of this 2 to 5 percent that might hatch by bringing them into the laboratory would extend over about a 6 week hatching period, but the rest of the 95 to 97 percent

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or 98 percent would never hatch. The controls, as of this morning, have not hatched at all. So we don't feel that this bringing into the laboratory, that effect is really playing a factor here now. Statistically we're still on the border and we have to see more hatching before we can really say - pronounce that we've had an effect rendered by the reduced gravity. But it certainly looks promising at this point.

QUERY Now you were saying that 1 to 2 percent hatch out over the entire 5 to 6 months diapause - diapause.

SPEAKER - diapause. You mean to say 2 percent hatch out the whole time and none others hatch out at all, or do the others hatch out at the end?

QUERY The others hatch out at the end.

SPEAKER Oh, okay.

QUERY In other words, you only get a sprinkling of hatching before the - the end of this diapause. At the end of the diapause, within the last 3 weeks, all the rest of them hatch out. So we essentially get maybe 1 or 2 percent that hatch out somewhere approaching the end of the 6-month period and at the end, essentially in nature when it's spring time and the signal is given, the other 98 percent or so hatch out within a 3 week period. In this case, of course, again by disturbing by bringing into the laboratory, you upset the total hatching. You only get maybe 5 percent total hatch, and they hatch out dribbles over one or two here over a 6-week period indeed earlier into the diapause phase, but then you never get completion of diapause for the remainder.

QUERY Do the ones start - started in the laboratory - Do you get usually more complete hatchings from them or do you get - do you see the same trends that they start in laboratory as if they start and stay in the wild? If they start and stay in the laboratory?

SPEAKER There are some differences in the laboratory. They're kept refrigerated to mimic the winter season and - for a period of time, and if they're not kept refrigerated to mimic that winter season you don't get the same kind of - of hatching statistics as you would if you did that. So normal procedures for the tamed rearing of these is to keep them refrigerated for a substantial period of time and then bring them out. The problem is that we can't shorten that 5- or 6-month period substantially by any technique that we know of so far. If we don't keep them in refrigerated condition for 5 to 6 months in the laboratory and then bring them out, we don't get very many hatched at all. So that the statistical - the numbers of hatching just goes dramatically down.

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QUERY How many will - will have to hatch before,
say, the end of the mission to tell you that we think we've
been successful?

SPEAKER Well, there's - there's two answers to
that question. "A" is to look at a scientific objective of -
of seeing is there an induced effect on the biological con-
trol of breaking this diapause.

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SPEAKER - E is to look at a scientific objective of seeing is there an induced effect on the biological control of breaking this diapause. We'll have to look a little deeper in the statistics there, but a rough guideline is probably if we get 10 percent hatching we have probably done something that can not be allowed for with biological variation. Certainly the time phasing of this hatching's extremely important and will drastically affect the statistics here. Answer B is, for practicality, the people at the USDA feel that they would have to have about 25 percent hatching before this would become extremely important enough to consider perhaps using zero gravity as mechanism to help their laboratory rearing.

QUERY Well, if they, say, if you get 10 or even 25 percent at the - by the end of the flight - by the end of the flight, we're still 2 months away from that, so that's a 5-month period on the wild ones, because if we're already roughly in that 3-month, we're right at 5 months. And I understood to really make a substantial difference you're talking about - like cutting it in half to be worth either using space in the future or using zero-g techniques on the ground.

SPEAKER Certainly if we can cut the time - the diapause time in half and get substantial hatching, definitely that would be exciting. The consideration is here that there is several aspects of time phasing. The tame ones didn't begin the diapause phase until about mid-October. Now, if we start to see hatchings sometime soon in the tame ones, there occurs a possibility that it might be better to send them up earlier into the game. If not, we'll have some estimate of when would be appropriate to send them up. Certainly the possibility exists that exposure to something like zero gravity or some other stimulus does not really take its effect until a certain period of duration into the diapause. And we'll have to look at that. But substantially shortening the diapause and still getting good numbers of hatchings at the end of this shortening, whether it's cutting the time 50 percent or cutting it by a third, both would be exciting I think. Right now we can only really rear them about once a year. If we can double or perhaps almost treble the ability to rear them in the laboratory, it makes laboratory rearing of the insects considerably more feasible.

QUERY Well, I guess some - some - a little more general than that then. How would you apply what you learn here, that weightlessness, if it does indeed have a good effect; how are you going to apply that in laboratory?

SPEAKER Zero g testing and usage of - you know, for tests we've done, is parabolic flying, things like that

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and - and it's pretty expensive. Space flights themselves are awfully expensive. We don't have any manned flights coming up again to take these moths along for any period of time until we're looking Shuttle, and that's a long way off. And it's pretty expensive just to come up with a moth flight to get it out and return it to a specific point and pick them up because even if they do several hundred million dollars of damage each year, space flights start getting pretty close to that in cost. So you know - what are you looking in the future? Are you just really futuristic or - or have you got a good realistic outlook on - on rearing them?

SPEAKER Well, there's again, two ways to approach this. Number one, if we do get an effect we can start to address - what is the mechanism, what has happened here to trigger this biological control which we have not been able to trigger with any other variations in the laboratory? The temperature, humidity, life cycle, wavelength of light, et cetera. The second aspect is, of course, which you have addressed, and that is, could we send eggs up into space, keep them there long enough to hatch, and then bring them back. NASA is in the - well, is considering currently the use of sounding rockets like Scott (?) rockets, that could take additional payloads up, and perhaps be retrieved by the Shuttle or of course, if the impetus is large enough, before the Shuttle's available perhaps go up and come back, be retrieved. The nice thing about this is that if a - such a utilization would be considered, the moth eggs are very small. Many, many could be sent up at one time. They don't require very elaborate automated system for providing maintenance, food and water, and so forth. A fairly simplified package could be sent up. We don't have the provisions currently scheduled to do such a thing, but cert - -

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MORRISON We don't have the provisions currently scheduled to do such a thing. But certainly if it was worthwhile we would want to. And the cost does not approach hundreds of millions of dollars. Indeed the costs approximated by NASA for use of this would be in the neighborhood of more like 10 million dollars.

QUERY The 10 million you're talking about is sending them up in something like sounding rockets and finding a way to retrieving them, either shuttle, which is about the only method.

MORRISON Well, we do have the knowledge to make the - a capsule retrievable, just like we've done with Biostat and we've done with a number of other pro - biological programs.

MORRISON It's just the length of time. You know, it's not like taking them up for 2 days or so unless you thought you could do that much in 2 days and bringing them back or weeks or so forth because it's a lot - lot harder. I'm not as familiar with unmanned, but it doesn't seem to be as easy as over a long period of time.

MORRISON We do have the one facility and it should be extremely easy to maintain the larvae up there. They only need essentially plant material to eat. They don't require you know, feeding and water. They don't require waste disposal systems like we've had to make for the primates that have gone up, and the mice and so forth that we've sent in the past. A fairly simple satellite could be sent up with a fairly large number of eggs. The Scout rocket capability I referred to that was considered recently is looking at a payload in excess of 300 pounds.

QUERY You said it would be rel - relatively simple to maintain a - them while they're in orbit. They don't require green leaves then to keep alive? I mean, many, many moths in the larval stage require green leaves where they get both their nutrients and their liquids. This is not the case, or what?

MORRISON Even if they did, where we have, you know, it's not that difficult to be able to maintain plants in that environment. We've been looking at that situation on how to grow plants. Have some fairly progressive ideas on the best way to handle that. Of course, we've been looking from the viewpoint of studying how the plant itself grows, and to be able to understand if there're induced effects on plant growth there. But in this case one could essentially probably even freeze plant material and just defrost it at appropriate times and - I mean there's all sorts of ways

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of preserving adequate food. There is laboratory food that we can also use that suffices.

QUERY Does the laboratory food require water to go with it, or not?

MORRISON I'm not sure on that.

MORRISON I don't (garble)

QUERY But they have been - been raised in laboratories using artificial or food that's not - not recently-harvested green leaves then?

MORRISON Yes, that's right.

QUERY Okay.

QUERY Okay. Now, have they been subjected to the g forces that would be - that they would encounter turning from orbit?

MORRISON No; they have not.

QUERY So you don't know at this point in time whether or not they can survive a return from space?

MORRISON No. I can't address that for sure. I am to understand that - that positive g's was considered as a way of perhaps precipitating breaking this diapause. But now the survival of the larvae under g forces, I don't think has been addressed yet.

QUERY Well, you say - I mean that the sim - with a simple centrifuge you can induce g forces. Has this been done?

MORRISON I don't think it's been done yet. Again, this particular detailed test objective was actually only conceived and mobilized starting about October. And the results now are opening all sorts of possibilities, and will open even more if we get a real statistical success and comes to the point where really feasible to entertain the idea of sending them up.

QUERY Okay. I realize that the EPA's put the old scrunc - scruncharoo on chlorinated hydrocarbons so far as control of pests like this, but is tests and research continuing in tandem with this effort to find alternate pesticides to -

MORRISON Yes.

QUERY - control it?

MORRISON Yes. They're doing that. They're looking at a variety of ways that they can either upset the life cycle to the point where they can use that as a type of control as a side development that - for pesticides that would be acceptable for widespread use. Mass rearing of natural parasites of the moths.

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SPEAKER Mass rearing of natural parasites of the moths. There are natural predators that exist. Unfortunately, they're just not in large enough numbers to really handle the problem. But these efforts are going on continuously.

QUERY What - what are some of the natural predators?

MORRISON There's a variety of birds and there's some other insects that - that go ahead and prey on that. For instance, wasps will quite often lay their eggs in the egg batches of other lepidoptera moths, if you will, and the wasps hatch before the moths do and essentially they have dinner right there.

QUERY And the research is continuing on this particular aspect?

SPEAKER Yes. This is a big enough problem that there is a continuing effort going on at the USDA, both at the Agricultural Research Service centers and also in concert with the Animal-Plant Health Inspection service. The APHIS, which is sort of the emergency branch that is concerned with the quarantine and with immediate counteractive measures to control the problem.

QUERY Have you got any evaluation as to the promise of the - the different methods under - under research at this time, including our orbiting moths?

MORRISON No. I don't have - can't really address that, although I can say that the other methods have been frustrated to the point where the Department of Agriculture felt this was definitely a worthwhile shot, and even though was mobilized we have a very simple observation-type of experiment here. This particular detail test objective was felt to be worthwhile because the other techniques just have not come through as promising as we like. The problem still exists. The control measures are still inadequate.

QUERY The moth itself. Now, that - in the wild that the stories that - or the information that's been released that I've seen is - indicated it attacked one specific type of tree, that is the oak. Does it in fact attack all hardwoods, or it - -?

SPEAKER It has some preferences, but it indeed - it likes some 500 species of trees.

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QUERY 500 species of trees.
MORRISON And plants. Right. And it just so happens that there's a lot of concern about the - the hard wood oak. One of the problems here is that the infestation of the moth is spreading, despite all countermeasures. Despite quarantine measures that are being taken by APHIS in the northeast United States. They have a program where they have a computer statistics central location where they're feeding in all the information on what the location of new outbreaks of the moth infestation. They're over a far west as Wisconsin. They're down as far south as Virginia. In the northeast there are many species of trees in our national forests that are somewhat resistant, can stand defoliation and still survive. In the southeast, in the other parts of our forestland, we have species of trees that could not stand that, and that would be wiped out with the first attack of these pests. So there's a lot of concern in containing them as immediate as possible. And then in s - inst - instilling procedures that will go ahead and retrench them and bring them under total control.

QUERY I understand they were introduced in the United States by an ambitious silk merchant, but I - I don't understand why no natural controls have - I mean, in nature as a rule, natural controls occur when a pest shows up. But there have been no natural defenses coming up. I mean predators that suddenly proliferate in great numbers to - to counter the pest like it occurs in - -?

MORRISON No, there hasn't been.

QUERY None at all?

MORRISON No. There are in other countries where the moth exists there are species of trees that are quite hardy and just are not affected very much by them, in spite of the defoliation they may do. There are a bigger prevalence of a certain select type of predators. Unfortunately, the predators that do exist here are just not here in sufficient numbers in the right locations at the right times to do much about it. You do have this business of a tremendous outbreak of the spring right when the trees are recovering from the winter and suddenly you have this massive onslaught of the caterpillars that eat up to as much as a square foot of leaves every 24 hours. And there just isn't enough predators to handle that sort of an onslaught when it happens at the break of spring.

QUERY Okay. Now, presume these eggs that are hatching in the spring, are the eggs that are laid the previous fall by the parents -

MORRISON Probably the previous summer.

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QUERY The previous summer. Do we have just one life cycle per year in this particular breed?

MORRISON That's right.

QUERY Okay. So if the trees could survive, - how long does the larval stage last?

SPEAKER The larval stage is in terms of weeks. 5 to 6 weeks.

QUERY 5 to 6 weeks. So if they - the trees can survive the 5 to 6 weeks of the larvae, there's not going to be another crop of gypsy moths coming along then?

MORRISON That's correct. That's why the laboratory rearing procedures are thought to be promising if they can be accomplished because if you prepare and have massive numbers available when the hatching occurs and you can sequence it such that when the caterpillars go into the larval stage - or go into the pupal state in the cocoon and they come out as adult moths, then you can have your full-scale attack ready to mount at that time and cover the entire area.

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MORRISON Caterpillars go into the larva stage or go into the pupa state in the cocoon and they come out as adult moths that you can have your full-scale attack ready to mount at that time, and cover the entire period of the adult phase. And you can really stem the time.

QUERY So actually because of this factor alone, these - would it be true that these insects will be particularly susceptible to irradiated sterile male system of control? I mean, - Unlike the screw fly, which mates year round, you hit them during this critical mating period which is probably just a matter of weeks. And that would take care of it in affect?

MORRISON That's makes particularly attractive, that's right. In fact any control procedure that you can instill that controls the adults, then you're able, since the adult cycle is relatively short in terms of the rest of the year, you are able to instill your control measure in a short period of time and really do the most good.

QUERY So really you're talking about maybe 1 or 2 launches just to get the sterile males you need for that one particular year?

MORRISON Right.

QUERY And then you do it again the following year?

MORRISON That's right.

QUERY So it's not a continuous thing like it is for the screw fly - screw worm fly?

MORRISON That's true.

QUERY I see. Okay. That makes it more attractive.

MORRISON This is one of the reasons why the laboratory rearing capability has been looked at so deeply. And all avenues are being investigated for - to be able to make that possible. Because, you do have this window, if you will, where you can really be affective, if you're prepared. Obviously, you can't have your laboratory caterpillars, the larval state and then the pupal and then the adult occurring at the same time as it happens in the wild. Because by the time you have a chance to radiate and then distribute, you're probably too late.

QUERY The gypsy moth, recently came from Europe. Is that correct?

MORRISON That's right.

QUERY Are their natural predators - I realize this is really opening a can of worms. Are they natural predators you can import to prey on it?

MORRISON I think that has been addressed. I don't know specifically of any natural predators that have been

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been imported. I understand that natural predator population rearing techniques have been looked at and have been done at least in the laboratory. So that the possibility of using natural predators and releasing large numbers into the environment has been looked at. It may have even been implemented on small test areas. I'm not sure on that. To my knowledge, though, we have not to this point actually imported any natural predators. Dr. McIntyre of the aphids, though might have some more recent information on that, that I'm not a ware of.

QUERY You mentioned the wasp as one natural predator and some birds, do you happen to know the species of the birds?

MORRISON Oh, I guess, black bird, the cockadoo, there's several others. I have some brochure information from the USTA that describes that and also describes some of the characteristics of the moth and this particular moth and its destructive potential and I can make that available to you.

MORRISON Thank you.

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SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Medical Experiments Briefing
Johnson Space Center
December 10, 1973
2:09 pm CST

Participants:

Dr. Royce Hawkins, Deputy Director for Medical Operations
Ed Michel, Chief, Biomedical Research Division
Dr. A. L. Homick, Biomedical Research Division
Dr. G. W. Hoffler, Biomedical Research Division
Bob Gordo . PAO

SL-IV PC-50A/1

Time: 14:09 CST 25:20:09 GMT
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PAO Okay, Abby and gentlemen. We'll start our medical briefing off. Of course many of you know Dr. Hawkins, Royce Hawkins, Life Sciences Directorate, and to his right will be Ed Michel, Principal Investigator for M171, Dr. Jerry Homick, who will talk about the M130 series, the M131 and M133 experiment, and Dr. G. W. Hoffler, who is co-PI for the M092 lower body negative pressure device. So we'll start off with Dr. Hawkins.

HAWKINS Okay, Bob. This brings us up to about day 25, I believe, in the mission, which has had, I think, some very interesting results to date with the three new crewmen, and the major areas of concern here at this time are the lower body negative pressure tests, the exercise response and metabolic studies in the vestibular area. And that's what we want to dwell on here this afternoon to try to bring you up to date as well as we can with the latest analysis of this data. Let me just say in general - I think the crew is looking very well at this time. We have no medical problems. They are in good health, and I think the - their overall performance is certainly up to the level of our expectations at this time. So I would like to move into the area of the - of the M092. Let's touch on the lower body negative pressure first with Dr. Hoffler.

HOFFLER Okay. Today is so called crew day off but as of yesterday we had performed inflight six each LBNP tests, the lower body negative pressure for the Science Pilot and the Pilot, and the Commander had undergone seven. The earlier responses to these tests were somewhat elevated as we expected, that is to say the heart rate over their preflight values and the pulse pressure narrowing, but the last test on each of the crewmen had shown a distinct trend back toward their preflight values and we have no concern at this point on their responses to these tests. However, each of them, just to show that space is not a respecter of persons, has had a presyncopal episode, these occurred between the 10th and 16 mission days. We've had several additional medical data points taken during these negative pressure tests, studies to estimate limb blood flow to the legs and also studies with special infrared film to look at the venous patterns of the face and upper bod during negative pressure. These have been accomplished twice, I believe, in the flight and we would only say that the responses are very much what we would have expected based on the information from the previous two Skylab missions. It's of interest to note that they have shown the decrease in their leg sizes, which parallels pretty well what we saw in the other six crewmen. Unless you have any specific questions I believe that's all I'd care to say at this time.

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PAO Okay. I think probably better just to go right on through and then open it up.

SPEAKER Okay. All right always done in conjunction with the 92 is the 171, so we'll talk about that next with Mr. Michel.

MICHEL To date we have run three test on each of the crewmen. All the runs were nominal, that is that they were within their preflight baseline range, in all respects. The SL-IV crew did not experience any difficulty in learning to ride the bike. If you recall SL-II had the restraint problem and SL-III, the first run or so on each of the crewmen was a little bit off normal, while they were learning to ride the bike. We did not experience this with the SL-IV crew. Evidently the movies and the comments of the other crews have helped in precluding this learning curve. The Science Pilot is experiencing some conditioning, based on the three runs we have to date. And, the SL-IV crew, as a whole are doing considerably more personal exercise than either the SL-II or the SL-III crews. If we compare the quantitative exercise, personal exercise, and by that I mean the exercise done on the bicycle ergometer, in their free time, that is the only quantitative piece of - exercise device that we do have on board. If we compare the first 17 days of the SL-IV flight with that of the previous two missions, two of the SL-IV crewmembers are exercising at a level equivalent to that of the pilot on SL-III, and as you know, up until now he had exercised the most of any of the astronauts that were - had been in space. The third member of the SL-IV crew, the science pilot, is approximately 80 percent higher than even the pilot of the SL-III crew. Now again, I was comparing the first 17 days of the flight, and as you know, from the past flights, they tended to exercise more during the middle and the end of the flight than they did in the beginning. Because the activation problems and thermal stress in some cases. So, it appears, that this crew is going to do more exercise than we have seen before. And, it appears that as time goes on in the mission it will even become greater. In closing, we've had no hardware problems, either with the ergometer or the metabolic analyzer. We did have a malfunction in the mini gym, which is one of their exercise devices onboard and it was repaired by the crew within a day so we didn't lose any data there. That's all.

PAO All right. The vestibular area which you know is been a very interesting one for us in the previous flights and I think, again, is also of great interest here in Skylab IV and Dr. Bonick will touch on it.

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HOMICK As you know the M131 experiment consists of actually 3 experiments. The motion sensitivity, susceptibility testing, or motion sickness susceptibility testing, the ocular gyro illusion test, and spacial localization. Thus far, we've conducted two of the combined motion sensitivity, ocular gyro illusion tests on the SPT and the PLT and three of these tests on the Commander. We've also conducted one of the spacial localization tests on each of the three crewmen. The first inflight motion sensitivity test was done at zero RPM in the chair, the same way it was done during the first two flights -

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HOMICK The first inflight motion sensitivity test was done at zero rpm. in the chair, the same way it was done during the first two flights. And then the next test on each of the crewmen was done at 30 rpm. This represents a little bit of a deviation from what we've done in the past in the sense that the past crews didn't start out at that high a speed in the chair. But this particular crew, preflight, had, through various training techniques, as it were, built up considerable tolerance to vestibular stress in the rotating chair. And preflight all of the crewmen were capable of riding the chair at either 25 or 30 rpm without symptoms. For that reason we thought it was safe to take them to 30 rpm immediately in flight. During those tests at 30 rpm no symptoms were manifested. This fits in well with the two previous crews in that following this initial period of adaptation that takes anywhere from two to three or four days, there seems to be a - a virtual immunity to motion sickness that develops. And this particular crew was fitting right into that pattern. On the - the OGI test the crewmen, thus far, are perceiving the oculogyral illusion with the same ease and the same frequency that they had been preflight. As a matter of fact it appears that the Commander is even a little bit more sensitive to the illusion, in that he's seeing it with slightly greater frequency than he had been preflight. The spacial localization test results are not well analyzed at this point in time, but it does appear that we are seeing the same types of shifts in localization that we've had with the previous crews. But these are subtle shifts and really in no way reflect any type of gross spacial disorientation on a part of the crew. Again, we - we're not experiencing any type of hardware problems that we are aware of and haven't really seen any surprises thus far with the experiment. Okay.

QUERY Several - Jerry, did I understand you to say at 30 RPM there were no symptoms manifested?

HOMICK None that were reported as symptoms. That's correct.

QUERY Well, do you expect them to increase on that 30, or is that 30 the max they're going?

HOMICK 30 is the max with the chair. And we'll simply continue to run the test at rather long intervals to see if any reversal occurs in their susceptibility.

QUERY And, Dr. Hawkins, I guess, on the 3092 runs there's been several times there have been some, I guess - I don't know if you call them problems or whatever, - I

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think there was 1 or 2 that were not completed. Is that correct? And what were the causes behind the noncompletion?

HAWKINS Well, we've had an incompleting run on each man one time.

QUERY Right, that's what I was referring to.

HAWKINS Isn't that right? Yeah.

HOMICK We've seen that in each of the other missions, too, and in postflight Apollo. It's nothing different, but each of them has, on this mission, experienced one early abort of the total protocol, right.

HAWKINS And each time we're able to go repeat the full protocol on subsequent runs.

SPEAKER Subsequently.

QUERY Have there been any PVC's or anything like that?

SPEAKER Very few, but occasional I - -

SPEAKER Nothing more than what you would expect in a routine monitoring of any average person. Just an occasional ectopic beat; PV or PAC.

QUERY It may not be a medical problem, but there's something wrong with this crew in that they're slower doing everything. Communication with the ground seems to be bad; they have to repeat things. Pogue can't remember to put filters in and he's told about an eclipse and then he finds it and forgets that he's told about it. And this is a - this crew had a longer training period than any of the other two, although they haven't flown in space, and they're now past three weeks. What - what is the problem if it's not medical? Or if it is medical, what is it?

HOMICK Well, Jim, I - I really - I really see nothing that at this point that I can pick or point to as a medical entity that would account for - for the type of things that you're saying. And I - I - -

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QUERY - past three weeks. What - what is the problem if it's not medical, or if it is medical what is it?

HOMICK Well, Jim, I really see nothing at this point that I can pick or point to as a medical entity that would account for the type of things that you're saying, and I think it is true that we have seen some of this. And I think it's really that we have three individual - new individuals up there and we're seeing a different type of response, a different rate of adaptation into the environment, and I think some of the - there have been some of the things which the crew have been required to do which they really didn't have extensive training preflight in things that were cranked into this schedule pretty late. I've - I've heard this statement made. I'm not - I can't really positively state this myself, but I have heard that to some of the early training was very early and as such there was some interval of time before they flew in the time that they had - last had training in some of these areas. And that may account for some relearning process that is going on. I think that's what we're seeing here is a - is a learning curve, a learning in flight of the accomplishment of a lot of these - of these tasks.

QUERY Didn't they also have the advantage of what was it, three or four months of flights by six other men?

HOMICK Oh yes. They - that's true. They've had two other crews up there prior to that.

QUERY They don't seem to have learned much from them.

HOMICK Well, Jim, I (laughter) - I can't answer how much they've absorbed from the previous crews. I think that there's no question, each crew has tried to hand over as much information that they think will be beneficial to the subsequent crew in accomplishing the tasks at hand and also of assisting them with the adjusting to the environment and all this, but nevertheless the - you know you're told something, often times you have really have to experience it first hand before you fully understand or appreciate what was said to you.

QUERY Let me ask you -

HOMICK Maybe this is part -

QUERY - this. If my observation that this group appears to be slow learners is correct, or what - how do you account for all this?

HOMICK I can't account for it, Jim. As I said, I cannot pick out any - any medical problem with - that would say that this crew is slower at all. I - I agree with you that some of the tasks have been performed a little - a little

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slower pace than what we would like to see but here again I think we're dealing with - with again with individuals and you're seeing again individual responses in this flight which - which we haven't seen before. And this I think is probably part of the data which you know we're going to wind up with at the end of the mission that says yes, you need - probably need more people even yet to give you a good statistical population with which to decide what - what to expect. What is the real capability of man. There are individual differences, really and truly. And I think we actually have to go through the mission to really go back and, and really be able to come up with firm answers as to why we saw certain things different. I just can't answer that at this point really.

QUERY What is this crew doing in their free time? In other words are they playing darts, are they reading books, are they talking about this aspect of their life up there?

HOMICK Well, they haven't had much free time really, and I think that's been one other thing where you get behind and everything starts, you know, domincing and this had unquestionably bothered the crewmen because they want to keep up on schedules, but when things happen and things go wrong, you get behind on those time line, then it's a difficult task to catch up. And this, you know yourself in your own life this can be very aggravating and very annoying to you to the point that it could even - can even interfere with your performance. You try to rush too much.

PAO Art.

QUERY One point. Early in the mission they complained about some of these medical experiments that were thrown in at the last like the infrared pictures and so on.

HOMICK Uh-huh.

QUERY Why were they thrown in at the last minute and why wasn't there some time allowed for them to train on it and so on?

HOMICK Well, a lot of it came out of schedule 111 where we did crank some of these things in in real time during the mission toward - toward the end of the mission -

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QUERY - - Why were they thrown in at the last minute and why wasn't some time allowed for them to train on it and so on?

SPEAKER Well, a lot of it came out of Skylab III, where we did crank some of these things in, in real time, during the mission, toward the end of the mission. To try to access the condition of the crew the changes in physiology that we were seeing and we found that these proved to be rather helpful although that we really didn't have any preflight baselines to compare it with, nevertheless it did seem to be a helpful and therefore we decided to crank these new DTOs call them, into the Skylab IV and we did and there just wasn't time enough to get them in to where you would you know you would feel that the crew had been completely and adequately trained in all of them. They were exposed to them and given as much training as time would permit, but, it nevertheless, it was between missions that this was all accomplished.

PAO

Bruce.

QUERY A couple of things. Royce, how would you compare this crew in its preflight work, I know you worked with them very frequently, how would you compare them to the other crews because I can't see that the crew's all that lazy especially in consideration of what Ed says about their exercise level. They're really putting in a whole lot of time. Where do they set their priorities in living in space, what did you see preflight that would indicate either the slowness or anything, have you seen anything in their personality makeup?

HAWKINS

Well, let me ask a Dr. Hoffler and Ed Michel about, they're the ones that worked really the closest with the crew in these major medical experiments during their preflight training phase and all, collecting of the baseline data. Let - let's give them a chance to compare the crews for you. Wick, you want to take over?

HOPFLER

Well, I - as far as incentive and cooperation is certainly you would not ask for any more in this crew, as in the others also. I think it is probably true that this crew didn't get even though they had a longer preflight training period. They did not get, at least in our case as much actual training themselves, in the procedures because of the way the scheduling came about. A lot of the tests are done in a different facility than the one in trainer, in which case we are doing the actual performance and they are just subjects. Even in those cases though we did give them as much instruction as possible, for instance the (Garble) they participated once preflight in learning what this exactly entailed and they participated in these

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leg volume measurements and in the blood flow test, but they're just no way that we could have scheduled the amount of training we'd have preferred preflight for this particular crew. I don't think it was any less desire on their part, we certainly did it whenever the schedule allowed.

QUERY

Ed, how about the 171?

MICHEL

For the most part I'd have to echo what Wick has just said. We did get more baseline data on the SL-IV crew than we did on either of the previous two and I'm speaking of the major medicals now. But, as Wick said I don't think we got any more data - baseline data which they acquired themselves preflight than we did the other two crews. One commented in as far as the exercise, I think that it's important to remember that we based on comments from the previous crews we are now allocating between an hour and hour and a half for personal exercise. This was not done on either of the other two flights, so the crew has the opportunity to exercise if they so desire. I believe if you looked at the data the SL-II crew probably had about a half hour and the SL-III crew, 45 minutes or an hour at the most. So the opportunity is there if they want to do it and evidently they're taking advantage of it. And, again, this is based on the remarks of the returning crews -

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MICHEL - - is there if they want to do it, and evidently they're taking advantage of it. And again, this is based on the - the remarks of the - the returning crews which complained that they did not have adequate time to exercise.

QUERY How much time are each one of them actually exercising? Gibson seems to be exercising a lot more. And you mentioned that he's being conditioned, how are you seeing this?

MICHEL In his - in his metabolic data, his heartrate is decreasing for the same worklevel, oxygen consumption's changing. His breathing - his minute volume is decreased for the same amount of work. He's not working so hard to do it. Now, the - the data I gave you was based on the quantitative ergometer data. You must remember in addition we have other exercise devices which this SL-IV crew are using. The minigym, we have a treadmill that was just put up for - during the SL-IV mission and the springs, which were still onboard from the first - or from SL-III. So, they are using these other devices which can't be quantitative, but it does provide additional exercise.

PAO Howard.

QUERY How is that treadmill working? You get any comments from the crew on it?

MICHEL Yeah, they found that if they tried to run on it, as you know ordinarily a treadmill will move and the human just follows it, here the treadmill's stationary and the human moves. It's an incline plane and it's teflon coated metal, and they wear socks. Now they try to run on it and they found that after 5 to 10 minutes they got muscle soreness. So, most of the exercises done on this particular treadmill are now are walking exercise. But all three crewmen are using it from about 5 to 10 minutes every day. Well - and this is going to help their calf muscles which were one of the complaints from -

SPEAKER I don't think now - just to correct one point on that Ed that they're still having this muscle soreness as they seem to have gotten over that.

MICHEL But - alright it's a combination of muscle soreness and just plain fatigue.

SPEAKER I think - really what it tells me is I think that they have benefitted from it and what we're seeing is really a beneficial result of that exerciser.

MICHEL My comments were directed to the fact, the length of time they're able to do it. It's like doing an arm exercise, you're going to fatigue much more rapidly than you would, if you used larger group-muscle groups.

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PAO

QUERY

Abby.
What are some of the limb volume measurements and do you notice that this crew perhaps is losing less around the calf because of these treadmill exercises?

SPEAKER

The volume measurements are very comparable to the other, two flight crews. Understand we did not actually get volume in the other two missions, it was just the maximal calf girth. In this one we're getting that as well as total limb volume measurement by incremental circumferences from the ankle up to the high thigh. And the percentages loss range around 8 to 15 percent different for different crewmen, different for different legs. And of course there's a certain error inherent in the measurement technique, but it's a true loss and not different from what we have seen on previous missions. I'd like to make a correction if I might. I counted my X's wrong and all the crews have - all three crews have had six LB&P tests - added a X in my counting on the Commander earlier.

QUERY

We have - we have two questions phoned in from our - the Cape from Mary Bub, the first one to Dr. Hawkins. How does this crew compare medically with the other crews at this point in the mission.

HAWKINS

Well, I think I touched on that in my opening statement Bob. Really that I think the - we have seen - we are seeing the crew right now that look very favorable with the other crews at this point. I think we have seen some differences in each of these individuals through the first phase of the mission, which have been different. They've arrived at different points at different - different periods of time. But all-in-all I think really I - their general condition and the way they're performing is shaping up is looks very comparable with the other crews. The other one we touched on I think -

QUERY

Any clues as to why this crew prefers to actually take a day off as compared to the previous crews preference to work on their day off.

HAWKINS

Well - here again I don't have any startling answers on that, it's again my interpretation assumption that this reflect this crew's personality. Their attitudes about their - their life and you know and the way they're - way they're having to conduct their lives in this environment. They do appreciate getting some free time. They have been pushed and they have reflected that push and the drive, and I think that they are just -

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HOMICK And they have been pushed, and they have reflected that push and that drive, and I think that they are just saying yes, we want a little free time to ourselves. And that's really all it means.

PAO Jim.

QUERY After the last mission Bean mentioned that there was some irritability between the crewmen. Has any of that sort of thing been reported during these medical conferences? They're all getting along okay.

HOMICK Honest, Jim, I have not heard any comments that would be positive - you know positive comments that would say that we're, you know, that we're getting on each other's nerves all the time, and I know I remember Al Bean did mention that in the post flight period, there were other periods of times when they would get a little bit irritable with one another, but I don't know to - I don't think it was anything of any serious degree even there. I think he was just mentioning it for the record that within the duration of time in this confinement that you're going to expect that type of thing out of human beings. And of course in your selection program you try to select people that are compatible and can work together under such adverse conditions, and nevertheless, I think even all those would answer that yes, you'd expect to see some of that. Now the important thing is now well they control it. I think that's the - that's the key to it, is how well they are able to control their emotions under conditions like that where they make get a little bit irritated with some particular thing another guy's doing at the time. But we have not had any indication as yet that this has really occurred. I really haven't.

PAO Mary - I mean, Abby.

QUERY This is going back to Jim's other question. Maybe it's - just an instinctive thing I have, but they don't really - something seems wrong up there. They don't really seem too happy, and I'm wondering if this bad morale could go back to the whole coverup incident. Do you think that's been sort of plaguing them, that they kind of been off step since then and they've never kind of gotten the swing of thing?

HOFFLER Well, you used a word there, bad morale, which is the first time I've ever heard it used by anybody.

QUERY Well, not bad morale. They just don't seem to be bubbling over with enthusiasm and sort of I can hardly wait to work today kind of attitude.

HOMICK I've been feeling that way myself (chuckle) pretty much lately. But seriously I don't - again I think you're dealing with three new people, three new individuals, and they don't have that outward personality like maybe Pete Conrad you know who was talking all the time or seemed to

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want to relate, or, or, or Owen who was you know more inclined to verbalize during the - during the actual performance of tasks and things like that. Do - And these individuals, I really just haven't heard them talking that much. I think again it's - it's really their makeup. I can't really attach anything more to it and I don't honestly think that there was anything holding over from any of the coverup you referred to as such, and I think you're talking about the vomiting back in the beginning. Is that what you're talking about? Yes, I don't think - -

QUERY No, not the big coverup.

HOMICK Huh?

PANEL (Laughter)

SPEAKER Well, is there something else you're not telling us?

HOMICK No, is there something else you're referring to?

SPEAKER I think that's the only thing that I can recall that was a little, that you could point to and say well, it wasn't - it should have been handled a little bit differently. We admitted that, but I don't the crew has any - any holdovers from that at all.

QUERY Hopefully you won't answer this that they're just three individuals again because other crews have at times, and some of the guys would just bound out of bed in the morning and be up before the crew wakeup call. This crew seems very slow starters in the morning in fact there are some mornings when they just say well we're going to roll over and go back to sleep for a while even when they lose a gyro. But you know what was the data you had on - what kind of sleep did they get preflight? Were they 8 hours a night or 5 hours a night, you know? What did they go best on? Because they really seem down if they don't get a full 7 or 8 hours sleep up there.

HOMICK Well of course we only measured sleep on the Science Pilot preflight. So I can't give you a quantitative figure on the other two crewmen as to what they -

QUERY Did they tell you what kind of sleep they normally got?

SPEAKER Well they normally something between 7 and 8 hours. That's pretty uniform throughout the group. And I think we've seen a very close counting of time slept by this crew in flight to where they tend to really try to sleep out as much time as allocated. It is ranged, oh, on the average about 7 hours. Earlier it's about 6-1/2. We have one individual who really - then the Science Pilot on this flight that - that seems to require a little more sleep than -

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SPEAKER Really - the science pilot on this flight that - that seems to require a little more sleep than - than other people. But I don't think it's any different from what is preflight requirements under terrestrial conditions. But he does require more sleep. And he - he a - he so asked for more time - more time that he can definitely count on for that sleep. Some people get by with 4 hours, no problem, and others require 10. And here again you're dealing with - with individuals - individuals variance. And that's - that's the type of thing we're looking for too is to what that really means, and what changes are really taking place in - in the environment of - of the Skylab that might very well be different now we've seen changes in depths of sleep and - in all three of the crews. I think this has been the most significant thing thus far in the analysis is the - is the difference of emphasis upon depths of sleep, and here again I - I don't - I can't - can't say what all this really means or what all this adds up to. Dr. Frost the Principal Investigator on this is still looking and analyzing the data and it will be awhile yet before we have the final answers on that.

PAO Abby?

QUERY How are they eating and what are their weights? Did they stop losing weight?

HAWKINS Oh, yeah, I - I think that they've been stable as - on - in their weight for oh at least the last 2 weeks, the fluctuation - the daily fluctuation is something like a half of pound and - on occasion is a pound difference. But it still pounce right back, where your commander has lost - has really fluctuated around a pound off of his - his pre-flight launch weight and the other two about 4 pounds. But I - I - I think that's - I think that's a stable condition that they're in. Their nutrition is good, they're eating well, fluid intake is good, see nothing - nothing wrong there.

SPEAKER We - the latest weight is out in - outside the, Abby on - this morning's report.

QUERY Have a question here from - submitted to us from CBS, can't quite understand it. How are medical experiments stacking up against EREP and other priorities in view of the dwindling TACS supply?

HAWKINS Well, I understand what he's saying. The TACS supply that - that - that requires maneuvering to get into position to do EREPs and - and all of that. And that's what he's driving at. And we - our medical experiments are - as he - in his own words they're stacking up against the - the EREP and the ATM I think very well, really, we're not losing anything. We've accomplished all of our medical experiments on schedule. And we have made one recent change in this interim between now and about 50 days where we will

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schedule our - our medicals 90 - 92, 171, 93's on a four day center, plus zero minus 1 rather than on a 3 day center, - -

SPEAKER

Plus or minus 1.

SPEAKER

Plus or minus 1, yeah. And that's really

have been the only change that we've made in the schedule of the medical data.

PAO

Howard?

QUERY

Is there any particular reason for making

that change?

SPEAKER

To try to accommodate some of the require-

ments to get in the EREP passes as - as you know these things come up they're - they're time critical and - and this is an attempt to try to - to work with them and accomplish as much of all of the science that we can.

PAO

Doctors, thank you very much. Ladies

and gentlemen thank you.

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SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Premission Medical Briefing
Kennedy Space Center
November 14, 1973
1:31 p.m. CST

PARTICIPANTS:

Dr. W. Royce Hawkins, Deputy Director, Life Sciences, JSC
Dr. S.A. Bergman, Cardiovascular Experiments, JSC
Dr. Stephen Kimzey, Principal Investigator, M115
Dr. Carolyn Huntoon, Principal Investigator, M073
Bill Pomeroy, PAO

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SPEAKER We'll get under way. We have with us today Dr. S. A. Bergman from JSC representing the cardiovascular experiment; Dr. Mike Whittle, coordinator - coordinating scientist on the M70 series of experiments; Dr. Carolyn Huntoon, principal investigator of the M073 experiment; and Dr. Stephen Kimzey, principal investigator of the M111. And we'll start off with Dr. Bergman.

BERGMAN Thank you sir. I'm here representing the principal investigator, Dr. R. L. Johnson, for the experiment M092. This is only one part of the cardiovascular done on Skylab, but I thought we'd concentrate on that because that is a well defined experiment established to answer various specific questions about the cardiovascular system. Basically, the lower body negative pressure stress was developed after it was known from previous missions and from aviation experience that sometimes people develop an orthostatic intolerance; that is, they get hypertensive, sometimes shocking and fainting when they stand up. Well, of course, in zero g there is no vector to produce this phenomenon, the (garble) of the lower body - lower half of the body is one way of causing this stress. What this does is pool blood in the lower body and when compared with baseline studies preflight to the inflight measurements and that of postflight, you get an assessment of how the body passively reacts to and deals with this stress. In Skylab, the experiments were (garble) and repeated several times over the mission - every third day. And we have defined the tolerance level for three crewmen on the first short mission of 28 days and then again on this last mission of 60 days. Some of the things that we attempted to measure was the heart rate response; the tendency toward presyncope or syncope, which is fainting; the blood pressure response; in general the - how well this works as a stress, as a technique of giving up these ortho stresses in zero g. The data show that there is a plateau. The first Skylab mission, for example, they plateaued approximately midmission with slight declines and recurrences of going back to a lower level of tolerance but, all in all, it turned out very favorably and there was no marked intolerance to this stress. The last session, which was 60 days, there was also a plateau but here again, toward the end, there was a slight decrease in tolerance to the stress. I might mention just in passing, parenthetically, that this stress is strictly passive. The subject lays there and allows blood to be pooled just as though he were being bled. So there's nothing he can do such as strain his muscles or any other maneuvers. He simply allows his own basic reflex mechanisms; cardiovascular, endocrine, et cetera, to compensate for this stress.

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On previous missions - previous two missions, we studied some preflight measurements that we cannot get in flight and these have looked not only as the parameters of heart rate and pressure, but have attempted to quantitate the electrical and the mechanical events which occur in the heart. There are many things that we'd like to know about heart function that you cannot get from the clinical EKG or the vectorcardiogram as we measure, but can only be determined by measuring mechanical events. It's called cardiography. The study of heart sounds, for example, is a method of looking at mechanical events. We do these quantitatively pre- and postflight, and we found some interesting but inconsistent changes to date. Also pre- and postflight, we have gotten X-rays and shown that there is a decrease in the heart size. Part of the decrease is believed - is small; perhaps loss of cardiac muscle (garble), other muscle atrophies with disuse. Most of it, however, is probably due to the loss of volume and Dr. Kimzey will discuss that a bit later. There are large losses of volume in the legs and here again it's not - it's a volume measurement that we get. But it's more than muscle, it's fluid as well. The problem of cardiac - decrease of cardiac problems on this next mission, we hope to get a better handle on it by doing noninvasive echo cardiography. This is very high-frequency sounds bouncing off the various structures within the (garble and determining the actual wall thickness of the heart, the ventricles. Using this technique we'll get an idea of what compartments are responsible for the loss of size; that is, the blood and the heart versus the heart wall itself. We look forward to this in particular because there is a definite relationship between heart size and heart function. And we have certain discrepancies between the stress to lower body negative pressure versus the stress to work or exercise. And with this mission, I think we have a real - a much better handle on the protocol and how to go about answering some of the questions that the Skylab experiments have raised. And we'll try to make this a more flexible approach in this mission as opposed to the two. I believe that pretty well covers the experiment.

SPEAKER Before we go on to the next speaker, we'll invite questions if you wish to take a lunge.

QUERY I don't mean to ask you to go into things the other participants are going to do, but if you could just perhaps expand a little bit on the last comment about the questions that have been raised on the protocols and so forth, and just what it is that you have done this time to enable you to get better answers from the last Skylab than you have done in the previous, over and above the echo cardiography.

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QUERY - - to get better answers from the last Skylab than you had done on the previous over and above the echo cardiogram.

BERGMAN Okay, first of all we have finally decided that the stress in zero g is greater for any given level of negative pressure. So to correct this, we have decided to change the (garble) of the individual so that not so much of his body goes into the negative pressure. This is more comparable to what we see on Earth. Another - another feature that we have decided to change is to make the measurements of blood pressure flow. This does not involve the negative pressure per se, this does involve the count, if you will, which provides negative pressure and by using this we can study blood flow patterns in the lower limbs. Dr. Bill Thornton will introduce a way of measuring the ability of the lower limbs to pump blood back into the central circulation, by isometric leg contractions. This will also be scattered.

SPEAKER

Okay, if there are no further questions - -

QUERY I wonder - I wonder if you could mention the percentage of volume decrease in the average decrease of the heart in the crews of both Skylab missions - for each mission.

BERGMAN Well, here again I really hesitate to number it, because here before we just measured heart size per se. And to say that the heart muscle decreases at a certain level, I think, would - we would be over-interpreting the data. That has been 1- to 3-percent change as far as the chest X-ray techniques of outlining the heart silhouette.

QUERY

In both missions?

BERGMAN

In both missions, yes.

QUERY

You said that there was not much difference between the two crews. The last crew stepped up the exercise program considerably, and to my way of thinking, that would reduce any - any changes. How - how did that work out?

QUERY

As far as heart size goes, let's start there.

BERGMAN

Well, as far as heart size goes, we don't know all the things that caused this change in heart size. That's one of the questions that we're addressing ourselves to. What other (garble) did you have in mind about heart size? You mentioned exercise - -

QUERY

Right, did that increase the circulation to the say - the lower body?

BERGMAN

Well, we don't have that data. We did not measure that on the first crew. We do have data points in flight of the second crew and of course have it on the third

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crew. So we have no comparisons with the crews there.

QUERY You don't know whether the exercise - the increased exercise affect - had any affect whatsoever on the performance - -

BERGMAN No, I didn't say that.

QUERY Okay.

