FREE FLIGHT: FAA STYMIED BY HIGH-TECH ADVANCES

HEARING

BEFORE THE

EMPLOYMENT, HOUSING, AND AVIATION SUBCOMMITTEE

OF THE

COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

SECOND SESSION

AUGUST 9, 1994

Printed for the use of the Committee on Government Operations

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FREE FLIGHT: FAA STYMIED BY HIGH-TECH ADVANCES

TUESDAY, AUGUST 9, 1994

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON EMPLOYMENT,
HOUSING, AND AVIATION,
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:02 a.m., in room 2247, Rayburn House Office Building, Hon. Collin C. Peterson (chairman of the subcommittee) presiding.

Present: Representatives Collin C. Peterson, William H. Zeliff, Jr., Christopher Shays, John McHugh, and Frank D. Lucas.

Also present: Representative William Clinger.

Staff present: Wendy Adler, staff director; Susan Mertes and Linda Thompson, professional staff members; June Saxton, clerk; and Judy Blanchard, minority deputy staff director.

Mr. PETERSON. The subcommittee will be in order.

This morning we will examine how the Federal Aviation Administration could be costing the taxpayers and the aviation industry billions of dollars a year because of how it applies new technology such as what we are calling free flight.

The topic of today's hearing, free flight, illustrates FAA's approach to new technology, an approach that is increasingly criticized. Air carriers claim they are losing about three and a half billion dollars annually from FAA's restrictions on free flight. Others put the price tag much higher, to almost $5.5 billion.

Today's technologies open the door to huge improvements in aviation efficiency, capacity and safety. And these improvements could also reduce costs for industry and taxpayers, could expand air service to small communities and could boost the general economy.

But FAA's delay in evaluating and placing new technology holds back progress and all the benefits that go with it. So when industry is ready to implement new technology, it is often held captive by the FAA's own bureaucracy and inefficiency.

Basically, free flight technology could free aircraft from excessive air traffic control. It could give air carriers—and pilots—more flexibility in directing their aircraft. Broadly defined, free-flight technology lets pilots safely fly their preferred routes without being overmanaged by air traffic control. And free flight's new efficiencies could also increase airspace and airport capacity.

It differs from the typical routes that air traffic control dictates to aircraft. Not only are these air traffic control routes less efficient; some say they are antiques—or should be.

The FAA says its national route program is free flight, but I don't think that is really accurate. FAA's national route program lets some aircraft fly their preferred routes sometimes, but they are still too controlled by air traffic management, and some argue that such extensive control is no longer necessary with the new technologies that we have available.

Today, some of the witnesses will argue that FAA, attempting to improve air traffic, is guaranteed failure if it relies on building upon the current air traffic control system. In their opinion, it is the current system that is the problem. It is so outdated that even if new technology is fully applied, it could only produce marginal benefits. They argue that with new technology and modern aircraft's capabilities, the current air traffic control system should be radically restructured.

Our present system of air traffic control dates back to the late 1950's and early 1960's when air travel was very different than it is today. We had pistoned-powered aircraft, not jets; only a few people were flying; and only a small number of aircraft were flying at any one time. Moreover, at that time airports didn't have any capacity problems, hubs didn't exist, and airport parking was easy. But that is all history.

The FAA did well by us then. The system it crafted essentially still serves us today, providing undeniably safe air transportation, as it always has. But now it is argued that the FAA, by building on that system and not considering any other method, limits the improvements that are possible in safety, capacity and efficiency.

Other related issues will also be raised in this hearing.

You will hear about FAA's reluctance to release certain information now available through new technology to pilots and air carriers. FAA collects all this valuable safety information: weather, location of aircraft, et cetera—but sends it only to the air traffic controllers. Yet this new technology could get this data to users, too, and that, some say, would increase safety. We are sacrificing safety and efficiency benefits by not sharing this information with users of the system, in some people's opinion.

But before we start today, I want to commend the FAA for breaking free from its institutional chains and showing that once in a while it can be flexible. For example, the FAA has, in my opinion, pushed the envelope on the Global Positioning System, moving faster and more efficiently than ever before and to the surprise of a lot of people, and I want to commend them for that. It has already issued several GPS approaches which I have taken a look at and more are expected soon.