BERGMAN I said those particular parameters that you mentioned, I can't say for sure. I think that exercises did have a very definite effect on the changes that resulted - the (garble) on these men post flight. I think that the exercise was helpful. Now, you know, that's the sort of think we'd like to develop more experiments to answer why and how, etc. And this will be discussed, I think, by the space doctor Whittle.

QUERY Two questions. How much does the lower body negative testing actually perform in terms of exercise itself, how much is the experiment fooling the system itself. And two, is it ever occurred in the protocol in the whole experiment to have one crewman that is totally inert most of the time that doesn't exercise and use his deterioration of the controls points.

BERGMAN To answer your first question, the lower body negative pressure's completely passive. It - it's very necessary that the individual lay perfectly still as he can and allow his body reflexes to handle the problem acutely.

QUERY (garble)

BERGMAN Well, we're using - you're using exercise in a different manner, I think. Exercise of the - Let me put it this way. It does - there is data to support the contention that repeated use of lower body negative pressure maintains a certain amount of tolerance to the mechanisms involved and maintain tolerance to the pressure.

QUERY (garble) one man that was not measuring - that does -

BERGMAN That's the kind of question that certainly demands at least some research. We've chosen not to do that sort of research at the moment. It's something to be determined later, but we're trying to find out what it is about - what - what - and if you begin to skip crewman off and have one - and began to introduce a different protocol, things up so much that you really don't have a stop - Everyone is more like doing a similar - doing similar tests, simulations, et cetera. At the end of 9 at the end of mission. They're - the - different, let me say, and that by itself cause - in trying to get data.

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QUERY Have there been any measurable difference in the two crews when it came to regaining their normal physical functions - normal physical conditions. Did Skylab II get back to normal more quickly than the Skylab I?

BERGMAN Well - -

QUERY How long did it take each to regain normal physical conditions?

BERGMAN Well, here again, you're talking about a human being which has a lot of things. Now you talk about exercises problems of the - of the second crew - they were certainly - certainly brought back faster. On some of the other measurements, M092, for one also showed this same trends. I think I let the other experimenters discuss the other measurements and how fast they returned.

PAO We just have time to go to Dr. Whittle, and we can always come back to these other speakers later on. Yes, Mike?

WHITTLE I'm involved with a series of experiments that measure what the body is composed of - the composition of the body and the physical shape of the body, the bulk of muscles and this sort of thing. And to give you a very brief resume of what we've seen on the two missions so far. The second flight that lasted twice as long as the first flight, we saw very much of the same changes occurring in the astronauts that we saw on the first flight. These changes were generally to a greater extent than on the first mission, but not twice as great. I'll go into a little bit more detail on the sort of changes we saw, but this is really what we've rather expected of most of the things that seem to be going on happened fairly early and then they do continue throughout the flight, but gradually declining so that by doubling the time, we see about 1-1/2 times the effect. As an example of this, the weight loss, which has been a fairly universal finding in space flights, the first Skylab crew showed a mean weight loss of about six pounds. The second Skylab crew showed a mean weight loss of about eight pounds so that they did show a bit more than the first crew, but not twice as much. Now, one of the experiments in this series is the mineral balance experiment and this is an extremely involved experiment taking a lot of the crews time. It involves the crew consuming a diet which is very accurately analyzed and known as far as composition of all the nutrients of interest is concerned. We also get back samples of all the urine and all the feces passed by the astronauts during the mission and we're - -

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WHITTLE Time - which is very accurately - analyzed and known as far as composition of all the nutrients of interest is concerned. We also get back samples of all the urine and all the feces passed by the astronauts during the mission, and we're able to take one from the other and find how the composition of the of the body has been changed as a result of weightlessness. One of the most important nutrients we look at is nitrogen which is the - most important constituent of muscle and this is an area in which we've seen some very interesting changes. As all of you know - if you want to be a big he man, you go out and exercise a lot and more you exercise, the bigger muscles get. Conversely, if you stop exercising and you don't use the muscle, it will gradually shrink. And this shrinkage of muscles, is what we've seen during Skylab. The big muscles of the leg in particular and also to a certain extent of the - muscles of the spine are doing work in all of us right now as we just sit here. If these muscles weren't under some sort of tension we'd just collapse to the ground. The muscles are in use when we are standing up, and when we're walking around. The only time these muscles aren't doing anything is when we're asleep in bed. So that these big muscles really throughout the day put out quite a lot of work. Now in Skylab - the crew have been riding the bicycle for an hour - hour and a half a day. And during this time, these muscles have been put under quite a reasonable load. But when the crew stops riding the bicycle, then they start pushing themselves around the workshop just using one hand or one finger to push themselves right down to the other end and the rest of their body is hanging completely limp and these muscles are not getting anything like the amount of work - up in orbit that they're getting just - existing in the gravitational field on the ground and we have seen in both crews shrinkage of these muscles. The nitrogen which is an important part of the makeup of these muscles have been excreted in the urine and on both missions we've seen an increase in the urinary excretion of nitrogen and - by using some photographic techniques - we can assess the size of the astronauts muscles before and after the flight. And we've seen the shrinkage of volume particularly of the legs but also as I mentioned to a certain extent of the rest of the body as a result of not using these muscles. The amount of muscle loss from the legs - It's very measurable - but it's not anything alarming. You wouldn't look at the man and say, he must have something the matter with his legs, there're all shrunk down. This is not the sort of thing you can see by eye. It is something that has to be measured.

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It's a fairly subtle difference. The volume of the legs is perhaps reduced about 5 percent, something like this. But it is a significant change - and it is something that we have been able to measure and assess by more than one technique. Now the other thing about which a great deal has been talked is calcium in the bones. I think some of you who were here at the briefing before the last launch left here with slightly the wrong impression about the calcium in the bones. Calcium is lost from the skeleton during space flight. It appears in the urine in quite considerable amounts. But this is in no way a worrying or frightening event. The body contains a great deal of calcium and the actual amount which appears in the urine is really very modest compared with what's there already. The first crew showed a loss of something like 2/10ths of 1 percent of the total amount of calcium in the body. And this present crew that have just come back, look as though they've lost perhaps twice as much of that, but we're still down as a fraction of the percent of the total body calcium. This is measured by this input and output technique which I mentioned. We also have a more direct way of measuring the calcium in the bones, and this is by a technique where a beam of radiation is shown straight through the bone. It's similar in many ways to just taking an x-ray of the bones and - only one of the - crewmen from this last mission that just come back shows any change at all in his bones that was measurable by the technique - he showed a very modest loss of calcium from the ball of the heel, which is the bone which is most likely to lose calcium if you're floating around in weightlessness, and this loss of calcium from the heel is of no possible clinical significance. It would have to - the loss of calcium from the skeleton would have to continue at that rate probably for a year before a doctor would even raise his eyebrows at - with any sort of worry as to the strength of the bones. So as far as Skylab is concerned, we have measured the changes, but they are not in any way worrying, they're just of great interest and they're giving us good data which should be able to let us predict what is going to happen on a longer flight such as a flight to Mars, where - then we may have to think seriously about - well, if this effect goes on for a year, then we might be in trouble. But certainly on 2 or 3 month duration missions such as we are seeing at the moment the changes are measurable but not in any way any cause for concern.

QUERY

Which crewman?

WHITTLE

Garriott.

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QUERY Were you saying that the other crewmen showed no changes?

WHITTLE They lost the calcium as seen by an increased calcium in the urine. But as far as direct measurements from the bones are concerned we saw no changes. This is because, by measuring calcium in the urine we can pick up fractions of a tenth of a percent of - the total body calcium. But actually direct measurements on the bones, we don't see anything until about 2 percent of the calcium has been lost from a bone, and the sort of losses we've been seeing have just been less than that except for just one instance in - Garriott, where he did lose about 5 percent of the calcium from the heel bone.

QUERY I just want to follow that. Get the right statistics. Now you gave us for Skylab II a figure of 2/10ths of 1 percent calcium loss and that was measured by calcium excreted in the urine -

WHITTLE Right.

QUERY And it was approximately 4/10ths of one percent calcium for the Skylab III crew.

WHITTLE That figure is not finally worked out yet. We haven't got all the data in, but it will certainly be less than 1 percent.

QUERY Okay. Now as to the direct measurement of calcium loss from the bone by the x-ray technique - what were the comparative figures as far as we know from both the missions?

WHITTLE On the measurements we made on the wrists on all crewmen, no change within the errors of the method which as I said is about plus or minus 2 percent. On the bones of the heel for the five - for five of the crewmen, no change within the errors of the method. On Garriott we saw around 5 to 7 percent loss from the heel. The heel is particularly sensitive to loss of calcium if you remove it from weight bearing because there are two major stresses on the heel. One is the weight of the body pounding on it as you walk around, and the other is the pull of the Achilles tendon on the heel which you feel standing on tiptoes, particularly applies to people who do jogging and - Garriott is - is quite an enthusiast for jogging and running and so on. The weight of the body is taken on the ball of the foot, which is quite a long ways forward of the heel bone and the Achilles tendon pulls on the back of the heel bone and puts something like four or five times the weight of the body onto the back of the heel bone in order to balance the see-saw with the weight of the body coming down on top. The ball of the foot at this end

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and the Achilles tendon balancing it at the other end. The Achilles tendon puts a tremendous stress on this bone and if you're not walking or jogging, the amount of stress on the bone would be very much less and we'd expect this bone to lose calcium much quicker than the rest of the body just due to this purely local effect. And I think what we've seen in the Skylab is that the general loss of calcium in the skeleton is not of sufficient magnitude to show up in individual bones; but that a local effect such as this - effect on the heel bone is sufficiently big to show up.

QUERY Curious - - it's not directly on the subject, but if the second crew in the condition they were when they splashed down or got on to the carrier, these three men had walked into a doctors office - and you didn't know they'd just been in space two months, what would you have thought had happened to them? Anyone who wants to answer.

WHITTLE Well, first of all they were very tired, they'd all been up for a long time and it was obvious from looking at them, that they were just suffering from plain old fatigue. The problem they had standing and the slight unsteadiness they had walking, I think would have made me think that they'd probably been in bed for a week maybe with some mild illness from which they'd now recovered. I certainly wouldn't in any way been alarmed at their general condition, but I would have thought that there had been something going on, but something nonworrying and obviously very readily recoverable. And that we saw; by next couple of days they were good as you or I.

QUERY Is the calcium following bedrest?
WHITTLE We haven't got sufficient data back from this last mission yet to be quite sure, but it looks as though generally speaking it's following the results of bedrest studies, yes. Another thing on calcium is that - Dr. Vogel's group from - University of California have been studying calcium losses for some time and have discovered that there are enormous individual variations from one person to another and in fact Carriott of all the crewmen, is the one that you'd most expect to lose calcium from his skeleton on the basis of these other studies and Lousma, you would expect to hang onto his calcium very well, and Bean was somewhere in the middle - so that the bedrest predictions as to who was going to lose calcium from their skeleton most readily have certainly been borne out.

SPEAKER Okay, I guess at this time we will move along to Dr. Carolyn Huntoon.

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HUNTOON As Mr. Pomeroy has already told you, I am the Principal Investigator on the Skylab Experiment M073, which is the Bioassay of Body Fluids. This particular experiment was designed and has been conducted in order to assess man's response, biochemically, to the stresses of space flight. And the area that has been showing us the greatest changes and has been of a great deal of interest of all of us is in the area of fluid and electrolyte control, and how these have been changing. You probably recall from our Apollo work, we did find very significant changes in the Apollo crewmen after they returned from their lunar mission, in this area, and it caused a lot of concern about long duration space flight and what sort of changes we might see. These early changes that we found and that might have been talked about - the weight change as an example - every space flight today, with two exceptions, we have seen about a 6 pound loss in weight, and everyone has discussed these weight losses in terms of water loss and/or tissue loss. With the experiment that we conducted on SL-II and III, we were hoping to get a little bit better information on the portion of that weight loss that was a fluid loss, and exactly when it occurred in flight. Because of the problems with the SL-II mission, early on, we didn't get the exact kind of data we thought we would the first week of the mission. And that left us a little bit still query about how those changes occurred. SL-III: we did get better data, and I'll mention that if we get to it. In this particular area there are two hormones that are particularly important to us in the control of water and salt. And if I could have the first slide. The antidiuretic hormone is from the posterior pituitary. It is - It's referred to as a neural hormone because it is released first from the brain, down to the pituitary which is an organ - a gland at the base of the brain. It acts as a kidney to retain water or prevent diuresis, anti, so therefore the name, antidiuresis. If we can have the next slide, we'll look at the changes in this hormone on - this is the SL-II data. If we look at a preflight mean in the urinary output of this hormone for the three crewmen we see the levels that it reached. If we look at the inflight means on 6-day centers (cough) and we see that early on, it was very high in the Commander, and it tended to come back down never really reaching preflight level. The Science Pilot

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was a little bit different. He was high early in flight and then tended to fluctuate more, being high again postflight. And the Pilot was safe high, throughout the mission, also. This we interpret as being a challenge to the body that took place inflight to retain water. And this - we wonder what is the mechanism that causes the body to need to retain water at this constant level throughout the mission. This first part, and the high peak first, I think we can explain on the basis of that tremendous heat load that the crewmen were operating under for the first week in flight. And I don't think that anyone would disagree that. That's pretty well documented. The rest of it, I believe, is part of the response to adaptation to the change in fluid compartments in space flight. May I have the next slide? Aldosterone is a hormone from the adrenal gland that responds to a variety of stimuli. Particularly, the ones that we are considering is - are the sodium (garble) or potassium excess renal factors. And by this we mean hemodynamic factors in the kidney - the change in blood flow in the kidney. And we'll see a response from the adrenal gland with the aldosterone secretion. This hormone acts again at the kidney, renal tubule. It can also act at the salivary, sweat glands, and in the intestine. But it acts to retain sodium and excrete potassium. So, we have a hormone here that, while it helps us to maintain our sodium balance it - when it is active it also helps to create a negative potassium balance. And if we could have the next slide - These - The data from the urine secretion of aldosterone in the Skylab 2 crewmen - And you can see the very significant increases throughout the mission in this hormone and still postflight for the first 6 days and then we can back down to a more normal - in fact, a less decrease in secretion, postflight, on those crewmen. This again might be interpreted as the body's response to maintaining a salt balance in the place of adequate salt intake but wasn't. The body had a need for sodium. It was using aldosterone to maintain the sodium. May I have the next slide? Urinary alkaline, you see, I'm showing you instead of showing urinary sodium because it is a direct reflection. We see early on in flight, losses of the side compounds in the urine. And, then, on the Commander, it seemed to level out for a while; it would have to go back up. The Science Pilot, after that first portion, seemed to be coming back down for a more preflight level; and the same thing with the Pilot. And this is similar to data that we saw on SL-III which is still incomplete, and that's why I'm not showing them today. The next slide. Urinary cortisone - This experiment - as I mentioned we're trying to get to the stresses of the space flight and - and he is responding, and if, indeed, the space flight environment is stressful to man. Cortisone is the

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main hormone from the adrenal gland that is responsive to this stress, and many, many different kinds of stresses can cause this hormone to be excreted in high concentration. It's very hard to say which particular stress causes this. We think in terms of shifts in blood volume compartment - the fluid compartment, and perhaps the actual physical stress on the body of not having the - the gravity that - that we're used to. But we do see, in this mission, and in SL-III, significant increases in urinary cortisone throughout the mission on all three crewmen. So, we do know that the - the - they were responding to a stress throughout the mission. It - It did please us to see that this reached a level that - and it didn't seem to go any - any higher after a while. The same thing happened on the SL-III crew, as though they reached a new plateau in their cortisone secretions. Next slide. The other area of consideration for stress was we were looking at the hormone norepinephrine. It's one of the hormones from the (garble) nervous system that is also responsive to stress. This hormone is particularly involved in the maintenance of blood pressure. In flight, we noticed an actual decrease in the Commander in this particular hormone. Prac - Practically no changes in the Scientist Pilot, and perhaps a slight change, toward the end of the mission, in the Pilot. But we notice on all three crewmen, very significant increases in this hormone after returning to Earth. And we do interpret this as the attempt, by the body, to maintain blood pressure after returning to a one-g environment. That's all I believe we have time for. So, in summary, we have attempted and measured quite a lot of these changes that we were seeing postflight. We also measured them inflight and have a pretty good idea of the time course. SL-III gave us much more data, and in general, the findings were very similar to these, although it appeared that on - on some of the changes that we noted in SL-II, we weren't seeing a plateau. However, on SL-3, it appears that a plateau has occurred usually around the third - fourth week of the mission. The next mission coming up we're quite excited about, because this will allow us to - to test this - follow this hypothesis of ours that a new adaptation has been reached by the crewmen. And so, we're waiting for this 85-day data. Questions?

PAO

We'll take any questions at this time.

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QUERY (cough) When you say the plateau occurred the third or fourth week of the mission (cough), excuse me, on the second mission, why didn't you see this in the third and fourth week of the mission - in the first mission which went four weeks?

HUNTOON Well, it's sort of hard to know if you've reached the plateau if you don't make a measurement beyond it.

QUERY And do you in any way think that you might - you might have two anomalous crews here? I mean there is a straight line curve.

HUNTOON Well, I think one thing that can be said - and I'll try to speak for all the investigators - medical investigators on Skylab, is that we have seen an awful lot of individual variations. And we - but we've felt this through - out Apollo; very difficult. You can't put all of the men and compare them with each other. And this is one reason that we ran a 21-day preflight control, as Dr. Whittle mentioned to you, collecting our samples daily for 21 days so that we could establish a baseline for each man. You cannot compare the - you can compare the percentage of response each man has to his own baseline. But the men, it's very very difficult to compare the men.

PAO Okay. Are you through - Our next speaker is Dr. Steve Kimzey, JSC, principal investigator on the M15, and I believe you have some viewgraphs.

KIMZEY I do. Before I start, the experiments I'll talk about represent five experiments that are the work of some eight principal investigators in various medical centers and at Johnson Space Center in Houston. These experiments look at the chemical and cellular components of the blood, and if I could get this first viewgraph. I think we could probably leave the lights on. They're all line drawings. I think they'll show up all right. I don't want to oversimplify for you, but if we separate the blood into its three main components, we get three large compartments: the plasma, or the liquid portion of the blood; a buffer coat composed of white cells and platelets, and then your main cellular (garble) the red blood cell. These experiments are looking at various components from the standpoint of their function and their volume relationships. You remember from last time, we indicated that the function of the white blood cells appeared to perhaps be compromised on recovery. And that this finding was, if anything, a very short term effect, and at that time we were very indefinite about its significance. We saw the same results on Skylab III with the lymphocytes, which are one type of white blood cell. Ability to function

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normally on recovery to an in vitro challenge; significantly compromised. The cells had recovered to normal by R plus 3 and in the words of the principal investigator, the findings - does not have clinical significance as such. We still do not understand what causes it. In fact it's a very baffling finding. You would not expect to see this response in any sort of normal illness situation. It does inquire that perhaps during the first few days following the mission that the men might be more susceptible to an ordinary infection than would the average person. But again let me emphasize that from a clinical standpoint we're not concerned about this. It is an interesting finding, and we will - we have added additional tests on this mission to try to explain it in more detail and understand exactly what is causing it. So hopefully after the next mission, we will have a better handle on it. The next viewgraph - I'm sorry, that's out of order. Why don't you see what's next? Yeah. Just hold that in your hand, it's a kind of simple one. If we look at the body fluids department Dr. Leach Huntoon talked about in general, we can divide them into basically extracellular and intracellular spaces. And one of the main intracellular spaces that we're interested in is the red cell volumes. On the first Skylab mission, as you know, there was a significant loss of red cells during the flight, a loss that completely unexpected, though it had been observed on Apollo. And we thought that the atmosphere of the Apollo was the cause, and since the atmospheres between Apollo and Skylab were different, it was a complete surprise to us to see this drop on the first Skylab mission. The - no, not that one. Go to the next one. I'm not sure how that one got slipped in. Yes, that one.

KIMZEY This slide shows the drop in the red cell mass from preflight level. The open figures represent the three crewmen on the first mission. On the second Skylab mission, we again saw the same average drop, but we saw a lot more variability with Commander showing only a 6 percent loss, and Owen Parriott, the Science Pilot showing a 20 percent drop. If you recall, on the first Skylab mission we remeasured this after 14 days. There was no increase in the red cells, no indication that the red volume was being made up, and it wasn't until some 40 days out that we begin to get a slope back to normal. The difference - the main difference between the first mission and this one is that after 14 days we now begin to see in all three crewmen a significant reaccumulation of the blood cells lost in flight. And we did a measurement on them in Houston this past week before we left, which is comparable to this time frame, and all three crewmen are back to their preflight level, if not slightly above. So we did see

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a drop similar to the first mission. The drop was about the same order of magnitude, which does suggest that the crew has stabilized and hasn't reached a new blood cell volume which may be, for a weightless condition, their normal blood volume. It certainly doesn't indicate that there's a continual loss after 28 days, which if it were, would be a significant finding. The amount of blood loss is not significant in terms of compromising a man's ability to perform normal functions, does not represent a threat to his health, or does not represent an end point or a great limiting factor with respect to the duration of the mission. That's fine. Yes. One way of assessing an increase in red cell volume is the making of a cell type known as a reticulocyte. This cell is a precursor of the red blood cell in the body, and the normal value runs about fifty reticulocytes per thousand red cells. This number - well this is the normal preflight value of these cells. On the first mission during the post flight period, we saw no indication of any increase in the number of reticulocytes, which coincides with the fact that the red cell mass was not reaccumulated during the 14 days post flight. On this mission, about 3 or 5 days following recovery, the number of reticulocytes in the blood began to increase, which is consistent with an increase in production of cells, which is consistent with an increase in the red cell mass back towards the normal level. Another finding on this mission was that the plasma volume was significantly lower at - on recovery, and this slide you've been holding is the one we're - no, you got the right one. The other one, yes, that's the one.

Okay, we - if you remember the graph we showed you at first, if we measure the hemoglobin concentration in the body, two things can make the hemoglobin concentration go up or down. One is a change in the red cell components, another is a change in the plasma volume. The plasma volume compartment is much more labile. It changes very rapidly with exercise, with space dehydration, very quickly. So an elevation in the hemoglobin concentration which we see from samples returned that were drawn inflight as well as well as samples that were actually measured in flight by the Science Pilot, indicates that there was a loss of plasma volume. This loss seemed to occur very quickly, and by mission day 3, was probably as high as it got. And this was also consistent with bedrest findings, which show a loss in plasma volume. The time course however, is very much shorter, so that they - they - seem to again it points to a redistribution

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of body fluids in a weightless condition. Is that the same
one on a different man? Why don't, we just skip that and then
go to that last one which is functions? Okay, that's the one.
The hemoglobin concentration measured in post flight showed the
same high value, and then a rather dramatic drop by R plus 3.
This dramatic drop in hemoglobin is due to a rise in plasma
volume and coincides with a sudden weight gain in the crewmen
of 2 or 3 pounds.

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KIMZEY

- - This dramatic drop in hemoglobin is due to a rise in plasma volume and coincides with a sudden weight gain in a crewman of 2 or 3 pounds between these two time frames. So what we're seeing is a reaccumulation of body fluids and a reaccumulation of plasma volume back to normal, resulting in the concentration of hemoglobin being - going down, and then oscillatory period as they begin to level off and get back to their preflight level around between 13 and 14 grams. Other studies in this series of experiments looked at - next slide - looked at red cell function. If we consider red blood function a model system, glucose is utilized and converted to a compound called lactase by a series of biochemical reactions. In this series of reactions, a high energy chemical compound called adenosine triphosphate is generated which is a source of chemical energy. This chemical energy is used for a variety of functions: Osmotic work to maintain a water balance in tropic cell membranes; the structural integrity of the cell; transport the molecules across the cell membranes; and normal hemoglobin oxygen carrying capacity of the blood. We looked at some 10 individual enzymes and metabolites in this path way, as well as studying each of these functions. And can sum it for you very clearly; all red cell function was normal postflight, which indicates no compromise in the normal function of the red cells as a result of the space flight condition. So if we sum it up, I think again the most significant finding in this series of experiments has been the change in red cell mass. We talked earlier about the possible causes. Red cells have a finite life span and so the amount of red cells in your body is a balance between a normal production rate of about 0.8 as a volume per day as well - the same amount of cells are destroyed each day through the normal aging process. All of our data to date indicates that the cause of the loss of red cells in Skylab is not an accelerated destruction, but is rather some sort of suppression of the red cell production. We do not understand the difference in the postflight response from the standpoint of the second crew responding very quickly and regaining their red cell mass. The first crew showing a - a delayed response of at least 2 weeks, perhaps longer before they began to reaccumulate the red cells. There are a lot of hyper - speculative theories that we've all kicked around, but in terms of having any absolute data for any of them, we simply do not have any at this time.

PAO

Okay, Steve, if you'll rejoin the podium panel - We'll take questions at this time for Dr. Kimzey and the other members of the medical team.

QUERY

I have two questions for Dr. Kimzey. The first is, do you have any indication that there was any reticulocyte response in orbit at all?

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KIMZEY We do not have any data from inflight. We do hope to return blood samples - Well, we return blood samples now, you know. This time we hope to return slides and actually do a reticulocyte count in flight. The blood as we are now getting it back, these cells are frozen and when they thaw, they're fractured. So it is impossible to do any sort of reticulocyte work. But on this mission, we are hoping to bring back dried blood films made in flight, with which we'll do a reticulocyte count after the mission.

QUERY Who is going to do this? Is it a problem to do a slide in zero g?

KIMZEY No, it isn't. It's a - it's a standard procedure which is part of the inflight medical support system and - so the capability is there, the equipment is there and the crew has been trained to make blood slides.

QUERY (Garble)

PAO He'll be right back.

QUERY What is the normal life span of red blood cells?

KIMZEY The normal span is 120 days.

QUERY I don't know anything about medicine, I guess, but where are red blood cells manufactured? In that in the bone marrow?

KIMZEY In bone marrow in adult males, yes. And as I said earlier, you produce about 0.8 of your red cell volume per day and you lose about the same amount; so you maintain a constant volume.

QUERY All right. Is anyone looking at bone marrow or is - to see if there's some change in the function there?

KIMZEY We'd love to look at bone marrow. Unfortunately it's a very traumatic and - sampling to do, to take a blood bone marrow sample. So we're not - do not have plans to take bone marrow samples from the crew. We have not exhausted all of our other procedures to isolate - cause to the crew. We are doing other tests such as the iron turnover rates, which are normal - indicating normal bone marrow functions. So we don't have any data right now, to point to and say the bone marrow is abnormal. What we have is - looks like - again, I'm being very speculative. It looks we have a normal production, but it's just slower rate.

QUERY Are there no indirect ways to determine the function of blood marrow other than red blood cell production?

KIMZEY Well, the iron turnover studies we're doing is an indirect way. And since they are normal, we were actually measure - iron is incorporated into the cells as they are produced. We inject a radioactive tag - iron 59,

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which is radioactive component of iron and we measure the disappearance in the plasma, as well as the reappearance in the cells. And this gives us an indication of the turnover of the iron or the incorporation of the iron into the new cell, which is a measurement of the rate of production. And if there is bone marrow damage or bone marrow malfunction, usually plasma iron turnover will be down in - as a good test - an indirect test, of bone marrow function. But now it's normal postflight, in both crews.

QUERY Very stupid question, I'm sure. How do the red cells get from the bone marrow to the blood vessels?

KIMZEY Well, they actually pass through a sinusoid in the bone marrow - sinusoid cavity. And it's a spongy-like material and the cells actually travel through these walls, these cavities into the capillaries and into the bones.

QUERY Another question was, Dr. Bergman promised that Dr. Kimzey would expand a little bit about the heart size and the problem of the cardiac muscle destruction, or what have you.

KIMZEY I noticed you did that. The actual total blood volume loss is on the order of average of 10 percent. And we aren't sure about the distribution of blood in a weightless condition as compared to the distribution of blood in the one-g environment. So we don't know - I guess I'm being evasive because if you don't know the answer to the question - It's possible that the lower blood volume in a weightless condition is actually what the body wants. If it wants anything. What the receptors are actually setting it for. If this is the case then, it wouldn't - I just don't know what the heart size effect would have - What it would have on the heart size.

QUERY Because Chuck Berry at one point during the middle of this last mission tells us there were two points of serious concern. And one was the - the reason for the red blood cell mass and the other was the heart size problem. And I'd like to know - and now we hear that there - I think - I don't remember who said it, but there might actually - people might actually think it's not marrow and hormonal, but there might actually be myocardium damage from these missions, which would lead one to believe that the many - the more times the man flew, the more heart damage - heart muscle damage he might have. Is there anything along these lines to back this up. And second, I don't know how you can measure a heart down to 3 percent. Nobody else seems to think you can do it.

BERGMAN I guess that's my question. First of all

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I - wanted Dr. Kimsey to answer these - to present the data on the plasma volume to indicate that this is done postflight and that is the point in time in which we take X-rays of the chest and heart. The decrease in the heart silhouette is therefore a combination of this decreased plasma volume, decreased red cell mass, and a possible decrease size of muscle fibers. So that it's very complex.

QUERY Don't you get a 10-percent cycle in that change in heart size perhaps, as much as 10 percent in the cardiac cycle?

BERGMAN We measure the - we actually take films during the end of fillings; that is when the heart is largest. And we also take a film at the end of ejections, when the heart is smallest so that we get both data points, pre- and postflight.

QUERY Well, do you feel there was actual myocardium damage, scars?

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SPEAKER No, I don't. There is a decrease in cardiac output postflight, but that in no way implicates heart damage as such.

QUERY Then you feel it - it was neural, hormonal, and plasma levels that you could attribute the - the three percent to. You don't feel this actual muscle loss, do you?

SPEAKER Perhaps it's a small amount of muscular atrophy at most. But yes, in fact, a complex set of all those things in concert to give us this picture.

QUERY Well, how do you define muscular atrophy if not loss of myocardio?

SPEAKER You don't actually lose it, it's just a matter of - a weight lifter lays off weight lifting, his muscles will go down a bit. That doesn't mean he's lost it.

QUERY Does it ever grow back?

SPEAKER Of course.

QUERY Are the hearts of the first space crew back to their previous size?

SPEAKER Yes.

QUERY They are?

SPEAKER Yes.

QUERY The second crew?

SPEAKER Yes.

QUERY This is perhaps a parallel question. I'll address it to Dr. Whittle, though. Eight days after recovery of the second crew, they complained of tired blood, to use Al Bean's own words and Lousma for his part said, Quote "Right now I feel anemic. I feel like I want to lie down all the time." The question is, did any of these three men suffer actually from anemia and how long does it take then to regain their normal sense of normal well-being (garble). Not necessarily do we want this in terms of highly refined data, but their own impression and their doctors impressions and then how could you compare the second crew with the first crew.

WHITTLE - - I think Dr. Kimzey ought to answer the - the questions on blood.

KIMZEY Well, I know what you're saying and we talked with Owen Garriott is a very intelligent man and very conscious of what's going on and was very interested in what we were doing. And I think the definition of anemia is very difficult to make. I think if Owen Garriott had walked into a doctor's office on R plus 3, and had such a low reading, he might have been looked at a second time and considered, perhaps, anemic. But in terms of having tired blood or being - or their loss of red cells affecting

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their functional capacity to perform work, it is not enough in our opinion to do so. In other words, the loss that they suffered - I shouldn't use the word suffered, but the loss that occurred in both crews is not on the magnitude to be considered a serious problem. If we had gotten a 30 percent loss in the second crew after getting a 15 percent loss in the first crew, then we would be extremely concerned. The fact that we did not see more loss indicates to us a plateauing or reaching adapting state and frankly - personally, I feel a lot better about these finding than the others. In terms of returning to normal for these men, which could cause a very - very good physical condition much higher than some of us would have in not as good condition in terms of the volume of blood per body weight. The first crew took somewhere on the order of 40 days to recover, but they did not start to recover until after the first 14 days post-flight. So somewhere between 14 days and 42 days they began to recover. The second crew began to recover after the first 3 or 4 days post-flight and by R plus 14, had made significant recovery in terms of returning to normal or returning to pre-flight. And by R plus 40 and all three were back within their pre-flight stages. So we did get a significantly different response post-flight in terms of rate of recovery of the red cell mass.

WHITTLE I think, in fact, the crew is probably diagnosing themselves flatly wrongly. I think what they were describing was the tired blood and everything was really the fact that they could not perform exercise at the same rate that they were able to perform it pre-flight. And my opinion on this was as a result of the fact that they hadn't been using their muscles while they were up there. They had lost some of the bulk of their muscles and they were just not as physically capable of performing this work post-flight as they were pre-flight. But they were told that they showed a decrease in the red cell mass. And I think that they were ascribing their problems in taking exercise to an anemia problem, whereas I don't think it was. I think it was just the fact that they were out of training and they needed to train up their muscles again.

QUERY What makes you rather sure that there is no destruction of red blood cells, but rather a depression of the manufacturing process.

KIMZEY We have done tests in the past on - on Apollo and in ground base studies where we can - we did get what we felt was an accelerated destruction of cells.

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When you do this, the functional test we do in the lab usually shows a compromise in the cells function, its inability to withstand stress changes in the high energy metabolic compounds in the cell, changes in the rate of transport of molecules across the cells membrane. All of these are characteristic of the increased intravascular (garble) which we can cause in ground based studies due to high oxygen, for example. We saw none of this in Skylab. We saw no indication of accelerated hemolysis. Some of the carrier proteins in the plasma which normally binds excessive hemoglobin and therefore would show short drops in your concentration if you did get excessive hemolysis did not change during the mission or- We've compared the inflight samples and the pre- and post-flight values are all the same. So we have quite a bit of positive data indicating that there was not an acceleration of destruction. Unfortunately, we do not have data on the other.

QUERY Two questions on the - for anybody that feels they'd like to answer them. First of all, - well, in connection with the cardiovascular findings. Was there any findings relating to the changes in the arterial system - the arterial ability to push the blood through? And the questions that I'm really directing to everyone is have the findings from all these various medical experiments shown any correlation between any event that occurred in flight, the excitement of the crew members on the solar flare or the fear that something was going wrong. Was there a correlation between all these findings.?

KIMZEY The - there was no correlation to - to any event that may have gotten their - into their systems - what overtime. As far as the arteries pushing the blood through, it's the heart that pushes the blood through, and the arteries more or less impede or temper the blood going through the arteries. As I mentioned post-flight, there was a decrease in the cardiac output. That is, at any given work level, the heart did not pump as much blood as had pre-flight. But this is a more complex problem because you have the loss of red blood cells - the end point is to deliver oxygen to the tissues. And if you reduce the cardiac output, and yet increase the ability of the tissues to extract what it needs, such as oxygen and nutrients, then you still come out with the same accomplishment. And that is you deliver what's needed. But here again, if you decrease the plasma volume and red cell mass, and there's also a slight deterioration of the cardiac muscles, and there's also a given (garble) of perhaps vessels feeding a muscle. All these things - it's very difficult to separate them out. But they probably all contribute to decrease the cardiac output and delivery of oxygen.

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SPEAKER This is a (garble) upon this. Very recently I read a report from Dr. Berry, and I'm not too sure what part potassium plays in the system. (Cough) As I got the impression that the body does not retain potassium. And any deterioration in potassium has some bearing on what I took to mean fatigue.

HUNTCOON Well, I would like to discuss this potassium point. On Apollo 15 was the first mission that we had actually measured an exchange for potassium and we did find a decrease. We measured it on Apollo 16 and 17 and found variable results and generally a slight decrease (cough) in total body exchange for potassium. I mentioned to you the hormone aldosterone which does contain sodium to maintain fluid balance in the body, at the expense of potassium. So we think that the levels of potassium losses as we saw in Skylab II and III, measuring them by a balance technique that's not described to you on the intake versus output. Those levels were about comparable - the loss of protoplasmic potassium was comparable to what we measured on exchange when we counted it, so we think that it's accounted for by the aldosterone plus the muscle loss that you would expect - the amount of potassium loss is muscle. So we have measured variable potassium usually - generally lost in potassium when it's lost. But with the high intake that we have had, and they have maintained very good intake throughout Skylab, it has not been a problem.

SPEAKER We can also point out that the muscle weaknesses associated with the low serum potassium, whereas the serum potassium measurements that we've got are all normal.

PAO We'd like one more question on the medical.

QUERY Dr. Bergman, what is your error estimation for your X-ray technique for heart size?

BERGMAN This has not been worked out exactly, but we did a preliminary estimation on several of the X-rays that we had analyzed in previous missions - Apollo to be exact. And we found that it was within 1 percent.

QUERY Then why do you need an echo-cardiogram?

BERGMAN Echo-cardiogram, again, is to try to ferret out which part of the decrease in the heart thorax is due to heart muscle versus - which of it is due to the (garble) of the heart. The echo-cardiogram virtually gives

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you a picture of the heart chambers and the wall thickness.

QUERY Could I just ask - How can you be sure
your error is only 1 percent - -

BERGMAN Well - -

QUERY - - without actually taking it out and
measuring it?

BERGMAN Well, this is by doing - any measure-
ment like you're right, of course. Any measurement like this,
you have to assume that over many measurements of the same
phenomena that you will approximate; the more measurements
you make, the more closely you will come to the real value.

QUERY Then how many times did you measure these
men just after they came back to Earth? (cough)

QUERY I'm getting - what I'm getting - -

BERGMAN Uh - -

QUERY - - at, of course, is how can you be sure
that the one measurement that you made, or two measurements
that you made just after splashdown, or shortly thereafter,
were the accurate ones - were as accurate as your pre-
measurements?

BERGMAN I think we've taken eight X-rays that
for a period of time before flight - -

QUERY On the ship?

BERGMAN We took six on the ship, I believe.
Let's say we take - we take one in the (garble) and indirectly.
We do it immediately, or as soon as possible, and we do it
after the 12 days, and we do it the next day, and then we
follow it until it's back to normal.

QUERY How long did it take for the 3 percent
to disappear?

BERGMAN I don't have it - the problem is that we
can't do this on a daily basis; I thought maybe (garble) a real
contact. It's just that on R plus 16, I think, when the
second crew, they were back.

QUERY Again, one final question if on the
cardiovascular response post-splashdown on the second crew
versus the first crew. It just seems that the second crew
recovered their orthostatic or happened to have much better
orthostatic tolerance much more quickly than the first crew
despite the fact they were in space for twice as long. Now
what do you do? You wait for the third crew and see which
of the first two was the normal?

BERGMAN I'm afraid so. We have theories to
help explain it, but we don't know the answers. It would be
very interesting to see what the third crew shows.

PAO Okay that completes our medical portion.
We'll turn now to astronaut maneuvering devices.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Khoustek Observations During EVA, Briefing
Johnson Space Center
December 24, 1973
11:02 CST

Participants:

William Snoddy, Khoustek Project Scientist
Terry White, PAO

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PAO Kohoutek project scientists, or the
Kohoutek comet observations.

PAO Dr. Snoddy, I guess we're still rolling,
aren't we, Art?

PAO Okay.

SNODDY Perhaps I'll start by saying it's not
Doctor, it's Mister.

PAO Oh. Everybody around here is Doctor.

SNODDY Yes. (Laughter). Some people have to be
different. Okay. I'll talk a little bit about Kohoutek. I
plan to say a little bit about the comet itself and the
status of the comet as we know it, little bit about the ob-
servations that we completed already on Skylab, then of
course say something about the EVA, which everyone's inter-
ested in. And then end up, I guess, by talking about some of
the things that ATM is doing on the comet. The status of
the comet is it's continuing to deveope nicely. As you
know, Kohoutek is rapidly coming to the end of the journey
that it started some 2 million years ago in towards the Sun.
Before that time it was in orbit around the Sun but at a
distance that - that never brought it any closer in than prob-
ably the planet Jupiter's orbit, and that was only for
brief periods of time. So it was leading a relatively quiet
existence way out on the outer fringes of the solar system
so far out that it took the light from the Sun about a half
a year to reach the comet. And as a matter of fact, the
Sun itself only looked like a star from that distance, some-
what dimmer than the planet Venus appears to us. So you can
see why that region is called a deep freeze and why it is
thought that perhaps the original material of the solar sys-
tem that perhaps condensed to form this comet should be
relatively undisturbed, being in a deep freeze of that nature.
And then something apparently did disturb the orbit of the comet.
It's been moving in towards the Sun now for some 2 million
years and on the 28th of December will pass by nearest the
Sun, and very obligingly will - is already vaporizing due to
the heat of the Sun, and this vapor gas lends itself very
nicley to spectrographic observations which is what we're
making on the ground and what people on Earth are doing.
And so this - it in effect telling us what it's made out of.
It's kind of giving us a message that concerns perhaps the
origin of the universe. So it - we're very - looking for-
ward very much to what happens the next few days. The comet
itself is pretty well lost to view from the Earth now be-
cause it's so near the Sun and the brightness of the sky
prevents you from being able to see the comet. We're pretty

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well depending on the observations of the astronauts who remark each day about how much brighter it appears than the previous day. A rather interesting observation was made yesterday with the ATM instrumentation. They were observing the comet and they used the TV system associated with the S052 white light coronagraph to help point the ATM system toward the comet, and it so happened that the planet Mercury was also in the field of view of this instrument at the same time - time so the crew was able to make some observation about the brightness of the comet relative to the brightness of the planet Mercury. And it's a rather tricky process to do that using the TV system because the comet is a more diffuse thing, whereas Mercury, of course, isn't and electronic systems tend to see these things differently so it's - it's rather tricky business, but they did make the comment that they couldn't really see any appreciable difference in the brightness of the two objects, which is interesting in that Mercury was about minus 0.5 stellar magnitude in brightness which is about in agreement with the Smithsonian predictions as to what they would expect Kohoutek to be at this time. So this give us encouragement that indeed Kohoutek is following the Smithsonian predicted curve which goes up to minus 4.2 on perihelion day, and we hope indeed that is the case because the brighter the comet is, not only does it offer a better display to the observers here on the ground, the public in general, but also it - it's a more intense object and therefore we can get more information from it from our instrumentation that's looking at the comet. The data from that TV system was supposed to have been recorded and played back down to the ground last night. I haven't seen it myself. I don't know whether they had the particular shot where they had Mercury and the comet in it or not, but if it did I'm sure the S052 scientists will be taking a good hard look at that and trying to determine just exactly what that does tell them about the brightness of the comet. We're all very anxious to see how intense it's really going to grow and what the dynamics of it really would be. The observations that we've completed thus far, we have, as of the day before yesterday completed - or I'm sorry, yesterday, we completed the observations out of the - the airlock, the scientific airlock, using S019, S063, S201, and S183. These instruments have been synoptically observing the comet throughout the time that Skylab's been up there. S063 had observed it eight times over the various intervals. S201 had observed it five times, and S183 had observed it three times. These three instruments were primarily looking at the - getting images of the comet showing the hydrogen cloud that would be sur-

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rounding the comet, the oxygen cloud, and the OH cloud, if there is one, and it's expected that there is. So we - they have been mapping the development of this cloud as these materials - as the comet's heated up. S019 is a spectrographic instrument that gets data over a a broad range of wavelenths and the - one of the more interesting things that it accomplished hopefully recently was on December the 16th. The comet passed within 3 arc minutes of the star Pi Scarpia - Scorpius. This is a third magnitude star, and on that particular day we observed this star twice with S019. Once, just before the comet got to it, to get a spectrum of the star, and then again while the comet was in front of the star so to speak, or while the coma of the comet was in front of the star. We want to see how the spectrum of the star was changed by the light from the star passing through the coma of the comet.

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SNODDY - - how the spectrum of the star was changed by the light from the star, passing through the coma of the comet. It's expected that some absorption could take place and we would get some absorption spectrum caused by the - the coma. This has never been done before in the UV and this is the only chance we had during the Skylab mission to get this sort of data. So we were delighted that apparently everything went well that day and we hoped that we got good data which we'll only know once the film is returned to us. On EVA day, we will be making the two kinds of observations of the comet. One, with a - this we call T025. This is simply a Nikon camera that will be looking at the comet through a series of 16 filters. These filters are based on specific emission wavelengths that are expected to come from the comet. In other words, different material associated with the comet such as the hydrogen, the oxygen and so forth, tends to emit light at certain particular wavelengths. So if you select a filter that only transmits that light, then what in effect you get is a photograph of the comet showing that particular material associated with the comet. If there were not any hydrogen there, then you would get a blank photograph. If there was some hydrogen just around the nucleus, then you would just get a little image around the nucleus. If there's a big cloud, you get the big cloud. So you get a photograph showing that particular material and it would show how that material is distributed relative to the nucleus of the comet. The density of the material at each one of these distribution points and of course, we want to do the EVA before and after perihelion in order to see what happens to this material as it goes past the perihelion of the Sun - as it goes past the Sun. The Sun is going to be giving the comet a great big thermal kick on December 28, the early part of the day. We're anxious to see what effect that has on the outgassing of these various materials. When we - we see the effect, then we try to work backwards then and decide to learn more about what must be the nucleus in order for these effects to have been observed. And that's kind of the name of the game is to determine what the nucleus is made of. S201 - well, let me see. The T025, in particular, will be looking at the - the material I talked about. The gases. We'll be looking at the OH - be photographing the comet as it appears in OH materials or gas, CN, C2, NH, sodium, and CO. So and then also it will be taking some photographs that are not at emission wavelengths but rather having to do more with the dust material which simply reflects sunlight. It doesn't - the dust material associated with the comet just simply reflects sunlight so that it has the same spectral characteristics the Sun itself has and does not emit any

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particular wavelength. So we have some filters that are picked to be away from these emission wavelengths due to the gases and show only the reflected light coming from the dust. I have some viewgraphs that show T025. Perhaps we can show them now. Okay. This is a photograph of an earlier version of T025. It - we now are using a Nikon camera and we have made a place to put in these special filters that were taking up just for the purpose of looking at the comet. And out here in front, we have the occulting disk. This particular instrument, the way it observes the comet is that it's pointed directly towards the Sun. That disk out in front acts like your hand. It blocks the sunlight off so that you see the comet out here next to the Sun. And then there's a filter slide that goes in front right here that you'll see in the next illustration in just a minute - the next slide. And there are four slides each with four filters in them. These - -

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SNODDY

- - see the comet out here next to the Sun. And then there's a filter slide that goes in front right here that you'll see in the next illustration in just a minute - the next slide. And there are four slides, each with four filters in them. These slides will be one by one placed into position and each of the four filters or total of 16 filters, will be placed in front of the camera, and then various exposures will be taken using each of the filters. The way this - let's see - the - let's have the next viewgraph, please. I'm sorry. That's not the next one. Let's hold that one. The line drawing is what I'm looking for. Okay. This gives you a little bit of idea what you see when you look through there. This - the Sun is - this is the field of view. The large circle represents the field of view of the com - of the T025 instrument. The center of the field of view is blocked off by the occulting disk that shadows the Sun. The Sun itself is the little dotted circle you see in the middle there. And then the comet will pass through this field of view. So, in other words - this instrument has to be pointed directly at the center of the Sun in order to be effective. So there are only certain days that the Sun falls within the field of view of this instrument. Over here on the right, you see on December 24th, the comet coming into the field of view. You see the nucleus of the comet with the tail behind it. On December 25th, you can see we not only get the nucleus, but we get a lot more of the tail. That is why we're having AVA on Christmas day, is in order to position the head of the comet at this particular position which is the ideal position within the instrument for getting good resolution, and also, to give us as much of the tail as possible. Then it goes on past the Sun traveling along that line. On December 29th, you see the comet again, the head of the comet, and you see the tail. Now this is more representative of the gas tail of the comet. The gas tail will more quickly move around and begin to point away from the Sun. The dust tail actually will not be able to move around that rapidly. And so, there will still be a dust tail. The dust tail will still be apparently be pointed back towards the Sun. So, we're entering a time frame where the gas tail and the dust tail perhaps will be separated enough for good observations to be made on them separately. And perhaps even the astronauts might be able to notice for the first time these two tails. In other words, in this later period here, you'll have a situation where you'll have a little bit of a tail in front of the comet and some of the tail behind the comet. It will be a rather complicated event we'll be watching here. So on December 25th and December 29th,

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are the two days that we have our best views of the comet using this instrument and those are the two days that the EVAs - from which the EVAs have been selected. Okay, could I have the - not the one you showed before but the other viewgraph. The black and white - the, yeah. This - I don't know which is the best - I guess this one. This shows the T025 as it is strapped on to the strut that Rusty talked about. You see the - let me see if I can stand up here - this is a special arm that was - is and sent up in order to attach the instrument that we looked at to this strut so it could be used outside. The occulting disk is up here at the top. This blocked off the Sun. Here is the filter slide that I spoke of showing three of the filters here and one in place. And that's just manually moved down into position. The astronaut looks through this. He aligns the occulting disk as a - as a filter right in the center of it that he looks through and he lines the sun up right with the center of that occulting disk looking through that filter that's at the end of the occulting disk. And then once he's done that, the comet will automatically positioned properly in the field of view. And then he'll go through that series of slides. S201 will be done in a similar fashion. This will be un - untrapped, moved inside. Then S201 will be brought out. And if we could look at the remaining viewgraph, please. This - the same area but different illustrators - it's strapped here to the - exactly the same fashion. Well using a different kind of - of strapping device but principally the same. The Sun, as Rusty talked about, had to be - has been occulted by this solar panel here, leaving the comet there for him to point the instrument at - -

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SNODDY - it's - it's strapped here to the - exactly the same fashion while using a different kind of strapping device but principally the same. The Sun as, as Rusty talked about, had to be occulted by this solar panel here, leaving the comet there for him to point the instrument and to do the observations with this particular instrument. He will be observing it in effect at two particular wavelengths. One that's particularly associated with hydrogen and one that's particularly associated with oxygen. T025, as I mentioned, will be looking at 16 different wavelengths. That's all of the viewgraphs. On 201 - On 201 the - the one that - that's looking at the hydrogen, it's expected that possibly the hydrogen cloud associated with the comet, when it's near the Sun, may be quite large, in fact, maybe 10 degrees in diameter even, which is 20 times the diameter of the Sun. And for that reason we need to go outside with 201 so it can utilize its full field of view, which is 20 degrees. We also have been using 201 out through the scientific airlock, but there we're restricted to a much smaller field of view and we also have to worry about the effects of scatter light and so forth off of the mirror system that brings the image in to the camera. On EVA we won't be bothered with that. We'll be looking directly at the comet and we'll have the benefit of the full field of view, so we can see the full extent of the cloud all in one image. And then to conclude let me say something about ATM. ATM began observing the comet on December the 19th, and it also observed it on December the 21st, yesterday, and today. In particular, the instruments S052, S082B, S055, and S056, were operated during these observation periods. We do not plan to operate ATM during EVA day tomorrow nor do we plan to operate the next day because there's kind of a dead period in there where the comet is - is not close enough to the Sun for ATM to observe it in its regular solar pointed mode, and yet it's too close for ATM just to offset slightly because if it offsets just slightly it begins to have thermal problems. ATM likes to be pointed at least 5 degrees away from the Sun in order to avoid thermal problems, and on the day following EVA the Sun - the comet will be less than 5 degrees from the Sun and so it's - it's not near enough for ATM to operate normally nor is it far enough away for it to offset in point, so we won't be observing it with ATM on the 27th - 26th, I'm sorry. Until late in the evening on the 26th. About 8 o'clock in the evening central standard time on the 26th the comet comes in into the field of view of ATM when it's in its normal solar-oriented pointing mode, and it will remain in the field of view of ATM instruments, particularly coronagraph S052, for some 22

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hours. So from 8 p.m. central standard time on December 26 till about 10 a.m. central standard time on December 28, the ATM will be observing the comet continually, except for short periods of time like, for example, when the Skylab is behind the Earth you can't view the comet, of course, but will be effectively observing it continually. The head of the comet will have moved out of the field of view after only the first 22 hours of this observation, but the tail of the comet will still be coming through the field of view and so that's why they want to continue it up until 10 a.m. central standard time on the 28th. The time at which the comet appears to be closest to the Sun from our point of view is 9 o'clock in the morning, roughly, on December 27. It's actually nearest the Sun at about 4:30 in the morning central standard time on December 28. So this period of observation, from 8 o'clock p.m. on December 26 to 10 a.m. December 28, will cover both of these periods of minimum elongation which is the time when it appears to be closest to the Sun through perihelion. We will, of course, be getting a lot of information with the white light coronagraph. They'll be interested in seeing the effect - the interaction between the comet and the Sun, between the tail of the comet and the Sun. The tail will kind of act as a - as a sort of giant detector showing the effects of - of the solar medium. Perhaps if a solar event were to occur and you had shock waves coming off from the surface of the Sun or you had - of course, always have the solar wind coming off from the surface of the Sun - -

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SNODDY - - a lot of information with the white light coronagraph. They'll be interested in seeing the effect - the interaction between the comet and the Sun, between the tail of the comet and the Sun. The tail of the comet will kind of act as a sort of giant detector showing the effects of the solar medium. Perhaps if a solar event were to occur and you had shock waves coming off from the surface of the Sun, or you have - of course, always have the solar wind coming off from the surface of the Sun. When the comet is in real close like this, it would be real interesting to see how these events interact with the tail of the comet and so we can learn something about the Sun as well as about the comet during this time period. During the 8 hours when the comet appears to be nearest the Sun, that is - that time again occurs at about 9 o'clock in the morning on December 27. During that time period, plus or minus 4 hours, the 82A instrument, the far UV spectrograph of NRL will - the comet will be in the field of view of this instrument. And, so we'll be taking some long time exposures with this particular instrument. And, that will be hopefully some very interesting data, that might tell us something about whether or not there's helium associated with the comet. It's never been detected before. So that's - I believe, pretty well covers what I had to say this morning.

PAO

Questions.

PAO

Back there.

QUERY

Do you have any indications that there might be any type of solar event, at this particular time? Any previous indicators that you - have you had any flares lately or any indications that something like this might occur, at this particular time, that would have an effect?

SNODDY One of the problems that we have is the fact that the comet is going to be behind the Sun. It will be above it, so that we'll be able to see the comet at all times. When it passes by the Sun, it never - we never lose sight of it, but it will be behind the Sun and so if there were a solar event, then it would have to occur from a point on the Sun that we can't see. So, I don't know whether there are thought to be any active regions back there now, or not. I see one guy going this way and one guy going that way, so (laughter) I'm not really sure what the possibilities are. We're just having to rather take pot luck, we don't know. A major event could occur and we wouldn't know it until we saw the effect on the comet. However, if the - so that's unfortunate in that respect, but we want to get continuous data to see if you know, so we would catch this effect if it did occur. The Sun is being reasonably active, but I don't

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that it just varies - very unpredictable.

PAO Tom Beldon.

QUERY How fast is the comet moving today, by your best calculations? And, at perihelion, what will be the speed of it?

SPEAKER I've got the numbers down in my briefcase. I can get them for you, right afterwards.

QUERY And - -

SPEAKER Go ahead. I was just looking to make sure I didn't get them out. I don't believe I did.

QUERY Of the original theory, was it not, that the comet was formed somewhere at the end of the solar system and now you're thinking that perhaps it was formed - or it contains material from outside - or in interstellar space -

SPEAKER I think - -

QUERY - - outside the solar system?

SPEAKER Yeah. The original ideas were in that perhaps the comet was initially formed from more within the solar system. Say around the planet Neptune, or something of that sort. And, then by some process were moved out into this outer region where they are known to like this one, is known to have come from. There were others who thought, "No" perhaps the comets were formed out in this outer region and would therefore have a makeup more similar to the sort of makeup that has been determined to exist in interstellar space, which includes the more complex molecules. Like the methyl cyanide, for example. So, when indeed, recently the first of December, using radio techniques, the methyl cyanide was detected in the comet and this gave strength to the argument of those who say that the comets were formed out in this region where this one came from and are more representative of interstellar material. Even though, they would still be perhaps gravitationally associated with the solar system and be a part of the solar system, they would nevertheless, be formed way out at this distance of half a light year as opposed to being formed much, much closer in.

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SNODDY - - formed out in this region where this one came from and are more representative of interstellar material even though they would still be perhaps gravitationally associated with the solar system and be part of the solar system, they would be nevertheless be formed way out at this distance a half a light year as opposed to being formed much much closer in.

PAO
QUERY
actual approach, at 4:30 on the 28th, will the astronauts be up at that time, or will you be doing it unattended?
SNODDY
No, we'll be doing unattended operation

at that time, yeah.
QUERY
Discuss S020. I think you might have missed that.

SNODDY
Well, that's not one of the common instruments. It's not going to be looking at the comet, it's going to be looking at the Sun, and I'm really not that familiar with it, to be perfectly frank. It's an extreme ultraviolet instrument that will be making observations of the Sun at very short wavelengths I believe.

PAO

Any further questions? Thank you very much.

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SKYLAB NEWS CENTER
Houston, Texas

SL-IV - Christmas Day EVA Briefing
Johnson Space Center
December 24, 1973
10:35 CST

Participants:

Russell Schweickart, SL-2 Backup Commander
Bob Kain, EVA Procedures Section
Terry White, PAO

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PAO Good morning. We have two back-to-back briefings today. The first with Rusty Schweickart and Bob Kain on tomorrow's EVA and then Dr. William Snoddy will follow with some of the Kohoutek observations description and status. Rusty, why don't you tell us what's going to happen tomorrow?

SCHWEICKART Christmas.

PAO Yeah. I mean otherwise.

SCHWEICKART Well, as everyone is well aware we're going to be out on the second EVA of the Skylab IV mission tomorrow. I guess before I start into the description of that EVA and what we'll be doing, I'd like to introduce Bob Kain, who's been supporting us all through Skylab on procedures development on all of these EVAs. Bob and the people who work with him have written all the procedures we've used thus far and that we'll be using throughout the rest of the program. And so some of the procedures questions I may throw at Bob here. The EVA will start out much the same way that the previous EVAs have begun. That is, we'll start the EVA prep right after post sleep activities. We will be again, powering up the command module tomorrow to stand by in case of troubles with the remaining CMGs. We obviously don't expect that that will be - that we'll have to use it. We've had no problems with the CMG since we've been controlling the temperature manually. But it will be standing by. Following the prep, then, at something on the order of 10 to 10:30 local time tomorrow, we expect to have hatch open and the order of events during the EVA is - we'll be doing the three science experiments first. By the way, Bill Pogue will be going out as EV-1 and Jerry Carr, the Commander, will be playing the role of EV-2 and Ed Gibson will be inside as EV-3. The first three experiments that we'll be doing take 150 minutes on our schedule. The total EVA is about 5-1/2 hours, and so just short of - that's a little over 2 hours, isn't it. 2-1/2 hours, we'll be running S020, which is the solar telescope of NRL, Dr. Tousey. Then we have T025 and S201, which is the Lyman-alpha XUV camera. And Dr. Snoddy will be talking more about those after this briefing. Following those three science experiments, we'll then go into what is very nearly a normal film retrieval replacement. The only exception to it being completely normal is that - well, I guess there are really two exceptions. One is we'll be pinning open the S082A aperture door on the in - on the Sun end, in the continuing saga of pinning the doors open, and the other minor exception is that on the S054 - that is, the X-ray spectrographic camera, we'll be putting on a small device called a shutter override mechanism which goes on the bottom of the film magazine and manually locks the shutter blades of the camera open and I'll

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So a little more into that later. Following the - the
retrieval and replacement of film, we'll then go into the fix
on the S034 filter wheel which - -

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SCHWEICKART - - and, I'll go a little more into that later. Following the - the retrieval and placement of film, we'll then go into the fix on the S054 filter wheel, which as most of you know, is not operating properly. Let me say just a couple of words about what we know about it. I don't know if this is the time to get down there or not. Let me delay on that. The filter wheel has six filter positions, and we get a signal - a telemetry signal on the ground and also on onboard talkback on the control and display panel, which tells us when each of the filters is in the proper position, that is centered for use. What we saw back, how long ago was it? Must of been a month?

SPEAKER (Garble)

SCHWEICKART Two months ago, something like that.

SCHWEICKART Was in going between filter positions 5 and 6, we got indications that the filter wheel left position 5, however it never arrived in position 6. Or I should say we did not get indication that it arrived in position 6. There are two basic ways in which this can happen. One is we could run into a mechanical jam in the gear train, which would just physically prohibit it from reaching position 6 on the filter wheel. The other alternative is that we could have had a return line, that is a wire, open up - have an open circuit, on the ground line that powers the filter wheel and we would get the same indications on the telemetry and on board, however in that case, instead of being jammed, anytime we have power on the filter wheel, that is to try and put it to some position, it will just continuously rotate. As I say, in each case, the indications to us on the ground are identical. So, tomorrow, when the crew first gets there. Well, let me, I guess maybe I ought to point to this model and then go on down there so I can show you what this looks like. This activity on the S054, this film magazine and - well, let me say that the telescope is of course located in the ATM, but the film is retrieved and we have access to the camera at the center work station down here, so that the crewmen, in this case, Jerry Carr, will go back down the normal EVA path to the center work station, where he has in fact just replaced this film. Retrieve the old magazine that we're using now, and put in the fresh magazine. He'll once again remove the fresh magazine, send it back up to Bill Pogue, in the area of the airlock, and then, using the tools that I'll describe to you, attempt to manually position this filter wheel, or let me say position the filter wheel, we think it'll take a manual positioning to do it, to a position called filter 3. That's a bit of a misnomer in that the number 3 position on the filter wheel is in fact,

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no filter at all. It's just an open hole. So, we call it filter 3, but it's wide open. And, let me - oops - get off my cord. (Laughter) We have a bit of a problem here. (Laughter) That's okay. This is the receiver that - we call this actually the camera. What we put into this with the film in it, we call the film magazine. That was a sort of an arbitrary definition. So, the camera here, this is called the shutter plate. The camera goes in on these rails - rather the magazine goes in on these rails and locks in. We have an electrical connection here and you can see this elliptical hole, located in the center of the shutter plate. That elliptical hole is where the solar image, the X-ray solar image, that is, comes through and impinges on the film.

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SCHWEICKART - - this is called the shutter plate. The camera goes in on these rails, rather the magazine goes in on these rails and locks in. We have an electrical connection here, and you can see this elliptical hole located in the center of the shutter plate. That elliptical hole is where the solar image, the X-ray solar image that is, comes through and impinges on the film. Now the trick here is to get down inside here to the filter wheel and let me tilt it up here, right here, this is the filter wheel and it's driven by this gear train down below as you can see. And what we have to do now is get down - of course this portion is not accessible to the EVA crewmen. All we can do is we have a door that's about this wide and about that high, and all of this is in relative darkness. The only light being when the crewmen are standing in front of it there is a light up above his head, but when he gets in close he shadows the whole area with his helmet anyway. And this is a little bit lower in relation to me right now than what it will be to Jerry Carr tomorrow. It would be about like that. The point there being that once you get the shutter blades open, you still can't see down, you cannot see to the filter wheel. And because of that, what we have is two tools which Jerry will be using. One is like a big dentist mirror, an inspection mirror that you can swivel the head on, and I'm sorry we didn't get those over here in time. And to this inspection mirror, we strap a - we tape a flashlight on the back end, and then by positioning the mirror and the flashlight we can shine the light down, down through the shutter plate to illuminate the filter, and then of course by looking at the mirror then be able to see the filter wheel. So this is sort of a dentist's office operation in a pressure suit. After he figures out where the filter is, then he goes in with a screwdriver and manually attempt to rotate it. Now let me just open up this shutter plate here. Somehow we've kindly closed the shutter blades. And I'm not sure you would let me point it this way and see if I can turn it. If you can see down inside the aperture, you may be able to see the filter wheel turning. And you can see that there are several layers of equipment between the shutter plate here and the filter wheel. And the whole trick in this thing is being able to look in there with a mirror for the first time and from the verbal description which we've passed up the crew, be able to tell what it is you're looking at and where to poke the screwdriver in order to skew the filter wheel around. Now what we do when we go down in here with a screwdriver is you actually poke a hole through the filter that's exposed there and then pry against the area of the shutter plate and

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manually just pry the shutter wheel around, step one filter at a time until we get to filter 3, which is the open filter. So that when we get done, we hope it looks like that. And of course, all of that's got to be done in a pressure suit - let me point it over to the camera there. All that's got to be done in a pressure suit by a fellow who's never seen it before. As I told the crew, it's sort of a good news/bad news job, you know. The good news is that's it's a simple task, the bad news is that's it's a simple task the second time you do it. I can walk in now blind and do the job, but the first time looking in there and knowing what you're looking at, is not easy. Following - Following that operation then the magazine will be put back in. It has a shutter override mechanism on it so that the shutter blades located right at the top up here will remain open for the rest of the mission. And this will insure two things. One, we will probably have some - since we do poke a hole in the filters that are presently in the filter wheel in order to move the filter wheel around, we will have some beryllium flakes floating around inside the camera. And we were concerned that there may be some possibility of the shutter blades hanging part way either - or all the way closed and not being able to open. So in order to prevent that, what we're doing is opening the shutter wheel, the shutter blades here and then with this override mechanism I mentioned on the bottom of the magazine they never close again. Now what that means is we can also take much longer exposures in the X-ray spectrum than we have in the past. So from a scientific point of view we also have an opportunity here to get much longer exposures.

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SCHWEICKART - shutter blades hanging part way, either well, or all the way closed and not being able to open. So in order to prevent that what we're doing is opening the shutter wheel, the shutter blades here and then with this override mechanism I mentioned on the bottom of the magazine, they never close again. Now what that means is we can also take much longer exposures in the X-ray spectrum than we have in the past. So from a scientific point of view we also have an opportunity here to get much longer exposures. The price we pay for it is that we do lose the very short exposures in that since the shutter's open all the time, as you drag the film from one exposure to the other, the short exposures will be smeared slightly. But we figure that's a small price. I think - why don't we throw it open to questions if anybody has any.

QUERY Yes; I've been curious. In what order will you do these science experiments on Kohoutek at first and how much work is there in mounting these things on the struts and so on?

SCHWEICKART I'll defer - I'll think I'd, Howard, defer part of your question to Dr. Snoddy as far as the scientific aspects are concerned. The order in which they'll be done will be S0 - at least the way we have them scheduled and there's nothing magic about that, but we have S020 scheduled first, T025 scheduled second, and then S201 scheduled third. And you remember that with S201 all of - all three of these experiments mount on - let me see if I can - here's always a challenge is trying to figure out what you're doing on the model here. Okay. This - this hand rail - I don't know if you can see it now - this handrail right outside the FAS area that has the handholds that go down along the EVA trail, all three experiments will be mounted - the first on the near end of that truss. It's about 5 inches in diameter, and all three of them will be mounted one at a time in that location. Now, with 201, our problem with it is that we want to see - we want to see the comet but we can't have the Sun in the field of view at the same time because of the nature of the instrument. It'll in fact destroy the sensitive - the sensing element if the sunlight falls on the lens, on the aperture. And as a result what we have to do is prior to the 201 observations we have to roll the spacecraft just slightly in order to - and of course with the Sun coming in this way, as we roll we cast - we take the shadow of this ATM solar array and cast it across this truss. And so we have to roll just the right amount to get a shadow - the shadow of the sunlight from the instrument and yet leave the comet, which is approaching the Sun, still in view. And so the field of view of 201

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is going to have the comet, and as you go from the tail toward the nucleus of the comet and toward the Sun, therefore, you're going to have the ATM solar array blocking the sunlight. And so we may have to make a couple of small adjustments in that maneuver in order to get the Sun off the camera but not block the comet from the field of view. The workload is not very high for the EVA crewmen in doing this. It's mainly just strapping the instrument in place, pointing it, and all these are just manually - well, one of them has a view finder, the others you - you're simply pointing them roughly using a, like a ring site. And - and then that takes say, the first 5 or 10 minutes of the experiment, and then after that it's a matter of just going through the exposures.

QUERY Because of the trickiness of the 54 experiment, is there - is there a chance, a good chance that that's it going to be - it's too tricky and that he might not be able to do it exactly be quite as good as the dentist - -?

SCHWEICKART Well, that's always possible. As I say, the only part about it that's really tricky is the - is the recognition of what it is you're seeing. Now there - there are other possibilities. For example, we could have a mechanical jam of such a nature that you just cannot move that filter wheel. That is, is that what we're doing is we're moving it manually counter to the normal direction - is we're moving the wheel counterclockwise, looking down on it, the nor - -

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QUERY - - good as a dentist and -
SCHWEICKART Well, that's always possible. As I say, the only part about it that's really tricky is the - is the recognition of what it is you're seeing. Now there are other possibilities. For example, we could have a mechanical jam of such a nature that you just cannot move that filter wheel. That is, what we're doing is, we're moving it manually counter to the normal direction is. We're moving the wheel counter-clockwise, looking down on it, the normal slewing from the motor slews it clockwise. So that is we should - we hope that if it is a mechanical jam, we're backing off from any - from whatever it is that jammed it. However, it's possible that we've got a jam in there of such a nature that (cough) we end up bending the screwdriver as much as we can bend it essentially until it stops and it just won't move the wheel. Now we don't expect that, but that of course is possible and if that happens, we're out of luck. There's nothing we can do except we'll have a better idea of where the filter wheel really is which we don't know right now.

QUERY Can you tell me again, exactly where the camera is?

SCHWEICKART It's in the side of the ATM at a location that we call the center workstation. Let me slew this around again. It's the normal position of the EVA crewman when he's replacing the film - well, most of the film in the ATM. We replace four film magazines here and then come down to the Sun end for two more. But it's this center workstation here. The man is in foot restraints. He's well restrained. It's a fine place to work. He may not want to live there but - (Laughter)

PAO Teel Salan. Wait for the mike -

QUERY What specific experiments or photographs is that camera taking? What is that one for?

SCHWEICKART These are - this is an X-ray spectrograph - spectroheliograph (sic). Okay. X-ray spectrographic telescope.

QUERY Which specific things are you getting out of - of -

SCHWEICKART The thing that we're getting that we're missing right now because of this problem is the - well, filters 5 and 6 on this camera, this telescope, are fairly thick beryllium filters. We're looking in the X-ray portion of the spectrum. These two filters that we think it's jammed between, were designed to pass very hard X-radiation. The kind of radiation that's generated by solar flares. One of the things we found over the past two missions about the X-ray photographs of the Sun, is that there's a tremendous amount of very fascinating radiation that comes from the high corona. That's a fairly weak and steady radiation. That doesn't get through to these two filters at all. So what

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we're missing is this great mass of data about the corona and its interactions with the solar wind and other observations that are being made. But what we want to do here is to move to this filter 3 position which then being no filter at all, again, allows a soft X-radiation through so that we can once again get this very valuable data which can be correlated with the other instruments on board. We feel that's more important than these heavy filters.

QUERY How would you estimate the photographic ability of this crew so far? Have they kind of messed up a few more times than you would've liked?

SCHWEICKART

QUERY

me say, were they -

SCHWEICKART

QUERY

with inside, haven't there?

SCHWEICKART

No, I don't think there's any way to evaluate that until we see what comes down on the film. Now of course, on this particular camera, of course, we don't know what we've gotten. We may have gotten nothing but a picture of the web between filters which is not very scientifically interesting. But Ed Gibson as you know, is a rather bright fellow and my guess is that we've found some very - they've gotten some very interesting data. But I don't think there's any way to really evaluate that until the results come down. And a lot of the results are in relatively soft terms also. It's in the information and the integration that gets stored in the heads of the individuals up there. Some -

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SCHWEICKART - - data, but I don't think there's any way to really evaluate that until the results come down. And a lot of the results are in relatively soft terms also. It's in the information and the integration that gets stored in the heads of the individuals up there. Some of the observations are rather subtle.

QUERY Rusty, just looking ahead to the Friday EVA. Is it going to be just the three scientific instruments and that's all? On Friday.

SCHWEICKART Well nearly so. I've got the list here.
Bob - -

KAIN It's Saturday, by the way. On, yeah, the 29, and mainly what we're doing that EVA. We start out the same way as we do on the 25th, with the S020, T025 and S201, and then we're going into a DAC documentary, which is taking the movie camera - the DAC out to the Sun end, and panning the cluster and getting some pretty good shots of that. And, then after that, the crewmen will come back into the S230 experiment there and he has a calibration clip attached to it at this point, and he'll remove that. The PI would like to see that removed. And, then, way back on the first flight, SL-2, Pete Conrad put a piece of sail material out around one of the struts out there. And, the crewman's going to go out and retrieve that and bring it back inside. And, we've come up with a new requirement to retrieve airlock module meteoroid cover sample. And, this piece of material was in the FAS area and it's about 6 to 7 feet long, about a foot wide, and half of it has been exposed to sunlight and the other half hasn't. And, we're going to bring that back and be a good material sample to evaluate what the Sun has done, and then that will be the closeout of the EVA.

QUERY How long are you looking for on that one?
How many hours?

KAIN We have a time line right now - looks like 3 hours 25 minutes, roughly.

QUERY What time is hatch, is it still 9 o'clock on that EVA, hatch open?

SCHWEICKART On the 29th?

QUERY Yeah, on the 29th.

SCHWEICKART It should be - It should be basically the same. Again we'll be bringing up the command module so that'll give us hatch opening around 10 o'clock, maybe a little later, but between 10 and 10:30 I'd say.

PAO (Garble), did you have another question? Tom?

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QUERY Rusty, from what you've said, I gathered that this EVA tomorrow is not considered as difficult as the Thanksgiving Day EVA was?

SCHWEICKART What did we do then? I forget.

SPEAKER 193 (garble).

SCHWIECKART 193, yeah, I'd say that. That's right. We had - We had a situation there where we were doing relatively complex tasks in an area where there were no EVA provisions in the way of handholds or foot restraints or the lighting, things of that kind. Whereas in this case the work we're doing at least is in an area where we have previous activity, and we have all the provisions. The labor involved in this one is not very difficult. It's more like radioing someone or getting on the phone with your doctor, who's describing to you how to take out your wife's tonsils. If you want to think about it that way. (Laughter).

PAO Any further questions? Thank you, Rusty and Bob. We'll move on now to Dr. Bill Snoddy, who is the Kohoutek Project Scientist for the Kohoutek comet observations. Dr. Snoddy, I guess we're still rolling aren't we, Art. Okay.

SNODDY (Garble) start out saying it's not Doctor, it's Mister.

PAO Oh. Everybody around here is Dr.

SNODDY Yes.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - S201 Kohoutek Briefing
Johnson Space Center
December 29, 1973
15:48 p.m. CST

Participants:

Dr. Thornton L. Page, Principal Investigator S201
Bob Gordon, PAO

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PAO Okay, what we'll do is have Dr. Page review the EVA and the comments by the crew on Kohoutek. And then when Milt Windler comes in, we'll have the change-of-shift briefing. Dr. Thornton Page, Principal Investigator for 201.

PAGE Okay, what I sketched on the - what I've sketched on the board here is the setup as we now view it. First of all, forget all these lines. The comet was described in some detail by the crew this afternoon who saw it just after Sunset. And the distance from the comet to the Sun is something like 6 degrees. We're not too clear about the size of these features, but perhaps I've enlarged them a little bit. There's a spike which extends out toward the Sun and a fan-like tail that extends out in the other direction, although, not exactly opposite. This angle here is something less than 150 degrees. The - they describe the color of this fan tail as being a beautiful yellow-orange. Nobody's quite sure why it should be yellow-orange. Of course, Sunlight is yellow and it may have been an effect - of the horizon. Because they were very close to the horizon at that time and the airglow in between - or - or just above the horizon could have provided some of the coloring affect. There were three instruments used on EVA. The S020 was used on the Sun. That's one of the Naval Research Lab Experiments and it's - has to do with X-rays. The X-ray emission of the Sun and - grows very strong when there's a flare and they were lucky enough on Christmas Day to get two flares, I believe during their observations on EVA that day. I don't know whether there was any flare today, it's unlikely, but it - there may have been. The other two experiments were T025 and S201. T025 just takes a photograph of the Sun with a - a disc that cuts out the Sunlight and shows surrounding corona, and in this case also the comet. They take photographs of that view with something like 25 different filters which isolate regions of the spectrum from about 2500 angstroms on up to the (garble) far experiment was done - S201 with the Sun covered up by the solar panel. And that's what these lines represent here. Well, it's rather an amusing time telling the crew how to set it. Well, rather than draw a picture on the teletypewriter which showed what you see here plus the 20 degree circle that is the field of view of 201. That would include the comet, but would not include the sun or the panel which we didn't want to have in the picture. The reason for that is more than just artistic composition. It was the scattered light - Sunlight from the edge of the panel here would fog a region of the photograph and - reduce the accuracy with which we could measure the comet's ultraviolet - far ultraviolet emission. This is called the far

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ultraviolet camera. And it operates in the region of Lyman-alpha the hydrogen - fundamental line of hydrogen. And well, I guess blue is a good way of indicating what we think we're going to get will be a big halo of hydrogen around the nucleus of the comet. Possibly bulging out on the backside and probably at its maximum size right now as the comet is close to perihelion. They had a hard time both on Christmas and today -

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PAGE

- - - as the comet is close to perihelion. They had a hard time both on Christmas and today in rolling the spacecraft so that this solar panel would cover the Sun. As you know they've got troubles with momentum management and on both occasions they rolled first to quite the wrong position and then had to change tweak as they call it and tweak it back. So in this case they first rolled so that the Sun was way out here somewhere and would have been in the picture and therefore was no good. And then by corrective motion - tweaking they brought it back so that the Sun got back of this edge and it's probably closer to the edge than I've drawn it on the board here. That was necessary because the comet and the Sun are so close, if we wanted to get the comet we had to have the Sun close to the edge. They found that sunlight in this case came through a crack which is this thin line across here and during this operation because of all the light, they couldn't see the comet at all, so that was the reason we sent up the picture which was made with O's around this circle and X's along the line and parentheses or something across here to show them where to aim the camera with this field of view so as to get the comet and not get the Sun or anything else. The camera got 33 photographs on Christmas Day and I think somethink like 32 or 31 today. As for these frames are automatically timed by a mechanism in the camera after the astronaut presses the start button and what happened on the first try today, the - he got the thing all set up like I've shown it here, pressed the button and then the darn spacecraft started rolling and the Sun was moving over this way and so they knew that the comet was moving in behind the panel. So Ed Gibson who is running it today stopped the exposures and got the pilot to straighten out the spacecraft and get the Sun over here. Most of that happened while we were LOS, out of contact and when we came back and heard what they were doing, they were just starting to redo the whole shebang. Unfortunately the film in the camera would run out at the end of what we'd planned for today. So they stopped after they had done two more sequences of 11 frames pictures each in this orientation. Actually this is all redundant because the sets of pictures we get taking them over again are going to be the same in the sequence we're through photographs of 1, 3, 5, and 15 seconds to get this hydrogen light which is very bright and then through another set of exposures of 3, 10, 30 and 100 seconds to get the oxygen hole which may or may not be there and will almost certainly be smaller than the hydrogen. And that so when we take a second sequence and the third, we're getting the same thing over again which will help to confirm

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the analysis when we get the pictures back. All of this we won't know how we've done until we get the pictures in February and develop them here and go through the painstaking scanning to see how strong this hydrogen halo is and how much bigger it is in these pictures than the ones we got earlier when the comet was farther from the Sun. Anybody want to ask any questions?

QUERY

Yeah.

PAO

Dr. Page we have one phoned in here then we'll let the people here take it over. Does the appearance of the spike on the comet indicate the comet is melting.

PAGE

No it's almost certainly largely a projection effect. Now very few comets, in fact I was going to say no comets have ever been observed this close to the Sun. That is I guess that's not true, it depends on where the Sun and Earth and comet are as to whether you get a good view of the comet at close passage but at this time the tail is undergoing some changes. I guess that melting is a tricky word, the sunlight is certainly boiling off gasses from the comet and with it the dust that is mixed in with the ice and other stuff that makes up with the comet nucleus. The reason for the spike is -

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SPEAKER this is from the comet, and with it the dust that is mixed in with the ice and other stuff that makes up the comet nucleus. The reason for the spike is largely the projection. The view that we're getting from the Earth - the position of the comet relative to the planet's orbit and line of sight to the Earth is changing very rapidly at this time. In fact, the astronauts even think they can see the thing getting farther away from the Sun, it's going so fast. The speed relative to the Earth is something like 40 or 50 kilometers a second, so 30 or 40 miles a second. And - and it's - it's going around its orbit around the Sun very rapidly. I think that what makes this spike, is the dust particles which have - have been ejected from the comet some what prior to the time we took the picture. And the spike developed it's - I guess in the last few days. It's probably - in other words it's not transient thing, but it doesn't - We're not going to keep on seeing it next week, I think. And this fantail, however, is new, or at least as I understand it the - the heating by the Sun large number of dust particles moving out here and well, I'm not entirely clear myself how - why it is so wide. This is supposed to be about 40 degrees wide here, a broad fan. I don't know what the dimensions are this way, so this may be only a short distance, that is, short in the sense of angular distance from the comet's nucleus. I already said that's about 6 degrees, and the way I've drawn it I've made it about 2 degrees long. It may be about that, or it may be somewhat smaller. But the - the spike melting is - the word (I criticize it - the spike is undoubtedly due to the heating of the comet by the Sun prior to this time, and that dust and other things including gas that have been boiling off. So perhaps it is melting. I guess that's as good a thing as any.

QUERY Dr. Page, you talk about the fantail and the broadness of it being new, or somewhat unusual. Is it possible that their - their viewpoint, their perspective, makes it appear broader than it actually is and that if - -

PAGE You're quite right.

QUERY - we could see it at this time it wouldn't look that way?

PAGE It's going behind the Sun and we're so - we're looking kind of along the tail, and so if I've drawn this correctly the tail ought to look like it's going away from you, and if you could see it from the top it would be much longer and therefore - you're quite right. The angle has been broadened by the projection.

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QUERY Then it's the same possibility then that -
that the other comets we've seen from Earth have had the
same structure of tail fanwise and we just haven't seen
it in that formation.

PAGE Yes. I don't know enough about all the
comets that have been observed in the past to say whether
this has been seen before, but it's a common term. So I
expect that the fantail is not particularly new. All I meant
was it was new when the - as far as I know, in the orbit of
this comet.

QUERY Question of geometry. For us, standing
on the ground looking at the Sun, does it seem as though
Kohoutek skims across the top of the Sun, whereas for the
astronauts, from the way they're looking at it, it goes behind
the Sun.

PAGE No. It's behind for all of us. The
diagram that I erased over here shows the general scheme.
That is, the comet went around like this and the Earth came
in like this and - well, I'm not quite sure, but I think
we're looking at it about like this. So we're seeing this
motion of the comet - well, I'll make the fan better. This is
now a view from the top and this is the Sun and here's the
tail. And maybe it's going out like that and this spike - I
don't know quite how to draw that on there. In any case,
we're looking over the top of the Sun. Now the - the thing
that's - <

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PAGE - - top of the Sun. Now the - the thing -
that's hard to put in this is your horizon on the Earth which -
But I know that this is the view that the astronaut got who
was aiming our camera standing just outside of the airlock
module hatch and this is the horizon that he saw, roughly
sketched in there and dotted lines so that the view that
we'll get in January at sunset will be very like this with
that up. Now, however - No, I'd have to think about that a
little bit, Abbey.

QUERY If we - if we were standing on the Earth
and say we could see it but we can't, but if we could see it
would it appear as though it were skimming across the top of
the Sun?

PAGE Well, you have to say when and what you
mean - -

QUERY At perihelion, - at perihelion.

PAGE No, no meaning time of day.

QUERY No, well - -

PAGE It's top is up on the Earth, right? So if
you're looking west tonight at sunset in a couple of hours -

QUERY But if I'm - I'm - I'm looking right at
the Sun. Looking directly -

PAGE Right.

QUERY - - at the Sun, the sky is a round ball
right in front of me.

PAGE But see if I look at the Sun, I don't know
which way is south, I guess that way isn't it? So if I look
at the Sun at noon and look up here, what I call up is that
way. If I look at the Sun at sunset what I call up is
90 degrees different, right. So you have to say when in the
day you're talking about looking at the Sun and that's what
I was trying to say, this is at sunset. This is the horizon,
the Sun has just gone under it. Then you'll see tonight
and more obviously in January the sunset and the tail of
the comet up and the comet has passed, well let's see it is
certainly north so it's - the comet has passed like that,
QUERY (garble) the north end of the Sun?

PAGE That's right.

QUERY So has it - has it gone by the north end
of the Sun?

PAGE If we can freeze everything here, stop
the rotation of the Earth, we would have seen the comet -
That's wrong. On this diagram, I happen to know it goes this
way. Let's see, it's coming more like this. No, that's
wrong too. They - the geometry is - is tricky because of
the changing reference planes that you're trying to refer this
to. That's what you have - (laughter). As we looked at it

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now on the other side here, it's - it's going further away in that direction, so it's certainly going out like this. And so night after night if you looked at it here, the Sun's here, the comet and so - I think that it - it's done this. So it came in from down here and it's going out up there. Now, what you call top and bottom is - is the difficult thing. And if you - -

QUERY If I (garble) tops the north end - -

PAGE North, yeah.

QUERY - - the north end of the Sun. Is that okay?

Does it pass by the north?

PAGE It went north of the Sun.

QUERY So I would be okay to say top - skimming across the top of the Sun if you're looking at the Sun directly as north being the top? Okay?

PAGE You got to be sure you're looking at north at the top. At noon that's true; at sunset it's to the right.

QUERY Never look at the Sun at sunset. (laughter).

PAGE That's the best time to see the comet.

QUERY In other words, the line between the Earth - if there were a line between the Earth and the Sun and it were extended pass the comet, would the comet be above the line or below the line?

PAGE Above - Well, it'd be north of the line, above. So, this is the Earth, this is the Sun, and that line through the Sun would be below the comet, and you're seeing the comet above the Sun.

QUERY Can I ask a kind of an elementary question, something that puzzles me? In your detections of the comet travel, what is described as the tail seems to be coming out at an angle rather than being, you know, what we consider a true tail coming out from the rear of the comet as it passes (garble).

PAGE Oh, it always - it always goes away from the Sun. So, as the comet came in down here, a difference of here say one of the places back in November - -

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PAGE - Sun, so as the comet came in down here at different so, here's the - one of the places back in November when we saw it. It had a small tail like this. And here it had a much bigger tail like this, and now it's got its tail that way, although there - there are several effects that make it, oh, curve, and there's a guy here from Colorado who's made elaborate calculations which show it's got a kink in it. And when it gets over here - it's going this way - it'll look something like this, and then as you go out here it gets smaller and proceeds it. So tail, insofar as direction is concerned, is the wrong word.

QUERY That kink that this fellow from Colorado believes he has calculated, is that the one they discussed about being traceable to a solar wind?

PAGE Yes. The effect that causes the tail, - there are two effects, the solar wind and the radiation pressure, the pressure of the Sun's radiation. Now the radiation is exactly away from the Sun, but the solar wind has a - it isn't going straight out, it spirals out, so it comes in at an angle. And so it's very likely that this comet already has had two tails, the one caused by the solar wind and the one caused by radiation pressure. And in general the radiation pressure tail is the dust tail, so it acts like that, and it's usually fuzzier, too. And the other one that depends - I don't remember, but I think it's this way - is a much thinner tail with filaments in it that you can see, and that is the gas tail, or more properly, the plasma tail. And the plasma is ionized gas. Hydrogen carbon monoxide ionized once, and what else? NH - CH radicals, chemical radocags like that, and - so you can see both of these with the naked eye and it's a common phenomenon, comets often have two tails. I was reading in the Times (laughter), article that there was one comet that had seven tails, just to show you that you can carry this thing to extremes.

QUERY Talking about that halo hydrogen, could you tell us something about the significance of that cloud and whether this one has a larger or a smaller one? What do we know already about the - -?

PAGE It's been observed on at least two, and I think more, comets by other NASA projects, in particular 109. They discovered it on Comet Bennett, I guess. But what we will show is the growth of the thing. As we say, we first observed it out here back in November, and then it got bigger here, and bigger yet here, and then it's going to get smaller I think, and by the synoptic set of observations we'll have a plot of how this thing changes in size, getting bigger and then getting smaller, and from that we'll be able to say something about how rapidly the hydrogen is boiled off the nucleus. It

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Isn't straight hydrogen, I think, when it starts. It's either methane or water or other compounds, including hydrogen, that then get dissociated. But as you can see, it'll take a little geometrical analysis here to figure out the true size, our photographs will show the angular size, in miles or kilometers, of this halo. And it - we ought to be able to tell how many tons of hydrogen have boiled off.

QUERY In that halo, you say it's going to get smaller going around. Is that just - is it going to be smaller in relation to the coma or is it going to be smaller in perspective from what we see?

PAGE Well, - -

QUERY Cause naturally the whole thing will get smaller, right?

PAGE True. Actually the Earth stays fortuitously at about the same distance from the comet, in this case. When we started, the Earth was over here and the comet was over here. And so what happened is that they went around here and we stay just about one astronomical unit, or a hundred million miles, from the comet. We're somewhat closer now, but - and in February the comet will get very much farther away and then the effect you're talking about will certainly enter. But the thing I was talking about was the absolute size in miles. So the coma gets bigger because the comet nucleus gets warmer and more gases boil off, and it's that size that we think will tell us how much gas is boiled off.

QUERY Well, then when it gets further from the Sun then it will - because it will be cooler - -

PAGE That's right.

QUERY - it will - it will be more compressed or it will free, I guess, some of those - -

PAGE Uh - -

QUERY - whatever, but it will actually become smaller - -

PAGE It's a little - -

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PAGE
how much gas.

QUERY - - eyes that, we think, will tell us
Well, then, when it gets further from the Sun, then it will, because it will be cooler.

PAGE That's right.
QUERY It will be more compressed, or it will freeze

I guess, some of those - -
PAGE Uh - -

QUERY - - whatever, but it actually will become smaller.
PAGE Yes. It's a little, yes, linearly smaller, and angular size is what our camera measures - -

QUERY - - What does it do to your theory, if it doesn't get smaller?

PAGE Well, we'll be real surprised. (Laughter)
I think what happens is, that this, well, I know it's a rate problem. You have so many gallons, quarts, cubic centimeters, or whatever you want to call it, of gas coming off every second, and this flows outward, it diffuses outward, because you've got a gas and a vacuum and all that. And, when you cut off that supply, there is no sort of pressure outward, so that the thing just collapses. Actually you don't cut it off, of course, what you do is, you've got the maximum right now of heating effect and therefore volume of gas coming off, and you cut it down, so you've saved by this point - cut the amount of gas coming off in half, amount of gas per second, and here 1/10 of something like that.

QUERY What's the estimated size of the halo at perihelion?

PAGE Let's see now, we went - it, I think we will get something like 6 or 7 degrees across, and this was one of the reasons for going out on EVA, because our camera, when we use it inside on the articulated mirror system or AMS, through the SAL, the scientific airlock, we're limited to 7 degrees. Out on EVA here, we got this 20-degree field and my guess, I guess, is that it's going to be at least 6 degrees, 7 degrees across here. And, it doesn't have a sharp edge, it just fades out. Our biggest difficulty in measuring this is going to be that we have a fogging all over the field of view from the Earth's, largely the Earth's geocorona, this hydrogen around the Earth, too, and so we're looking out through the very kind of stuff we're trying to photograph in the comet and all we have here is the intensification and I think, that, well the edge here that we can detect is where it's oh, say 5 percent or 10 percent brighter than the background. In the middle it probably will be 10 times that. And, well, I guess that's the answer.