And they are doing testing on category two and three landings which I am convinced are going to happen. I am convinced it can be done. It is just a matter of us proving it.

So I am very pleased with the work they have done in that area, and maybe with this hearing we can get some focus on some other areas.

I am also pleased with the FAA's announced plans to revitalize general aviation. There are a number of things that are under consideration, and I would like the FAA to keep me informed on the progress of those initiatives. I hope FAA does act promptly because I really think we have some tremendous opportunities in general aviation and much needs to be accomplished.

This new FAA approach, such as we have seen with GPS, one that is more responsive to users' needs, should be a model for future FAA efforts, and I hope that it will be.

We have so many opportunities today with new technology to really change the system to the benefit of the users. The FAA now has a chance to develop an effective strategy to reap all these potential benefits, and we hope that they will do that.

I would now recognize the ranking member of the subcommittee, Mr. Zeliff, for any opening statement that he might have.

Mr. ZELIFF. Thank you, Mr. Chairman, and I appreciate your calling today's hearing. We will have a chance to examine FAA's implementation of new technologies and specifically look at the free-flight technology.

free flight, as you have indicated, is very intriguing technology because it could potentially revolutionize the way we manage air traffic. Instead of flying very set flight patterns under the direction of FAA air traffic controllers, free-flight technology would permit aircraft to fly the most direct, the most efficient route between destinations.

This new technology has the potential to increase airspace capacity, boost airport capacity through more efficient use of runways, reduce delays and provides billions of dollars in savings to air carriers. Obviously, consumers would benefit tremendously from lower air fares and increased availability of flights.

The Air Transport Association estimates that the major air carriers are losing about $3.5 billion every year because we do not fully utilize new air traffic management technologies such as free flight. Given the uncertain financial condition of the industry, this is a situation that we simply cannot allow to continue indefinitely.

Of course, air safety must always be our primary consideration, and I am aware that reservations do exist about moving too quickly with this technology. Our efforts to improve airspace capacity and efficiency should not in any way come at the expense of safety.

I hope the FAA can now update us on how they are progressing with the new air traffic control system. Our capacity to see the benefits of a free flight routing system is dependent largely on modernization of the air traffic control system. I find it disturbing that we continue to hear about long delays, cost overruns and cancellation of systems, and this simply cannot continue.

I had the pleasure of visiting the Boston Center, air traffic control facility located in Nashua, New Hampshire, last year. The center controls all air traffic in New England, down in New York and for 150 miles out in the Atlantic ocean, and I talked with people who managed the flow of air traffic on a day to day basis, and I was impressed by the professionalism and the dedication.

I also saw firsthand the equipment that they use, which by anyone's standards is sadly out of date and in desperate need of modernization. It became readily apparent to me that the FAA must do everything possible to see that the modernization process is completed.

I look forward to hearing the testimony from our witnesses and exploring these very, very important issues further. I thank you, Mr. Chairman.

[The prepared statement of Hon. William H. Zeliff follows:]

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STATEMENT OF THE HONORABLE
WILLIAM H. ZELIFF
BEFORE THE SUBCOMMITTEE ON
EMPLOYMENT, HOUSING AND AVIATION
HEARING ON FREE FLIGHT

August 9, 1994

Mr. Chairman,

Thank you for calling today's hearing which will examine FAA's implementation of new technology, and specifically look at "free flight" technology.

Free flight is a very intriguing technology because it could potentially revolutionize the way in which we manage air traffic.

Instead of flying very set flight paths under the direction of FAA air traffic controllers, free flight technology will permit aircraft to fly the most direct and most efficient route between destinations. This new technology has the potential to increase airspace capacity, boost airport capacity through more efficient use of runways, reduce delays, and provide billions in savings to air carriers.

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I look forward to hearing the testimony from our witnesses, and exploring these issues further.

Thank you Mr. Chairman.

Mr. PETERSON. Thank you, Mr. Zeliff.

We are pleased today to have with us Congressman Clinger from Pennsylvania, who is the ranking minority member of both the Government Operations Committee and the Committee on Public Works and Transportation, Subcommittee on Aviation. Most importantly, he is a pilot like I am and has had an opportunity to fly a GPS approach such as I have. We welcome his presence here and his continuing interest in aviation.