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QUERY What about the oxygen halo? What size do
you expect that to be?
PAGE And, that'll - - probably be smaller. No
one's ever seen it before and it may not be there. But, if
you've got water coming off here, the relationship will be
roughly 2 to 1 in number of particles and so this chemical
reaction, which would be the disassociation of water by the
sunlight, the water having been boiled off the nucleus of
the comet. You'd expect to get twice as big a halo in oxygen-
in hydrogen then in oxygen. But, there are a number of other
features. The excitation of hydrogen to produce the light
I've shown here in blue, the Lyman-alpha halo, I think is
very much more effecient than what will cause the oxygen to
glow. The oxygen lines are 1304, 1356 angstroms and the
process is somewhat different. But, if water is producing
this, we ought to see them, I'm fairly sure. If, however,
it isn't water, but say CH₄, then you get H and carbon. And
probably the carbon grabs an oxygen, and we know this CO. To
balance this, you have to have oxygen, and methane would give
you something like this, and so it could be that there isn't
any oxygen halo because we're not getting water from the
comet. And I guess the whole business of what the comet
is made - ~

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PAGE - isn't any oxygen halo because we're not getting water from the comet. And I guess the whole business of what the comet is made of, the primordial material and all that, comes in here. It's not pure water, nor is it pure methane, but probably a mixture of that and ammonia and also some other nasty things, including methal mercury. Methal - I'm sorry. Methal cyanide, which - That Time article was real good about what people worried about when comets came passed (laughter), and the idea in back - was it 1910? - that Halley's comet would asphyxiate everybody in the Earth because of all those nasty gases in the tail. (Laughter) People went out and got gas masks and took pills and all (laughter) sorts of things to keep from being poisoned by the comet. I never heard that before and the Time researcher who dug that up (laughter) deserves an (garble).

QUERY What can you tell us about the brightness, and is it up to your expectations or beyond?

PAGE Yes. I think it's coming out just about - well, on the conservative estimate. And this picture I mentioned - we've asked the crew to try and draw it as carefully as they can and - and tonight it ought to come down on TV and we hope they'll be - They were talking today about a - a bright star nearby and for the life of me I can't figure what it is. The - the map of the sky has Mercury, which has been the comparison up to now, over here, and Venus, which is way back out here somewhere, so it couldn't be Venus, and there're a few stars near the comet, sort of like this, Or - yes, something like that. And this - this - the brightest of those is about, oh, 2-1/2 magnitudes, which is not a terribly bright star. I mean - well, it's a good bright star but it isn't any where as near as bright as Mercury, which is a minus 0.6. So Mercury would be, say, 3 magnitudes brighter, which is - 2-1/2, 6 - is about 16 times brighter. So the thing they're talking about this star is 1/16 as bright as Mercury as they're talking about being able to see. And they saw it somehow, even close to the Sun, so we're a little confused as to what this means about the brightness of the comet. The best way of measuring that or - or estimating it would be to compare it with something that's known. And 3 or 4 days ago Mercury was the thing to compare it with, and we know just how bright that is. If they're comparing it with this it ought to be - the comet now ought to be about minus 3, 4 magnitudes. Four and two is six. 5 magnitudes is a factor of 100, so it's something like 250 times brigher than that star. One of the other confusing things about these brightnesses is that when you're talking about the brightness of a diffuse object like

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a comet, you've got to add up in your mind's eye all this as well as the little bright spot in the middle, and so it's not an easy job to measure the brightness.

QUERY

Well, should the comet get any brighter then it is now or will it start decreasing in brightness?

PAGE

QUERY

No, it can only go down now. Okay. And was there anything in the

description from the crewmen today that indicated any unexpected changes in the comet since perihelion that, you know, something unexpected?

PAGE

Right. The things that might happen is splitting up and flaring or sort of disappearing all together. None of those extreme things have happened. (Laughter) It's still there. It's about as bright as the people at Harvard estimated, I think, and the spike is unusual but not tremendously so and the fantail we talked out is another development that's not - not un - not unusual really.

QUERY

If - can you comment on the colors they described, yellow and orange.

PAGE

QUERY

Yes, I know what you mean. Particularly orange.

PAGE

Dear old Kohovtek was nonplused by that one and he doesn't know all that much about the astrophysics of the comet. I - I'd be guessing. There are emissions. In other words, the composition of the material in the comet accounts for the color. As I already said, it could be an effect of the Earth's atmosphere. The air glow that was close -

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PAGE - - in other words, the composition of the material in the comet accounts for the color. As I already said, it could be an effect of the Earth's atmosphere, the airglow, that was close by when they were looking at it. It could also be that some of the compounds in this comet that have boiled off in forming this tail have emission bands in the red part of the spectrum. And, I guess, I don't have in mind all the possibilities, but compounds like CN, CO, well CO is out in the tail. C - wait a minute - CO, CH and all, some of them ionized and some of them not ionized, give you all sorts of emission in the spectrum that, you know, you have to add up in order to say what color the thing's going to look like. And, if there were some strong bands in the red, that would add to the sunlight scattered from these dust particles that make most of this, to give that reddish color. I guess we'll know as soon as we get some of the spectra analyzed. Right now, of course, Earth observations are almost impossible, so spectra at this stage in the game have to be the ones that are on Skylab, taken by Henize in his S019 experiment and Tousey in the S082 experiment. So, that the answer to just what's causing that red color, I don't think can be given until we get those spectra back.

PAO Any more?

PAGE Sir?

QUERY Would you mind speculating on what all this means, wWhat all this tells you as best you can tell from this very limited perspective?

PAGE I guess the - I think this strong fan shaped tail that - You're quite right. We're probably looking down a longer tail that's not so broad, means a lot of dust, and the general idea is that the large amount of dust would mean the comet is a new one that hasn't been past the Sun before. Speculation - This is really not so much speculation because I think the orbit of the comet shows that it's coming from a very large distance so it's been a long, long time, millions of years since it was - it's been a long, long time in the deep freeze, and so I guess that the interesting things we're going to learn are the compounds that are in that little nucleus. We can see from this description that there must be a lot of dust in there, and so it's a very dusty comet. I haven't had time to speculate very much or I could have given you a better story.

PAO Okay, if there are no more questions, we'll go right into the change of shift briefing with Milton - -

SPEAKER You all can all leave if you want to and it'll be all right. (Laughter)

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Mission Day-28 Review
Johnson Space Center
December 13, 1973
1:30 pm CST

Participants:

William Schneider, Skylab Program Director, NASA Headquarters
in Washington
Kenneth Kleinknecht, Skylab Program Manager, Johnson Space Center
Stan Reinartz, Deputy Skylab Program Manager, Marshall Space Flight
Center
Bill Pomeroy, PAO

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PAO Okay. At this point, 28 days into the mission, we're ready to give you a Mission Status Review. And we have with us today, I'm going from my right, Stanley R. Reinartz of the Marshall Space Flight Center, Deputy Skylab Program Manager there, William S. Schneider, NASA Headquarters, who is Skylab Program Director, and - pardon me, William C. Schneider (laughter). And the middle initial S. goes with Mr. Kleinknecht who is - Kenneth Kleinknecht who is the Skylab Program Director - Manager here at Johnson Space Center. We'll start off with some remarks by Mr. Schneider.

SCHNEIDER Thank you. Good afternoon, ladies and gentlemen. As Bill said, we're just completing day 28 and have 56 to go. And it seemed appropriate for us to pause for a moment and have a little review of our accomplishments and a little forecast of what we see ahead of us. First let me start by commenting on the crew's health and well-being. We do hold, as you know, regular reviews of their health. And, of course, I'm very pleased to say that their health is great, they're in great shape, their weight is stabilized, they have no weight loss. And the doctors are very pleased, not only with their physical well-being, but also their mental well-being and the job that they are accomplishing. Turning to the accomplishments, there have been many. The medical experiments, I won't dwell on those other than to say, they've all been accomplished as planned. In the Apollo telescope mount, the solar observatory, we have managed to accomplish, to date, approximately 84 hours of solar viewing, which is perhaps about 10 percent less than we had planned prelift-off, but we have consciously shifted time after lift-off from the ATM into the Earth resources area. However, even during those 84 hours, we have had several very significant accomplishments. Ed Gibson did manage on the - December the 4th to catch a limb flare, which is very significant to the solar scientists in that it was the first limb flare that has been caught in Skylab. And they're very, very pleased. The principal investigators tell me that the flight crew exercised perfect judgement and perfect execution in getting all the data that they possibly could from this limb flare. The other unique ATM viewing activity had to do with the viewing of a helmet streamer. And I'm not going to try and tell you what a helmet streamer is. I've just about told you all I know about it. We also did have a very successful CALROC firing. As you know, we calibrate the inorbit ATM instruments by rocket firing from White Sands. That was done and was very successful. All in all, the ATM performance has been very well, very well done. And that, despite the fact that we

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added nine new joint observing programs to this mission after the Skylab III crew returned. Those new observing programs were primarily aimed at looking at new concepts that the principal investigators had developed as a result of looking at the Skylab II and III data, as well as, one or two observing programs that have to do with the comet Kohoutek. As I said, we did shift time from ATM into EREP on a conscious basis and we were able to get 12 passes. As you know, we did have some problem with some filters on one of the instruments. So we will probably have to repeat some data, but all of the mandatory sites do come up again. And we do have that opportunity. I guess the significant observation that we had there had to do with the - with the ocean currents in the Yucatan Channel, where we have come up with some ideas which should help the weather bureau in better modeling the Earth's atmosphere and better predicting the Earth's weather.

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SCHNEIDER I guess the significant observation that we had there had to do with the - with the ocean currents in the Yucatan Channel where we have come up with some ideas which should help the weather bureau in better modeling the Earth's atmosphere and better predicting the Earth's weather. And of course, as you know, during the extravehicular activity we did fix the 193 experiment. Comet Kohoutek, despite some of the early reports in the paper that said perhaps it wasn't as bright as - as previously expected, we have had 45 separate observations of the comet. And just before I came over here, why, Bill Pogue made some very brief comments about the fact that the comet has gotten significantly brighter since the last time he saw it and now has a tail which he estimated to be 2 to 3 degrees long. So it looks like the comet is performing well and moving in there just as the scientists had told us it was going to. I won't go through all of the corollary and student and operational DIOs and science demonstrations that we've had. We've been ticking them off as planned and they've all been going very well. More significant ones were - that we added late were the barium cloud observation, which went very well, and also the laser observation, which went very well. We've had 80 different opportunities, at 80 different times we have done what we call Earth observation. This is a new series of experiments that we added after Skylab III, where we train the crew to observe geological phenomena from orbit. And they are doing that on a regular basis and we've done that 80 times. Of course, the true accomplishments can't really be unfolded after we've analyzed this data. So this is kind of an operational accomplishment. The true science accomplishments won't be known until several years from now, I'm sure. Turning to our in-orbit hardware. We have had one control moment gyre that has failed and we're now operating on two CMGs. One of those CMGs every once in a while gives a little hiccup, but I guess it's causing mostly trouble for those of us on the ground getting white hairs and wondering if it's trying to tell us something, but we seem to be in good shape, the vehicle's under control, and we have no - no worries right now other than normal worries that you might have in that area. The ATM control and display panel has had some fluctuations in the - in the coolant flow, quite a few of them as a matter of fact. We not quite a 100 percent sure what that means. Although Mr. Reinartz was telling me just before we came over here that the data is now indicating that it's probably a situation that is very controllable. We had instrument that has gone bad in the ATM, the 5054, which is the X-ray telescope built by American Science and engineering, apparently

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has a filter stuck in the field of view, and we will in all probability try to correct that on the next EVA on - on 88 around Christmas. We have a procedure set up that looks as if it's possible for us to correct that. Well we've repaired a lot of other things, the S183 experiment, the S009 experiment, the airlock module coolant loop, and all-in-all for a vehicle that's been up there for almost eight months, I guess it's a little over seven months now, I guess it'll be seven months tomorrow, it is behaving very well and we are very pleased with the mission as it's been progressing so far, and we think we're getting excellent data out of it. Right now, unless something unforeseen happens, we're GO for our 60-day mission, open-ended to 84, as we've explained to you previously, and looking forward to talking to you again in 28 days. You can turn it over to questions.

PAO Thank you, Bill. At this time we'll take your questions, if you'll wait until we get a microphone to you.

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SCHNEIDER Often ended to 84 as we've explained to you previously and looking forward to talking to you again in 28 days.

PAO Thank you, Bill. At this time we'll take your questions, if you'll wait til we get a microphone to you.

QUERY Bill, you made a statement that the doctors were very well pleased with the physical and mental attitude in the job that the crewmen are doing. Dr. Hawkins recently in a briefing made some comments that the crew was working slower on some tasks and they would like to see, and he indicated that, there was no - he said there was no medical reason that he could find and hinted, at least to me I guess, that there was some underlying concern as to this crews' stability as far as doing their tasks and I understand Dr. Berry in Washington has made several comments that doctors are privately somewhat concerned about it. Wonder what your feelings are? Is this crew moving slower? The number of mistakes that have been made, do you check them off as the individuals, as Dr. Hawkins does, or exactly what is the case?

SCHNEIDER Well, well, let me say that I read the same reports you did and did investigate them. I, for example, I talked to Dr. Berry today and he is not concerned and thinks that the report in the paper was overstated. We have talked to the doctors, Dr. Hawkins and all the medical PIs and they are I guess we could even quote them, Ken, you might want to quote them when I'm finished, they are quite pleased with their performance. We have gone back to try and to see if there's any statistical basis to impressions that people may have received and can find nothing that bears out those impressions. Now this crew is more silent on communications than previous crews may have been, but this to is by design. This crew had before they lifted off, had said that they were going to put their comments, the majority of their comments on the channel B tape and they are. And if you read the channel B tapes you find that they are great numbers of comments on there about the experiments and what they're doing, so we had expected them to be more quiet, they are more quiet, they are different individuals, obviously. But we have no concern whatever and I can find indeed when I press people to the wall to see if you really do have a concern. I find no medical concern about their medical, medical condition, or their mental condition and I certainly have not been able to discern any of it myself. Ken did you want to say anything.

KLEINKNECHT Yes I think the error frequency or minor mistake procedural error on this mission has been no different than the other missions. In general across the board. There may be some specific areas where maybe they bunched up. They

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have not made any procedural errors that caused us to lose the bulk of any experiment data or the major part of any experiment data. I think if you look at procedures too, from the procedures standpoint, procedures change, flight data files change, just like hardware changes proportional to the time between missions if you will. If you go back and look at the month previous or just prior to the launch of Skylab II, there was about 6000 stowage changes and that's inputs to our flight data base and stowage data base. The month prior to Skylab III, there was about 8000, and a month prior to Skylab IV, there was about 17,000. Everyone of those stowage changes effects a procedure someplace. Now some of the stowage changes were just taking something out. But that's removing something that a crew had worked on before. We have the same standpoint, from the same standpoint I think in significant activities. The changes and new activities for the Skylab II crew were primarily associated with the workshop problem we had after its launch. Skylab III crew had a number of changes, new activities like six-pack changes, refrigeration modes, new exercises, fixing S009, twin-pole sunshade, soforth. In those type changes there was twice as many in Skylab IV as there were in Skylab III.

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KLEINKNECHT - - S009 twin pole sunshade and so forth. In those type changes, there was twice as many in Skylab IV as there were in Skylab III. I think the success of this program or this mission isn't going to be judged on how much the crew talks or any minor deficiencies in procedures, as Bill said, it's going to be judged on the returns and the analysis of the data after the mission and after the program. And we see nothing at this time that says that we aren't going to get what we intended to get. As a matter of fact, significantly more than we intended to get out of the program.

QUERY As I'm sure you're aware, this is about the point where they approached the number of days that the Conrad crew had in space. And the Conrad crew had 81 hours and 41 minutes of ATM time, and had 11 EREP passes, and all with the filters in the cameras, had three EVAs, took time to deactivate the space station, and arrived there at a point where they had to work under very hot conditions for several days. With those things in mind, how would you rate these crews at this point after a month?

SCHNEIDER I don't think you rate crews. The - The Skylab program had been designed to have different emphasis as the missions went on, and you can't compare one versus another to say whether or not you are accomplishing the same things. The - if you look at workload for example, the Skylab III crew at the end of their mission were going about, were averaging about 28, 29 hours a day of experiment work. The Skylab IV crew at this point is averaging 25 to 27 hours a day work. And that means that you're talking about differences of minutes of experiment operation, not hours between them. So I don't think this crew has anything to be ashamed about in their performance. I think they can be quite proud of what they're doing.

KLEINKNECHT I think certainly we're scheduling differently for this crew than we did for the other crews. And if you specifically want a rating, I'd rate them all equally. And I don't think you can totally rate them until the program is over either. But don't forget we didn't get everything we planned to do on Skylab II out of the way because of failures. Some things you couldn't do because we didn't have a solar scientific airlock. The Skylab II crew did more - or Skylab III crew did more than we planned to do preflight. We took that experience and we used the experience on the ground. At this stage the ground people have some 210 days of real time flight experience behind them and this crew has 21 days. Maybe we ought to be attacking ourselves a little on the ground too from the hardware stand point. A lot of these procedures change have come about because the hardware is not working 100 percent. There

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isn't very much hardware up there that's working exactly like the crew's basic training was performed on. They're doing workarounds. This crew has also done some repairs. S193 was the most difficult EVA we've done, not from the standpoint of physical exertion and work, but it was a very precise task and difficult to do with gloves on, and that was an outstanding performance by this crew. And if you take the things that the other crew has had to do, when something had to be done, they've all done an outstanding performance, I believe. If you look back at the training, the training is about equivalent for all three crews except that there is more changes from one crew to the next. The Skylab IV crew had to pick up all the changes that came about as a result of the Skylab II mission - as a result of the Skylab III mission and as a result of the additional failures, plus the significant amount of new experiments, DTOs and activities we've given to them. And we on the ground got carried away a little bit. Bill and I have talked about this, is we probably let too much get into this crew at the last few days or weeks before the mission. Now the crew was very enthusiastic about this. You know we increased the mission to 84 days. We needed stowage space, we had to get consumables, food and so forth aboard. And the crew says I want you to take everything off of there that could be interpreted to be more convenience from the operational standpoint, that's a convenience, or that it's a little inconvenience for me to not have it and put things on that will produce science.

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KLEINKNECHT - - consumables, food and so forth aboard. And the crew says I want you to take everything off of there that could be interpreted to be more convenient from the operational standpoint, that's a convenience or that it a little inconvenient for me to not have it. And put things on that will produce science. And so we did exactly that.

QUERY Well, I'm sure that they're doing as good job as you say they are, Ken. And I want to know, before I ask this question, that they had the advantage of the experience of six men before them 3 months in orbit. Now I want to ask you, they're going to have to go back over six mandatory EVA passes, as I understand it.

KLEINKNECHT EREP.

QUERY What's going to be knocked out because of that?
KLEINKNECHT I can't tell you at this stage. I think we'll catch them by selection of EREP passes. We'll select EREP passes that get the other requirements plus the six mandatory sites. That's not six passes, I believe it's the six mandatory sites. Now weather, lighting and so forth gets involved in that. But there will be time with the right light in front of us now where we can pick those up. Now take the filters. I don't know why we make such a big deal out of the filters. We have six cameras there. Three of the films - Well one is perfectly all right, two were over exposed, and we can correct that on the ground. Two others are over exposed and we can bring back a significant amount of it - get a significant amount of the data out of the film with the I, I guess it's the IR, we will lose it. So it wasn't a total loss. Don't forget we have operated 190 in the past with the damn door closed, too. And I don't think we got very much. Now it wasn't very many passes. But you - Why do you jump on something like this? It looks like you want to try to make the news.

QUERY Well maybe we are making too much of it. Why are you going back over the sites?

KLEINKNECHT We said they're mandatory sites. We're going to get them. That's the kind of flexibility we're trying to build into the program. And fortunately we must have done it right in this case. Now, certainly, I wouldn't say that everything that we miss one time that we're going to be able to go back and get, we're also going back and getting a lot of things because of hardware failure. Like experiments that had to go out of the solar airlock, can not. And look at the activity - the hardware changes, the procedures, the crew training that has to go in to do those things EVA. And these crews, all of them have been just as enthusiastic in going back and doing that. And they're covering up for our mistakes on the ground, when they do that. I think you ought to attack us more than them. They can't

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defend themselves. I think they're doing an outstanding job.

SCHNEIDER Don't think we wanted those filters to be left out. We certainly are just as disappointed as they are but, as Kenny says, the basic problem when I think about it in retrospect, is that it probably belongs to us up here. We stowed that spacecraft full of so many things. We took out all of the stowage assistance materials. We crammed everything into that spacecraft. And we literally made it hard for those guys in the first few days. And while that was a good thing to do, I believe in total, for the program, it probably started the crew out a little bit behind the power curve, because they had a lot of things that they had to find, pick up and stow. And while - I agree with you, they had the advantage of having had six guys up there before hand who could have given them some help, and who did give them some help as a matter of fact. They also had the disadvantage of going back to a spacecraft that had been used by six people. And it's perfectly conceivable that even the things that were left up there weren't in - weren't the way we thought they were. And so, therefore, all the procedures that we had up there would not be correct. So, as Kenney says, we're not particularly happy that filters were left, but we don't think that it's a very Earth shattering catastrophe. It's something that we are going to recover from, just as we have recovered from a great many other things. And we think the crew is doing a fine job.

QUERY How many passes did you say we were short on EREP of the total planned, prior to the - -

KLEINKNECHT Yeah, we - -

QUERY - - first flight.

SCHNEIDER If we get, I believe, three or five passes, we've given EREP all the passes that we had told them we were going to before the program - before we started the flight phase. Now, obviously, we expected to give them more than that.

KLEINKNECHT That was a part of the extended mission, is to be productive. But we didn't - We still think we're going to get all that we set out to do on this mission.

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SCHNEIDER We had - I think it's three or five more passes we - we've given EREP all the passes that we - we had told them we were going to do before the program before we started the flight phase. Now obviously we expect to give them more than that.

KLEINKNECHT That was a part of the extended mission is to be productive. So we didn't - we still think we're going to get all that we set out to do on this mission.

QUERY Would you summarize what you think are the most important scientific discoveries or discovery so far?

SCHNEIDER Well, you - if, if - you have to talk about Skylab II, which of course is the only dates - scientific data that's had any analysis to date, and there the ATM principal investigator is literally rewriting the book on the Sun, and I'm fairly certain that it'll take five years before all of the new knowledge that comes out of ATM will be fully analyzed, understood, and decimated. In the Earth resources area, why I guess the only - the only real one that I know of today is that - is the - the potential mineral source out in Ely, Nevada, that we found on one of the 190B pictures. I myself personally think that there's a great deal of potential in the materials processing experiment. We developed a crystal, germanium (garble) crystal, in that experiment. That's an order of magnitude larger than any we've ever been able to develop on Earth. Now those crystals are kinds of crystals that are used in all of our electronic equipment. So I think the potential from that is probably very exciting, to me, and could conceivably have long term benefits to all of us.

SPEAKER I'd like to add that Dr. Hemenway with S149 discovered a different micrometeorite flux density than we had used by samples from his S149 particle collector, which is the first time we've had an instrument this precise, as accurate as that. I can't quote this because I didn't hear it directly, but I understand that the - the solar physicists say now that they have more quality data from AIM than they had from all the previous solar observations from the Earth. Now it's obvious that they can see things from space that they couldn't see from the Earth, but they are very enthused about the data with respect to a lot of the EREP data. We're still in a mode of processing much of the S90 - S192 data and the PIs really haven't had a chance to dig into that yet.

QUERY This is dredging up past history and, but this is a 28-day review and - and we have been discussing the quality and care of your astronaut training and its effect.

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Early in the mission, as you recall, Bill Pogue was ill. And it developed in effect the crew was exercising a cover-up as to the extent and nature - precise nature of his illness. And you recall they accidentally bugged their own spacecraft and as a result we were able to get some extremely rare and candid conversation among the crew, and during that Pogue commented that he believed it was the - the preference of the managers on the ground if - if the exact nature and extent of the illness was not known. Now, my question is, that something has puzzled a lot of us, is how a guy who's been in the astronaut training program, gone through this quality training program you've talked about earlier could come to this conclusion, a conclusion he obviously felt - sincerely felt because they were talking about it candidly?

KLEINKNECHT Let me try to address to that first. We - We did - were privy to listening in on one of their private conversations that they thought at the time I believe, although I can't be sure of that. I guess as a comparison, I may hate to hear you listen on some of our management conversations, too, before we come out with a decision. We, certainly everybody can sit around and talk about things that shouldn't be done are ridiculous, but I submit that the crew made the right decision ultimately, and they had made the decision before they were reprimanded for that. They had - they didn't throw that sample away. They kept it. From the comment regarding the managers, I don't know what he meant and what he prompted - what prompted him to say that, but I'll interpret it. And I think what he intended to leave the impression would be that we didn't want sickness, and we would rather not have to be worried with sickness, not that we did not want them to report it, and we certainly didn't want sickness. We never have wanted sickness, but we have never, and no one has ever said anything about covering up.

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KLEINKNECHT - - and no one has ever said anything about covering up. Apparently that wasn't a satisfactory answer.

QUERY No it wasn't because the comments were specifically related to the cover up, the preference he stated that - -

KLEINKNECHT Well, I just addressed to that. That we didn't want sickness, that's right. And you're trying to interpret it what you think he meant. I'm admitting I am, and you don't know. He can't be here to defend himself or to discuss it rationally.

SCHNEIDER You and I as you try to reach a decision why you, at least the way I do it with these guys, is we try many many different things on. And I know I say a lot of things including some things about my bosses that I don't really mean and I wouldn't even want them to hear, frequently, infrequently, infrequently, boss. But as Kenny says, the important thing is that they did make the right decision and they did not throw it away. Now it's useless for us to speculate on what he meant or why, or how he got that impression on anything like that. Even if he had that impression he ultimately gaged us right. He ultimately said, well I guess they really would want to know about that, and they did save it. So that's all we can - all we can do is speculate on them. We can't really say why they said anything.

QUERY In the same reference to that, Bill, I understand that you were rather livid about the coverup itself, and you were quite concerned that the other things in this mission may come up that the crew may not discuss candidly with the doctors or with other, with Program Managers. Have you still got that concern from any of the activity of the crew?

SCHNEIDER Well, your choice of livid, I was alone in my apartment and I don't think anyone knew if I was livid or not. I was concerned obviously and came right in. And we did investigate it and look at it and follow the course of action that we said. I have no concern, no concern whatsoever right now that the crew is withholding any information for the doctors, from the doctors or in the the science world. After all, most of the things that we've been discussing here today, as far as errors are concerned are things that they reported on the channel B tapes, which is where we read their original conversation. Bill Pogue said "I left the filters out." Now if he was hiding things why he could have easily have not said that and when the got back then the data would have been bad. It could have been very easy to do. Some of you looked through those channel B

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tapes there are many things where they say I didn't do this, and I didn't do that, I did do this, and so forth. The doctors tell me they are being perfectly candid with them, they have no qualms about their rapport. They seem to have a very good rapport with one another. I guess I have to say that it's perfectly conceivable that I could have even exercised the crew on this sickness because I was quite concerned about guys getting sick, you know. And I was the one who pushed real hard to make sure they took their pills before hand. And where the procedure had been to do it for 2 days I said no, we'll do it for 3 days, and things like that. So you know it could - it could very easily be that they had in the back of their minds some notion that we were, that we would feel that way. But again, as I said earlier, the important thing is that they ultimately did gage us right, they ultimately did do the right thing, and so all's well that ends well. If we had not read that on that tape, why they would have saved the vomitus and everybody would have been happy, I guess.

QUERY If I understand you correctly when you say they did the right thing that's saving the results of his sickness, right? What about hiding the sickness?

SCHNEIDER Let's see I've got to go back in my memory. It seems to me they were about to report that weren't they, Ken.

KLEINKNECHT We heard the discuss - the sickness or the symptoms, I'm not going to get into a discussion of what sickness and what's symptoms. The sickness, oh hell. Well I've come to work in the morning and had heart burn or something and spit up a mouth full of something. I don't consider I'm sick. But anyway, - -

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KLEINKNECHT We heard the discussion, the sickness, or the symptom, I'm not going to get into discussion of what sickness and what symptoms, the sickness, oh hell.

QUERY

- - physical evidence.

KLEINKNECHT Well, I've come to work in the morning and had heart burn or something and spit up a mouthful of something. I don't consider I'm sick. But anyway it had occurred prior to the time we heard the discussion. We heard the discussion and then they didn't destroy the evidence. They saved it. It was later then the following day I believe, I don't know exactly the timing that Al Shepard talked to the crew and suggested that they do report everything and have a good flow of information, and they said yes, they said they had, so they didn't in a course of the way things normally get reported, they did not report it before they were talked to. But we have absolutely no evidence since then that there's been any restriction or constraint on the flow of information. Now that remains to be seen, too, I guess, until you look at the data and you talk to them when they get home, but we have no reason to believe that we don't know everything and I suspect that maybe we know more about what's going on in this mission than we did the others, because of that and I think they probably bent over backwards now to make sure that they do put everything on channel B or discuss it, during the real-time passes, but that's speculation on my part, too. If I didn't have confidence in the crew I shouldn't have been here.

QUERY

On a different subject, Bill is there anything other than the possible loss of another gyro, anything that we are seeing, now like the ATM C&D cooling loop or anything else that could cause anything, any early end to the possible 84 day mission.

SCHNEIDER

Well, obviously there are a lot of things that could cause early termination, but nothing that is currently - hiccuping - the CMG if, if the CMG, if another CMG came, failed, why, the way we've been planning it is we would have an orderly, an orderly return. It would not be any emergency situation. We would put our house in order, get as much scientific data into the command and service module and come down in the best recovery area possible. In all probability if it occurred soon would try to see if we can get the recovery ship out on station and if that took a few days, we might wait for that too. But the C&D panel, if that went out which as I said Mr. Reinartz was very encouraging to me today, if that went out, would curtail some of the experimentation, but would not curtail the mission. Ask him a question, he's just sitting here doing nothing. (Laughter)

REINHARTZ

I'll get to that.

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QUERY I don't know if this question is directed to you or not, but I'd like to know what things you are adding to the mission or what changes you are making in your instructions and procedures for the next few weeks. One I know of is that there's a plan to investigate these eddy currents in other parts of the world. Can you tell me of any other procedures or changes you're making or adding?

KLEINKNECHT I didn't know of any. I don't know of any now that that we're, we're considering some things that we may want to bring home that were not in the original plan and they turned out there's some items of inventory, some special lenses, camera that we may, we would have to buy, otherwise for ASTP. There's some materials that we can bring home for engineering evaluation of degradation. Materials in a space environment and there's a number of things that we may want to consider bringing home that would help us analyze the performance of some of the equipment after 8 months, 9 months in flight now. We're going to look at those things and probably the most significant things to bring back are things that save us money. Not that we can spend more money on, we'll be very cautious about those things because some of them that have been brought up to date, you would have to remove the last day or so before return and stow and we don't think that we ought to encumber the crew with those kind of changes after 85 day mission, to change their last days stowage and add new activities to them but we will, we had the first discussion of those things yesterday and we're going to be actively pursuing that we do have some volume in weight capability to bring more things back than the planned science. Obviously, priority will always go to the exposed film and data, tapes and so forth that's up there.

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KLRINKNECMT - - to change their last days stowage and add new activities to them. But we will - we had the first discussion of those things yesterday, and we're going to be actively pursuing that. We do have some volume and weight capability to bring more things back than the planned science. Obviously priority will always go to the exposed film and data takes and so forth that's up there.

SPEAKER The only other mission planning change that's actively cooking is the S054 filter repair which I mentioned before. We're currently thinking of doing that on the December 25th EVA, although it's conceivable that more thorough examination might say we might do it on the December 29th EVA. But we are developing the procedures to get that filter out of the field of view.

QUERY In the event that CMG 2 fails, in precisely the manner that CMG did in fact fail, can you enlighten us as to what the balance of the mission would be as to what your plans would be for an orderly return, and the time involved, 2, 3 weeks or whatever?

SCHNEIDER Well a great deal depends upon when it would happen. If it happened for example right now, our actions would be different than if it happened some time later in the mission. And it all has to do with how much attitude control capability we have. At present our plan would be to shift as soon as possible to the command module RCS control which can give us any where from 10 to 20 days of attitude control capability. We have in addition to that, the ability to control using the workshop TACS system, the thrusters on the rear of the workshop. And I believe - I believe that takes something around 2500 pounds of TACS per day. So you end up saying how - where are you, how much TACS do you have left, and decide what you're going to do. As I said, right now if you had to do it today, we probably, I haven't really thought this one through completely, but today we probably would not do an EVA. Some time later when we got closer down to December the 29th when the rescue vehicle would be available, we probably would do an EVA, again being able to devote some attitude control gas to doing EVA as contrasted to having leaving it available for attitude control. So by orderly return, what I mean is if we have the ability to do it, we would do an EVA. We would go out and get the ATM film back, we would put all of the scientific data we have into the command module, and we would then select the best possible day for reentry and then we would go on into reentry. Now there are a lot of ify's in there. The best possible pass depends again, as I said, for reentry depends on when it is. If it's now, we don't have a recovery ship

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out there, and we'd have to find out if the Navy could get a recovery ship out there. If it's after the first of the year, a recovery ship will be on station, and then we'd have a different posture. So an orderly reentry means we're going to do as much as we can and come back in in roughly as soon as we can consistent with bringing back as much as we can of the scientific data. It's not an emergency situation by any stretch of the imagination, but it's not something where you say you're up there for a month or anything like that. Did I thoroughly confuse you?

QUERY I understand.

END OF TAPE

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QUERY - understand. In other words that the
CMG fails completely as did the CMG 1, then you would have
10 to 12 days - -

SCHNEIDER 10 to 20

QUERY - 10 to 20?

SCHNEIDER Yes.

Query - plus the balance of your TACS propellant.

SCHNEIDER Yes..

QUERY Okay.

SCHNEIDER But our ground rule is that we would want
to schedule a reentry at least 10 days before - at least 10
days before we would run out of attitude control capability
so that we retained a rescue capability throughout the
mission. That's why - that's why I'm very iffy about whether
or not you do an EVA if it happened today.

KLEINKNECHT I think a primary objective is to get to
a primary landing area, returning the science we have, and
to preserve the capability for a rescue, and we may go then,
on like five day increments, when you got to that posture of
reviewing where you stood and do you still have 10 days in
front of you. It's a new mode of operation or control mode
and it could be a little - that's why we get the 10 to 20
days, it could - we could maybe be a little more - say you
conserve a little more energy and last a little longer or
maybe it wouldn't be as efficient as we think it is. And then - -

REINARTZ The same thing applies to the TACS, Kenny.

SPEAKER - then acts the same way - -

REINARTZ We have not been in that mode, what we
call a wide deadband mode of oscillating slowly back and
forth. It could vary in the amount of TACS that we would
use and then Bill gave what we think is an upper figure or -
with a little time it could be as low as about 1600 pounds
a day as compare to Bill's 2500. So it would be someplace
in that range and it would depend on what we would see after a
little time that would help us make that decision.

KLEINKNECHT I think we did get into this five day
planning cycle. Then each five days we'd look it as - what is
the most significant things we can do during the next period
whether it's an EVA or - or EREP or ATM or what it is, and that
would change.

QUERY Well, after the first of the year if the
CMD goes out totally what would be your reaction in relation
to the rescue vehicle? Would you immediately prepare it for
launch as soon as possible or - and then put it on standby,
or what - what would be your reaction here exactly?

SCHNEIDER As of the 20th of December the rescue
vehicle will be nine days from launch, and it will stay in

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that posture. Now we will - we will if - if it went out, if a CMG went out after the first of the year, I would not activate the rescue vehicle, we would maintain - we might wet - we might make a decision to wet the rescue vehicle which would put you five days from - from launch, but I would not go down - would not count down to T zero.

KLEINKNECHT Well now that the CMG going out is not a survival thing. It's a - you couldn't do much work after you ran out of control but you might still be able to rescue.

SCHNEIDER

Yep.

PAO If there's no further questions I do have an announcement to make. We have a news release ready on the shuttle procurement action. You might want to pick it up on your way out. Thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Status Briefing
Johnson Space Center
November 28, 1973
3:17 p.m. CST

Participants:

William Schneider, Program Director
Bill Pomeroy, PAO

SL-IV PC34A/1
Time: 15:17 CST
11/28/73

PAO Okay, at this - today we have with us from NASA Headquarters, William C. Schneider, the Director of the Skylab program who will give us a status report on the Skylab as we're about two weeks into the mission. And I might announce before he starts that we will not have a change-of-shift briefing today because Chuck Lewis had a doctors appointment or some other thing. He couldn't make it, anyhow. We will not have a change-of-shift today. Dick?

SCHNEIDER Okay, first thing I'd like to apologize for any inconvenience I may have caused you by being late. But, unfortunately, I was unavoidably delayed. We just in the past few hours completed a TAG up between the Marshall and the Houston experts on control momentum gyros and attitude stabilization and the general problems that we have been having in - in the CMGs. And we have concluded that we really do understand what is going on and that we had a specific maneuver yesterday which was very sensitive to initial conditions, and that there was nothing wrong in our understanding of what happened. That was the maneuver that we had put in. Our simulation did not have exactly the right initial conditions in it. And if you put the right initial conditions, why, you get out the amount of propellant that we used. So based upon that, why, we feel we have essentially eliminated the restrictions on - on maneuvers for the remainder of the mission based upon, obviously, any successful simulations of all maneuvers, which we always do. And our plan now is to carry on with the flight plan as published yesterday for tomorrow, which has the solar inertial EREP pass in it. And then on Friday to do a first Z-local vertical EREP pass. The reason for not doing one tomorrow is it takes us about a day to do all of our pad updates and all of our simulations and everything that's required for the - for the maneuver. And all of our people in computers yesterday were tied up analyzing the problem, therefore, Friday is the first day we can do it. We believe that the remainder of the mission will continue essentially as planned. We'll obviously, be a lot more careful about maneuvers than we were in the three CMG case, because with two CMGs you do use TACS attitude gas for all maneuvers. But we anticipate that we will allow ourselves a budget which will permit EREP passes - excuse me - EREP passes, Kohoutek observations, and all of the other kinds of maneuvers that we have in our - the flight plan to continue. As I said, there will undoubtedly be detail changes as we go through the mission, but fundamentally, why, we'll continue on as planned. We don't anticipate any early curtailment of the mission because of - because of

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attitude control problems and indeed we still have our nominal 60 day open end to 84 ahead of us. As far as crew health is concerned, the doctors tell us that they're in great shape. They each initially lost a little weight. One - Jerry Carr lost a pound, the other two lost, I think, about 4 pounds, and they've remained steady at that. Ed Gibson has asked for a little more food, and we're looking around to see if we can find a few extra bits and pieces to give him so he doesn't get hungry. But he's not losing weight. And in essence, why, the mission seems to be off on - on a - on a pretty good start. Let's see, did I not cover anything? Well, I think I've best just go to questions now. Huh?

PAO Okay.

QUERY Bill, I understand essentially unchanged, but, can you list how the mission will be changed. What will be the scientific loss if any in EREP and com - comet observations and so on.

SCHNEIDER Well, it's difficult to say. We'll probably be much more careful about how we do things. For example, we will probably plan our EREP passes essentially so they're around noon, you know that - that they are around no - -

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SCHNEIDER We will probably plan our EREP passes essentially so that they are around noon, you know that - that they occur around - around noon time not noon local time, you know, solar noon. And we had not been 100 percent that careful in the last missions. We allowed ourselves to drift on either sides of it, which gives you a little more flexibility, so in essence we think we'll probably - there'll probably end up being some EREP sites that we probably will not be able to get. But we won't know that until we go through the simulations and try. As far as Kohoutek is concerned right now, I think we'll - we'll probably be able to do all of that, although, we're going to be hard pressed to do more than one maneuver a day, I think. We'll probably set up a budget for ourselves and stick to you know, so many pounds a day average, as a - as a goal.

QUERY Can I press you just a little further and ask you for some kind of percentage on the amount of EREP that you don't think you'll be able to do? Would you guess something like 5 percent of the planned photography and observations?

SCHNEIDER It - it certainly would be a reasonably small number; it's not like half or anything like that. It's - it's some percentage but I don't have any way of saying what percentage that is until I - I see what the detail results come out. And we - you know we kind of play this 2 days in advance and everyday we're going to be looking at what we can do 2 days hence. Now, we were going to be hard pressed to get all of the EREP work in this mission anyway, because Mother Nature hasn't - doesn't cooperate. We don't get light on the U. S. after - about December 10th until January or so. We - we had some sites that we'd - we thought we wouldn't get in the - in a normal mission.

QUERY Bill, if - you say you're planning 2 days in advance and it takes a full day just about to run through all your sims on the maneuver and you come up say on Friday and the weather's socked you in. Can you easily go to a Kohoutek maneuver in place of the EREP maneuver for that day.

SCHNEIDER We always plan two - two Flight Plans for each EREP day. One EREP and one non-EREP, just for that contingency. So we always have two - two Flight plans for each EREP day in hand.

QUERY I'm aware of that, but I mean are you - do you - can you run an EREP sim and a Kohoutek sim and be ready to do either one?

SCHNEIDER Yes, yes.

QUERY Okay.

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QUERY Can you go into a little bit more of what the maneuvers are to observe Kohoutek? How much TACS fuel do you think they'll cost? And will you modify the viewing a little bit?

SCHNEIDER The maneuvers are basically roll maneuvers for Kohoutek. The one that we did yesterday there was roll, pitch, and yaw. And that was one of the problems. So the Kohoutek we basically roll so that we can look out the anti-solar airlock at the Sun. Now, you asked how much - how much each - each specific one takes a given amount of fuel and I guess Kohoutek is like a couple of hundred pound seconds. And you asked what we - what we would modify. I think what what we're probably going to end up doing is having a lot more soul searching in the Flight Management team, deciding what to do rather than modifying the - the observations. The EREP as I said will be narrowed down probably around noon and the - the Kohoutek we'll probably make some modifications to it to do it at a more optimum time, but the basic science results which would be the obse - observation of the comet will probably remain unchanged.

QUERY Bill, I don't know what the numbers were but I assume that there was a plan for unmanned ATM operations after this crew comes back. And I wonder if that's going to be effected by the - the use of the TACS gas during this manned portion?

SCHNEIDER No, there were no plans to do unmanned ATM observations. As you probably know, there's only one experiment up there that could have gotten back data in an unmanned mode when you don't have any film up there. So - and the cost of keeping the - the network and everything else alive after - after the mission was just prohibitive for just that one experiment. So we - we were planning on deactivating the ATM at the end of the mission.

QUERY What type of data can you get with a solar inertial ER - -

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SCHNEIDER - - of the mission.
QUERY What type of data can you get with a solar inertial EREP run tomorrow?

SCHNEIDER Well - fundamentally, pretty good, because that specific task happens to be one where the lighting is good and the Earth is - Earth is in the view of the - view of the instruments. We'll get good 193 data, that's the microwave experiment. The 192 data probably won't be as good as the we would with Z-local vertical.

QUERY Bill, how would you characterize the performance of this crew as opposed to the first two crews. These - they seem to have gotten off to a slower start and do you think the possibility that they're all three rookies has something to do with it?

SCHNEIDER No, these guys are well trained. I - I believe that they have had a fairly slow start. I believe the problem there was one where we sent up, you know, a thousand pounds of things in that command service module and we took out a lot of containers and we used stowage material in place of packing material and - I suspect they got themselves into a great box initially in just having a whole lot of things strewn around the spacecraft. They seem to be getting into the swing of it now and those couple of days off we gave them to catch up really paid off. No, I think - I don't think they have - the fact that they're three new guys has anything to do with that. Everybody goes up now sometimes or another.

QUERY We have a question that had been phoned in asking what will be the effect on EREP passes over Europe this mission?

SCHNEIDER Let's see, we have EREP passes over the U.S. and over South America. I'm - Yeah, I guess we have - we have some EREP passes over Europe in the - in the middle of December. The same - the same restrictions on those passes as on the U.S. passes. We probably will try to center them around noon, and we will probably go into the passes in - in - in a slower manner, and we probably will shorten up the length of passes, just as we will in the U.S.

QUERY Is it correct to assume that there may be more passes than originally planned, but shorter passes to make up for the - - ?

SCHNEIDER No, I don't think there'll be more. I think we'll be lucky if we still get the fifty, only because we run out of lighting.

QUERY Or shorter.

SPEAKER I suspect that they'll be shorter in duration. We'll center them around noon. Whereas, what we had been doing was not necessarily centering them around noon.

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so we could get passes early and get some sites on one side of our pass and not necessarily keep up on the other side. So we'll center them around noon and that generally shortens up the pass.

QUERY Can you give us a comparative figures, approximations?

SCHNEIDER - -

QUERY 15 minutes versus 25 or does that fall apart?

SCHNEIDER That - that's the kind we were talking about. But I really can't give you any specifics because we're going to run ea - we're going to set up each EREP pass and run the simulations and make the decision on the basis of the simulations of just how long they'll be. I'm generalizing in saying that from the kinds of things we've seen, we'll probably have shorter passes centered around noon.

PAO Okay, thank you very - Well, we have one more.

QUERY When you say noon, you mean noon local time over the area that it's passing? Is that what you refer to when you say noon?

SCHNEIDER No, it's centered around when - when the Sun is - Sun is right on the spacecraft noon.

PAO Okay?

SCHNEIDER Okay, thank you.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

SL IV - Urban Systems Project Briefing
Johnson Space Center
December 7, 1973.

PARTICIPANTS:

E. L. Hays, Manager Urban Systems Project Officer
Bob Gordon, PAO

SL-IV PC-45A/1
Time: 10:07 CST
12/7/73

PAO This is Skylab Control. The briefing in the Houston News Center will begin momentarily by Ted Hays, who is Manager of the Urban Systems Project Office here at Johnson Space Center. He will describe the forthcoming installation of a full-scale test model of the Modular Integrated Utility System. Any Skylab station passes taking place during this briefing will be taped for a delayed playback at the conclusion of the briefing. We'll turn over the line at this time. At 16:00 Greenwich mean time, Skylab Control.