Mr. CLINGER. Mr. Chairman, I thank you, and I want to commend you for holding this hearing.

As you indicated, in my other hat, I am the ranking member on the Aviation Subcommittee, and we wrestle with the problems of how we are going to deal over the next decades with the exponential increase in—anticipated increase in air travel in this country.

We took one step yesterday, I believe, in finally approving the Airport Improvement Program Conference Report which will address some of the critical needs in some of our major airports and, hopefully, increase capacity. But this is an area that I think this hearing is of very great interest because it does look at some new technologies.

As we know, as you have indicated, the FAA is charged with moving aircraft safely and efficiently through the skies. And with regard to safety, no one, I think, can argue that FAA has not done an outstanding job. The record of guiding tens of millions of flights is unparalleled anywhere in the world.

And with regard to efficiency, FAA has managed this task well, although recent developments in navigation and communications technologies and changes in the manner in which air carriers deploy and schedule aircraft have led many in the industry to question the current regime of positive control and continued reliance on the defined system of airways.

Under positive control, the air traffic controller directs all aircraft movements on the ground and in the air. The pilot flying an instrument flight LAN cannot deviate from an assigned altitude or heading unless first receiving permission. And, as indicated here, under free flight, a pilot would not necessarily rely on an air traffic controller for direction except to the extent the controller seeks to resolve potential conflicts.

The current airway system relies on a huge network of VCR stations that was and is, I think, a logical method to direct aircraft around the country, but the advent of modern navigation technology, such as the GPS and the Inertial Navigation System, now permit aircraft to operate completely independent of ground-based VCR stations.

More importantly, these technologies allow aircraft to operate point to point instead of relying on the current maze of airways, saving both time and fuel as has been alluded to by you, Mr. Chairman.

While the term free flight suggests point-to-point service, the term embraces a series of technological and procedural changes that, if we take them all together, fundamentally affect the current proven method of safely separating and guiding aircraft across the system. It really does represent a rather dramatic change in current practice.

In my mind, the question of the hour is how and if FAA should shift from the current air traffic control regime to an advanced and more efficient system without undermining safety, and that, I think, has to be the bottom line in any conclusion in this area. The implications of free flight are undeniably attractive, but implementing these changes requires extraordinary changes in the management of air traffic and an exhaustive validation of the technologies upon which free flight relies.

The FAA is presently involved in kind of a critical review of where they are going with the upgrade of the old system. I think this hearing is an appropriate time to be holding this hearing because that review is ongoing.

So, Mr. Chairman, I thank you for calling this morning's session. I appreciate your permitting me to be a part of the hearing and thank the witnesses for taking the time to be with us today.

[The prepared statement of Hon. William F. Clinger, Jr., follows:]

Opening Statement of
The Honorable William F. Clinger, Jr.
Before the Housing, Employment and Aviation Subcommittee
Hearing on "Free Flight"
August 9, 1994

Mr. Chairman, the Federal Aviation Administration is charged with moving aircraft safely and efficiently through the skies. With regard to safety, no one can argue that FAA has not done a superb job. Their record of guiding tens of millions of flights is unparalleled. And with regard to efficiency, FAA has managed this task well although recent developments in navigation and communications technologies, and changes in the manner in which air carriers deploy and schedule aircraft, have led many in the industry to question the current regime of positive control and continued reliance on a defined system of airways.

Under positive control the air traffic controller directs all aircraft movements on the ground and in the air. A pilot flying an instrument flight plan cannot deviate from an assigned altitude or heading unless first receiving permission. Under "Free Flight", a pilot would not necessarily rely on an air traffic controller for direction except to the extent that the controller seeks to resolve potential conflicts.

The current airways system relies on a huge network of VOR stations. It was and is a logical method to direct aircraft around the country, but the advent of modern navigation technologies such as the Global Positioning System and inertial navigation systems now permit aircraft to operate completely independent of ground-based VOR stations. More importantly, these technologies allow aircraft to operate point-to-point instead of relying on the current maze of airways, saving both time and fuel. While the term "Free Flight" suggests point-to-point service, the term embraces a series of technological and procedural changes that -- taken together -- fundamentally alter the current, proven, method of safely separating and guiding aircraft across the system.