PAO Okay. Our Urban Systems Project Briefing with Mr. Ed - Ted Hays, I'm sure many of you know. He's Manager of the Urban Systems Project Office here at the Center. And what - Mr. Hays is going to review the background of the project first and then go into the modular system he has with us here, today. So, Ted.

HAYS Are we all set? Ready to procede, Mr. Johnson?

HAYS I don't know how many of you people are aware of the background of the Urban Systems Project Office and the work that is being conducted here at the Center. The background is: in the fall of 1971, we looked at how could apply some aerospace technology to the people on Earth, in other words, for the benefit of the people on Earth. And at that time, there was compelling problems associated with pollution abatement, water resources, natural resource conservation. And emerging at that time was the business of energy and - At that time it wasn't called an energy crisis. It was everybody looking aghast at the increase in the anual consumption of energy. And they were trying to quantify what was going to be the result of this. Well, we here at the Center and my particular background, is in life support system. And we - And the center here have gone through the Mercury Program and the Gemini Program and the Apollo Program. And each of these space vehicles, as it relates to expendable resources, that is, oxygen, electrical power, water, we evolve new concepts to be more economical, as it relates to the use of expendables. A very good example of it is in Mercury to provide cooling, we evaporated water. And we had to take the water with us. And through Gemini and Apollo we used space radiators. So we had no expendable to concern ourself as it relates to heat rejection. Then we had some studies on the board that related to the total system package - onboard system package that would provide utility services for a space station. So in this instance then we really had to be mindful of expendable supplies, energy conservation, and so forth. And in this regard, we recycled water and we rejected heat by space radiation. We used solar energy for electrical power generation. Any wasted heat, waste energy, one is carefully looked at before

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it was rejected, to see if it could be used for other utility purposes with the space platform. Well, we then conducted a short study and built a zero-altitude space station that looked like an apartment house. In other words, we then evolved the design of a (sic) earthbound space station, wherein, we integrated all of the utility functions to the maximum benefit of the total system and not to the benefit of any individual system. This was back in 1971, which essentially means that we integrated the power gener - -

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HAYS - - Of an earthbound space station wherein we integrated all of the utility functions to the maximum benefit of the total system and not to the benefit of any individual system. This was back in 1971. Which, essentially means that we integrated the power generation, the solid waste, the liquid waste, the water management and the environmental conditioning which in the - in our earthbound terms is the heating ventilating and air conditioning system of your residences or dwellings or places of business. So, with this background, a report was published and a program was evolved with the Department of Housing and Urban Development, and it's called the modular integrated utility system, which is in - We can hardly do without vernaculars or acronyms. It's called the MIUS Program. And what we'll talk about is where we stand in this program. We, as I indicated in 1971, we had the concept sort of outlined in the form of a reasonable report. Then the Urban Systems Project Office was instituted in March of 1972. And like any new operation, we immediately could not function at 100 percent efficiency because it was just myself and another man designated to start it up, and we recruited from within the Center and we had our staff about 80 percent, at about August of '72. And the staff is 30 to 35 people, of which about 25 are technical people. Now - then we began to retread the space people or retrain them or retread the space cadets so that they could talk urban language and be familiar with, for instance, power generators of the earthbound type, and heating, ventilating and air-conditioning equipment, water processing equipment, solid waste management equipment. And then once you get your inventory of technology established, then we go to work. Now, it's important to make note that the program is under the sponsorship of the Housing and Urban Development. There are other - It's a multigovernment agency program. The NASA is doing feasibility studies. The Urban Systems Project Office is doing technical studies. The Atomic Energy Commission, the Oak Ridge National Laboratories, are in it and they are doing some technical studies. The Environmental Protection Agency are in it, and they are making available to us, their basic technology and also establishing the environmental criteria for the designs. And the National Bureau of Standards are making a valuable civilian technology and providing expertise in their specialized fields. More recently, the Department of Defence has entered in on the program. These are all covered by official memorandums of understandings and working agreements between the various government agencies. Another possible point that should be made is - In order to provide credibility and serve a check on designs throughout the program, the National Academy of Engineering has instituted what they

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call the Integrated Utility Systems Board to provide some technical review and also provide some expertise in institutional affairs. In other words, how do you implement new ways of doing business in the marketplace. And the people who are on the Integrated Utilities Systems Board are - Well, I'm not going to try to say how much wheelbase they have, or how good they are, but I can give you an example of the people. Mr. Shoupp, who is the Vice President of R&D for Westinghouse, is on the board, and - Do we have a problem here? - -

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HAYS - - (garble) some technical review and also provide some expertise in institutional affairs. In other words, how do you implement new ways of doing business in the - in the market place. And the people who are on the integrated utilities system board are - well, I'm not going to try to say how - how much wheelbase they have, or how good they are, but I can give you an example of the people. Mr. Shoupp, who's the Vice President of RND for Westinghouse, is on the board. And - do we have a problem here?

SPEAKER (garble)

HAYES Shall I go? Okay. And Mr. Lou Roddis, who is the President of Consolidated Edison, and Mr. Joe Swidler, who is the Chairman of the New York State Public Utilities Commission. And there are about 15 or 20 people on there and there's some people from the Carnegie Mellon Institute, The Department of Urban Planning. So now with that brief type of introduction, what I'd like to - - Well, first, phase 1 in the program is the technical studies. In other words the - the initial work. And we are in the phase 1 activity in the MIUS program. Now, with that background I think maybe we might get into these visual aids that I brought along. And if we can shoot up the first slide, it goes something like this. In other words, we have our current HUD/NASA phase 1 activity, and what we're looking at is a design feasibility of using MIUS, this modular integrated utility system design concept as an alternate method of providing utility services to facilities communities, and community examples. Now, it has to have advantages over current ways of doing business. Now, that could be economic advantages. It could be environmental advantages. It could be energy advantages. It could be natural resource advantages. It could be making land available for development that wouldn't otherwise be capable of developing into communities and so forth. We'll go into this in a little detail - sort of a first-cut detail, but we're principally here to discuss this design fabrication and evaluation of a MIUS integration and sub-system test article to provide data on the total system's problems. In other words, when you begin to integrate all of the mu - the facilities within a municipality it's a presi - it's a precedent. It's not only a technical precedent but it's an institutional precedent, because electrical power is normally provided by the public utilities and the potable water and liquid waste is a municipal function, and the solid waste is by and large by some private enterprise.

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But they've never been put together completely. Now there is a lot of total energy plants in the country that are integrating the power generation and the heating ventilating and air conditioning, using the wasted heat for those functions. But buttoning up the water cycle and the solid waste has not been generally practiced. Now this test article is called the MIST, which is another acronym which means the MIUS and Intergration and Subsystem Test Article, so there we go again. Next slide. Now the design approach that we're using is integrating the electrical power, water processing, solid and liquid waste management, and environmental conditioning, heating ventilating and air conditioning, intertwine those systems and the utilization of any residual energy for other utility functions. Now to more or less - and this is common knowledge and it's becoming more common knowledge. You pick up the - the newspaper or any periodical and it says here is the power. The way we do business now we have a power generator, and if we're lucky we have 40 percent efficiency on the power generator, and then the balance of the energy is rejected to a body of cooling water. In other words, you've seen those little drawings that says, "Here, I put in a pound or a gallon of diesel oil and I get 40 percent in electrical power and the 60 percent is wasted." Now, what we're doing, we're parlaying this residual energy off the power generator to heat the building or the facility and to air condition it. In other words, you can - there are thermally driven air conditioners so that you can use this residual energy for residential or community heating and cooling. You can use it for water processing, if you wish. And if you start looking at this solid waste management, then we're talking about using the energy within the solid waste to provide us additional thermal energy to pump back into the system. So now let's - I think maybe the next slide - - Let's - let's hold that one. Let's put up the next slide and hold that one because I think this will flow a little bit better. Now, we're going to use a community as an example. Now this could just as well be a shopping center or an ap - large apartment, a office building, a hospital. But normally the way you provide these utility services is by dispersed - highly dispersed geographically and institutionally devices. In other words, got my power generator here. I have - I take the loss of efficiency and reject the residual energy to cooling water; then I get about a 10 percent transmission loss, and finally we get the electrical power here. Now this energy crisis that we're in we're concerned about what we're pouring into this plant here.

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You have fuel collection and processing. And in solid waste, normally, we transport it to a land fill. This is the - this is the - the cheapest, but it's not necessarily the most economical from a total national level. In some - in some area in the country land fill is very easily - easy to come by and there's some places where it's extremely difficult where you have to go 100 miles to dispose of your waste. Well, you have to collect it and then somehow dispose it. Now, let's talk about incineration where we take the solid waste and we transport it to an incinerator and we then have a land fill situation. But when we have this incinerator in this remote location, there's no opportunity to put a heat recovery unit on. Well, you can put the heat recovery unit on it, but then what are you going to do with the heat? It's no - it's not in an area where you can conveniently pump it back into where you need it. Now, municipal water sources are - you usually treat your water and then distribute it into your community, and then liquid waste. Liquid waste is sewage. You have a collection and you take it to a remote sewage plant, and then you have an outfall of either primary treated or tertiary water. And there are problems associated with this, which aren't my - aren't germane to what we're talking about today. Now the next slide says MICS would do on-site electrical power generation with recovery of heat. We'd do on-site water treatment. We would do solid waste incineration with recovered heat - waste heat. We'd do water processing, and we'd do the heating and air conditioning with the wasted heat. So, you have your collection of your water coming in, you would process it. The result of incineration you still have to transport the residuals from your incineration process to some remote site.

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HAYS - - heating and air conditioning with the wasted heat. So you have your collection of your water; coming in, you would process it. The result of incineration, you still have to transport the residuals for incineration process to some remote site. Now let's go back to that other slide. Now we've looked at - you want to find out essentially how this concept plays with credible urban examples. So we've taken garden apartments, hospital shopping centers, schools, high rises and office buildings. Now if you take those and characterize them, in other words one of the jobs that we had to come up with is how do we know the differences in facility requirements between these - these, these heterogeneous types of municipal facilities which - when you put them all together become some sort of a community. Guess the best example, of that is the difference between apartment house and a shopping center is the amount of water that's used and the amount of solid waste paper products that are need to be disposed of and the characteristic of the product. So you have to characterize these particular community elements. Then you have to push it into a community design if you wish. But we have done - We have conducted single point designs on these facilities and we've won a community design. Now there are sensitivity studies that have to be made and have been done. In other words, when you're parlaying waste heat, it makes - it should make a difference in whether you're in Houston or in Minneapolis. In other words, these are the - We've taken this garden apartment and analetically moved it around to five different geographical locations to determine the environmental sensitivity of the concept. Now then there is an economy of scale so for this garden apartment, we've varied the - the size. Now - we have another slide now? So these are the studies that we've been hammering around with. Typical study results and we've extracted some data on consumable reduction over the current way of doing business on a community design and on an apartment example. And the apartment example that I've stated here, this one, we've rendered in Houston and this community example we used in the Washington area because it's more or less of a - a plain vanilla environment. You know, it's sort of a norm, where Houston is hot, humid all the time like - except today. And Washington has sort of nice falls and springs are beautiful and so forth. The energy savings 38 percent and 33 percent in the trash load reduction, 80 and 74 percent. That means, here, you have to take 20 percent to the land fill; here, we have to take 26 percent to a land fill. There's one other point that should - that's not on this slide. When you do your on-site water processing, it gives you the opportunity to take that water and pump it through your cooling

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tower which reduces the amount of water that you need to support the system. But it further means that if you on-site process your water, the outflow from the community or whatever you're talking about is not sewage. It is tertiary treated water. So therefore, you can give it back to some uncontaminated body of water. So that - that, that is background material now. Now characteristic of NASA's way of doing business - we wanted to put together a test article to find out the - the problems that might come up and bite us on this that doesn't lend themselves nicely to analysis. So I think the next slides get to the - the MIST. The MIST, as I indicated before, is the acronym for the MIUS integration and subsystem test article and this is a model of it. And this is a - give you some perspective. This is a 100 feet by 30 feet. Okay. And it contains all of the elements of a MIUS. Now the point of the MIST is to resolve the key MIUS subsystems and total system design issues. I'm just going to leave that hanging there and we're going to talk about those. Now, in this program, we have computerized buildings and we've computerized hardware. So therefore, we have analytical models of credible hardware. And when we do these designs, then we - we actually run a computer analysis and come out - spits out certain types of data. This will, since we can actually run the total system, it'll provide data to the cap - calibrate and verify our analytical tools. And then it does provide a test bed for the evaluation of promising design concepts. You know, future design concepts. Now if we want to talk about what are future design concepts that appear reasonable, you know, everybody's talking about solar collectors, we could do pyrolysis of waste instead of incineration and we could use fuel cells, we could pump in a little coal gasification or shale oil and you could look at how these new concepts, emerging technologies play with this integrated approach. Next slide. Now the key technical issues are - since we're working heat, parlaying heat is - the techniques of heat recovery, how we - the techniques of distributing it with minimum loss - this mixed mode of air conditioning. Normally, all the airconditioning that you have is compressive air conditioning with rare exceptions. Now you've heard of these - the gas company with the gas driven refrigerator, which refrigeration or air conditioner is a heat driven refrigeration system. So if we have waste heat, it would pay us to drive air conditioners. When we don't have the waste heat, we have to go into an electrically driven compression air conditioner. So therefore, the mixed mode of air conditioning you want to look at. Thermal storage is another way that you can conserve energy. In other words,

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sometimes your power generation - you have a high demand on your electrical power and you have no use for the heat. So if you could store that heat and use it when you need it, that's money in the bank. Thermal storage techniques and we have a thermal storage in here. Then the integration of controls and displays. How do we operate the machine? Now since we are again - give you an idea of a power curb, a daily power curb for any characteristic facility is a step function. You know, at night, there's not much power being used and each facility has a characteristic curve. You know, the one end of the spectrum to another is - the church doesn't use hardly any power until Sunday, I guess. And then you know, it uses power on Sunday. But what we do here - we're looking at the controlling of the burn times of the incinerator because there's sometimes when we want the heat from the incinerator and sometimes we don't. So how do you work that? Since we're incinerating and processing water, we want to look at the predictability, the affluence, and the deviations that it relates to environmental quality. And then since we do have - and this is characteristic of the total energy picture, is that we do have a great deal of low-grade waste heat. And that's by definition once it's below 120 degrees or something like that - 130 degrees. You can't drive air conditioners with it. You can do a marginal job on space heating but we would hope that we could dry sludge with low grade waste heat or we could take the biodigester liquid waste treatment plant, and jack up its temperature, and increase its efficiency, and therefore, increase its capacity. Or in new communities, I guess I have heard this and I think that probably is very true, that anytime that you put in a liquid waste treatment plant, by the time you're finished, it's undersized. So another way of putting this is if we're at a premium in land use, if you can increase the temperature of the process, we can reduce the square footage of the - of the land that it takes up. And besides, you know, you'd rather have a small waste treatment plant than a great big one. You know, just aesthetically would be better. Next. Now this - the MIST will have this capability. We'll be able to do generate 230 kilowatts of electrical power and we're going to get this type of energy off the jacket and off the exhaust and off the oil cooler. So in other words, this is the thermal energy that we're going to recover from this system and parlay into space heating and cooling. We'll be able to handle 70 pounds per hour of trash with recovering this amount of heat.

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HAYS - - recovering this amount of heat. As a result of this and this, we will be driving 50 tons of air conditioning under some modes of operation and we will be heating at this particular rate. These are maximum capabilities, and we have this hot and cold thermal stor - storage capability. And we'll be able to process 7000 gallons per day of liquid waste, and we'll get 300 pounds of sludge. Now, when we run this thing, we run it to simulate an office building in some modes. We'll run it to simulate a hospital in some modes. We'll run it in a shopping center in some modes. In other words, this is not - this is a test article that provides us the verification that indeed we - when this thing eventually is taken into the market place, that we have not overlooked those aspects that - that doesn't lend themselves to analysis that you just flat have to test. Now, there's sometimes when we'll be running at very, very low energy. You know, just simulating a real life apartment, or a shopping center. Now, this does not mean that this is sized for a shopping center. It's sized - each component is sized as small as we can size it and still play it together logically and get the data, you know, the relationship. It essentially would support 60 people, there about, 60 to 50 to 75 people. In any event, some of the - some of the subsystems are scaled 120th, and some are scaled a quarter, but it'll provide the information we need on satisfying those technical issues. Do we have another slide? Is this the last one?

SPEAKER
HAYS

No.
Oop. Well, this is just a slide of this thing here. And I guess it might be well to go through it here - we'll go through it here. Here's engines, the engines is the prime mover; that's your power system. The liquid waste treatment, this is the biological treatment with the metro - metpro which is nothing more than a physical chem system that takes primary treated bile - biologically treated water, and takes it to a tertiary level. Now we have a reverse osmosis which is a super filter to take out - Dissolved solids? Okay, dissolved solids, because if we don't take out the dissolved solids and try to put this water through the cooling tower then we get into some scaling problems. The incinerator with heat recovery, now we have sewage and solid waste that we feed this thing in addition, you know, liquid waste, and thermal storage and cooling. That's a - I mean - and cooling load. And over here we have the electrically driven compression chillers, and here are the thermally driven absorption chillers. So, everything there is - everything here provides power, solid

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waste, potable water, liquid waste management, and solid waste management. Next slide. This is a - We have - the instrumentation that we have. We have 49 operational measurements and 139 engineering measurements. This also, you know, by the time we finish this, why, maybe operational measurements for a plan of this type would go down; but we've put a great deal in. Now, that - that completes what I have to say, except if you want additional background data on the total program, this hearings of the Subcommittee on Space Science and Applications, and Subcommittee on Energy or the Committee on SCIENCE and Astronautics of the House of Representatives, 93rd Congress, first session, May 7th, 22, and 24th. On pages 220 - 238 through 250 are statements that Mr. Seigel, who is the HUD senior man, made before the McCormick's energy committee, and there's a statement that I made there. In other words, it'll give you a - it'll put the program in national perspective, rather than, you know, in - in MS - JSC/NASA perspective. It gives you what EPA does, what NBS does, what the HUD does, and what thir plans are. But I just want to stress that we are currently in the phase I effort. And this - oh, this device currently - the building should be modified by the 11th - - 16th? - - 13 of December, and we should be in acceptance testing by the latter part of March. And then - and then we have a - a period of - of a very set period of testing to a very stringent test schedule to - to satisfy the test objectives of looking into those technical issues that we see in - in integration of this type of - of subsystem work.

PAO May I make a suggestion? Maybe one of you can go down there to answer questions.

HAYS Sure.

SPEAKER Maybe there aren't any.

PAO Okay, just wait for the microphone. Start with Bruce.

QUERY Ted, what is the cost of the project, and a breakdown on the cost of the test article?

HAYS The test article is \$870,000. Now when you talk about the test - the cost of the project, I can't talk to anything other than the cost of the, you know, our activity here. And let me - let me put it to - let me - let me - let me try to put it to you in this fashion. The cost of the project is - the NASA is providing the - the civil service compliment. That's the 35 civil service people are coming out of the NASA Office of Applications. You're familiar that Mr. Matthews in March of last year had been relieved of his duties as deputy to Dale Myers, Office Manned Space Flight,

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and he is currently the Associated Administrator for Applications. So, under his umbrella we are. And the Housing and Urban Development people pay for out-of-the-pocket expenses like NASA travel, consultant costs. There are some expertise that we do not have in the NASA inventory and that is architectural. So we have an architectural operation; they pay for that. And then there is a - some other shortage - short skills that we don't have in the economics area. So we have some support services in - in economics and in some simulation activity. Not because in the simulation activity the NASA does not have the skill, but the NASA doesn't have enough of that skill to go around.

QUERY And when will they say the bulk of the testing, going through all the different types of testing you're going to do, when will you expect that to be through?

HAYS It should be through by August.

QUERY August. Okay, I got my project - -

HAYS Miss project manager's here, plus the -
Yes?

QUERY When will we see a practical application, and how is this thing going to be marketed? How is it going to be offered? And how many units per community et cetera?

HAYS I knew that was going to come up. This is - this is the phase II activity. In other words, this is the demonstration phase and it's being handled by the Department of Housing and Urban Development. Now they - they're - their present schedule, and that's why I was calling your attention to these documents out of the congressional testimony, I'm not sure of the exact timing of this, but they intend to authorize a demonstration project.

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HAYS - - documents out of the Congressional Testimony. I'm not sure of the exact timing of this, but they intend to authorize a demonstration project in mid-74. This is their present intention. Now they're responsible for the implementation of it. So I don't know, you know, at this present time they're looking into how they will implement it and what they will implement. So, I'm not avoiding the issue, but it just hasn't been defined.

QUERY Let me just follow that up with how many units per community? Can you discuss that? As far - what would it take for a city of this size for something like this?

HAYS Yeah. Let me drag out - For a community of what?

QUERY A city such as Houston's size.

HAYS Well, we haven't run it for a city such as Houston. But let me - Let me - Let me take a moment - How about throwing this thing out.

PAO Don't hang yourself now.

HAYS Maybe I should. Okay. Here we go. We took a community and we've studied 21 new communities throughout the nation. And we idealized the new community. And it had a 20-year development cycle. And we had constraints that we would use 1974 process machinery. Incidentally, there's one important thing. Anything we do right now has to be with articles of commerce so you have no development risk on the sub elements. So we take a community of 110,000 troops, 20-year development cycle. You would put the integrated utility system in at a rate that is commensurate with the way the community develops. So now, this then constitutes a new community of 110,000 20-year development cycle - This is a village complex. And here is another village complex, another village complex, another village complex, another one, another one, another one. Each complex, village complex has 5000 people. Now I don't know how many acres because I didn't bring that with me, but this is developed in horrendous detail. This is the village center of the village complex. This is the central business district and this has hospitals, universities, and so forth. The example that I quoted that 18 percent had a MIUS at each individual element. In other words, we had 29 MIUSs. We also took a flyer on it and said what makes - What's another make sense MIUS rendering? And we threw a MIUS in here, and we threw a MIUS here, here, here, here, here, here, here, 8 MIUSs of two different types. And our energy savings was essentially the same. And the trashload reduction was essentially the same. You know, in other words, it didn't get within - well within the accuracy of our analytical capability. And the only difference appeared to be when you got a lot of MIUSs your capital cost and your operating cost went slightly higher. You know, I

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can't talk to the city of Houston, because we haven't run the city of Houston. We haven't run a city. Like I say, we've run those isolated instances of shopping centers, the hospitals, and then we've put them together in a satellite community. Because this was a question that was asked of us of the integrated utility systems board. But that could be done. You could analyze it. You could do it. But, you know somebody has to ask us and then we have to accept it and I don't know how those things go right now.

QUERY Do you have any idea how much one of these units would cost, or what is the projected cost of operating a unit?

HAYS Yeah. We have - We have some economics on it. And it's - the economic analysis is currently under very very careful scrutiny by the NA - National Academy of Engineering, Integrated Utilities Systems Board. It appears that the front end costs are higher. And the O&M costs are less, operations and maintenance cost. In other words, we're - From what we look at right now, we're competitively attractive and in some instances we are competitive. But now let's talk about 1 thing. It's the implementation of the financing that makes the difference. Because the analysis that we did was we looked at total cost and did not consider who pays, regardless of who pays. We didn't consider subsidizing and grants from municipal water systems. We didn't consider rate structures of the power system. In other words we just took this community and we said this is how much power we would have to add to this remote power station. This is how much capacity we would have to add to the sewage plant. You follow? Now that isn't the way, necessarily, the world works. So the point is, that there are institutional issues that have to be understood. And we're doing the technical work. And there's other elements of the program that are looking at the implementation. And that includes the total implementation. You know, the institutional. The legal aspects, the financial aspects, the governmental aspects.

QUERY One of these units; just roughly how many people say could it serve in an apartment building? How large an office building?

HAYS You can build them to accommodate - You can build them any size. They're, you know, they're not size limited. They're - I don't know what the sizes limits are. We haven't seen them yet - seen it yet. In other words, you can put together this thing. This isn't - it is not something that you go buy off the shelf. It's a method of doing business. It's a philosophy. It's a concept, rather than a - give me a MIUS. MIUS is more at this point in time

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a method of - an alternative method of implementation. In other words, if you wanted to get twice the kilowatts you would buy possibly 2 powered prime movers of twice - you know, of the same capacity. Or it might be more economical to buy one that's the proper size, you know.

QUERY Ted. Several things. First of all, since your group is doing the feasibility studies and the testing, it would seem that you might have a handle on when we could reasonably expect these type things to be used in other than in just a test article, a community to actually be set up with something like this. Are we looking at 2 years, 5 years, you know, 10 years, or what?

HAYS Using the current philosophy, using articles of commerce, bondable items, you could do it withi - you could start - you could commit within a year of doing things of this nature. But you understand one thing. The government's role in these type of things is to demonstrate it and demonstrate the advantages. But then it's to interest the private enterprises. I mean, in the idealistic world it's to interest them and say here is a better way of doing business. Now, I don't know what bias the energy crisis would have in this. You know, there might be something that comes up and says "thou shalt," but that's way beyond my crystal ball.

QUERY Pardon me if I missed this, but what models are you using in your simulations? What form do they take? How large are they? You see what I'm getting at? I'm seeing a model here and you're talking about 100 feet by 30 feet. What have you been using?

HAYS Well. Oh, boy. I wish I'd brought those numbers with me. I don't have them with me, but there is 1 model just off the top of my head on that village complex that has to accommodate 15,000 people. You know, three neighborhoods plus - three neighborhoods plus the village center - -

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QUERY Pardon me if I missed this, but what models are you using in your simulations? What form do they take. how large are they? You see what I'm getting at. I'm seeing a model here and you're talking about 100 feet by 30 feet. What have you been using?

HAYS Well, oh boy, I wish I'd brought those numbers with me. I don't have them with me, but there is one model that - just off the top of my head, on that village complex, that has to accommodate 15,000 people in a three - three neighborhoods plus - three neighborhoods plus the village center, constitutes residences of 15,000 people plus you know a small district, you know it's a small business district.

QUERY The actual size of what you're working with is what? Are you - did you build one - -

HAYS

SPEAKER

QUERY

SPEAKER

a - -

HAYS

QUERY

There's been no - -

HAYS

QUERY

HAYS

QUERY

All right that's what I thought but I wanted to make sure that you haven't been using - -

HAYS Oh, no. No, no. When I answered that was an analytical model.

QUERY

the kilowatts and all the little MIUS?

HAYS

QUERY

HAYS

this is diesel oil, this is a diesel oil prime mover. Yeah, it's a diesel electric generator. But now that - I know the sensitivity of diesel oil, but this concept, I - I could care less whether I'm powering this thing on diesel oil or gas from coal - coal gasification or shale oil, you know, you can get prime movers that's going to work on anything but right now, huh?

SPEAKER

HAYS

or coal gasification. Excuse me?

QUERY

Natural gas.

Yeah, natural gas. Natural gas, oil

Reactor?

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HAYS That - that - we haven't looked at that one. We - well we just flat hasn't - haven't gotten around to looking at that, because it's not an article of Commerce but ge - you - you could - I suppose as a thermal source, as an energy source work on nuclear reactors, you know, but I don't know that much about nuclear energy or what the minimum size or what the economics are. But you - you can - we're using oil.

QUERY Ted, once you bring in your fuel source and your initial water source are you from then on pretty much self contained other than your continuous supply of and I would suppose - would hope that it would be a decreasing level of supply of - of fuel? You pretty much self contained from then on?

HAYS No, no, no. You have to continue bringing in oil.

QUERY That's what I'm saying.
HAYS But you bring it in at - you know, 38 percent less than you normally use. Okay, you know, that's what the numbers show.

QUERY Okay, do you - does that continue to dec - decrease or does it - -

HAYS No.
QUERY You'll use 38 percent less than you would normally use.

QUERY Okay, what about water?
HAYS Under current regulations you get a decrease of maybe 15 to 30 percent in - in flow water, because you're using your process water, you're reusing it for those purposes that current regulations will permit you to use them. In other words, current regulations prohibit direct reuse of water, so what we're using it, we're throwing it through the cooling tower. And we're using it for lawn water and irrigation purposes within the area. Does that - -

PAO Abbey?
QUERY Have you made any economic studies of how much it would cost to convert our present system to one of these MIUS systems?

HAYS Convert?
QUERY In other words, to go from our present to this new system or is this going to be applicable only to new communities?

HAYS We have not looked at conversion. Let - let - let me put it - let me - let me qun - qualify that a little bit. If you indeed were to redevelop an area of a city, now that - that is a conversion of a sort and put in something of this nature, then you have a very high

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probability of not having to disturb the infra structure of the city that feeds that isolated island that you were trying to redevelop because you're putting your power generation in there and you're using your solid waste. Since you're processing water, you probably can use storm sewers rather than liquid wastes lines, okay. And since there is such a constraint in direct reuse of water, if you were going to, you know increase the population density in that isolated island you would probably have to enhance the infra structure of potable water to that area.

QUERY One, last one, for me, Ted. I gather from what you were saying earlier that when you talk about interesting commercial - -

HAYS In - in - -

QUERY Interesting private industries or something in this, then you would foresee, well I mean in the long range to government doing - ding the implementation of it. You would foresee, I guess one giant utility company for the homeowner to fight instead of 3 or 4, in other words, you would have one - one industry in charge of the MIUS, or are you still talking about 3 or 4 - -

HAYS Those im - that implementation hasn't been, you know, hasn't been cleared up at all. But the - see there's - you know in - in the program concept, you have the phase 1 and the phase 2, and the phase 3. The phase 1 is these technical studies and the phase 2 is a demonstration project or projects, and then phase 3 which goes along pervades the whole program is - is keeping those people who are responsible for such things, apprised of the program, so that - should there be you know, necessities or advantages for them to do business this way, that - that it's available, you know interesting, private enterprising, apprising of the - of the program. Of the program and its advantages and disadvantages as the case may be.

PAO

Dave, you have any question?

QUERY I really didn't quite follow you, in what you're talking about here of the MIUS, total new concept in new communities, now as to the feasibility of using this in our present community, did you say it was highly unlikely or indeed it could be feasible if not practical to use some of the existing systems in existing communities, the systems within that community to attempt this?

HAYS In an existing community of single-family dwelling units, I don't think there's a ghost. And - in an area where you have a very high population density, you know, it's conceivable that you could take a large office building, a large apartment and convert it. But you have to

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realize that you've got some - some utility distribution systems to put in that we've not really looked at. I - I would say there's - there's problems there. We just flat haven't looked at that. At this point in time.

QUERY

Well, in relation to that question, Ted, if - if an entrepreneur were putting in say a Geenway Plaza or Plaza del Oro or Houston Center, within an older area how about th - how about an application there?

HAYS

That's fine. We - he - he has nothing there. He' just got the bare ground. That would be fine. That would be a good application, because you've got - you got a high - high density there and that's a - you're talking like the Houston Center and well - that Plaza over by the Astrodome where it is residential-commercial.

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HAYS - - you got a high density there. And that's the thing you're talking like the Houston center and the plaza over by the Astrodome.

HAYS Where it is residential/commercial, you know since we're trying to parley, waste heat why, our utility distribution system gets very practical. In that community example, all of those homes with single family dwelling units were electric because we didn't want to tickle the tail of the dragon of utility distribution system into each one of them, although that should be done. We should look at that because in a suburb of Philadelphia where I use to live we had district heating. Now you know that had to be somehow economically an attractive thing because of the whole community lives that way. So apparently, I don't know, Jim, I think that if you're going to start from scratch and you've dug a hole and you're putting water pipes in it and if you'd rather throw in another pipe beside it or something, if the codes permit it why you might be in pretty good shape even though if you didn't have real tight population density. You know a bunch of people per acre.

PAO We've had the line down for a hour and 10 minutes now, ladies and gentlemen, and I'm sure Mr. Hays will answer your questions here on the floor. We have an announcement that Jack Lister, Director of Personnel here at the Johnson Space Center, just announced that 1400 separate car pools have been formed here at the Johnson Space Center, which means beginning Monday, 2,000 fewer cars will be driving on to the Johnson Space Center. This averages out to be 2- 1/2 persons per car, approximately 3500 civil service employees and contract employees are now signed up for car pools beginning Monday. And the average is 3 persons per standard car and 2 per compact, so this - And we have an article in today's Round-up, if you'd like to get a copy on the way out, which explains that. So we return the line to Terry White at the Mission Control Center.

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SKYLAB NEWS CENTER
Houston, Texas

SL IV - Kohoutek Briefing
Johnson Space Center
December 7, 1973
4:32 p.m. CST

Participants:

William Snoddy, Skylab Kohoutek Project Scientist, MSFC
Don Green, PAO

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PAO Well, we're ready to start this evening's press session with William Snoddy, S-N-O-D-D-Y, who is identified as the Skylab Kohoutek Project Scientist from the Marshall Space Flight Center. And he is ready this evening to tell you a little something about good old comet Kohoutek. Go ahead.

SNODDY Okay, thanks. I haven't really prepared much on the way of formal statement. I thought we would primarily have discussion, find out what questions people might be interested in. We've been releasing some material and I don't want to try to reiterate all of it. I will say as far as the Skylab's observations of Kohoutek are concerned, we are pleased with what's been done so far, and we're looking forward to making many more observations. We began our observations on the 23 of November with S233. And we've been making them regularly since with that particular instrument, and then we started a sequence of measurements with our corollary instruments on November the 25. We've now, or today, scheduled to complete the second sequence of measurements with these instruments. Particularly that's S063 and S201 on December the 5th, S183 on December the 6th, and S019 on December the 7th. I don't know if that experiment number is sufficiently define the experiments, but we'll let it go at that right now. So we want to try to redo this sequence of measurements with these particular experiments at an increased in rate as the comet becomes more dynamic as it approaches the Sun. We hope to start the sequence again of these 4 instruments, on around December the 12th - something, that time period. We'll be making measurements in between, but we're trying to get this - this is part of our synoptic sequence where we on a regular basis observe the comet with a particular set of instruments. Lets see, the comet itself, that time on, is developing quiet nicely. It's going to be, scientific point of view a very nice comet. You never know for sure with comets how their going to behave. For example just in the case of the tails of the comets, there's two types of tails. There's the type 1 tail which is a plasma tail and then there is a type 2 tail which is a dust tail. Some comets have both tails, some have one or the other and there have been some cases where they haven't had either. Well, initially on Kohoutek we saw the development of a nice dust tail, which is the one you primarily see when you go out to look at it, and you'll be seeing later on. And that's interesting in itself. But the other tail the type 1 tail, is the ion tail is the one that is really interesting in the sense of telling us something about the composition of the comet. Because this type 1 tail, the ion tail, it - we see it by virtue of it absorbing light from the Sun

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and then readmitting this light, fluorescing in a sense, in a real sense, at certain particular wave lengths. And the particular wavelengths are a function of the material that the plasma is made of. So we were hoping to see a good plasma tail, because this in turn would tell us something about the composition of the comet. And at first we had no indication of this tail, but now the tail has come into being. It's been reported to be even longer than the dust tail, which is not unusual. It's anywhere from 3 to 6 degrees in length now, this is based on ground based observation. And it's showing the known emission characteristics that you can measure from the ground. So we're real anxious to see what our data we're taking on Skylab will show us about this tail when we get the results back after splashdown. Most - almost in every case our data is onboard Skylab is on photographic film and so won't know until after splashdown just what we have there. The one exception to that is an ATM experiment S055 which telemeters all of this data directly down. But this instrument will not start observing the comet until some time after mid-December when the comet becomes brighter and more intense. So we do have now both of these tails. The dust tail is only about 2 degrees long, the plasma tail, as O said, is 3 to 6 degrees long. There is structure noted in - in these tails, both of them. This is of interest to people who are interested in comets. This structure also tells us something about the medium through which the comet is passing. Some of the observations on

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SNODDY - - in these tails, both of them. This is of interest to people who are interested in comets. This structure also tells us something about the medium through which the comet is passing. Some of the observations that we're doing on Skylab, are oriented not so much towards the comet itself, but towards learning something about the solar system and the medium through which the comet is traveling, for example some solar physicists study comets not because they're interested in comets, but because of what the tail of the comet tells them about the solar wind and the solar magnetic fields. And it's the plasma tail, the type 1 tail that really has this strong interaction with the sun. So we're - we will be getting this information we know now since the comet does have this particular type of tail. So far as the expected brightness of the comet is concerned, I believe the original Smithsonian predictions on brightness, back right after it was discovered, which means you have to make quite a extrapolation, were that the brightness, the maximum brightness of perihelion would be minus 5 and minus 10 in stellar magnitudes. Currently they are saying that they believe it'll be approximately minus 4 - minus 4.2, but I think we can round it off to minus 4. Which in this system, the higher the number if it's a negative number the brighter the comet, so minus 4 mean we're a little less, a little bit below the original lower estimate with minus 5. This brightness of the Comet is related to a couple of things. One is how far we are from the comet, the closer we are to it the brighter it will appear, that's kind of an inverse square law. And so the comet's position relative to the Earth is changing and this in itself then will cause the comet to vary in brightness. And the other factor that causes the comet to vary in brightness is the distance between the comet and the sun. As I eluded to previously, the - all the light from the comet is really sunlight in one form or the other, it's either reflected sunlight and scattered sunlight, which is what comes from the dust tail of the comet, the type 2 tail, and from the nucleus itself the surface of the nucleus, or it's the readmitted light, the fluorescent light which is the kind of light we characteristically get from the ions of the plasma associated with the comet. So the comet gives out no light basically of it's own. It's sunlight in one form or the other either absorbing, and readmitted or reflected. So the distance from the comet to the Sun has a lot to do with how much light it gives off. That's another thing about comets in that you don't see them when they're far off because they're not near enough to the Sun to gather much light to reflect towards you. So that's why comets normally aren't discovered until they're quite near the Sun. We were extremely fortunate in this case to have discovered, this particular comet when we did

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back last March when Kohoutek did discover it, because this gave us an exceptionally long lead time. It's real fortunate that discovered it at the time that it did, because shortly after he discovered it in March, along in about April, the orbit of the comet and the Earth were such that the comet was on the other side of the Sun from us and we couldn't see it because it meant that we would be looking at it in the daytime and it was far too faint to be seen in the daytime. So had he not discovered it when he did, we probably wouldn't have discovered it until it came out from behind the Sun which was in late September. And so it probably would have been in October or so before we would have known there was a comet of this size coming. So in any case this so this business of the comet's position to the Sun is a real interesting thing in that the comet as it gets closer to the Sun it's going to pick up more sunlight and therefore appear brighter just because it's closer to the Sun itself. And also by being closer to the Sun, the Sun's effect on the nucleus causes more gasses and more - more shall we say melting of the nucleus, meaning more dust and gasses given off, so there's a bigger cloud of material around the comet and this also makes it appear to be brighter. So it's not just an inverse square law between the distance of the comet to the Sun, but rather it is an inverse to some power law. And this is usually more than a - more than a square, typically it's on the order of 4 to 5 an inverse fourth power or fifth power. And this index is subject to great variation between one comet to the next, and it's awfully hard to know, in any particular case, how a comet's going to behave. In the case of Kohoutek, we're now assuming an inverse fourth power behavior. And if you plug that into the equations then you come out with this minus 4.2 value the Smithsonian is giving as being the brightness as it goes around the Sun. So this will be a very nice comet. It will be quite visible especially it will be visible after it goes pass the Sun in the evening because for one thing the Earth is somewhat near the comet at that time, and there'll be more dust and gas associated with the comet so it should be brighter at that time. And it'll still be a very nice object to the naked eye to see. The amount of light that this corresponds to is about the light that Venus gives off which is quite a bit of light. It'll be spread out more. It won't be a point as near a point that Venus is, the light will be spread out more, but it should be a very interesting object to the eye still. And of course scientifically so far as the Pis who are looking at the thing as Skylab is concerned, they are - we're no qualms about the data we're getting now. And we'll continue to get

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it's going to give us a lot of scientific data. Perhaps I'll stop with that and see what questions there might be.

PAO

Okay, Jim Lunney, away from the mike please so we can get deathless question.

QUERY

Ray, would you comment on the report that the comet has disintegrated and then give us the source of your information and where you got it.

SNODDY

Okay, yes this is not the first time in Kohoutek's lifetime we've heard this sort of thing. And it's something that we especially want to be alert to in connection with Skylab because with men up there we can react to these sort of things. And maybe I'll talk about the kinds of reaction we might do if indeed this was the case. We depend on the Smithsonian Astrophysical Observatory as our experts in this area. They are the world's center for comet information. If somebody discovers a comet or makes a measurement on the comet of any unusual nature, he calls it in to the Smithsonian Astrophysical Observatory, there they collect this information from all over the world. And so we depend directly on them to tell us about these - well the day to day evolution of the comet and also on any special things such as this. I talked with them just before I came over here, they have data that they have received today, I - photographic plates and so on and they have taken a very firm position that the comet has not split up it's still evolving exactly as it been evolving in recent days. And as I say this is not - it gets back to the problems I guess the fact that you only see comets when they're near the Sun and this means that you see them as a twilight object, either in the early morning or the late evening and you only have a short period of time. The comet rises and just a little bit later the Sun rises and you have a short period of time in which to observe the comet, you got the sky background conditions are changing continually, it's a very difficult observation to make, that's why really there's is very little - there's so much to be learned about comets, its an area that is just really, they pop up unexpectedly, you can't plan on them, all of a sudden it's here and then well it's hard to see when it is here and it just, I think this is kind of confusion that exists between observers and if you look at the literature, you know just on trying to say on a given day how bright is the comet, You can look in textbooks, for example, where they give observations made on comets in the past. And on any given day, you'll find that there'll be what amounts to a fact of a hundred in light given from one observer to another, it's just a very tricky thing to do. Haze conditions in the atmosphere, it can certainly affect you, a lot of thin - and you don't have like I say much time to work in. You can't take a plate and develop it and go back and do it again. You've only got a few minutes perhaps

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to get your data for that particular day, so that is the
Smithsonian position and they sounded very firm in it. That's
one reason they exist, I guess is to try to pull all
these things together to see that everybody knows exactly
what is going on.

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SNODDY To see that everybody does know exactly what is going on.

QUERY Some months ago right after - a few weeks after Professor Kohoutek discovered this comet Dr. Whipple, I think it was, is quoted as saying this would be the comet of the century, the brightest, et cetera. Of course now the predictions are - are declined somewhat, will it in fact still be the brightest comet of the century, and if not what was the brightest one?

SNODDY Ther - that's a - that's a kind of a tricky question because some comets as I say the brightness of the comet depends on how close it is to the Sun and how close it is to the Earth. There have been some comets that were bright that came very close to the Sun and so for a brief instance of time even though they were much smaller they appeared to be exceptionally bright to the individual trying to observe them, you might not really ever know that the - a comet had come passed because it might not ever be particularly visible to the naked eye. For one brief instance, just as it went pass the Sun, these are called Sun grazing comets they can become exceptionally bright, simply because they come so close to the Sun, but it lasts only for a small period of time and it doesn't help the ground based astronomers that much in terms of trying to get data, because when it's further away from the Sun, where they can see then it can be much - it can be you know, nowhere nearly as bright. So there have been comets that have gotten to minus 10th magnitude only for a very brief period of time. I can't give you the - Ikeya-Seki, I believe is one. What was the year on that, John? It was a Sun grazing comet that came very close to the Sun and so it appeared very bright only for a short period of time. Kohoutek though is - is certainly the comet opportunity of the century, because of our Skylab being up there, and the opportunity - and the long lead time that we got. I believe it was Ikeya-Seki, that caught everybody almost by surprise, suddenly it was there. Nobody had a chance to prepare for anything, you know, and it was gone almost as quickly as it came, because it was only when it was real close to the Sun that it was bright. So from the scientific point of view that's - they mi - you might say it was brighter but it wasn't much of an opportunity - it certainly wasn't a great comet in the sense of an op - scientific opportunity. This one is a great comet certainl in the sense of a scientific opportunity and still is.

QUERY Because of its early discovery?

SNODDY Early discovery in th - in - and even it's current brightness is quite good. We're getting - we

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have - we feel we're getting excellent data on Skylab right now. And we're going to learn a tremendous amount about comets, not only from Skylab but everybody has been able to prepare for this one. And it is a great comet in that sense.

QUERY Do you have any clues as to why it is not as bright as it was first expected to be?

SNODDY Smithsonian or - is the group that works the black magic on these comets. They take the information they have from it when it's way off like it was last March - a very dim thing, and they try to decide what type of comet is it? Is it going to be a gassy one or a dusty one and then they try to decide what size the nucleus of the comet must be based on the brightness that they're observing at that time and they look at - it's kind of like predicting the weather. The look at the data that they have on comets in the past and then they say okay, it's going to be between minus 5 and minus 10. And it's fallen a little bit lower than the minus 5 but it just didn't evolve in quite the way they had hoped that it would. And it's what this means in terms of the comet itself is difficult to say. We don't know that much about comets to be perfectly frank (laughter), there's a lot to be learned about them, and that's why we're hoping of course to do with this particular opportunity.

PAO I have two questions which were phoned in from a correspondent who works out of the Cape, I'd like to pass them on to you and get your response to them.
UPI observed - -

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PAO I'd like to pass them on to you and get your response to them. UPI observed in a dispatch out of Europe, that the comet was breaking up. The question here is it true or false? Would you answer that for the - for the edification of that person at the Cape?

SNODDY As I said earlier the Smithsonian Astrophysical Observatory have taken a very firm position that the comet is not breaking up.

PAO Second part of that is why do you think that report came about?

SNODDY I think I addressed it a little bit in that observing comets is a tricky business, and if the comet were to break up it would be a very exciting thing, scientifically because if it - and I believe it's some 13 comets have been known to break up, so it can happen. Dr. Whipple has said there's a 20 percent chance that Kohoutek would break up. How he gets that number I'll never know, but in any event that gives you some idea that it is possible. If it were to say separate into two pieces and then from a scientific viewpoint this means that we have the interior of the comet being exposed to the vacuum of space and to the heat of the Sun and would start melting or evolving gases and dust. And we'd like very much to know what that interior is made out of, and so we would like as quickly as possible and to start getting spectragraphic data on this material that would be coming off from the interior. We might have some gases in there that would come off and - from this fresh surface and then in a matter of hours or days be gone. So you can't wait around on this observation. So, I - ever if - if it were indeed the case and you know you can't wait around for 3 or 4 days to confirm it, then it's too late you want people to know that it - that it may be happening, you've alerted people to the fact that it may be and if indeed that's the case then you have for example, a - a contingency plan on Skylab for - if there are several events that we would want to make real-time changes to our observing program. One is if the comet were to split, if it were to split we would want to immediately as soon as we could within a few hours try to start getting spectragraphic data on the comet to what kinds of materials might be coming off, to see if any new materials are - are showing up, that we haven't observed in comets before. At this particular time period the instrument that we have designated as being the prime instrument that we would want to look at the comet is the SO19. Karl Henize's UV spectragraphic camera, and it so happens that the instrument is scheduled to operate right at this very time, I think just in a few

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minutes from now. So, I'm kind - we planned this observation I would say a couple of months ago to that effect, it would have been extremely fortunate if indeed the situation had developed but, that - if he were not scheduled and if Smithsonian had confirmed this then we would be from a comet viewpoint be pushing to get that instrument on the comet just as quickly as we could. And then that would be followed by another instrument of another nature, and this other instrument is on a certain scale frequency. So, we had rather get a few false alarms like this than to not get the report at all, you know. And I suspect that's probably - it's just enthusiasm in the scientific community.

PAO Last - last question from this correspondent is this, what can the special comet camera tell us that we can't determine from using other cameras which are on board Skylab?

SNODDY I assume - I wonder which one he meant there, do you think - -

SPEAKER S201, I'm sure.

PAO S201.

SNODDY S201, well that's the one - that's the one that was sent up especially - that was the - there were two new experiments, on the Skylab that were not already there. And these two were added solely for the purpose of the comet. We had 12 instruments in all that will be looking at the comet. Ten of the 12 instruments were already up there anyway for the purpose of stellar and solar observations and so they will also be observing. We have two new instruments that were - would not have been there had it not been for the comet, one of the is S201, which is the - let's get the exact proper title of that instrument. The FAR UV electronographic camera, you see why I have to look it up. It makes ob - -

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SNODDY The FAR UV electronographic camera, you see why I have to look it up. It makes observations at extremely short wavelengths particularly down around the wavelength of 1216 angstroms which is where hydrogen gas tends to emit a lot of light. That's the hydrogen Lyman emission. By the way this instrument is the same instrument that was carried to the Moon on Apollo 16. And if you recall there was a little telescope that well, not little fairly large 50 pounds or so that was set up on a tripod on the surface of the Moon, and used to - pointed by the astronauts up towards the Earth and stars and so forth. It was the same instrument in fact the one that we have on Skylab is the backup to that particular instrument. So it's real good at detecting the presence of hydrogen gas. This is one of the materials that comets have recently, it's been recently learned, I say recently in the last 3 or 4 years from space observation. We know that there's a big cloud of hydrogen gas that surrounds some comets anyway particularly comet Bennet. This was discovered by the OGO and the OAO series of satellites. The size of this cloud of hydrogen for that particular comet was on the order of 2 degrees or so in size. In other words, the Sun is a half degree so you can see this is quite a large cloud surrounding this - this comet. In the case of Kohoutek what we want to do is - is see how this cloud of gas evolves as the comet comes in toward the Sun. In other words we want to find out how much hydrogen is the comet giving off and what's the distribution of the hydrogen around the nucleus of the comet and how does this distribution change, and these amounts change as the comet's position relative to the Sun changes. This helps us to determine what must be the nucleus of the comet, what must it be made of. So, this - that's the main purpose of this particular instrument is to measure this hydrogen cloud and the way that it evolves.

QUERY In later in December and in January for us Earthlings, can you tell me exactly what - what the comet will look like in - in the sky? Do you have - have a pretty firm picture of it? Will the tail be - be very clearly visible most of the time at twilight when - whenever it's visible, and also will it - will it be visible at all during the day of - you know between rather than - -

SNODDY Excuse me go ahead.

QUERY Rather than just before or after sunset depending on the date?

SNODDY I think the only time that it would be visible in the daytime is on the day that it, and I'm not sure what the possibility of this is, but is the day that it

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is nearest the Sun, which is around December the 27th or 28th, that time period. That's when it's nearest the Sun, that's when it will be the brightest. And in the case of Ikeya-Seki, you could hold your hand up and block the Sun out, you know and see the comet there beside the Sun. And it was thought I know some of the earlier estimates that you would be able to do this. I really don't know for sure what the probability is now of being able to see it on those days at this brightness level. I haven't heard anybody say, and I haven't thought it through, but it would be only on those days. And later as it gets - you would have to get farther away from the Sun because you've got that bright sky out there that is going to mask the comet. And so along around the 10th of January or so is typically given as a good time frame for seeing the comet. The Sun will set and the comet will set sometime afterwards. Its tail will be pointing up into the sky away from the Sun. And it does by the way look like in one respect that the Kohoutek is really measuring up to its expectations and the tail is growing even faster if anything than was originally predicted, is my understanding. So we should have a - a very nice display from that standpoint. So I guess that the tail would be 20 or 30 degrees in length, and I guess those estimates must still be firm since the growth rate is at least that fast. And although it won't be as bright it certainly should be a nice object to see. You should be able to see all of that with the naked eye I believe, during this time period.

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SNODDY - - and although it won't be as bright
it certainly should be a nice object to see and you should
be able to see all of that with the naked eye, I believe during
this time period.

PAO Okay, for the benefit of the writers and
the transcript girls the Comet Ikeya-Seki is spelled Ikeya-Seki.
If we have no further questions, that concludes the briefing.
Thank you gentlemen.

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SKYLAB NEWS CENTER
Houston, Texas

Skylab-IV Premission Briefing
Kennedy Space Center
November 15, 1973
2:00 p.m. CST

PARTICIPANTS

William C. Schneider, Skylab Program Director
Leland F. Belew, Skylab Program Manager, MSFC
Kenneth S. Kleinknecht, Skylab Program Manager, JSC
Dr. Walter J. Kapryan, Director of Launch Operations, KSC
Richard G. Smith, Saturn Program Manager, MSFC
Dr. Royce Hawkins, Deputy Director Medical Operations, JSC
Col. Alan Vette, Director, DOD Manned Space Flight Support
Donald K. Slayton, Director of Flight Crew Operations, JSC

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SPEAKER Can I have your attention, please? Everybody back there? Okay. I have a couple of announcements before we get started with our Permission Press Conference. There will be a Pioneer pre-encounter briefing at NASA headquarters, Monday, at 10 a.m. That will be piped in here, and for those going to Houston, it will also be piped in at Houston. Tomorrow morning we'll have a - a bus leaving here for the press site at 4 a.m., and then we'll start our regular shuttle service to the press site starting at 5 a.m. And usually we encourage people to ride the shuttles and leave your cars because you have limited parking out there. However, we seem to have ample parking at the time so I would encourage you if you want a car pass to go to the accreditation desk downstairs and we'll do our best to fix you up with a car pass and you can take your own car out, and be relatively independent as far as coming and going goes. We have buses going out tonight for sunset photography. It will leave at 4 p.m., and I would like you to - if you plan to take that to register at the photo office. We also have another one going for the MSS rollback and that will leave the News Center at 7:30. Now the one going out at 4 to cover sunset, we'll also make arrangements to either get you back after that or if you want to stay to cover the rollback we'll make arrangements for that too. Both of those we'll appreciate it if you'll check in with the photo office before hand so we'll know how many people are going out. I'd also encourage all of you if you haven't read the little sheets that's given out at the time of registration to please do it. Invariable, the night before launch and on launch morning, we end up with some people at the wrong places and held by security and sometimes missing the launch and we don't believe any of you want to miss the launch. Yeah, I think we're ready to start our press conference. On my right is Admiral Alan Sheppard, Chief of the Astronaut Office at the Johnson Space Center. To his right is Dr. Royce Hawkins, Deputy Director of Medical Operations at Johnson Space Center. On his right is Arnold Aldrich, Deputy Manager Apollo Spacecraft Program Office at Johnson Space Center. To his right is Kenneth Kleinknecht, the Skylab Program Manager, Johnson Space Center. On his right is William Schneider, Skylab Program Director, from NASA Headquarters. On his right Dr. Walter J. Kapryan, Director of Launch Operations, here at the Kennedy Space Center. On his right Leland F. Belew, Skylab Program Manager, from the Marshall Space Flight Center. On his right Richard G. Smith, the Saturn Program Manager, from Marshall Space Flight Center. And on his right Col. Alan S. Vette, U.S. Air Force

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Department of Defense Recovery Forces. Mr. Schneider, you want to start?

SCHNEIDER We have completed our final reviews of the preparations for launch of Skylab-IV, the thire Skylab manned mission. And all inspections have been completed and all analyses have been completed and all of our examinations about operations and preparations for the mission have been cleared and we are now GO for launch at 9:01 tomorrow morning. The weather promises to cooperate. The weatherman says the weather will not be quite as nice as it is today but will not be bad at all, and it will be very pleasant. And we see no - no reason at present why the - why we should not be able to launch successfully. We've spent the last few days telling you about the Skylab IV launch vehicle and spacecraft and I don't have much more to add over than what we've been telling you about in the last - in the last week. You were all aware of the problems that we had and the fixes that we put in and all of our - as I said all of our inspections and analyses have confirmed that the vehicle and the spacecraft are ready for flight. We haven't said too much about the the in-orbit vehicle, the Skylab workshop, in the past few days although we've answered a few questions. I'll turn it over to Lee Belew now, who can fill you in on how the workshop is doing up there.

BELEW Status to date is - during the unmanne? period we've been doing quite a bit of unmanned operations on the ATM experiments, some of those. Some of the things that will be done soon after the crew arise is as follows. You know we have a coolanol loop. We're on our second cool - on our second coolant loop in the A - in the spacecraft, that coolant loop that's in the airlock module. The first one we cut off some time ago because it did have a leak, the second one has been determined to be leaking. We expect that it will hold until we get up. And we do have a service kit thath's going up that is a kit that has the coolant in it, and we will reservice sometime within about 4 - the first 4 days after arrival. That's been completely checked out on the backup for workshop in St. Louis, and we're quite confident that that'll operate satisfactorily. We have enough coolant to reservice both loops and we see no problem in support of the 80-some day mission. Yesterday we had an anomaly in the ATM fine pointing control system. The ATM is pointed by a corresponding control system that's basically the total Skylab pointing system. Nested within that out on the ATM spar is a fine pointing control system that operates the instruments, that points the instrument to a very high accuracy. That

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system we found coming out of the dark side of the orbit going in the sun side that would have that latching system to release automatically and allow the canister to point the instruments (garble) acquiring sun and point (garble). That latching mechanism all the way down to the latch. It (garble) itself, and some time within about the next 3 hours, we activated the backup system. It did operate properly. We feel we are - we're in good shape to support the mission. However, as it continues we to - we're taking up another fix, we're taking up a cable, about a 16 inch cable, some pound and a half. It could be applied as an EVA fix in case we think the backup on the secondary system might have some anomalies in it. If it's a generic type problem, we don't think it is, but just in case, we do have a possible fix for it. No decision has been made to implement that. We will wait and see how the mission goes before we make any further decisions on that subject. We are pressurized to the 5 psi. We pressurized the station yesterday and no problem in that exercise. Expendibles - we're in good shape on oxygen, nitrogen and water, and I assume the - Kenny or someone may say something about that additional food that's being taken up. Our power system in funct - functioning properly. We had no major problems during this unmanned period. We see no problem in providing all of the power required to do the total job of experimentation as well as the general housekeeping activities. With that I'd say the spacecraft is in, I'd say, excellent shape to support a 60-day open-ended up to 84-day mission.

SPEAKER Thank you Mr. Belew. Col. Vette you want to give us an update on the - -
VETTE Roger. When we got the first hold on the original launch we held all the DOD forces in place wherever they happened to be. And then immediately after we got the GO sign Tuesday evening, we started them off onto their forward positions again. At this time they're all on their positions and they're in the green. The primary recovery ship is in San Diego in port and it is called the New Orleans. And it's scheduled to sail right after the first of the year for Hawaii to begin supporting target points in the Pacific starting on the 13th of January, and will continue to do so until after the mission. This will be the primary landing area - mode. Any landings before the 13th of January will be covered by Air Force helicopters and fixed-wing aircraft out of Hickham Air Force Base in Hawaii. This is called the secondary landing area mode. The DOD staff, composed of communicators, network people, recovery, PAO, and weather, are presently in the MOCR in Houston with the NASA recovery folk, and they'll act as a team

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out there to support this mission. The DOD manager assumed operational control of all the DOD forces at 9:01 this morning, which is - -

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SPEAKER And they'll have the team out there to support this mission. The DOD manager filmed operational control of all the DOD forces at 9:01 this morning which is T-24 hours. And the DOD then is ready to support the mission. And we would like to wish Skylab good luck and a successful conclusion of the program. Bill.

SPEAKER Thank you Colonel (garble). Open up to questions now if you will wait for the mikes to get to you so that your friends in Houston can hear what the question is.

QUERY Dr. Hawkins have the - the Astronauts been given any instructions or do they have any plans on different maneuvers or different arrangements when they get into the work shop to try to prevent the motion sickness problem from recurring?

SPEAKER Well, the only - the only instructions that have been given to them have been to proceed cautiously. And not to - you know not to go at it too fast. Take your time and - and just feel your way along. This is - this is really the only approach to - to the problem.

QUERY Mr. Belew, in the kits they're taking up to reservice the coolant loop, is there anything within them that will plug these leaks?

BELEW No, there's no - no items to plug the leaks. We've - we've been unable in the last mission to detect where they may be.

QUERY Could you clarify a little bit more exactly what this latch is and what it does and what the problem is?

SPEAKER Well within the ATM canister. You know the eight instruments connect within a cylindrical canister on a (garble) that canister is moved about 0.6 degrees by gimbal actuators in the far axis. And it's those actuators that do the fine pointing of the instrument. Those actuators are locked up during the launch portion of the mission. It had to be to preserve the integrity of the system. They are - they are also locked up during portions of the orbital activation. For instance during the time that we have the instruments in the ATM pointing control mode. Those instruments that system is locked up when we go around in the dark side of the orbit and they're automatically unleashed as we hit the sun. That's in order to keep the canister from flopping around during that per - that portion of the - of the uncontrolled ATM timing. The latch is just a locking mechanism that freezes that actuator from moving and its driven by a motor. We think the problem's within that motor itself perhaps it ran against some friction that may have been contamination.

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Or, there may have been a short in the motor. Where it would have a redundant motor - we have a redundant motor it's on the same shaft. And when we went into our troubleshooting procedure we activated the secondary motor or the secondary set of logic and that did operate properly. We still think that we may have a good primary system. We don't intend to activate it unless we run into trouble in the secondary. Next.

SPEAKER

Sorry, go ahead Tom.

QUERY

Next question to Kenneth Kleinknecht. Kenny can you tell us go into a little detail about what they're bringing up. How many different items and what it weighs.

KLEINKNECHT We're carrying up about 2000 pounds. About half of it is operational equipment, food, drinks. And the other half of it is film, experiments, and obviously some equipment that we put into the operational category for repair or contingency repair. One - one complete set of ATM film is going up that we hadn't planned on initially. A lot of 35-millimeter film for visual observation. The new UV camera for S201 for Kohoutek observations, coolanol servicing kit. We have a spare TV monitor for the ATM, carrying their own TV camera. We will not have any TV during the launch or rendezvous this time. You can save weight when it lands on the TV monitor on the ground because we have them up there. All in all we have removed about 150 to 200 pounds of operational equipment that was done based on our experience and use of clothing and various things like that that we found now that we didn't have to take. And that gave us a capability to carry the additional experiments and things like coolanol servicing kit.

SPEAKER

Next, anyone else.

QUERY

Dr. Hawkins you said awhile ago that the crew had been told to proceed cautiously and not to go to fast along. Isn't that essentially what the SL-III crew was told also so there's not really any change?

No see the crew is quite acrobatic.

SPEAKER

Yes.

SPEAKER

Is that right too?

SPEAKER

They - they are flying acrobatics and they are also engaging in other forms of head motions. In the water for example Dr. Gibson is - has what you call acrobatics under water. He's even using this form of conditioning too.

QUERY

Are the other two - are the other two also doing these similar water acrobatics?

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SPEAKER Not to my knowledge. But do you know for sure? Ed's the only one that I'd that I'd really talk to about it.

QUERY

SPEAKER

QUERY

Personal preference of his or --
Personal.
-- or something that he felt that he needed and the others didn't?

SPEAKER

It's a personal preference. I think he just wants to try it out and see what value it may be.

SPEAKER

Again, you might say that in the last Skylab crew we were a little surprised because this was the real first serious problem we had with motion sickness over the years since 1961. I guess that there are (garble). My feelings as to why it happened on this particular crew and certainly the speed in which they attacked their problems probably had a lot to do with it. As well as the volume of activity in which they got involved. And they just got over driven to some degree. I think we learned a lot from that lesson.

SPEAKER

QUERY

Okay.
In connection with that, will they be allowed under any circumstances to spend the first night in the lab or are they going to spend it aboard the CSM?

SPEAKER

SPEAKER

QUERY

The first night in the command module.
Questions?
We keep hearing about an open day - a open ended mission with 84 days of consumables aboard. Suppose they go the 84 days and have to fly the rescue mission aren't they going to get awfully hungry before that crew gets up there?

SPEAKER

No. Our ground rules are that we have 84 days plus rescue capability. We have 10 additional days beyond the 84 on board. It may not be filet mignon but that's food.

SPEAKER

QUERY

Okay, thank you.
Okay Dr. Hawkins has any of the crew done any trampoline acrobatics such as rebound tumbling and so forth?

SPEAKER

(laughter).

QUERY

Not to my knowledge. (Garble).
I'd like to ask Admiral Shepard, what he thinks about 6 hour EVA? Whether its going to impose extreme difficulty on a man to stay out that long?

SPEAKER

No that question is about the likes of some of older surface EVA considering the level of activity. Here is manual activity as far left. We have no concern with

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that what so ever. In addition to that we don't have to follow as quite rigid a time line during the EVA activity. They're more relaxed there.

SPEAKER

Do we have anymore questions from Houston?

SPEAKER

Yeah. I have one question that was handed to me here. Houston in their time line release have it as a 56 day mission. Can Mr. Schneider put up with it at 56 - 56 60 or what is the nominal?

SPEAKER

We'll review the proceedings on the 56 day. Our assumption is that if there's any reason that we don't want to extend the mission it'll take us 3 or 4 days to get the DOD forces back in positions. So we're thinking that the first one will probably be something around a 60 day mission. We in all cases no matter what the mission duration is we will position the exact duration on the basis of a disposition of the recovery forces. And we will recover in the best possible area to get the crew back for one day back in forth in one day for recovering. So when we say 60 days 56 days we mean it's on that order of magnitude and the best recovery day around that.

SPEAKER

Could I make one comment in respect to the length of the mission. Personal comment I don't want to speak for NASA but I'm sure they all agree with me. That you know it was essentially a 60 day mission and if anything we get on this mission over 60 days we think of course as an improvement it's an extension of our knowledge. And I think that anybody here feels that you'd be less than kind if you suggest that we only include 79 days for example that we did not have an successful mission.

SPEAKER

Well put Al.

SPEAKER

Do we have anymore questions from here at Kennedy?

QUERY

I'd like to know I think maybe for Kapryan and for Admiral Shepard too. After this we have a long down now. I'd like your view of the impact of that one the launch capabilities of - -

END OF TAPE

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QUERY - - Sheppard too. After this we have a long stand down and I'd like your view of the impact of that on the launch capabilities, operations here, and on the astronaut crew itself having that many months upcoming of relative inactivity and one shot then nobody knows.

SPEAKER With respect to activities at Kennedy following the Skylab program we of course do have and will have a dedicated ASPT launch team. We have developed and are still developing the simulations such that we will be practicing major test activities, the countdown activities throughout the period prior to the time that we actually have to start processing the hardware. So we intend to be running exercises where we will keep the crew alert and proficient throughout and when we do have a little bit of spare time of course they will be doing some work on the shuttle program.

SPEAKER With respect to the crew and perhaps you know the crew from the Soviet docking mission is already in their training cycle. As a matter of fact most of the crew will be leaving shortly for a joint training session with the Soviets in the - in their trainer. So they're well underway as well as a few of the astronauts who are directly supporting that mission. And we have also a group that have been working for a number of months directly in a design phase providing pilots inputs and design phase of the shuttle program and they're happily engaged in that particular pursuit. We have a tremendous amount of data on lunar programs which is being analyzed and will continue to be analyzed by some of the scientist astronauts as well as some of the medical astronauts will be analyzing and continuing to analyze along with the other doctors medical data which has accrued from both Apollo and Skylab. And we really don't have anybody who's out of a job nor do I perceive that we will have anybody out of a job. A number of - several of the astronauts for example are working in management areas in Houston already. We have Gene Cernan, Charlie Duke you know have both been working out in the West Coast now. So I don't think we're going to have anybody sitting around with nothing to do. And nor do I see any notable problems during that time period.

PAO

Mark.

QUERY Just to sum up an earlier comment by Admiral Sheppard I was wondering how many days you would consider it required in space for a successful mission?

SPEAKER

Fifty nine and three quarters.

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SPEAKER Correction, fifty nine.

SPEAKER Yeah, I think that comment here, that ha - was made primarily you talk about open end mission. That's a term that we all automatically understand. We think that anything that we get on this mission is more than what we've done in the past is considered to be a success. So we don't have to go 84 days - 85 days to have a successful mission. That's the point.

SPEAKER One of the (garble) we've been trying to say is that Skylab success is not today dependent it's dependent upon what information we're bringing back from the experiments and we could have an extremely successful mission by coming back with one piece of very significant scientific data so no one is really going to know whether Skylab was successful even if we stayed up there as long as possible, until we've done a detailed analysis of the scientific results and find out what they really mean to you and me and the rest of the world.

SPEAKER I think if we make the Kohoutek observation we will have done - we will have accomplished tremendously more than we had expected to accomplish most of the other things are more information on the same type we've been getting. The Kohoutek is something that isn't going to occur again and it will be the first time ever that anyone has had a chance to look at this comet as we will be able to. We were - the manned programs were the only ones that respond to that after the discovery of the comet. The unmanned programs cannot get the same observations. The same observations.

QUERY What are they doing?

SPEAKER They're making some observations but not the same ones we are.

QUERY The last crew seemed to go through their work schedule fairly rapidly after they got started is - has there been any reshuffling of this last coming crew's workload in the event that mission does go 80 some days do they all have plenty to do at that time?

SPEAKER We feel they will be busy the entire time. We haven't done any reshuffling but we've added to there's more ATM and you can spend 10 hours a day on the ATM console making ATM observations. And we have more ERF tape and film we will get many of the sites that we haven't had a chance to observe yet. We continue to get the medical data as we always have and that comes up every three days almost a full day of medical.

QUERY The comet observation data add a significant amount to their workload?

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SPEAKER No significant. It takes - we do two EVAs for comet observation, and we do some comet observation using the scientific airlock also.

QUERY Just a couple of questions I don't mean to bring out spirits down. But I need some technical data. I would like to know when the last time was that the launch escape power was tested? And I would also like to know if there is an 85-day mission or 84-day mission aboard the workshop at that point how many days of oxygen aboard the workshop will be remaining if there's a rescue in the necessity they must wait out there?

SPEAKER Yes, I can speak to the launch ex - excuse me launch escape tower we have in fact had a particular issue in that flight we test motors that were made at the same as the launch escape tower motors before each flight. And motors that are tested the satisfactory performance are the ones in the tower that we find have been tested we had an consideration with some of the material and some of the samples that had to be analyzed and we in fact evaluated a motor that is the mate to the one we're flying I can get further information on these tower motors. But in fact the program does involve testing before each flight (garble) motor to test that particular (garble) and motor series. Would you repeat the question on oxygen?

QUERY If you go for an 84-day mission and then you've got a necessity for a rescue the crew will have to wait for a rescue how many days of - -

SPEAKER On that oxygen Ernie, of course we use oxygen-nitrogen mixture, we don't oxygen alone we've had very minimal leaks on the spacecraft as you might know by following the mission. We can run another 90-day mission no sweat from the oxygen point of view. Nitrogen as well we have less reserve on nitrogen but it's in the neighborhood of 60-90 days or better.

PAO Over here.
QUERY Dr. Kapryan what hardware is available to support a second Skylab mission and approximately what would it cost to run it?

KAPRYAN I - I guess you better address that question to Mr. Schneider.

SCHNEIDER We have complete workshop AIM and airlock, MDA, all experiments some of them we've taken some liberties with to get spare parts for the ones we've got since we have complete sets it's in the configuration of Skylab when it was launched that's to say it had the micrometeorite shield on it. We have the 119 SCM in the launch vehicle available to us.

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Back in Downey there are two command modules 115 and 115A I believe, which are in various stages of preparation they're not complete and there are no plans to complete them. And there are launch vehicles back in the chute and at Huntsville that has been - that are available and could be launched. The price of an exercise like this is you have to ask yourself what else would you do other than fly a duplicate for example you would probably not fly the micro-meteorite shield and probably there are other things that we might - might change. But - -

END OF TAPE

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SPEAKER The price of an exercise like this, you have to ask yourself what else would you do other than fly a duplicate. For example you would probably not fly the micrometeroid shield and there are probably other things that we might - might change. It comes up - comes up depending upon the assumption you make anywhere from a half a billion to a billion dollars. Depending upon what you decide you might add to the system.

QUERY

Thank you.

QUERY

Schneider. All under (garble) that question, Mr. the bicentennial year of 76, we launch a second Skylab mission. And do so on the international level with Foreign participants bearing some of the cost. Do you have an enlargement to amek on that?

SCHNEIDER

Well it has been - I have read that in various trade publications and what not, it has been discussed, there are no active plans for that launch of a Skylab 1 or any other Skylab 1.

QUERY

Mr. Schneider, I think you gave us - I think you gave us once a sort of general figure on what the two slips have cost. Could you repeat those for me?

SCHNEIDER

I think what I've told you is that at the end of program, which is of course where the cost of any change comes about, we expect to be down around the one to two hundred thousand dollar a day expenditure rate. That will be in that neighborhood. I can't tell you just where it will be at that time, it depends upon what happens during the flight which is coming, how many people we begin to peel off towards the end of the mission.

PAO

Any questions to ask here?

QUERY

Mr. Schneider, you can fly a five man mission in rescue. Send up two new astronauts to recover them. Is there any possibility of flying a five man mission to start with?

SCHNEIDER

I think Lee Belew built the vehicle to really only handle just about three guys comfortably. It would be very difficult to have five guys up there, I think it would probably upset the thermal balance and a few other things.

SPEAKER

We can't fly - we can't fly - launch a five man command module, it's not safe. I wouldn't put two people below those couches when there is any potential for a land landing. Kind of ruin your whole day, I think.

SPEAKER

Besides that there are only three beds up there, somebody'll have to be floating around all the time.

PAO

Any other questions there?

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QUERY This would be for Bill Schneider, I guess, have you given any consideration to allowing Apollo astronauts on the STP to revisit the Skylab in 75, to see if they could activate it, bring it around, get inside, take samples and bring them back to study?

SCHNEIDER Our directions have been to leave the workshop, when we leave it, leave it in a condition where it can be revisited by somebody in the future, whether that be ASTP or Soviets or green men or (garble) or what have you. We are in the process of trying to determine what the optimum way of leaving the vehicle for that. I hasten to add that the probability of anybody going back there several from now and finding a vehicle that was operable is a very very low number.

PAO Are there any questions from Johnson?

PAO Okay, we'll take one last question from him.

QUERY What is the last flight to be, how long is it likely to be up?

SCHNEIDER Seven to ten years, I believe is the number.

QUERY Operable?

SCHNEIDER Just in orbit.

PAO Thank you very much gentlemen.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Launch Status Report
Kennedy Space Center
November 13, 1973
6:00 P.M. CST

Participants:

William C. Schneider, Director of Skylab Program Office, HDQS
Walter J. Kapryan, Director Launch Operations, KSC
Richard G. Smith, Manager Saturn Program Office, MSFC
Chuck Hollinshead, PAO

SL-IV PC-7A/1
TIME: 18:00 CDT
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PAO Dr. Walter Kapryan on his right is the Skylab program Director, William C. Schneider and to his right the Saturn Program Manager from the Marshall Space Flight Center, Mr. Richard Smith. Mr. Schneider.

SCHNEIDER Good evening, ladies and gentlemen. We've conducted a review of the Saturn SIVB stage and the results of our review today have revealed that the vehicle is - has adequate margin for safe flight as is, and we intend, therefore, to continue it. We do expect to continue our examinations and going to look at them in some more detail, some more detail computer studies but we expect that they will continue to confirm our original - our assessment today. The additional inspection of the launch vehicle as we - that we described last night is continuing and appears to be going satisfactorily and has revealed no - no additional concerns, and therefore - and, of course, that will continue. And therefore, we are continuing with the count leading towards a launch on Friday, the 16th, and we will continue to look at the systems as we go on preceding towards that point.

PAO Okay, we'll open up the questions.
Dick?

QUERY There's been a little confusion as to what you mean by a firm commitment being made tomorrow. Is that to say that what you're making now is not a firm commitment?

SCHNEIDER We know of nothing today that would keep us from going. We have as a normal scheduled event, before every launch, an L minus 2 meeting at which time we sit down and review everything, not just things such as the cracks that we've been wrestling with the last few days but the entire operation, recovery, flight ops, launch ops, and everything. We will continue to do that. We will at that time also look at exactly where we are in - in the crack situation to see if the additional 24 hours has revealed anything. We are committing to launch in that we are activating the fuel cells for example.

QUERY Are you going to be putting those splints or whatever, braces on the structural beams?

SMITH We are not planning on any repairs to the beams and the SIVB stage. Our assessment shows that the condition that they're in, we have more than adequate margin for safe flight.

KAPRYAN If you're referring to the doublers that we described last night, they are already on and we're - that job was completed at 7 o'clock this morning.

QUERY That was the fins but you were talking about some - some bracing for the patching I think you

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called it for the beams.

KAPRYAN Last night we mentioned that that might be a possibility. We have decided that we don't need anything.

PAO Mark?

QUERY Just - just to nail this down all the way on the confusion, you haven't just simply decided to wait and make your final firm decision, vis-a'-vis the cracks tomorrow afternoon?

KAPRYAN As of right now, we know of no reason that we can't launch. We have activated the fuel cells; we are going ahead as if we're going a launch on Friday. We do have as a normal schedule event this review. We will hold that as always. As a special part of the review, we will again look at the things we looked at today to see if there's any new data. We think that all of the new data the 24 hours additional will merely confirm what we - what we found today.

QUERY And following up a question I asked yesterday, have you been able to tell from the documentation that you have looked at and the history of the - of the vehicle whether there was anything unusual about any part of the vehicle that might have caused this - what appears to be large series of coincidental cracks?

KAPRYAN We have not been able to determine any peculiarity in the history of the hardware that's specifically associated with this vehicle.

PAO

We'll get the back and come back up here.

QUERY

Could we have a status report on the - the laboratory itself? When are you going to start pumping it up. What's it doing right now? Have you seen any low level sensors?

KAPRYAN Well, we've seen no level sensors and we have maintained it all pressure. I guess we are in nitrogen. We will begin the depressurization on L minus 1 day and repressurize. There's been nothing - nothing different has occurred in the workshop of and above what you've heard in the past few days.

END OF TAPE

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SCHNEIDER - - has occurred in the workshop over and above what you have heard in the past few days.

PAO

Fred.

QUERY

Will this be the first time, Bill, that NASA has knowingly committed astronauts to a rocket that has what will might be called minor defects, and can you give us the reasoning behind that if that is the case?

SCHNEIDER

Well, we have in the past launched with defects after having analyzed those defects and making determination that there is no safety of flight or safety of mission concerned that we do have adequate margins. The analysis that has been conducted to this point in time with respect to these reaction beams in the IV aft inner stage has shown that we have more than adequate safety margin for flight.

PAO

Go ahead.

QUERY

Has any change been made whatever in the margins during the boost phase or any other phase nearby? Have you changed anything at all with regard to your own factors and the situation that obtains during launch?

SMITH

That's kind of a difficult question to answer, in that I guess in principle you would have to say that the SIV reaction beams with the crack are not as strong as they would be without a crack. I think that goes without - without saying. But normally you'd design with a certain factor of safety in mind and most of of the design was done pretty - very conservatively. And we've considered all of the facts that's associated with this particular crack and the structure and the load bearings past associated with it, we find that we have in excess of what we normally say a 1.4 factor of safety. In other words, we keep a 40 percent margin over what we expect to see in a worst case flight condition, and we have that margin.

QUERY

Why is it difficult to answer? The answer is seemingly that is no.

KAPRYAN

Well, it's a matter of schematics more than anything else. Okay. The part would be stronger without the crack but it has adequate strength just the way it is. Okay?

QUERY

But my question was you haven't changed any parameters of safety during the lift phase during anything - -

KAPRYAN

No, no - -

QUERY

As far as flight is concerned, as by as far as the flight director is concerned, range safety off set, nothing in - -

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KAPRYAN No - -
QUERY - - that category, sir?
KAPRYAN No, no. Our competence factors we
have not reduced. Okay?
PAO (garble) up here, please.
QUERY After - after the RP-1 fueling tomorrow,
will you have an inspection of the fins to see if there's
any stress cracks on them and what kind of inspection would
that be?
KAPRYAN We do not plan to inspect the fins. We
have installed these massive doublers over them and you
can only see a small part of the fin. And we have
demonstrated through testing that we do have a very adequate
safety factor. So there is no concern. As I indicated to
you yesterday, the material of this doubler is not a stress
corrosion susceptible material and we have no concern over
that.
PAO John, you want to follow up?
QUERY So if you - if the fins develop the same
kinds of cracks that they developed earlier, the old fins,
these doublers would be more than enough - would provide more
than enough margin to take care of the - -
KAPRYAN That's correct. If that happens, we'll
never know it - we'll never know it.
PAO Rusty.
QUERY You mentioned - you mentioned earlier
that one reason you wanted to launch on Thursday was because
the weather forecast was better. What's the weather gonna
be - what sort of weather do you expect on Friday, and
because of the trouble you had have you changed the weather
criteria in any way?
SPEAKER Weather criteria has not been changed.
We are going to continue launching to the same weather
rules that have been developed since we had the launch of
Apollo 12. The weather for Friday, at the present time, is
still not expected to be quite as good as on Thursday.
However we shall have, we are expected to see scattered
cloud cover, temperatures on the order of 72 degrees,
visibility of 10 miles and winds, I believe, from the
northeast on the order of 8 knots. So that's very definitely
within our margin.
PAO Mary. You were previously concerned,
it seemed to me, about what - -

END OF TAPE

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QUERY We were previously con - very concerned, it seemed to me, about whether there was some area of the vehicle that had the same material where you might have cracks that might create a problem. And call for the overall (garble). Can you tell me at this point in time how many areas you have inspected and apparently are flawless? How many are in points where you can't reach them, and what is your rationale for thinking those are okay and generally for going ahead?

SPEAKER I don't know - Remember the exact number. Let me use like the SIB stage - as an example. There - there were somewhat in an excess of two thousand items that have potential stress corrosions and susceptibility. We were able to inspect a good portion of those, majority of those. Those that we were not able to inspect, we were able by analysis to show that the stress level in those were low enough for us not to have a concern.

QUERY Well, could I follow that up with - I understand that you had a lot of computers running today across the country and all these people making up all these analyses. What do they show about this material?

SPEAKER We were not looking at the - in the computers, but at the material. We are taking a reassessment, reinspection, and a relook at our stress analysis to be sure that what we have seen in some of the forgings recently that we did probably consider their stress level and made our previous assessment. We're really validating our previous assessments, and that does require quite a bit of computer activity to support that. Mary?

QUERY Did you inspect - you must have inspected in the IVB too. How many (garble)?

SPEAKER I don't remember - I do not remember - don't know the exact numbers of the hardware, but we have an inspection going on right now on the SIVB stage. And I think in the aluminum parts we, if I remember correctly, are about 85 or 90 percent finished, we found nothing. We have some steel parts to look at; we do not expect to find anything. And again those that are not acceptable, we're reanalyzing and validating our previous experience.

QUERY Are these two thousand parts or aluminum items in the second stage IVB, as well as the IB?

SPEAKER I don't know that number, but we can get it for you. Mary?

QUERY Do you plan any changes in the flight plan presenting a Friday launch?

SPEAKER No, we will go on with the flight just as planned. A five day - the five day realignment that we had why made us have to lose five days for the EREP, but that

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all, it will be part of our real time flight plan.

QUERY Did you use the 209 as a test article?
Now a question of its reliability for the rescue vehicle,
and for its use on the ASTP mission, if it's not used for
a rescue.

SPEAKER We have not used the 209 vehicle as a
test article. We've done nothing to that vehicle that would
compromise the capability for rescue or ASTP.

QUERY Rusty and them will be back on the other
side of this.

QUERY How about the crew? How are they taking
this and what is their schedule now?

SPEAKER The crew is taking it very philosophically.
They have expressed to us that they have confidence that we're
going to do the right thing, and we are. I believe that they
were relaxed today and we've got a couple of sessions with
them tomorrow for training. And I think they were put on a
schedule - I don't know any more than the general details
as they are here.

QUERY Okay, as far as the out of plane steering
on Friday morning, were you still going to go for an M5
rendezvous?

SPEAKER Yes. We have a good window on - a nice
long window on Friday.

SPEAKER You call thirteen minutes a long window?
(Laughter)

SPEAKER It's better than thirteen seconds.

QUERY If under the stress and weight of reloading,
some of these cracks widen - this is a two part question -
would you still go and if you decide to splint how long
would a splinting job take?

SPEAKER Well, are you referring to reaction beams
of the fins or both?

QUERY I'm forgetting about the fins, I want to
know about the beams.

SPEAKER We have no concern about those beams
during the loading operation. The maximum loading condition
is during the max view range just before the inboard engines
cut off. But we would not anticipate this to grow at all,
and we have adequate margins for safety.

SPEAKER Tom in the back.

END OF TAPE

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PAO Tom in the back?

QUERY Bill, you said yesterday that there was some people opting for repairs and some weren't. Was this the unanimous decision today to go ahead?

SCHNEIDER I'm - I'm sorry, I didn't quite understand the question.

QUERY You said yesterday that some people were opting for repairs and others weren't. Was this an unanimous decision today?

SCHNEIDER To my knowledge it was the unanimous decision. The management did not override the technical people. The technical people recommendations was to go as is. And Dick could you tell better whether it was unanimous?

SMITH It was an unanimous decision not to make any fix. I think yesterday it was reported in the press conference we had only a very short time to look at it. Obviously, we started in parallel looking at a potential fix as well as determining whether or not a fix was required; in this case it was not required.

SCHNEIDER I - I may be unfair to some about management types but I know at least there is one management type who thought they need a fix and I had only heard technical opinions that we did not need one and I - I'm - I'm that one. And the technical people did convince me today that we did not need one.

PAO Any more questions? One more up here.

QUERY I - I guess it will be for either Kappy or Bill. Just to backtrack a little, you did know that this aluminum was sort of susceptible to corrosion. You have known that for some time I presume. And this bird was moved to the launch pad in August for a rescue vehicle if needed. And some of my editors have asked me why was it not moved back to the barn inbetween time and then moved back to the pad if you felt that this salt air environment might endanger some of this material.

SCHNEIDER At the time that we splashed down from Skylab III and no longer had a requirement for a rescue, if we had moved back to the barn, we would have had to roll back out 3 days later to meet our normal scheduled requirement.

PAO Mark?

QUERY Specifically, which manned spacecraft have been launched in the past with SIB or were there also SV situations similar to that, where there was corrosion or other defects that were not critical?

SCHNEIDER I don't remember that. All I can say is that throughout the development of all vehicles nothing

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is ever perfect and there are always some things that you end up analyzing and deciding that it is all right to go as is.

KAFRYAN Yeah, like for example, with the Apollo 10 vehicle, if you recall on the SIC, you had a - a fuel tank bulkhead reversal. We satisfied ourselves that we had an adequate safety margin for a launch by running a proof test. So, we have had experiences of that nature in the past.

PAO Say, I guess I have one announcement to make and that is that the traditional ball game will be tomorrow night. Is that correct? Thank you very much, gentlemen.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Announcement of Second Launch Slip
Kennedy Space Center
November 12, 1973
3:10 p.m. CST

PARTICIPANTS:

William C. Schneider, Director of Skylab Program Office, HDQS
Walter J. Kapryan, Director Launch Operations, KSC
Chuck Hollinshead, PAO

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PAO Okay, I think we're ready to get started. On my right is Dr. Walter Kapryan, the Director of Launch Operations here at Kennedy Space Center, and on his right is William C. Schneider, the Skylab Program Director. Mr. Schneider

SCHNEIDER Earlier today, around noon, during a routine inspection of the Saturn SIVB stage, the second stage of the rocket, some additional cracks were found in the structural material in that vehicle that is of a serious enough nature that we have decided that we will not launch this coming Thursday. The examination and a subsequent technical evaluation led us to believe that these specific cracks are not necessarily of a nature that they wouldn't be required to be fixed. But it has caused us to question some additional material, and we have scheduled an inspection this afternoon of some retro-rocket brackets on the Saturn SIVB. That will take an additional 8 hours, and therefore we will not be able to launch on Thursday. However, we do intend to use the time between now and tomorrow for a careful reassessment of all such materials that might be in the bird, such that we can then tell you whether or not we will be able to go on Friday or whether or not additional work will be necessary. So at this point the launch on Thursday has been scrubbed, and we will be able to tell you tomorrow what the full implication of what we found today is.

PAO Okay, we'll open it for questions. We'll start back here with Mark.

QUERY Are you going to - well, first of all, could you tell us how much of this material is aluminum material, is on the spacecraft on the rocket, where it is, what you're going to be looking for, and how you're going to be checking it out? I guess this is for Mr. Kapryan.

KAPRYAN Well, as far as the SIVB is concerned, first of all, the cracks that were found today were found on what are referred to as reaction beams in the aft interstage. It's the part of the stage that is built by McDonald Douglas, but it's the part that stays with the S1B. When you have separation and SIVB ignition, the numbers that have developed these cracks will stay with the S1B. And one reason for the statement Bill just made that these beams are in compression rather than in tension. And so some of the technological experts have said that we could fly as is. We do have the same material, this 7079 T-6 aluminum in the main, what we call the main tunnel pan and the auxiliary tunnel pan. Now these are channels within which we have instrumentation and cabling harnesses running, and don't really see any loads of concern. The

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KAPRYAN other member is the thrust reaction
runnion for the retro-rocket motor. That is going to be
inspected as Bill had indicated. It's about an eight-hour
job to remove the therm, (?) to then perform the inspection
and to reinstall the therm.(?) Now with respect to how much
more of this material, or stress corrosion, is susceptible
material we have on board, as you know there's been an ex-
tensive program and extensive surveys have been conducted in
recent months. That whole program is now under review and
we are going to spend all day tomorrow making an overall assess-
ment of what it really means to us. I can't tell you how
much we have on board that we are going to have to look at
at this time.

PAO

John?

QUERY

Do I understand it correct that this,
where the new cracks are, this area was not under stress and
if that is correct, does that change in any way your evaluation
of what caused, what was the really basic cause of your other
cracks down the fins? In other words, are we dealing with
something more than stress corrosion, are we dealing with
metal fatigue?

KAPRYAN The metalurgists feel that it is stress
corrosion that we're seeing. Now, of course, they can't give
sample and take it to the malfunction lab and conduct an
analysis. Now right now we don't have any plans to do that
with the bird that's on the pad. It just so happens that
these beams are seeing load but they're seeing a compressive
load. The crack has occurred right in the middle of the beam
at a forging parting line and they say that that is historically - -

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KAPRYAN - - that they feel that we had residual stresses there that just made it open up. For example, we have two beams on the 209 bird that have similar cracks and that stage is not under load at all at the present time and they're in the identical location. So, it had to do with fabrication and there are some residual stresses in there and it's opening up and to tell you right at this moment exactly why I guess we're not - we can't do that.

PAO Someone want to finish up?

QUERY How deep are these cracks, how long are they, how many are there?

KAPRYAN On the 208 we have found one crack -

QUERY - - (garble) on 208

SPEAKER The bird that's on the pad, Skylab IV - Skylab III, if you will. We have eight beams, eight of these reaction beams. Seven of the beams have got cracks. They each have one crack and their all in the same location. If the eighth beam has a crack, well we'll find that out when we run dye penetrant checks. You can't see it by - with a magnifying glass with the naked eye. I've forgotten now what you really asked me (garble).

QUERY How deep are they and -

KAPRYAN They run - as far as length is concerned, they run from - the shortest one I think is a little in excess of an inch long and the longest one about 2-1/2 inches long and in looking a 209, where you can actually see the bottom surface the - I think the deepest one is on the order of a quarter of an inch or between a quarter of an inch and three eighths of an inch.

PAO Tom?

QUERY The other day you said, Kappy, you said that age was not a factor here, that nature did this to it, that was your quote. Sounds like we've got a little bit of both on this one.

KAPRYAN Yes, I guess I should have qualified my comment - I was talking, I think, in answer to a question from Mary with reference to the relative condition of the fins that we had on 208 versus the fins that had been in storage because the ones that are in storage see a benign environment and that was one reason why we had more confidence in them. And of course, they don't have cracks, these other new beams that we are installing now. I just put it in that - in that reference. The metallurgists tell me, and they all told me since I made that comment, that age does make a difference.

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QUERY (Garble)

QUERY Bill, I know that the Skylab launches have generally been designed to that you have two-days on and three-days off. I have several questions. The first is would you - would you want to schedule a launch on this Friday without having a backup day?