In my mind, the question of the hour is how and if FAA should shift from the current air traffic control regime to an advanced and more efficient system without undermining safety. The implications of "Free Flight" are undeniably attractive, but implementing these changes requires extraordinary changes in the management of air traffic and an exhaustive validation of the technologies upon which "Free Flight" relies.

Mr. Chairman, I thank you for calling this morning's hearing. I also thank our witnesses for taking time out of their busy schedules. I look forward to hearing their testimony.

Mr. PETERSON. Thank you, Mr. Clinger. We appreciate you being with us and look forward to working with you on this.

Next, I will recognize our newest Member, Mr. Lucas from Oklahoma. Glad to have you with us.

Mr. Shays, do you have a statement?

Our first panel of witnesses today are Michael Boyd, president of the Aviation Systems Research Corp., who is accompanied by Capt. Michael Baiada, president of RMB Associates, and also Norman Watts, of the FAA technical center.

We also have Capt. William Cotton, manager of air traffic and flight systems for United Airlines; and Roger Fleming, senior vice president of operations and services of the Air Transport Association of America.

It is the custom in Government Operations Committee investigative hearings to swear in all witnesses. Do any of you object to being sworn in? If not, would you please stand and raise your right hand?

[Witnesses sworn.]

STATEMENTS OF MICHAEL BOYD, PRESIDENT, AVIATION SYSTEMS RESEARCH CORP., ACCOMPANIED BY CAPT. R. MICHAEL BAIADA, PRESIDENT, RMB ASSOCIATES; AND NORMAN WATTS, FAA; CAPT. WILLIAM B. COTTON, MANAGER OF AIR TRAFFIC AND FLIGHT SYSTEMS, UNITED AIRLINES; AND J. ROGER FLEMING, SENIOR VICE PRESIDENT, OPERATIONS AND SERVICES, AIR TRANSPORT ASSOCIATION OF AMERICA

Mr. PETERSON. All of your written statements will be entered in the record. We appreciate you being with us. Mr. Boyd, I guess we will start with you; welcome to the committee.

Mr. BOYD. Mr. Chairman, thank you. We want to thank you for having us here to discuss this issue.

Today I think to sort of set the pace here a little bit, what we would like to see happen is three basic things: First, a realization that the current system, while safe, does costs not only the airline industry, but the economy of the United States, billions of dollars a year, and it needs to be addressed with whatever technology there is today or can be found.

The second is that the technology and the timeframe involved are not as great, we believe, nor is the money as great, as otherwise believed in terms of getting a free flight system in place.

But the third point which I think is critical here is to understand the gravity of this situation. We have seen the airline business lose billions of dollars over the last few years. We have seen various estimates from $3.5 to $5 billion in excess annual costs to the airline industry every year due to the current air traffic control approach.

The problem is that this is a major controllable cost, and what the major airlines have talked about in the last 2 years is basically only one controllable cost: labor. And what we have had is labor unions and other employees giving up hard-earned wages and work rules in exchange for keeping their companies alive. If we had a free flight system, they would not have had to do that.

The basic savings estimated by the ATA, which we think are very conservative, would equate to, essentially, the same amount of money that United employees just gave back to their company to keep it, "alive." So this is a major issue in terms of keeping airlines alive, but it goes well beyond that.

What concerns me and concerns others of us here is that we need to elevate air traffic control from the area of technocrats and lower level people at airlines and put it right smack on top of the in box of major airline CEO's. I have not seen the CEO of American Airlines nor of Delta nor of United mention this issue.

They should be here. They should have a conga line going into the FAA Administrator's office right now demanding change because it is costing them money and it is a controllable cost. Before they go to labor, they need to talk about this issue because it is controllable.

Another point is that the other costs to industry are enormous. USAIR canceled an order for 40 Boeing jets. If we had a free flight system, I would maintain they probably could have ordered those jets.

So the current air traffic control system is constricting the entire economy, the economy of Hartford, CT, the economy of Idledale, OH, the economy of St. Louis, the economy of places even like Cedar Rapids where they make avionics.