SCHNEIDER Yes.

QUERY Okay, and the second question is; do the - do the problems that you've seen in this launch vehicle make you think that perhaps before this can be launched there should be a 100 percent checkout of the rescue vehicle which (garble) delay this?

SPEAKER No, we - what we've initiated here has been a re-examination of the - of our rational of the structural integrity of the vehicle on the pad, and that's what we're going to be looking at tomorrow. Doing a checkout of the rescue vehicle wouldn't help and besides we have no physical way of doing that.

SPEAKER And, and let me add something to that. If - if you're referring to a physical inspection to look at stress corrosion susceptible areas on the rescue vehicle, we can do that in parallel with the normal checkout that we'll be conducting. So it would be done on a noninterfering basis; it would not add to the time so we can handle that, that we feel quite well.

SPEAKER We've asked that all vehicles that we have be looked at in the next day.

PAO Over here?

QUERY A couple of questions first of all, in referring to 209 - -

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QUERY - - are talking about the ASTP rocket?
QUERY If this is another backup we're talking
about here - -

SPEAKER That's the Skylab rescue vehicle - -
QUERY Okay, fine.

SPEAKER - - and if it is not used for Skylab,
it will be turned over to the ASTP.

QUERY Secondly, Bill, how much more time do
we have left before the problem, the coolant problem on
the space station gets to be critical?

SCHNEIDER I think as I told you we expect any
day now to get a low-level sensor. The pressure in there
this morning was 10.3 psi. And we expect to get a low
level sensor warning indication shortly. If the secondary
system behaves like the primary system, we have probably
at least two weeks and maybe a little bit more before we
end up with a low pressure. In the event we did end up
having to turn that system off, we do have procedures
whereby we can operate the vehicle at low power until we can
get up there and service that loop. So if it takes us a
longer time than we anticipate right now, and we did com-
pletely lose pressure and we have not lost the mission.
We do expect to go up and reservice the loops. Of course,
I'd be fooling you if I led you to believe that we think
that that's a good thing to happen, it's a bad thing to
happen. It would be much better if we can get up there
and service it while we still have one loop operating.

PAO Radmier?

QUERY I wanted to make sure I understood
Kappy correctly. These are seven vertical beams in the
structure, not the bolting ring. No effect on the bolting
ring at all. And also, what time today was the problem
discovered, because Bill answered a question yesterday
that there were no other problems above the first stage?

KAPRYAN These are vertical beams as the bird
sits on the pad. The discovery was, I guess, right around
noon, maybe 11:30 or 12:30, I've kind of lost track of time,
but it was around mid-day today.

PAO Now let's get somewhere on this side
in there.

QUERY Yes, I've got several questions. How
long are these beams, and, also, I'm not sure in my own
mind, I'm not much of an expert. But it would seem to
me that perhaps you might have more aerodynamic stresses
on a fin, which is sticking out than on a vertical beam,
or maybe I'm wrong. In other words, how do the aerodynamic
forces bearing on an area where you might have a
crack or a slight damage, what would they be proportion-
ately, say, in a thin area as opposed to this new area

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where you got them?

SPEAKER It's about 15, the beam is about 15 feet long, Mary. I think, as I said, there is at least some technical opinion that says these specific cracks that we saw are not serious enough that we would worry about them, and we might conceivably fly with it as is. We have not made that decision, but there is some technical opinion that says that would be okay. What we have said to ourselves now is, is there something else in the bird that we have missed? And that is why we want another day to go back and look at it. As I said, we identified one item this afternoon that we said we really must get a look at. And we are looking at that tonight, and we are giving ourselves 24 hours to re-examine all of the material in the bird to see if there are any others that will cause us - give us any other cause for concern.

QUERY Well, on the aerodynamic stresses - now the other day Kappy said that, you know, if one of these things let loose you're very likely to break up the rocket from the other cracks. You know, if you'd flown without a max q say, for example. Now, what is the best expert opinion on what would happen, you know, the aerodynamic stresses on this middle section? I don't know what the proportions are.

SPEAKER The answer we got today, though we haven't gone around the horn with everyone, the answer we got today with the best technical people we have is that nothing would happen. We would have no problem as far as that - this section's - concerned.

SPEAKER They said we could fly with this crack. We don't (garble) crack - -

QUERY Do you think the cracks split further?

SPEAKER That's correct. They can't split much further. You'd have to look at the beam itself in detail to understand that. There's a guide fin that's directly behind these cracks that we are seeing. And there are two bolts that are holding this portion of the beam in compression on either side. So the fact that the hole is there.

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SPEAKER - - either side, so that the fact that the hole is there, that makes it a self-limiting crack. The crack can just go through the hole where this guide bolt is and it stops there. It's a press reliever that happens to be there.

QUERY There's a beam-like saw, right? And then there's something on either side of it?

SPEAKER Right? The beam goes vertically and you've got two bolts on one side and this is kind of a boss (?) that sticks out. And then you have a little bolt right in the middle that was used to help locate the beam in position when you made it. The SIB and the crack is appearing just in that one small area. The crack cannot go more than in - vertically it can only go about 2-1/2 inches and it can go in maybe something like 5/8 of an inch or so, it can't go anywhere else. That's all it can do.

QUERY Can't crack the whole thing apart?

SPEAKER No. That's why some of the people have told us look, let's just go by this, but we say we have to look at other areas.

PAO

Query

Tom?
We were given to understand that the cracks in the fins were caused when the load was put on the vehicle. Now why would these cracks - these specific cracks we're talking about today, why weren't these discovered previously? Why did they just appear now?

SPEAKER Well, I - think as we said - since we found them on 209, the suspicion is that they're result of residual stresses left in the forgings from the fabrication process. There was an inspection of these beams done in the last week in October and they were not detected.

PAO

You've been waiting for him.
Over here? Excuse me; go ahead, Tom.

QUERY Precisely which other areas of the bird will you be looking at that are made of this same material and are there enough of them or are they vital enough in certain places where it could possibly necessitate going back to the VAB? If that happened, how long will the delay be?

SPEAKER Well, we can't answer that until we complete our look tomorrow. I told you what we've identified so far today, which is that one yoke. We know we want to look at that. We've asked everybody to go back and come back and tell us tomorrow what other stress corrosion susceptible materials might be in there, where we might have to worry about cracks, and just how much do we have to worry about them. And we will be spending the day looking at that. If the results are that there has to be more work done,

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again we will have to then assess that at the time and tell you whether that means five days or ten days or whether we have to go back to the VAB. We don't know.

PAO

Tom?

QUERY

Kappy, are you going to patch these cracks? The cracks that you found today in these beams?

KAPRYAN

My answer to you right now is, yes we will; however, we have not set down and specifically assessed what we're going to do.

QUERY

And if you could assess right now, what are the chances going on Friday, though?

SPEAKER

Fifty. Fifty at best.

PAO

Tom?

QUERY

What I need to get at is - is this rocket any older or younger than the previous two rockets that launched Skylab crews? Secondly, are you performing inspections on this rocket that you didn't perform on the first two? Is it possible that we launched the first two and you had the same problem. They were approximately the same age, weren't they?

SPEAKER

We built these rockets, as I remember, on about 2 months centers so, this rocket is 2 months older than the one with the number previous - -

SPEAKER

Two months younger.

SPEAKER

Two months younger. Yeah, that right.

And so, I guess we're launching it at about the same age as the last one. So age, per se, has nothing to do with it. We did initiate some special examinations as a result of the E-beam incident, but there are a great number of inspections that were done normally, so I can't really say whether or not these particular places were looked at or were not looked at, that's one of the things we want to look at.

QUERY

Okay, maybe the E-beams, that incidental which was 2 or 3 weeks ago, tipped you off, but did you have a few days before the launching of the last Skylab, for example, did you have one of those quote "routine" unquote inspections of the fins and also a quote "routine" unquote inspection of that inner stage area?

SPEAKER

Well, let me tell you how - how this one came about today. There always was a routine - -

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Kapryan Now this one came about today, there always was a routine inspection of this area where these cracks were found today. However the engineer in looking over his drawings took specific note that the material in these beams was the same material as in the fins. And so he says, I look very carefully, now whether or not the cracks were such that he would have found them if he had looked at them in a normal manner or not, I can't say. He did look at it and he did find them.

QUERY But I think you said earlier that these cracks were the results of some stresses in manufacturing. How come they weren't discovered much earlier even before the thing left the shoes?

SCHNEIDER Stress corrosion, I'm not a stress corrosion expert. But if stress corrosion occurs, suddenly, after the materials have been sitting and have been exposed to both stress and corrosion, you need three things. You need stress, you need corrosion and you need time - time that the part is subjected to both stress and corrosion.

QUERY I think one of you said something - stress left from manufacturing.

SCHNEIDER Residual stress.

QUERY Residual stress.

SCHNEIDER What happens is residual stress (garble) got a tension in there and you get some corrosion that goes under the surface and you get some intergranular displacement and then suddenly a crack appears and so time is a factor.

QUERY How did they see that up there because that these, you can't see with the naked eye?

KAPRYAN Let me - Let me handle that one. First of all to get back to the fins, for 206 and 207, the same detail inspection of the fin area was made after the count-down demonstration test before, just before the launch as was done this time. It was the same inspection and then there were no cracks. With respect to this area where the cracks were discovered today, that area is part of the what's referred to as the routine stress corrosion inspection area, and 208, this area was specifically inspected on the 25th of October by a McDonald Douglas inspector and by McKinney Space Center civil service inspector. Now they, when they were looking at this area, were not looking at it from the stand-point that I know that this is 70-79 T6 aluminum and that (garble) look at it, they had a work order that said you should inspect the interface between the S1B and the S4B for (garble) look at the meeting surface for any indication of cracks scratches, ect. And I - just before coming here we talked to NASA inspector and he said that on the 25th of October

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KAPRYAN they got on their hands and knees; they had a flash light and they looked; they did not have a magnifying glass. Now the engineer who made the inspection today did have a magnifying glass and the first two beams he looked at he did not detect a crack. The third beam he looked at he did. He then went back to the first two beams and having found the crack in the third beam, it was readily apparent to him that they were also in the first two beams. So he missed it. So these cracks are very fine lines and you really got to be looking for them. So how they were missed? We know that the inspection was performed on a the 25th of October. The guys who inspected say they think that if the cracks had been there, they would have seen them, but they did not have a magnifying glass so we can't tell you that the cracks were not there at that time.

QUERY It took a magnifying glass to find it?

KAPRYAN Yes, but once that you find it and you know it's there, man, you don't need a magnifying glass to see it. You and see it with the naked eye.

SPEAKER Mark.

QUERY I got a couple of questions that have been kind of cropping up during this. When is - when the fin situation hit, when was it last week, whatever day, Wednesday?

KAPRYAN Sixth of November.

QUERY (Garble) and the at that time you told us that you were going to check all of the aluminum area, the same aluminum for stress corrosion. And now today on the 12th we find that the more, I was wondering why it took six days to find those, when you knew that it was routine stress corrosion area?

KAPRYAN That's all I can say that it was part of the work order that was scheduled to be done today and it was done today.

SCHNEIDER It was in an area that is not, this particular area that was looked at today was - is in an area that considered a benign area, and I guess we'll have to say to you that being in a benign area, the rational was that, you know, it isn't of that concern.

QUERY It can wait.

SCHNEIDER It can wait because frankly we just did not expect to see anything there.

QUERY Well, I just kind of had the impression from the fin scrub press conference that you had people climbing all over that rocket looking for aluminum in orders of priority and this one as we said.

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QUERY -- we didn't expect to find any.
QUERY If you decided that you did have to go
- replace all of these beams - these vertical beams, the
seven that are - if you did decide to replace them, would
you have to go back to the VAB?
SPEAKER I do not believe from what I've seen
of them, I don't believe it's possible to replace them. I
think you'd have to replace the whole intrastage structure.
SPEAKER We would - we feel that we could make
repairs, but to replace them as part of primary structure,
(garble) and it's riveted and it would be an extremely
difficult manufacturing process to undertake here.
QUERY And if you had to repair them, that is,
do more than just simply patch as you - if you - as you
mentioned to Tom, would you have to go back to the VAB?
SPEAKER We don't know that yet, Mark. We don't
know what the repair might be, so we can't speculate as to
whether or not we can do it in its place or not. It's
conceivable that it could be done in place.
QUERY When do you estimate tomorrow that
you're going to have word for us?
SPEAKER Sometime in the afternoon.
QUERY Late afternoon?
SPEAKER Probably.
PAO Let's go on back.
QUERY Who has told the crew? Anybody up there?
SPEAKER I called Mr. Kleinknecht in Houston and
asked him to call the crew. I assume he did.
PAO Mark?
QUERY Joe, I have a figure of 100,000 to
200,00 dollars per day of delay. Is that correct?
MORRISON (Garble)
QUERY When do you start running into budgetary
problems that would mean you'd start thinking about curtailing
the mission?
SPEAKER Well, as you may recall we canceled
the Skylab backup vehicle about a month early so we have
a little bit of reserve that can take care of slips like
this. I - I --
QUERY you be a little more specific?
SPEAKER I'm sure if we're talking about a
couple of weeks, why, we're in good shape.
QUERY You would still have the capability
after two weeks to go perhaps 85 days?
SPEAKER Yeah. Yeah.
PAO (Garble)

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SPEAKER Let's speak from a financial standpoint. That's not the only consideration on 85 days, got a lot of others.

QUERY Are you still working on the fins and how far along are you and when do you think you'll have that sewn up? We've forgotten to ask in the last couple of hours.

SPEAKER Well - - the replacement of the fins is almost complete, we did make a decision to incorporate a design modification. And this design modification will require the retro-fitting of an aluminum block or doublet, if you will, but it's - it's a heavy block. It's a rather massive block over each of the lower brackets on the tailfins. In other words, there's going to be two of them for each fin. There'll be 16 altogether. They're made of a 2219 aluminum which is a very forgiving(?) aluminum that the stress corrosion people say we have no stress corrosion concerns over. The brackets are being qualified at the present time on a testing in Huntsville to design loads. And the calculations analytically at least, the answers we have are that we could have one of these cracks occur, such that a lower bolt would take no load whatsoever, that in the forging itself, and the block would still maintain structural integrity. So, we are incorporating these blocks in a retro-fit mode to these new fins.

QUERY Are these blocks like braces right at the point where the fins attach to the rocket?

SPEAKER Like doublet plates, over the ends.

QUERY Doublet plates? What are - what are -

SPEAKER Just another plate over the top.

QUERY Like braces?

SPEAKER Right. But it's massive. It's machined out of a block of aluminum that's about 7 inches long, it's more than 5 inches thick and more than 4 inches in the third dimension.

QUERY (Garble)

SPEAKER Pardon?

QUERY (Garble)

SPEAKER It's one piece; it's one unit.

SPEAKER No, doublet plate is a better term.

QUERY You can't have one on one side and one on the other?

SPEAKER No, sir. There's two for each fin.

QUERY Well, isn't there one - -

SPEAKER No, not one on the inside and one on the outside. One on each side of the vehicle. One here and one here. Mark, thought you meant one on the inside and one on the outside.

SPEAKER Well, you see we have an upper and lower bolt at each of these fittings, so we - -

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QUERY We were talking about spreading between those two. On each side the one (garble)

QUERY

Now, we do have one here and one there.

PAO

Let's go back in the back to Red here and then we'll swing around to the front again.

QUERY

I'd just like to clear up some confusion in my mind between the two of you. I'm getting the idea that you're concerned about the possibility of cracks in the base of the retro-rocket, on the side of the stage, that you can make a repair but you haven't made the decision to make a repair of the seven vertical beams and that you're really not sure you can go Friday. Can you sort of clear me up here?

SCHNEIDER

Okay, we're really not sure we can go Friday. We do not know that there is any crack in the retro-rocket support yoke, that was one of the areas that was identified as being of the same material with no residual stress and therefore considered previous to this as being benign and not susceptible to stress corrosion just as this area was. We made the decision to go and look at that, and that's in progress. So we don't know whether there's anything there or not; we don't expect there to be anything. The failure that we did find, the cracks that we did find today, we are still looking at them. Some technical experts say that we could go as is. There are some of us who think that we would probably put some type of (garble) material on that, too, but we have not made that decision.

PAO

(Garble) more?

QUERY

But that explanation confused me a little bit on whether - not I'm sure, if you don't find anything wrong with the retro-rocket - I mean that seems to be okay, and you make a decision that you don't have to do anything further with the vertical beams, then would you find yourself in a position that you could go Friday?

SCHNEIDER

Yes, assuming that the examination that we've started, we've asked all of the contractors to go back and reassess the structural integrity and the material that they have on board and to report to us tomorrow as to whether or not there are any other areas that will give us any uncertainty and should - will required further examination. Okay?

QUERY

Yes, except that I did not understand after all these SIB's that we've had and all the experience having to look for areas that - why it isn't at your fingertips where these things might be?

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KAPRYAN The logging of those things is at our fingertips and we can give you a book like that that says it is. What we're asking is for each engineer to go back and re-examine his rationale to see whether his original assessment is still valid in light of what we've found here.

PAO Art Kramon? Come in, come over here.
QUERY Gentlemen, was this alloy created specifically for use in this vehicle. Have you any idea - -
QUERY How was it chose?
SCHNEIDER I don't believe so. Kapp, do you

remember?
KAPRYAN Well, I guess it's a product of the aerospace industry. It's a high strength alloy. And obviously had no history of corrosion. QUERY It was a new material. I guess eight or nine years ago it was the in thing to use. Well, now eight or nine years later after this material has been used why we're getting smarter.

QUERY Does that indicate poor methods of testing or party control or - -
KAPRYAN Well, you know these forgings of high strength alloys was kind of a new thing, so I think today if these forgings were to be produced, they probably could have done a better job. It isn't a criticism, it's just the state of the art, if you will.

QUERY But in addition to the forgings, what about NASA's means of verifying the quality of those forgings?

KAPRYAN Well, I'm not sure I know how to answer that. Pardon?

KAPRYAN Oh, I don't think a mistake was made. I think that people based on the knowledge that people had at a given time, the design was made and that was the state of our knowledge. Eight years later people know more about the material than they knew before it was ever first used. You can call that a mistake, if you will.

PAO Tom?
QUERY Can you point out where this retro-rocket support yoke is?

END OF TAPE

SL-IV PC6H/1
Time: 15:15 CDT
11/12/73

QUERY You can point out where this retro-rocket support yolk is?

SPEAKER (Garble)

SPEAKER No, there's one under each. I think two of them. One on each beam. There's four of them, four of them, yeah.

SPEAKER Takes about 8 hours to take all of the screws out and look at them and put all the screws back in again.

PAO Mary?

QUERY Kappy, did you say you were going to take the fairring off to look at everything?

SPEAKER The fairrings over these retro-rockets, the - the title for this is a thruster reaction trunnion for the retro-rocket motor. There's a fairring over it.

QUERY Say that again?

SPEAKER The thrust reaction trunnion.

QUERY Thrust reaction trunnion?

SPEAKER Yes, for the retro-rocket - for the retro-motor. And there's a fairring over this. The fairring has to be removed. It's now our job to remove the fairring, perform the inspection and reinstall the fairring.

QUERY But that's not the big one? That isn't a - where is it right there, okay. The other thing was if - if you decide - if you haven't found any other errors or anything and if you decide to do some patchwork in this beam area, you know, like you were mentioning, various things and what have you, could you do that before Friday? Or would you very likely (garble) - maybe postponed until the 20th or something like that? In other words, how long does it take? And?

SPEAKER Well, the - the talk that we've had up until now - the discussion we've had up until now has been that yes we could beef them up, but the specific design has not been discussed in any detail. I guess, I personally, giving you my opinion, to think that if we - we made the fix probably going on Friday would be rather low.

PAO John?

QUERY (Garble)

SPEAKER Oh yes, yes, yes, the - the thing that would keep us from going on the 20th is that, man, we find that we just don't have structural integrity period and we've got to do a lot of things.

QUERY Patchwork and so forth, and the other thing was, that could be done so - the other thing was on these blocks, these new things that you're bringing down from Huntsville to patch up the fin area, and re - reinforce those.

SL-IV PC6H/2
Time: 15:15 CDT
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How long is it going to take you to get all of those things, gidgets, in place?

SPEAKER Well, we feel we could have had them installed for Thursday launch.

QUERY Well, they're not here yet, are they?

SPEAKER Oh, they're here. Yes, they came in

9:30 - -

QUERY I mean they aren't on the fins?

SPEAKER They're in the process of being installed right now. First one went up just as we were leaving to come to this press conference.

QUERY Could you tell us - I sort have forgotten how that dye stuff work, you put on a dye and if there's a crack it outlines it deeper or something?

SPEAKER Well, yes you coat the surface with - using the dye penetrant fluid and I think the fluid that they're what that is. And then you let it sit for awhile, and then you have another chemical agent which you use to remove it and then you let that sit for a few minutes and if there are any cracks what you normally do is - you take a - a - dark cloth, just like the old-time photographers used to do when they took a picture through the camera and you're going with the black light. It's a fluorescent inspection, kind of like if you go to some of these psychedelic joints and you see all the dandruff on your coat. It's that kind of inspection and then - if you got a crack there it will show up.

QUERY Are they going to do that kind of dye stuff all over these (garble) areas or are they just going to look with magnifying glass?

SPEAKER Well, we - we're making dye penetrant checks of the beams that we discovered a crack in today. We made dye penetrant checks of all of the areas of the fins that we were concerned over.

PAO John?

QUERY You can take the fifth on this if you want to. But, is there any possibility that (chuckle) that these failures, these cracks could be attributed to faulty care and maintenance?

SPEAKER Well, I guess I ought to answer that one since I'm responsible for it and I say I - no I think the same, what we would like to refer to as tender loving care, has applied to this bird as any other. Every crew of astronauts that we've launched, we're launching three lives that are precious as the ones we've launched before and I would answer that this bird has had as good handling as any other bird has.

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QUERY In view of the fact that you said that the structural members in which the cracks were found today were low on the priority, can we assume that a number of other elements made out of the same Al - alloy have been inspected and come clean?

SPEAKER Well, - - yes, as far as the special alloys. There are other alloys that are highly susceptible to stress corrosion. The material that the E-beams is made of - these have all had a special inspection. Every component in the bird that's got - that is highly susceptible to stress corrosion and is of a critical nature that inspection has been performed.

QUERY Now - and - now that the cracks have been found today are we going to go back and inspect all of those once again?

SPEAKER Pardon?

QUERY Are we going to go back now and inspect all of those once again?

SPEAKER We don't - - No.

SPEAKER Let me add something to what Kappy said. We have had as you - we've said repeatedly a - some special inspections of stress corrosions susceptible material. One of things we may not have been ab - may not have said but because we understood it was - some of the stress corrosion material is inaccessible, and in those cases we have asked for an engineering rationale and evaluation as to why the engineers believe that it's okay. And if those rationales now that we want to go back and re-examine to make sure that there is nothing in there that we don't really want to buy off on. That's what today's examination really is.

PAO You have any more questions? One last question over here?

QUERY Mr. Kapryan, you mentioned the time about patching those cracks. How would you do that, what procedure?

SPEAKER Well, it - it - I think would be similar to what we're doing with the fins. We would have a doubler material; we would use the material that we know we would have no concerns, with with respect to stress corrosion and having sufficient strength to withstand whatever loads it's going to be subject to, and then probably just bolt it in place.

PAO Thanks Mr. Schneider, thank you Dr. Kapryan.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Launch Status Report
Kennedy Space Center
November 11, 1973
4:30 p.m. CST

PARTICIPANTS:

William C. Schneider, Skylab Program Director, NASA Hdg.
Chuck Hollinshead, PAO

SL-IV PC-5/1
Time: 4:30 CST
11/12/73

PAO Well, with that I would like to turn it over to the Skylab Program Director, William P. Schneider.

SCHNEIDER As we announced an hour or so ago, we have completed today a fairly detailed look at where we are and what we have lying ahead of us to prepare Skylab for its launch. And I've concluded that we have a tight schedule, but it is still doable. Our schedule now calls for us, as we have previously planned, to replace two fins at a time from here on out. The ones we got before are good ones on the end-stable base to support the vehicle, and that work is in progress right now. We've allocated roughly 12 hours for each pad in our schedule, which says that we expect to be completed about tomorrow about this time. If we do do that, we have something on the order of 12 hours of contingency in this schedule. So while you can see 12 hours is not a great deal, and we would certainly be more comfortable if we had more time, it is doable schedule and we fully expect to be able to accomplish the changeout, and if so, why, we will be launching as schedule on Thursday.

PAO Can I open up the questions? Don?

QUERY Is there any consideration being given to using the Friday launch opportunity?

SCHNEIDER If we miss Thursday, we will definitely go for Friday. Friday's got a good window. It's, I believe, a 15-minute window; opens up about 9 o'clock in the morning. The weather forecast for Thursday is better than it is for Friday, and we most certainly would like to go as soon as we can.

QUERY Would you have to make a decision to go Friday, than Thursday?

SCHNEIDER Well, we can make that at any time until after we get down to the last critical moments of the count, but we can have a hold at the last hour of the count and still in the next day, you know.

QUERY Has the fuel loading resumed, and what is the status of the lab itself?

SCHNEIDER Well, the status of the lab itself is unchanged. As of this morning we still had not had any low level sense of warning on the thermal, on the coolant channel, so it remains as before. As far as when this propellant loading begins, we pick up the count again at say about 5 o'clock Tuesday morning, and I'm afraid I don't know when propellant loading begins, but I can get that answer for you.

PAO Any other questions? Tom?

QUERY Mr. Schneider, I presume that the mission duration aiming for 90 days with active schedule as it had been is unchanged?

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SCHNEIDER Yes, we plan on doing the mission just as previous, 60 day open-ended with the possibility of being extended on a week-to-week basis up to a maximum of as much as 85 days.

QUERY Wind's going to get high while you're over there?

QUERY Much as the wind hampered you out there, and right now there's some pretty bad clouds overhead there, has that heavy rainstorm that lasted several hours tonight hurt you badly?

SCHNEIDER Yes, we don't want to expose any surfaces to water. We would have to take precautionary measures to keep water off the bad metal surfaces. The wind has been an inconvenience, but the (garble) had, as you may have seen on the TV, been able to come up with some schemes where the wind hasn't been a serious problem at all. It's uncomfortable to be out there because it is very windy, but it has not held us up to any serious manner.

QUERY Mr. Schneider, I understand the problem of the propellant tanks a few weeks ago. Have you satisfied yourself that these tanks are go the the mission?

SCHNEIDER Yes. During a test while we were testing the level senses, why, we managed to cover up a vent line and we pulled a partial vacuum on the fuel tanks and we collapsed the dome on two of them. Those have been satisfactorily buckled, ballooned out, and all the tests have been completed, and the vehicle is in excellent shape and ready to go.

QUERY Thank you.

QUERY Mr. Schneider, have you come any closer as to why each of those eight fins have cracks, and not just two or three of them?

SCHNEIDER No, we have not. We're still busily searching the records and trying to see if there's anything different about these. I'm sorry to say at this point that we have no clue as to why all eight of them developed cracks, and I'll be as happy as you'll be when we do find that answer.

QUERY All right.

QUERY During this phase build have you been able to work anywhere else in the stack? Have you found any other surprises or completed any other loading that you can eliminate later in the count?

SCHNEIDER No. The spacecraft pilot, course, has just been coasting. You may know that we had a couple of cables in the instrument unit that we had planned on changing out. We've managed to do that in these last few days, but that was very minor work, a couple hours of retest. The

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vehicle we have uncovered nothing more in the vehicle that gives us any concern.

QUERY I wonder if I understand this correctly. You hope to have all the fins changed by tomorrow about this time, but you do have another 12 hours that you could complete it if there's some slippage.

SCHNEIDER Yes. Yes.
QUERY Have there been work populations out there on fin changeouts?

SCHNEIDER Let me give you an estimate and say there's probably been about 30 people out there. That's 30 people up on the vehicle and probably another 10 or so down working on the fins and quite a few back in the backrooms doing testing and checking.

QUERY Would you describe the spirit of the crew during this delay? Been any grumbling at all, or have they been just their usual jolly selves?

SCHNEIDER The flight crew? I talked to Jerry today and he's eagerly awaiting a go and was very happy when I told him that it looked like we'd go Thursday. They're eager, ready, well trained, and trying to relax.

QUERY (Garble)
SPEAKER Jerry, testing on the A circuit; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

END OF TAPE

Skylab New Center
Houston, Texas

Skylab IV - Launch Delay Press Conference
Kennedy Space Center
November 7, 1973
12:30 pm CST

Participants:

William C. Schneider, Director of Skylab Program Office
Walter J. Kapryan, Director Launch Operations, KSC
Richard G. Smith, Manager of Saturn Office, MSFC
Chuck Hellinshead, PAO

SL-IV PC-3A/1

Time: 12:30 CST

11/7/73

PAO Okay, I think we're ready to start our press conference. On my right is Dr. Walter Kapryan, the Director of Launch Operations from here at Kennedy Space Center. Seated on his right is Richard Smith, Manager of the Saturn Program Office at the Marshall Space Flight Center, and in front of us is William Schneider, the Skylab Program Manager from NASA Headquarters. We'll start off with Mr. Schneider.

SCHNEIDER Good afternoon. The launch of Skylab IV, the third manned Skylab mission, has been delayed from Saturday because we have detected some stress corrosion cracks in the fins at the bottom of the launch vehicle. These were detected yesterday for the first time during the routine inspection. We do inspect these at the countdown demonstrations of all missions. And we did detect cracks, at least one crack on each fin and two cracks on two of the - six of the fins. These cracks have been deemed to be sufficiently bad that we must change out these fins and we're planning on doing that. The work has begun; new fins are being shipped in from New Orleans and they will be installed here at the Cape on the pad. We have said that the launch is no earlier than the 15th because this is new activity for us, and since it is being done on the pad, we're somewhat at the mercy of the elements. And we will formally assess the status of our activities on Sunday and make a determination at that time as to whether or not we can launch on the 15th or whether or not a few days if necessary, to complete the job.

PAO Thank you, Bill. They will take your questions now. Do we have some mike handlers? If you will just hang on for a minute here until we get the mikes to you. Let's start over there on this side please.

QUERY These cracks apparently are confined only to the fins. Didn't you have an inspection 90 days ago, and was it then not determined, or it was determined that there were no cracks then?

KAPRYAN We did inspect the fins during the first week in August, shortly before rollout to the pad. At that time there were no cracks whatsoever. It's part of the stress corrosion inspection program that has been underway for several years. The material, the (garble) material for these fins is a corrosion susceptible aluminum. And we do periodically inspect. The requirement has been to inspect shortly before going to the pad and to make an inspection approximately every 90 days and within the last several days prior to launch following a countdown demonstration test where we actually load the bird with all of the propellants and the fins. This is primary a load bearing structure which actually supports the vehicle while it is sitting on the pad. So on all of the previous L-Bs we have performed that

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inspection at the same point in time that we did yesterday. This is the first time that we have detected any cracks.

QUERY What caused these cracks, or what do you think caused these cracks? And do you think age of the bird is a factor here?

KAPRYAN Number 1, we don't think age of the bird is a factor. It is the exposure of the material to the elements. These spars, of course, are of forged aluminum. And there are always residual stresses and components of this nature. And we were pretty certain the stress corrosion - We won't have a 100 percent feel for the total mechanism that occurred until we get the first fin removed and into the lab for failure analysis.

QUERY Mr. Kapryan, you said these were load bearing fins?

KAPRYAN Yes. They have eight holddown arms that support the space vehicle when it is sitting on the mobile launcher. And the fittings are attached to these spars on the fins. So the actual - total load of the bird goes through these eight fins.

QUERY The fins are related to the holddown arms?

KAPRYAN Well, they are attached to the hold down arm.

QUERY In other words, they are not interspaced; they are at that particular point?

KAPRYAN I'm not sure I understand what you are asking.

QUERY We don't have a fin and then two feet over there is a load bearing arm?

KAPRYAN No, it's at the bottom of the fin.

QUERY Now, if we loaded these tanks with the fuel as you have, and have just got these things covered with a coat of paint? Is this what has happened, apparently? Was the corrosion underneath the paint and just showed up when you put the weight on there?

SCHEIDER No, that is not the basic mechanization, we think, that does exist in the stress corrosion field. It can be pointed out we've got an alloy and heat-treated that we are susceptible to stress corrosion. Now to get any of the following, you have to have a certain stress level within the material, you have to have moisture present and a corrosive environment which definitely you have in a salt atmosphere. And time is involved as a part of the process. Now with those three factors there, you can be good today and have a crack tomorrow, yet the actual loading of the vehicle may have attributed to that final crack during the countdown demonstration test. But it is not the

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type of thing that you could have be covered up by paint and fail to detect. I think the inspections which were conducted the first of August showed clearly that we had no cracks, and the final inspections yesterday - yes, we do have cracks.

PAO

John, over here.

QUERY

Now, you said there is one crack in two fins and two cracks in six fins? Is that correct?

SCHNEIDER

That is correct.

QUERY

What are the sizes of these cracks?

SCHNEIDER

I believe the longest crack is approximately 1-1/2 inches long. And some of them have space (garble) long enough that you can basically put your thumbnail in.

END OF TAPE

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QUERY Have there been any more cracks detected in the rocket? I heard some report that there have been some other cracks earlier that didn't seem to be a problem.

SMITH We did detect in what we call 2 beams in some of the low bearing structure that attaches out to the fin. We did detect some cracks a few weeks ago, those have been repaired. They were stressed erosion cracks, also. Probably somewhat similar in low bearing features - different in low bearing features, but a similar type of crack.

QUERY How did you repair them?

SMITH Those cracks were in about a 10 foot forging maybe 12 inches thick. We were able to cut out the sections that were cracked and put in basically doublers and build back up our factor of safety that way.

QUERY What are doublers?

SMITH Put a second layer of metal on it and fasten it around.

KAPRYAN On the bird that we have on the pad right now, we only found one such crack. We initially discovered this on the 209 bird which is in the VAP. And we then inspected the one on the pad and we only found one crack. So we only have to make one repair on it.

QUERY (Garbled) bird in the VAP as far as cracks goes?

KAPRYAN As far as the 2 beams are concerned, we discovered three cracks. They have all been repaired. Last night, we conducted an inspection of all the fins and there are no cracks. I g., of course, the fins have not been subjected to any real load and they have not been subjected to the elements.

FAO All right. Go ahead finish your question, back here, please.

QUERY Where are the 2 beams and what are they? What are their functions?

SMITH Well, behind these fins there are boxlike structures that are in a row. In the center there are have 105 inch diameter booms to go and they go around the barrel that is in there. There's a basket-type structure on one side of the top and on the other side of the bottom there's a big forging about 10 feet long that has a cross member that you stick across to make that's in the shape of an F, webbed at the top and bottom in the lower. We found cracks along that center section in a few locations.

QUERY Mark, do you want to finish what would be the effect of these cracks if you were to launch without replacing the fins?

KAPRYAN We would probably have a failure in flight. We have a critical loading condition when we go

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through max cue, max dynamic pressure and with the condition that we have discovered with these lower bolts which are the tension bearing, load bearing bolts, we would have a factor safety of less than one when we went to the max cue, we would probably have had a breakup of the vehicle at that time.

PAO Howard Benedict.

QUERY What is the plan now for replacing these fins? How do you do it? How long is it supposed to take? That type of thing.

KAPRYAN Well, we have a schedule that which, of course, is subject to refinement. As Bill Schneider has indicated, we haven't ever done this on pad 39. We did do it previously on pad 34 and on pad 37 under somewhat better conditions than we have right now. We hope to be in position to start removing the first fin in the 8 to 10 o'clock time frame tomorrow morning. And we hope to be completed with the replacement of these fins by sometime on Saturday night.

QUERY How do you remove them; with cranes or what?

KAPRYAN Well, there are two ways to do it. We could use the hammer and move the mobile service structure back and use the hammer head crane for this operation or we also are looking into the possibility of leaving the mobile service structure in place and then we have handling equipment that we could actually install the fins without having to use the crane. We would have to use the hammer head crane in order to get the fins on the zero level of the lot initially. And, we are still working that and we won't make the final decision until some time later this afternoon.

PAO Mary?

QUERY You say that you feel that it is mostly corrosion and not age, but how could you explain that we have them now? We've had many IB's before and never had them and they sat on the pad a heck of a lot longer. And then why weren't they detected during the 3000 or along that period of time?

KAPRYAN Well, Mary, the inspection was performed after the 3000 run demo. We performed the inspection in the same way that we now as we did for the other bird. We did not conduct an inspection immediately. These particular beams are cracked and the others weren't. Right at this point in time, I don't guess we have an answer. We've still got a lot of work to do to analyze that.

PAO Red!

END OF TAP

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QUERY Walt, this sounds like two questions. But actually it is related. The Sunday definitive decision and extra fin. You get a crack when you reload. Do you anticipate the possibility of a crack when you reload and do you anticipate having to change another fin?

KAPRYAN Well, I guess - let me say, we don't - we do not anticipate a recurrence because of the time element to the minimal exposure that the new fins will have to the elements in this corrosive environment. However, we are not certain, so at the present time it looks as though we're gonna have to go in, like we did on Skylab II, and load the bird early and have several hours in our countdown after we've got all the propellants onboard to send an inspection team out to perform a final inspection just a few hours before launch.

QUERY Not on Sunday, then?

KAPRYAN No, that will be done on launch day. The Sunday decision is based primarily on our wire activity and how well we have done with the replacements. And then by Sunday we also hope to have some feedback from the failure analysis.

PAO Rusty.

QUERY We wanted to get this crew in early because there was some problem with the cooling system and we're putting them off quite a few days. What effect is that gonna have on that system?

SMITH Well, it'll give us more uncertainty about what its status is gonna be when we get up there. We had anticipated that we would get a low level warning on the 11th. The latest data said that the low level warning would probably come a few days later than that. If we get a low level warning, that doesn't represent disaster. That means we have reached a point where one time during the day we've gotten low pressure. We still have several weeks of operation before - based upon the primary loop experience. We had several weeks of operation before anything happened that we'd worry about. It gives us - we'd like to be up there, but it's not disaster. Not a disaster.

PAO For Donalby?

QUERY From what you said about what you think what caused the problem. Can we assume the little Earth tremor we had here, 2 weeks ago, had nothing to do with it?

KAPRYAN No, I don't think it had anything to do with it, Tom. I don't think so, now - I can't just give you a positive answer because we didn't go back and perform

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that inspection at that time. But we're pretty certain that it did not.

QUERY What, specifically, are these corrosive elements you're talking about? How many fins are you gonna have to remove, and how big is a fin?

SMITH The corrosive element we're talking about is salt - chloride. I don't know the exact size of the fins.

KAPRYAN The fins - each fin weighs roughly 485 pounds, and I guess I would just guess - I didn't check the dimensions, looks to me like they got about 30 square feet of sail area - frontal area, on each one. About 30 square feet, and I was just guess at that thing.

PAU I can - we have the dimensions of the fins down in the newsroom or Joe Jones, back here can give them to you.

KAPRYAN We are planning to replace all eight fins.

QUERY Couple of - two quick ones. Mr. Kapryan, when you say - you anticipate a breakup of the flight. Are you talking when you gimbal your engines and actually aim for your keyhole in space, this is the stress you're throwing onto the fins themselves?

KAPRYAN Doug, let me defer that one to Dick.

SMITH It's not actually in the gimbaling of the engines itself. It's when we go, really, through the maximum dynamic pressure range. Shortly after Mark 1, we get the (garble) air dynamic load off - buffeting and all on those fins. Now, I predicted breakup. We do that on a - what we call a free signal or basically a work case condition. Normally you never fly that type of condition, but we make all our risk assessments based on that type of profile. So, under that we're very marginal, maybe slightly less than the factor of one. But, in a normal mission you - you know, good chance you don't have that high a load. But you don't take that type of risk.

QUERY The first fin that you will remove, will this be immediately sent to Marshall for your finite test?

KAPRYAN Our thoughts at this time is we have materials people here at the Center, from Marshall and Chrysler. We will do the initial look here, to get a quick look assessment. We say stress corrosion and we think that it - we want to verify that. Then we will probably take the remaining fins back to Marshall for more detailed analysis.

END OF TAPE

SL-IV PC-3D/1

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QUERY If these are load-bearing fins, how do you remove fins while the thing is still on the pad?

KAPRYAN Well, we of course are going to drain RPI later today, and so the weight that these fins will be supporting will be much much less than is supported just prior to launch when we have propellants onboard. And there is sufficient strength so that we think we could even remove two at one time, but we're not planning to do that right now. We're just going to remove one at one time. As a matter of fact, when we installed the fins initially in the VAB, we installed four fins and it sits on a fixture with four fins supporting the weight configured condition that we will be in.

PAO Mark.

QUERY I was just a little curious about the failure analysis that you are talking about. What conceivably could it be other than this? And what would be a worst situation for you in a failure analysis that this?

KAPRYAN I can answer what would be the worst condition. We fully expect it to be the stress corrosion type crack, if it was purely a tension crack not associated with stress corrosion. This would indicate probably a deficiency in the forgings that had not previously been detected, and that could be worse case situation. I doubt very seriously that we run into that. The probability of that is very low. We are of course going back and researching the history of each of these forgings to see if we can determine any indicator of deficiency.

QUERY What type of thing do you do in this failure analysis? What type of tests do you run them through?

KAPRYAN It's primarily a cutting and polishing and examination of the grain boundaries, the types of cracks, the grain structure, a metallurgical-type examination of that nature. It's not a testing pull-test, or that type of thing.

PAO John.

QUERY This touches on John Wilfred's question a little, I think. I don't see yet how you can take one fin off if they are all bearing weight. How do you relieve the weight on the one fin in order to remove it and then replace it with another?

KAPRYAN Well, the load is fairly evenly distributed all around the fin. There are eight of these and the center distance is such that in the early condition, we're not quite dependent on all of them. We can have several of these fins off, and the other will have sufficient margin to support the weight that we will have. We see, on launch day we will be working several million pounds of a million pounds. We're working a lot less than that now.

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SMITH (Garble) I think the point that is being missed there is adjustment capabilities so that we all carry an equal load. If you back that adjustment out and you off load that one fin, you can take it out.

KAPRYAN Yeah, the hold on can be adjusted just like a jack.

PAO Ed Fitts.
QUERY is there a possibility when you analyze these that it could be less serious than what you think now?
SMITH No, I don't think less serious. I mean from what we see, we've got definite cracks. There are fairly open cracks indicating that the load has redistributed. Yes, I'm sure that those bolts are taking some load, but from a safety standpoint, we assume that they are taking no load, and would not take a risk on that basis. So I don't think it would get better.

PAO Howard.
QUERY I would like to ask Mr. Schneider a couple of questions. First, would you describe what you mean by a low level warning on the secondary coolant loop? And if you do get that warning, can you still reservice it? And the second question is, would you still consider an 85 day mission if you launch 5 days late?

SCHNEIDER Okay, the low level warning occurs whenever the pressure in the coolant loop reaches 19 psi. It gives us a warning that says you have 19 psi. The pressure in that loop, because it's a closed system and it's subjected to the thermal stresses, varies from time to time during the day. So you may get down to 19 psi for a short period of time. We have not reached that point yet. When we do, the system will just keep right on operating. The pumps don't begin cavitating until they get down to around 5 psi. I believe the Skylab 3, I've forgotten whether it took 2 weeks to go from 19 psi to 5, but some number of days. With regard to the question, and yes it can be reservices if we get below that pressure. We can reservice at any pressure.

END OF TAPE

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SCHNEIDER The question of whether or not we would go 85 days, the Skylab is still planned as a 60-day open-ended mission and we will make that conscious decision on a weekly basis and we fully expect that we have the capability of going 85 days and we'll have to be continually watching the systems toward the end of the mission to see whether or not we can. So we plan no changes in our mode of operation.

QUERY How many cracks have been detected? How long is this rocket been on the pad and is it one that has been on it the longest of all?

KAPRYAN Not the one that's been on the longest. It's been on the pad since the fourteenth of August. And there - we know that we definitely fourteen cracks. One on each of the eight fins and another one on six of the eight. We have another one that is questionable, it may or maynot be a crack. But we have another one that looks questionable but we - we've determined that is is not a crack. So at the most we feel that we could have fifteen. We know we have fourteen.

QUERY Why - why can you say that you don't think age is a factor because these fins, as I understand, are something like eight years old and even with all the care, I understand that some metals undergo deterioration with time. Why can you rule it our, in other words, as not being a factor because you've never had a problem of this kind and we've had corrosion a long time.

KAPRYAN Well, first the environment that these fins have seen for the last years has been a controlled environment so that there have been no conditions conducive to corrosion. And then secondly, the fins have been subjected to any loads that would increase any - any problems that might be there, should there be any remaining residual stresses. We know that these forgings do have residual stresses, so it's a question of not being subjected to a loaded condition in a corrosive environment that we're saying is we - we feel we're in pretty good shape.

QUERY To Mr. Kapryan. Are you getting your new fins off the 209 vehicle and if so, which vehicle would serve as your rescue?

KAPRYAN We are not getting them from the 209 vehicle. We are getting new fins shipped in. By noon tomorrow we expect to have twelve fins here and as you know, we need eight. We would not want to recover the fins from 209 because we'd then have to do a replacement and we plan to use 209 for the rescue mission, if that's required.

PAO Tom Neldon. Ex - excuse me, go ahead.

QUERY Would the 209 vehicle then be used for the Apollo-Soyuz link-up then?

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KAPRYAN Yes, we - if we do not fly 209 for rescue, we are thinking very strongly of using 209 for ASTP.
QUERY Therefore, if it was used for rescue, then would that negate the Soyuz-Apollo - -
KAPRYAN No, we have another bird in the - in the stall.

SCHNEIDER You've actually got two. You have the 210 vehicle and the 211 vehicle.
SPEAKER Tom Neldon.

QUERY Mr. Kapryan, when was the last time there was a serious enough problem with the launch vehicle to delay a manned shot?

KAPRYAN I guess I can't - (garble) as far as the Apollo is concerned, I can't think of any manned launch that was delayed as a result - He said launch vehicle.

PAO Oh, right.
SPEAKER Kapryan, I don't believe a Saturn (garble) has delayed a launch.

KAPRYAN Not a manned launch, anyway. I can't think of any.

QUERY I'd like to know if there are any other exterior parts of the vehicle made of the same material as the fins, and if so is there a chance that you would predict anything might go wrong with that?

SMITH There are other exterior parts that are made of material - I won't say specifically this material because there are a family of materials that are susceptible - that have the potential of the same type of phenomena. These are routinely inspected, as this one is done. Most of these are not in as heavy a pressed area as these particular forgings. And (garble), we don't expect to see a problem there. That's why we looked, of course.

PAO Doug?
QUERY Would these parts - two questions, one - Would these parts lend themselves to X-ray techniques? Because they're aluminum at all?

SMITH They - they lend themselves to X-ray techniques, but this type of phenomena you - you don't have a crack today, and if you took an X-ray and it's good, and tomorrow you got it and you can see it, so - -

QUERY But the fissure might be going down a lot deeper than the outside instructions reveal.

SPEAKER The X-ray would show, perhaps.

END OF TAPE

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the bottom of the crack, how far it went down. But the surface of the crack, either was visual or using a dye on the surface, a (garble) type dye, you can detect it without X-ray. In fact, normally that type of detection is more positive than X-ray.

QUERY On the load bearing factor, would the hold-down arms, themselves, really take the full blunt of the loaded vehicle, as opposed to the fins?

KAPRYAN Well, yes, they do. The load is transmitted from the vehicle to the launch pad or the launch table through these hold-down arms. Yes, they have that strength.

PAO Mary.
QUERY How much will it cost, in terms of hardware cost. How much will the new fins cost? And how much will it cost to delay the mission, say five days, and then again ten days and what is your best guesstimate on whether it really is going to be five or ten?

SCHNEIDER I'm afraid I don't recall how much these fins cost to originally purchase. They exist now. They are in - they were in New Orleans and they will be here. They were spare fins. Or at least, we had spare fins on the inventory. As far as how much it would cost to extend the mission, at the end of the Skylab Mission we expect to be spending maybe a hundred, two hundred thousand dollars a day, and it will be depending upon just exactly where we are in that range at the end of the program. What was your third question, Mary?

QUERY I meant the cost of the delay, if you have to delay five days at the beginning, I mean for the launch.

SCHNEIDER Doesn't matter; it really comes out at the end.

QUERY Two hundred thousand a day? Somewhere?
SCHNEIDER A hundred, two hundred thousand a day.

Yeah.
QUERY And then I wanted your best guesstimate at this point in time, of what - sort of pros and cons of whether we wait five days or ten days.

SCHNEIDER Okay, as Kappy said, we have a schedule, that will lead us to a launch five days from now. As we've said, this activity, although we've done it on pad 34 and 37, we've never done it on pad 39 and the conditions on 34 and 37 for doing this were better. So a wind condition or something that we haven't anticipated might cause us to feel that we needed a few more days. Right now, the schedule

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says we can make a launch in five days. We'd like to be conservative and not say that we're sure we're getting that until after we've gotten well into the change out and have understood exactly the magnitude of the change out job. And, we expect to do that on Sunday. And so it's a reasonable bet for the fifteenth but, certainly, not a sure thing.

PAO Herb Gold.

QUERY If you do have to take it back to the VAB. How far would that put you off?

KAPRYAN We would - If we have to go back to the VAB, we'd probably mean, roughly, on the order of a twenty-six or twenty-eight day turnaround. However, we don't anticipate any requirement to go back.

QUERY If the wind problem arises, so that you cannot use the mobile cranes or the hammerhead crane, would you go back to the VAB?

KAPRYAN The forecast that we have from the weather people is relatively favorable one up until next Sunday. And, we expect to have the fins replaced by Sunday. If we see winds in excess of twenty to twenty-five knots, we may have to hold up the operation for an hour or two. The weather people tell us that if we see gusty conditions, it's just gonna be relatively short duration. It's not gonna be an all day kind of thing.

PAO Howard.

QUERY I have just a quick question. Where will the failure analysis be conducted on these fins? Here or at Marshall?

KAPRYAN The first one we anticipate doing here and Kennedy's facility. The remaining ones, we'll probably carry back to Marshall. That has not been firmly decided. It's being worked right now.

PAO Doug?

QUERY Manpowerwise is it just a few number of people able to work in a small area? Or does it help to have more men on the job, or will you three-shift it or four-shift it? How will it work?

KAPRYAN Well, we will be working around the clock, Doug. We don't really - see, right now, we're saying we're constraining ourselves to just working on one fin at a time. Since we do have a degraded set of fins, we don't want to remove more than one at a time, so it's not - manpowerwise, we can shift people and we don't have any real concern as far as the fatigue factor is concerned, if that's what you had in mind.

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PAO Ed Fitts
QUERY Can you give a better description on
the size of the forgings? Are they bolted right to the
locks tank or just what does it look like where this
problem developed?

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KAPRYAN These particular forgings of these fins are bolted to a box beam structure, part of which is built up with these E beams that Dick Smith referred to earlier. The fins are actually bolted to this box beam structure, not directly to the tank itself.

QUERY (garble).

KAPRYAN Into the boss beam. I think Dick will give you a little better field for it.

SMITH Now this is a cut away of the fin without the outside skin on it. What we're talking about is this. There's one on this side and one on the opposite side, and then a similar spar at the top. And these are the two areas of attachment into the vehicle. Now you see a rib in this spar and here a dot indicating a bolt hole. There's a bolt hole here and here and a similar thing on the other side. What we are finding is a crack from the bolt holes on the bottom side going into this outer surface of the forging. And we've got that on one side of all eight fins, and on the other side of six, and one question.

QUERY What is the approximate size of the forging thickness and so forth?

SMITH I don't have that information, I would estimate this to be probably about an inch thick.

KAPRYAN I think that right where we have the crack, the wall thickness of the flange is on the order of a half an inch.

QUERY One question I don't like to ask but what would happen if somebody on the night shift or on any shift had gone around with a hammer and chisel and just whacked each one?

KAPRYAN Well, I guess this would be pretty bad, but these cracks are not that kind and nature did this to us. Now after we have the flight readiness test, Doug, we have the buddy system out there and we never have any one person there by himself.

PAO Do you have any more questions?
Go ahead, Don.

QUERY I just wondered, what time was this discovered last night? I wondered why we didn't hear about it until this morning?

KAPRYAN Well, I was having a launch readiness review with all of my contractor base managers. And about 3 o'clock, after Pat Young got through telling us how good a shape we were in with the first stage, he got a phone call in the middle of our meeting and said we had some indication of cracks in at least one of the fins. Now that was at 3 o'clock in the afternoon. Now you want to

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bear in mind that we get many many reports of this nature throughout the flow. So it was several hours later, and we had our telecon so that all us guys, the management and in the technical experts could get together. And that was an after midnight telecon when we really determined what we had and what we had to do.

SCHNEIDER And there was a notice put out at that time; sometime after midnight.

QUERY You said something about the possibility of some forging problems. Is there any significance in the fact that the cracks were discovered in all eight fins not just one or two, but all eight?

SMITH We are researching the history of those forgings to see if we can determine some common factor there. That's undergoing now.

KAPRYAN We don't have the answer yet.

SMITH It really says that all of the were very uniformly made.

QUERY If they don't launch on the 15th, which other date is intended?

KAPRYAN We go in 5-day cycles. We have the 15th and 16th of November available to us. And then if we should miss that, we have the 20th and 21st, I would assume.

PAO Are there any other questions? Okay, just for your information, we'll be keeping the News Center opened. We'll be on essentially a daily work basis, 8 to 5 until we get to T minus 5 days which I believe is Saturday now. And then we'll run 7 to 7, again. We'll put Duty Officers on and also if anything happens at odd hours and so on, we'll be sure to let you know. Thank you very much.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - PRIME CREW PRESS CONFERENCE
Johnson Space Center
October 3, 1973
8:34 A.M. CDT

Participants:

Gerald Carr, Commander (CDR)
Edward Gibson, Science Pilot (SPT)
William Pogue, Pilot (PLT)
Jack Riley, PAO

SL-IV PC-2A/1
Time: 8:34 CDT
10/3/73

PAO Good morning. This is the final pre-mission conference with the Skylab-4 crew. From your left, the commander, Lieutenant Colonel Gerry Carr; Science Pilot Dr. Edward Gibson; and the Pilot, Lieutenant Colonel Bill Pogue. We'll go right to questions. Bruce Hicks.

QUERY Gerry, how do you stand in your training right now? At what point are you?

CARR As far as the Command and Service Module training and workshop systems training is concerned, we're finished. We're just in a mode now where we're maintaining proficiency. We got into this position in order to be ready for the possibility of a September 25th launch to either rescue or to possibly just man the workshop early. We're now over that phase. So we're ready. Now the mode of training that we find ourselves in is proficiency as far as systems is concerned. And as far as the ATM work; and as far as the Kohoutek comet work is concerned, we're just kind of in the beginning now. A lot of our procedures for ATM are being modified. They're not major modifications. But they're definitely modifications which we'll have to re-evaluate in a training cycle. And the comet work, we deliberately held off until we got a complete evaluation of just exactly what we're going to do. So the things that are left to go are preparation for observation of Comet Kohoutek and the latest updates in our solar observations.

QUERY What equipment is still not ready to go? Several of the experiments, I assume? And what - How much would your flight have suffered, other than Kohoutek, had you had to have gone, say, in September?

CARR As far as I know, unless anybody knows anything different, I think all of the experiments are ready to go. And the only experiments that weren't ready were the Kohoutek experiments.

QUERY What would your flight have suffered except for Kohoutek had you had to go in - in the evaluation of your training and really being ready?

CARR In the evaluation of training and the whole works, I think we'd been almost completely ready. Because, as I mentioned, the only training we left out was the more advanced solar physics training with the ATM and the Kohoutek training. And I'll defer to Ed Gibson a little bit on some of the ATM training that was left to be done.

GIBSON Well, we've learned a fair amount from the first mission. And we're learning a lot, and have learned a lot over the past couple of months from the second mission. And we've tried to incorporate this into our observing programs. Incorporating that takes a fair amount of effort and coordination. And we just didn't have the time to do that had we gone up on the 25th.

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PAO Arthur Hill.

QUERY I do - Of course, you'll end up doing what - as far as launch date, what the administration says to do, but do any of you have any preference as to whether you go early, that is November the 11th, or the 21st, or how do you feel about the priority of the importance of observing this comet? When would you like to launch the flight, ideally, if you had that power?

CARR Well, I think - I think, the date that we've got is probably the best date that we could have. The observations of the comet are definitely important. They can be adequately covered with this particular launch date. I think that if we swung the launch any later, in order to better bracket Kohoutek, that we would suffer the effects with Earth Resources observations. And Earth Resources are certainly one of our prime missions and prime objectives. And so, I would be very reluctant to sacrifice the first Earth Resources period in order to get Kohoutek. So, I think, right now we've got about the best - the best compromise that we can get.

QUERY Well in that case, what do you think about the possibility of extending it to 70 days? How do you all feel about that?

CARR We're extremely interested in the idea of extending for 70 days. And as we understand it right now, that management is giving it consideration and that it won't be until something like the 20th - like the last week in October when they finish the medical evaluations on the Skylab-2 crew, that they'll be able to give us a go ahead on going for 70 days. If we go 70 days, we will very nicely bracket Kohoutek, as well as, get our early Earth Resources work that we want to get done.

PAO Arthur Lord.

QUERY This is for any one of you. Can you tell us if you have talked at all, to Alan Bean's crew about their physical condition? And if you have, have you learned anything from their experience in the Skylab-3 mission?

PAO Bill, why don't you fill that one?

POGUE Yes. We have talked to all of them, of course. Had quite a long talk about the physical conditioning. Captain Bean is convinced that, as I think, he indicated to you yesterday, that exercise is the answer. They've been in the gym every day since they got back and they look pretty good, as far as I'm concerned. I don't see a thing wrong with them. However, I'm sure, the medical people can give you more technical and accurate evaluation. They're all convinced that there's nothing to preclude an extension to our mission. At least, they're confident to that extent.

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And they appear to be in excellent physical condition, with the exception of any sort of thing they may have mentioned to you yesterday.

QUERY Are you going to do anything different during your flight, as a result of these discussions with the Bean crew?

POGUE Yes. Partly, as a result of the discussion with them, and also, as a result of some developments in the exercise area, we intend to use another device to exercise the large muscles in our legs under a force, which will roughly simulate a one g environment. And, I guess, accurately, this device could be described sort of as a poor man's tread mill. But it does enable us to exercise the larger muscles of the legs, which are not stressed by the present exercising techniques.

PAO Mary Beth.

QUERY I have a couple of questions. First of all, how much exercise y'all intend to do? And then secondly, Dr. Homick said yesterday at a press conference, he believed that in looking for answers as to why the first crew didn't get motion sickness, you know, in the first part of their journey and the second did. He thought perhaps that an emotional factor entered into it. The fact that the Conrad crew was sort of charged up and a lot of adrenalin because they were expecting great problems, and the second crew was more relaxed. How do you look towards your first stays in space? Do you think you'll have a problem? Are you going to take scop/Decx? Or what are you going to do?

CARR Well, let's see. We'll have to start at the beginning on that one. (Laughter) Physical conditioning, I think that we'll probably schedule an hour a day, which is the same that Al Bean's crew scheduled.

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SPEAKER - - physical conditioning. I think that we will probably schedule an hour a day, which is the same that Al Bean's crew scheduled for physical conditioning, but undoubtedly we'll sneak in as much as we can on any spare moments. I think this treadmill, poor man's treadmill that Bill Pogue was talking about is probably going to be an extremely valuable device. I would - I don't know if you have gotten any data on this thing, but it is extremely simple, and I think either drawings or something like that can possibly be made available so that you can see exactly what it is. I think that it would take more time than what it is worth to describe it to you, but it is a very simple little mechanism that works very beautifully. As far as the motion sickness problem is concerned, I think Dr. Homick is probably got a pretty good idea there. It seems to me that if you got enough adrenalin and pumping, you just don't have time to get sick. And I found that to be the case in any motion sickness situation, at least in my experience. That if you are busy doing things yourself and the old adrenalin is pumping, you really don't, the brain apparently can't cope with the idea of getting sick while it's busy doing other things. So I think that's probably reasonable as far as our mission is concerned, we're kind of half way between the other two. We're looking at a mid day launch time, which means that we probably are not going to be able to activate the workshop on the first day, which means that as soon as we get docked, and then get that possibly the probe and drogue out of the tunnel, it will be time to go to bed. So we will somewhat remain somewhat confined during the first day which should probably help the motion sickness situation because most of us are convinced that you get motion sickness problem primarily from moving around in large spaces. And so we think possibly that will work in our favor. We certainly hope that we don't have as much adrenalin pumping as Pete and his guys did. I'd like the mission to be a little bit more routine than that. However, we're prepared to cope with just about anything that can come along.

PAO Bruce Hicks.

QUERY Ed, what were some of the things that Owen passed on yesterday during the debriefing that they had with you all? What were some of the changes that they recommended in say not the ATM viewing and so forth which is being, I think, revamped already? But what were some of the things, maybe operational that were discussed that they recommended changes in?

SPEAKER You mean in the ATM area or overall?

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QUERY Overall.

SPEAKER Okay. I, unlike Bill, did not get a chance to talk to him. I got a chance to talk to Owen for around 5 minutes. And I did talk specific things in the area of ATM to him which had hardware impact at this time. I'll just mention those real quickly. One thing that they found out they were able to use what we call an XUV monitor to great advantage up there, in order to look for several new things that we found on the Sun. We're taking along another long persistence scope which allows us to see these very faint and subtle features much better. And hopefully, we can get a little better handle on some of the new things we've observed on Skjlab I and II.

QUERY In the operational area, was there anything that - -

SPEAKER No, I did not discuss in detail any of the operational areas.

SPEAKER A couple of fancy holidays, Christmas and New Years.

SPEAKER Well, we might go EVA on one.

SPEAKER They're talking about an EVA to watch Kohoutek on Christmas day. That seems to be getting a lot of attention and evaluation right now. As far as anything special that we're going to do on either one of these two holidays, I really would prefer not to say anything right now.

SPEAKER We don't have a tree stowed in the command module. We don't have any trees.

QUERY What are your present plans for reserVICING the coolant loop in the workshop?

SPEAKER Well, right now the servicing of the coolant loop looks like pretty much the same kind of job as your refrigeration man does when he comes out to the house to recharge the freon in your air conditioner. We have one of those neat little saddle valves that you can just strap onto a pipe and cinch it down, it punches a hole in the pipe, and then you can load it. That's essentially what our system is. We have a tank which is going to carry coolanol. We'll take it up, strap a saddle valve onto the coolanol-primary coolanol line, cinch it down, and then connect up our coolanol tank and pressurize the tank with nitrogen from the spacecraft, and just fill the system up again. And right now it looks like a very simple procedure. Bill and I have both trained on it. Bill is going to be the prime guy to do the work and I'm going to be the chief photographer. And we hope to be able to send back some good pictures of just exactly how the job was done and what problems were run into.

END OF TAPE

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SPEAKER - - Be able to send back some good pictures of just exactly how the job was done and what problems were run into.

QUERY What all does this involve?

SPEAKER The tank carries 6 gallons, as we understand right now. And it will probably only take two of them - two gallons to completely service the loop again. So essentially, right now, we have enough coolanol to service the loop three times, although right now, we're up against the wall on command module weight and I wouldn't be surprised to see that we reduce the amount of coolanol in the tank in order to keep the weight down.

QUERY I'd like to ask you, what better observation can you do EVA on Kohoutek than you can with the instruments and from the Skylab - interior of the Skylab itself? What the purpose of observing EVA?

SPEAKER Okay. One of the problems we have with the instruments being inside is we have to roll the whole cluster 90 degrees to use the one good airlock that we have remaining. We plan to use the articulated mirror system, which is just a mirror which allows us to look around the corner in order to make some observations. But that does take it's toll in terms of the attitude control fuel and other considerations thermal. So we'd like to be able to get some fairly long duration observations all at the same time, with some specialized instruments that we can work inside or outside, but it's really the duration of the observations.

PAO Jules Bergman, right behind you there.

QUERY Ed, how much of Kohoutek and what you do during that EVA will be visible to the eye or the television camera?

SPEAKER It depends when - on the 25th, we may be able to get some IV. That I'm not certain of. I haven't looked at the practicality of that. To the eye back here, you probably will not be able to see much until it goes past perihelion and it shows up at - well you can see it in the morning. Let me put it this way. Before perihelion you can see it if you want to get up early in the morning.

QUERY Like 4:00.

SPEAKER 4:00. Essentially an hour before sunrise. Most people will see it, though, after the 28th, or the 28th and subsequent for maybe about a week or so, when it will be most visible from the sky here on Earth. That's when it will be the largest, because it's just gone by and gotten the maximum solar heating and has expanded and become largest and brightest and also, it's at nighttime, 5, 6, 7:00 in various parts of the country and you'll be able

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to see it very well.

PAO

QUERY

Mary.
The pocket mice that they had and the vinegar knats came to an unfortunate end. And the people told me they had a backup package, and I wondered if they were going on this mission. They were going to try to get it on, it was my understanding, or do you have any other live passengers?

SPEAKER

The answer is no. I think the vinegar knat and pocket mice experiment probably fell off because of the weight limitations we're up against. We're definitely not taking that experiment with us and to my knowledge, there are only three live passengers going up. I just might add one thing. We kinda brushed by Kohoutek. I think our attitude as a crew about Kohoutek is that we consider that portion of our mission to be an extremely nice bonus that's been tossed in. I think the people in the field of astronomy feel that the Comet Kohoutek is probably one of the most significant things that's happened in the last hundred years. And they're extremely interested in getting the data. We feel very, very fortunate that we lucked out and Skylab is going to be airborne about the time that Kohoutek was coming by. But I would like to emphasize again, that Kohoutek is not the prime objective of this mission. The prime objective of this mission are still the three prime objectives that have been in Skylab since its inception, and that is the medical aspects of extended flight, Earth observations, and solar observations. But we consider Kohoutek to be a very beautiful added bonus that we just kind of fell into.

PAO

Okay. We'll take a few minutes for photography and then we'll start the individual interviews. We will start early, so for purposes of your schedules, we'll start the individual interviews at 9:00, which will move you ahead at 20 minutes on your schedule.

END OF TAPE

SKYLAB NEWS CENTER
Houston, Texas

Skylab IV - Mission Profile
Johnson Space Center
October 2, 1973
2:44 p.m. CDT

Participants:

Marlowe Cassetti, Guidance and Dynamics Branch
Milt Reim, PAO

SL-IV PC-1A/1
Time: 14:44 CDT
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PAO All right, we'll get started here. We have Marlowe Cassetti the Mission Planning Manager for Skylab. And we'll let Marlowe get started.

CASSETTI I have some hand outs too up here. You want to go ahead and pass them out? We've got a lot of additional information that isn't on these charts you might want to jot them in. Yeah, a little of each. Can I have the first viewgraph please. I think they are all - just show them in order on the center screen would be fine. We're going to be talking about the mission profile and some of the considerations we have had on mission planning. And a lot of this information will be a repeat of some of the data and back ground that was given by some of the earlier speakers. Al Bishop in particular. So I'll try to breeze over those. The next slide, please. I'll try to cover some of the major events, some of the aspects of launch window, lift off times, et cetera, some of the details of the rendezvous plan. I'll talk briefly about the EREP passes. We've already heard most of that about the opportunities, and some of the kind of mission information. Next chart, please. This is kind of an over view of some of the history and some of the planning. The first vehicle, the Saturn 5 orbital workshop of course was launched on May 14th at 12:30 p.m. Houston time. The Skylab II launch was 10 days later than the anticipated or the planned May 15th date with lift off on May 25th of course following all of the problems, micrometeorite shield, the solar array, anomalies, and so forth. We flew it for the full planned duration of 28 days. And of course it landed on June 22. I've got some information here you can play around with elapsed times and so forth. This convention is day of year, starting off January 1st at day 1, hour and minute Greenwich mean time. So you can basically just subtract the landing from the launch time to find the duration elapsed days, SL-II the first manned mission flew 28 days. Skylab III we lifted off on July 28th in the morning, and as you know we landed this past Tuesday on the 25th at 5:20 p.m. These are all Houston times I'm quoting. The total duration was 59 days 11 hours and 9 minutes. Now originally we planned this mission for a 56 day mission. And the decision was made about a month before committing before the launch of that mission to extend the, to get a 3-day extension to bring the ground track that was off the Pacific, U.S. Pacific coast about a thousand miles away to march the ground track in or wait subsequent days to get a couple of hundred miles from San Diego. It was the experimience from the first crew, who landed out in that area, by the way, the thousand miles away

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It was the experience - the medical experience with the crew that they found that - a bit of a problem to distinguish what some of the effects of the space flight was from the rolling motion of the ship and so forth. They weren't able to - they felt it would be better to being closer to land and get the crew to - to steady - a steady base and do the experiments there. So we had the emphasis then to get back into - into San Diego and as you know, we were less than a days steaming away from there. That's how far we're planning a launch on November 11th at 10:04 a.m. central standard time or if you will 11:04 a.m. eastern standard time. The mission that's based lined, as you heard from the discussion of Mr. Kleinknecht and Bishop is a baseline of the 56-day mission. We will land January the 6th at 4:44 p.m. central standard time. The landing for this particular time and date will be off the Hawaiian Island chain in the mid-Pacific area as we call it on an ascending ground track. As oppose to the landing area for Skylab II and III, which were descending ground tracks off the coast of California to recovery in San Diego. Reason for that, during this time - the orbit and time of the year and everything that descending westcoast pass is at night. It's - it's not available to us to land. We prefer going there. It's easier task recovering out of there. It's no big deal to recover out of Hawaii. I'll talk about that sometime when we get to end of missions. As Mr. Kleinknecht described, or as he told you some of the benefits of extending the mission longer, contingent upon the medical data. We - and this is where I don't have a lot of information in my hand out so if you will you may want to copy some of these numbers down. The extension to January 19th gives us a total ellipse duration of 69 days, 6 hours and 56 minutes. The landing would be on January 19th at 5 p.m. central standard time, rough time - a few minutes either way from there. It's - which is 6 p.m. eastern standard time. Now, the reason that we are going off an oddball increment, first of all, it may be a little confusion, about what's 60 days and what's 70 days. As far as ellipse duration goes, first day is day zero, course but it's elapse day 1, so this would be the 70 - the January 19th is the 70th mission day. It happens to be 69 elapse days, there is a little bit of confusion when you talk mission days and elapse days, as far as elapse record goes or a total duration of the mission, that's why we refer to it as 69 or 70 day mission. Why are we going on November the 11th? Well, briefing we've been - it's obvious to get good coverage of the Kohoutek comet, which of course is the main driver on this mission. It was advisable to go in the time frame of November 11th and terminate sometime around the middle of January. Comet Kohoutek has perihelion passes, the closest approach to the sun on December 28th and with the

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mission time frame as it is, we will get good opportunities to see it preperihelion be able to observe it through the perihelion of course and have some days post-perihelion. As Al Bishop mentions probably our latest date is about January 3rd for Kohoutek observations and EREP and those kind of experiments because we have to start closing down the workshop, deactivate it to come home on the 6th, extending of course to the 19th, we and don't want to belabor the issue but we certainly have many more days - -

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CASSETTI - - extending, of course, to the 19th we -
And don't want to belabor the issue, but we certainly have
many more days of Kohoutek observations available. The
anticipated closest approach to the Earth, right away, occurs
on January 13th. Now the comet is not as brilliant as it
is on earlier days when it is technically further from the
Earth but closer to the Sun and getting a higher amount of
solar interaction and throwing off a brighter tail, et cetera.
But, as it was mentioned, the scientists are interested in
observing both pre and post perihelion to ascertain the chemical
and physical changes that take place. This is a - and I'm,
by no means, a comet expert at all. As I understand, as
comets go, this comet does pass very close to the sun. It's
0.13 astronomical units, which, I think, worked out to be
some 13 million statute miles from the Sun, or, I think, about
13 solar diameters away, somewhere in that time frame. So
this is basically what's setting our launch date and landing
date. Of course, there's the big factor involved in picking
a launch and landing date, of course, not only for Kohoutek
observations but the program cost as Mr. Kleinknecht had
mentioned. Next slide, please. This is a rather busy chart
and it may take a little while to study it. I presented it
before at these press briefings and I think - I don't know
whether it snowed everybody or everybody knew what I was
talking about. But basically this is a normalized chart that
tells when lift-off times occur. Before I go into a detailed
explanation about lift-off times and so forth, I should caution
you that we have somewhat of an uncertainty in predicting
exactly when lift-off time, and even day, will occur. The reason
for that is a sort of many fold. I'll give you a couple of examples
of what has happened. Most of this information was developed
in the trajectory data generated during the Skylab 4 mission
before we undocked. Now undocking gives the workshop a slight
impulse because for every action there's an equal and opposite
reaction. When we spring the command and service module
away from the workshop it pushes it a little bit more. But
that's not too readily predictable so that - that impulse
has then changed our orbit slightly. And slight changes
to the orbit on our deorbit day, which was the 25th of September,
tends to propagate so that when we reach lift-off day on
November 11th, it could change the time of day in which we pass
over the Cape. Also, we're not a 100 percent clairvoyant in
knowing exactly how the atmosphere is up in these high altitudes.
It does have a periodic variation and so forth. And so there's
an atmospheric drag uncertainty that the drag is always
continually dropping the altitude of the workshop very slightly.
But that changes its ground track. Then another thing that came
up that was rather unusual on this mission that we didn't see

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on Skylab - on the first manned mission - was that that we started doing the lower body negative pressure experiment on the crew at a fairly periodic time in the orbit. And every time we got through using the experiment invented for - Every time we vented through the experiment vent on there, it gave a little push to the vehicle. Normally, venting like that kind of randomly happens in orbit so its not contribution is generally zero, but we started seeing this in our data. The vehicle appeared to be dropping in altitude much faster than the atmosphere could ever account for. And we believe that it's the venting from the lower body negative pressure device. That may have been - That may be some of the reasons why we're predicting a slightly different orbit than we were. Now compounding on this, and there may have been some confusion a few months ago when they announced the date as November the 9th. There's another compounding problem and that is that Skylab was originally designed to be in a repeating controlled orbit that flew over the Earth every 72 revolutions. And Skylab-2, because of the Saturn-1 problem - Skylab-1 problem, we weren't able to get up to the vehicle until some 10 days later than we had anticipated. And when we got up there, in order for us to set the orbit at the right repeating altitude and so forth, would have cost too much fuel out of the reaction control thrusters. So we weren't able to get back on the right track. We were about 50 miles off, to the east I believe, east or west. Well, then we got up on this mission - this past mission on Skylab-III - it was to the west. And immediately started having RCS problems and did not want to commit the propellants in doing those burns to trimming up the orbit, since it was a secondary objective. And as a result the orbit started drifting quite freely. Now, had we been able to trim up the orbit, we would have been launching for SL-4 on November 9th. But because of this drifting effect, it has an appearance that the ground tracks are sliding relative to the Earth terrain. That - the launch date has changed or continually changes. So, let me get into this a minute. If we were to launch on November the 6th, and 7th - the information's here, but let me jump to the 11th and 12th, because those are the day of interest. On November 11th, which is day 315, our launch window opens up, which is the way to read this bar across here, at 11:03:59 a.m., eastern standard time. $M=5$ is the number of revolutions or orbits it takes to do the rendezvous. And as we proceed along, at the bottom, is when we close the window, which is a little window within a bigger launch window. And we close the windows some, approximately, 8 minutes later for $M=5$, and we keep switching, $M=6$ and $M=7$, $M=8$, and so forth, until we get out to what we call the 37.4 degree azimuth limit.

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And that's when the vehicle can't steer any further north, because we start flying over the east coast United States. Got orange safety limit out there. And that turns off the launch window. So, basically, from 11:04 to 11:19 a.m. eastern daylight - eastern standard time, we have a 15-minute launch window. Now the next day - this line, by the way that's drawn here is sort of another constraint that's not such a hard constraint. And that is that we will sacrifice 700 pounds of equivalent payload loss to steering the Saturn launch vehicle to get us in the right plane for rendezvous. This is a function of how that loss is as you go through launch window; 700 pounds occurs out here. Now if we extend it up, to say, 1500 pounds, we can extend the launch window roughly 8 minutes. And this is the number that's kind of soft, because it really depends on when you get down to this point, if you've tried to launch on the 11th, you've had some technical difficulties, what have you, and you start committing to go on the 12th, then you may certainly want to open up more than the 1 minute of window that's shown here on the chart. In other words, it goes from 10:38 to 10:39. Now right now, we've got a ground rule that says we'll allow 700 pounds. It's depending on the weight of the spacecraft and other factors involved, maybe weather. The weather may be real good at the time. Whatever the case, it requires a joint decision by the mission director and so forth. We may open that window up another 8 minutes and sacrifice, say, 1500 pounds.

END OF TAPE

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CASSETTI - Mission Director and so forth. We may open that window up another 8 minutes and sacrifice, say 1500 pound. The amount of the pounds here is the thing that's up for arbitration. So that's why I really can't give you a good definite time. It could be at 10:30, the window opens up and closes at 10:39. Now, I'm also showing data for what happens on the 10th and you see the 10th is outside of our two dash lines here. There is an (garble) launch window, but we'd have to fly over the - populated U.S. areas or - or U.S. east coast land mass and we - we don't do that. Now what's happening - This whole pattern is sort of fixed in space and we're finding out now - we're processing some data on tracking. We've had the deorbit - excuse me, the separation event. We've had a couple of weeks of tracking the unmanned workshop and it has slightly different drag characteristics, and so forth. We're also using skin tracking as opposed to radar transponder tracking, so our accuracy of data are a little bit poor. But we're finding that this pattern is beginning to shift to - to - the left- hand part of the screen, as a result on the 10th, we're approaching the point where, if it shifts any further, we can just about catch a little bit of launch window there on the 10th. So don't be surprised if - in another week or so, we may officially announce launch date is now the 10th. And, it's because of this phenonena, it - we're taking in new tracking data and processing it. Now in order for us to catch the 10th, we - this whole chart is predicated on the bases of a launch into a 81 by 120 nautical mile orbit. Now if we raise that apogee altitude up to say 200 miles, it in affect, brings this curve over further to the left. So have to change our insertion orbit to catch that day, but these are the things that are being evaluated and I'm sure by the end of this month, we'll have a pretty good handle on what that revision will be. Going along here, moving right along, on November the 13th and 14th, we, as well as the 15th, we have no available data but - no available days to launch. But as you see, again here on the 16th, it's beginning to push that line a little bit, that we might face with that oport - option and could possibly go with that. However November the 16th, which is 5 days - our orbit has a characteristic characteristic of it tends to repeat itself in a 5 day periods. Five days after this launch window, we have one that looks similar to it. It opens up at 9:03 and closes at 9:19, 16 minute launch window. The next day, however, you see that the (garble) closes quite a bit out here. Have very little launch window there. And it keeps on going, thusly. Going to the next chart, I'll give you a little bit of the numbers

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on the rendezvous. That's - that's fine. It's really not a lot to say about this particular rendezvous in comparison with our other missions, just that we've had two very well executed rendezvous on the first and second manned missions and certainly hope to have the same situation here. I'm showing you what the nominal M equal 5 rendezvous plan would be where we insert into the 81 by 120 nautical mile orbit, 9 minutes and 50.6 seconds after - that's ground elapse time after lift-off. Do a separation maneuver of 3 feet-per-second, it raises our apogee a little bit. We do a few phasing maneuvers that basically are height adjustment maneuvers. They bring our perigee up. First bring it up - excuse me, bring our apogee up - from 80 by 120 to 121 by 203. Then we do another phasing maneuver to get the 121 up to 203. If we have to make a plane change maneuver and this not only does not occur but in case of execution maneuver - execution errors in the maneuver, it will occur sometime between these two maneuvers, wherever the node of these planes are. To do a corrective combination maneuver, which basically is another plane change and altitude adjustment. We bring the apogee up again. Coellipic is a maneuver where we try to get coelliptic or, in the case since we're shooting a circular orbit, we're sort of co-circular with the target orbit, which is of course the - the Saturn workshop. And then we move on into the TPF maneuver, terminal phase finalization, where we basically then, put into a 231 by 234 orbit, which is the orbit at this particular time and day. The orbit changes slightly in altitude, because it is decaying - has been decaying slightly. And like I say, it's pretty standard - diagram shows you where all these maneuvers are relative to the darkness and the schematic. I think we've shown these so many times in the past. I - I don't think there is anything really new about this. One thing that I forgot that we (laugh). We always leave off this chart, and everybody always ask and that's the docking time. And I can almost remember that - I think it's 9-1/2 hours ground elapse time. If you can bear with me a minute, I think I can pull it off another chart. Yes. Ground elapse time, 8 hours and 3 minutes. It's at a GMT time of 7 hours 24 minutes. So - yeah, I see, knock off 6 - knock off - that'll be 2:24 a.m. eastern standard time, on the 12th. Okay. Next chart please. No, sorry, hold on. Is there a question on that?

MS
QUERY

(Laughter)
(garble) If they lift off at 10 -

QUERY If they lift off at 11 eastern and 8 hours later, they dock, it doesn't go to 2:24 a.m.

CASSETTI
QUERY

Ah - -
Which docking date (garble)

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SPEAKER Have to be in the evening.
CASSETTI I'm sorry. Did that - What did I tell
you. Did I tell you 6 a.m. eastern?
QUERY No, you gave 2:24.
CASSETTI 2:24. I've got 7:24 GMT of docking, which
is 8 - suppose to be 8 hours and 3 minutes after ground
elapsed - GMT -
QUERY 7:24 is 2:24 EST but that doesn't - what's
your launch time?
CASSETTI 16.03 GMT.
QUERY And that's 11:03 a.m. EST. Your talking about
p.m. there.
CASSETTI Launching at 11:0 - 11:04 eastern standard
QUERY - is going to 18:04
QUERY (GARBLE)
QUERY I'm sure that GMT (garble)
QUERY (Garble)
CASSETTI Yeah, it could be. Well, it's - it's
8 hours - 8 hours is the ground elapsed time.
QUERY - EST.
CASSETTI Table I've got may be a off.
It's roughly 8 hours after - it is 8 hours ground elapsed time.
QUERY Okay.
CASSETTI Oh, I'm -

END OF TAPE

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CASSETTI Oh, I'm sorry, I was reading - I was reading 7 - 724 that's minutes and seconds, it's zero hours 7 minutes GMT. Okay, there's the - okay. Sorry about that.

QUERY But that is 8 hours 3 minutes- -
CASSETTI Yes, it is. I just read off in minutes as hours. (Chuckle) This next chart shows the EREP passes, I think Al Bishop covered it pretty thoroughly. Because of the orientation and the orbit relative to the Earth and the fact - and the Earth and the Sun, and the fact that we have an orbital regression rate that during a period of time in the middle of December we have, virtually a very poor EREP opportunity, these show really the days of EREP that are available. We have some days early in the mission, descending passes over the U. S., lighting gets poor, we can then - also concurrent with that we have European and African passes available. Generally, when the vehicle goes over the U. S. at a particular time of day, let's see - a time of crew day, it also has passed over the same latitude at generally the same local time. So if you take a place in Europe that's at 40 degrees north longitude and - north latitude, and you pass over there at a certain local time, then as the orbit - as the Earth revolves around the vehicle we pass over a place in North America at 40 degrees north. It's generally the same local time within a few minutes variation so when we have good available lighting in the U. S., it's generally true of Europe, the problem is when it's light in Europe it's not consistent with the Houston day - crew day that the crew is on so it tends to be different time with the crew day so they have to get up earlier or generally for certain passes or later. Really, not a whole lot to say about this. It does show the advantages of pushing the mission beyond the January 6th date because we do see the United States again for ascending ground tracks gives us certainly our - our main emphasis on EREP is the domestic sites. We have more investigators in task sites in the United States. We - I think I mentioned to you about the ground track shifting, the - our plans - I had a chart but it's kind of confusing and I know the numbers are changing quite a bit. We have a plan that's going to cost a little bit of reaction control system propellant but when we get up there for Skylab-IV, sometime after the beginning of the mission we will do a burn that puts us on a repeating track, not quite on our pre-mission track. But we will be able to see some of the original planned ground sites for EREP. Our plan - our present planning has that in the system. Next chart please? Al Bishop showed this one also. Main thing I wanted to point

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here was that the span of the mission we're planning from November the 11th, Earth starts off here, to the first part of January, we're over here and the comet sweeps pretty well around this kind of an arc during that mission span. If we go beyond, into say the 19th of January, the comet has moved around almost to the point where it's about here and the closest approach, as I had mentioned, the comet to the Earth is around January 13th. It's about - I think it's 0.8 of a astronomical unit which is the mean - Earth-Moon - Warth-Ssun distance. Next chart, please. This again is the end of mission sequence that has to do with the 56-day mission and it's not like - it's not at all like what would happen with a 69-day mission. Mainly, just some of the highlights of this you can probably look this over and see some of the things that are different than previous missions and that is when we go into the Hawaiian Islands we get some good end of mission mission tracking which we didn't have these last couple of missions. Notice the guys did a burn you never heard from them until they were by the carrier and that's not true of this particular mission. Let me just go through we'll do an undocking and flyaround, it's in GMT of that particular day and ground elapse time from lift off. - So at 1730 hours we do the undocking, we will do a flyaround last inspection of workshop. We'll pick up some TV over the states at Texas and Mila that's 1 p.m. Eastern, that's about a 10-minute pass, should have real time TV there. We do our separation burn to get away from the workshop, coast around a while, we do a shaping maneuver which is the first of two deorbit burns that drops our altitude from a 230 mile circular orbit down to a 230 by 90 orbit - 230 by 91 orbit. We go around a couple of revs with - in this lower orbit we get tracking, confirms our orbit, and so forth. The main reason for the long rate between the two burns is if this one isn't executed properly, if we have a STS failure we can go to the backup RCS system and we got enough time to reconfigure the vehicle retarget the burns and everything so that we can do the RCS deorbit to get us back into basically the same landing area. If Everything goes well though, we do the SPS burn at 22:00 hours GMT, we will get a data pass over Honeysuckle which is the tracking station Australia. Hit entry interface, believe we should be out of blackout and see some - get some talk through Hawaii and we'll have landing at 22:44. Next chart shows the last part of the ground track in this do the last burn, of course, we've gone around these couple revs in the lower orbit. We do the last burn pass over eastern Australia, right almost over the Honeysuckle tracking site, and ascend in the - over the Hawaiian chain. Next chart, please. And this shows the footprint, this is pretty preliminary

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we're still - as you know we kind of juggle these things around, and so forth, but this one shows us landing on a track that just passes off Johnson Island. The landing point is at the end of this line here, it - it's roughly 200 nautical miles northwest of - of Honolulu, and certainly a comfortable amount of steaming distance, as I mentioned, for the - to get the crew into port to carry on medical examinations. That's all I have.

PAO

Wait for the mike, please.

QUERY

Splashdown, splashdown is on the 19th

of January is - is it in the same area?

SPEAKER

Oh, no it is not. Splashdown on the

19th is going to be off the - west coast of the United States off San Diego in a similar area as Skylab - the second Skylab mission.

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CASSETTI - - similar area is Skylab - the second Skylab mission. I don't have any - yes, I do. I think I gave you some tires on that earlier. Yes, 5 p.m.; that's a fairly rough time but it's probably good. Central - be 6:00 eastern. January 19, I believe, is a Saturday. That's unacceptable? Well, the 6th is on a Sunday, and that's at 5:44 p.m. I didn't look at the pro football schedule, but might have another Heidi bowl or something like that. Yes?

PAO Howard.

GUERY When you're talking about the launch windows, you kept talking about sacrificing 700 and 1500 pounds. What do you mean by that?

CASSETT Well, yes, sacrifice is probably a bad word for it. We have a excess launch vehicle capability for putting payload capability into our 81 by 120 orbit. That payload capability has been running on the order of 2, maybe 3000 pounds in excess of what the command service module weight is. I don't know the exact number for this, but I'm sure it's in the 2 or 3000 pound region. No, I take it back. It's probably in the 4 or 5000 pound region. Now, it's one of these games where you want to play probabilities and so forth. The worst thing you could do is not have enough gas to get into orbit, and you really would not be able to continue the mission, and all. You'd have to come down and land at some - without getting up to the workshop. Well, to make a long story short, we certainly want to add enough reserves and so forth which is equivalent to payload capability, to say that we want to in a statistical sense, be able to and let's say one out of a thousand chances, to always go in, except for that one chance or so. And then we maybe, say, well you know if one of the engines fails in the first stage, we want to be able to continue and that's what we call engine-out performance. So you add all these things that are conservatisms and you say, okay, I've got so much capability and now doing this yaw steering, I have to give up some of that capability. Now, and that's the part that's not a black and white situation. It's sort of qualitative. It usually takes a lot of managers sitting down to ascertain whether they want to take that. I hate to use the word risk, but it is a risk; they're trading off one kind of capability or failure versus another thing, and that's getting up to the vehicle with the right launch window. So the - in a way, you pay a penalty for doing this kind of yaw steering. It's doing a dogleg in space as sometimes referred to, where the plane of the orbit is away from the launch site and you got to sort of point the Saturn launch vehicle at that and then kind of skid into the plane. And that is less efficient than just launching right into the plane. And that's basically what the performance loss is.

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PAO

Bruce.

Query

Ken Kleinknecht mentioned going on the 21st for a nominal duration stay to watch it. But I think he also said the 19th as a splash day which would mean really going on the 21st and coming down on the 19th, would be a 59 day - is that really the consideration or would it be - would we be coming down on what - I guess the 16th?

CASSETTI

Well, let me kind of interpret a little bit what I read into what he said is about the 21st. To get the right amount of science on Kohoutek, if that was the only thing that you were doing, you'd probably have a mission - that the perihelion passage was probably right in the middle of the mission. So you have equal amount of perihelion and post perihelion observation. Ideally we would have planned, probably have planned the mission that way, although there are some - it's not quite compatible with EREP as you could see. EREP gets helped by moving it late but not too much later, you lose off the stuff in the beginning. The other aspect is that for, the later you go in January, you got to pay a price that the - program incurs more cost because we weren't originally planning on flying that late in January. Now the context that Kenny was using, going the 21st, was still with the option of extending the mission another 10 days. So if you were to launch 10 days later than the 11th or the 21st, we would be considering a 56-day mission and a 69 or 70-day mission, which would make you come down roughly 20 days later than - no, excuse me, 10 days later than the 19th or the 29th of January. And that's basically it. Probably the big decision is in cost, and there is some desire to get up to the unmanned workshop, too, as early as you can.

QUERY

Have you been told to look at the possibility of a 80-day mission?

CASSETTI

I think it's being evaluated - there are missions that can be flown 80 days. Some of the problems you get into, as Kenny mentioned, is you start having a problem with food, and you know, just common things like facial tissues and a lot of the things that you generally have up there that are certainly adequate for 56 days and you could probably push them to a 70-day mission but, you know, 80 days and longer tends to be a problem. I think the general going option is the 70-day option. Looking at that increment from the 56-day mission.

PAO

Did you have a question, (garbie).
Anybody else? You got another one, Bruce?

QUERY

If you were playing Jimmy the Greek would you bet on 56 or 70-day mission?

CASSETTI

I would say 70 days. I tried to have them move it from the 11th, though. That's my anniversary and my wife's accusing me of doing it on that day so I don't take her out. But I told her that's never stopped her before.

PAO

Any more questions? All right. We have another briefing coming up here in just a few minutes. I understand that Dr. Hawkins is on his way down. So we'll have a short break here and we'll reassemble. Thank you.