The system is hurting the entire economy, not just the area of airlines or the consumer who flies airlines. That is why it is critically important that we address this. And, most importantly, it is critically important that others in the industry get involved, that the chairman and CEO's of major airlines be here and not pass it down the line, that they understand this is a cost and that the heads of labor unions understand that the air traffic control system is costing their members what they have bargained for over the years, money.

The chairman and CEO's of companies like General Electric Aircraft Engines, Northrop, Textron, should be here and look into this because it is directly affecting them and their jobs and their futures.

It goes well beyond this, and we believe a free flight system could make this happen. I am sure Captain Baiada can tell you about how it can happen. We believe this is probably the most pressing need right now facing the airline industry. It is not labor costs. It is not the other endemic inefficiencies that some major airlines seem to be in love with. The problem today that is most controllable is air traffic control. When we solve that, the airline industry can return to health, the consumer can benefit and so can communities.

And I will pass it over to Captain Baiada.

Mr. BAIADA. Thank you.

Before defining or outlining what free flight is, a few important baselines and assumptions must be outlined.

First, there is not an airspace capacity constraint anywhere in the world today. We only have ATC capacity constraints.

If time permitted, we could go up on the roof. We could count the number of airplanes you see at one time in the airspace. You are looking at hundreds of cubic miles of airspace, and if you see more than one to two airplanes, I would be surprised.

The view of the constraints in the sky today comes from the view of the controller, an 18-inch video screen. By the time you add the data blocks and other depictions of the aircraft, it looks crowded. But if you actually put the aircraft size in relation to the airspace presented, it would probably be less than one pixel and not even be visible on the screen.

Second, free flight is not chaos or random actions by individual aircraft. It will not reduce safety. In fact, as lateral and vertical navigation increase through GPS and other technologies, it will actually increase safety by providing random routes back into the system.

Third, regardless of the testimony you may hear today, technology is available today to allow the free flight concept to move forward quickly. Not 2000 or beyond—today—now.

Fourth, the current ATC control-oriented philosophy must be replaced with an ATM separation-management philosophy. This is the hardest problem faced, the philosophical change required to move forward into the free flight environment.

Will these baselines in our assumptions, we can now define free flight, which is really a simple concept. I have heard it from some of the Congressmen this morning. Free flight is user optimized, dynamic routes.

Fixed routes and altitudes, the linearization of traffic flows used today to assure separation, would be replaced with technology identifying potential conflicts long before they happen. This will allow each aircraft's flight path to be optimized by the owner or operator individually, as part of that operator's system and in relation to the airspace system. In other words, let the people who own the aircraft asset control it.

This simple business requirement, which for the airlines is control of its production line, is, in fact, enjoyed by all other nonregulated industries today.

As part of our written testimony, we have submitted a proposal that with relatively inexpensive, off-the-shelf hardware and software, free flight can be implemented quickly and it is estimated at one-hundredth the cost of the $2.5 billion already spent on the advanced automation system.

This proposal is not meant to be the definitive answer for free flight, but it will begin the philosophical change so desperately required so the airlines can regain and capture control of their production lines.

Remember, ATC's primary task is to separate aircraft, don't let them hit each other. The current control methodology used to do this is rooted in the 1950's technology and is no longer required.

Finally, the question is not if free flight will be implemented but it is how many more airlines and companies will go out of business before, in fact, free flight is implemented.

Thank you.

[The prepared statement of Mr. Boyd and Mr. Baiada follows:]

Free Flight
Reinventing Air Traffic Control
The Economic Impact

Captain R. Michael Baiada, RMB Associates
Michael J. Boyd, Aviation Systems Research Corporation

Executive Summary

Mr. Chairman, we appreciate the opportunity of appearing here today to present our findings on the important matter of bringing America's ATC system into the 21st century. Our statements today are based on a comprehensive study we have recently published on this subject. Our testimony today will provide the highlights of the RMB/ASRC study, *Free Flight - Reinventing ATC: The Economic Impact.* It is our hope that it will widen and enhance the forum of ideas on what our nation will need to accomplish in bringing its ATC system into the 21st century.

Air transportation is a critical part of the national transportation infrastructure. It is a major part of the total economic infrastructure of not only the US, but of the world wide economy. And it goes well beyond scheduled air service. General and business aviation are critical parts of the infrastructure as well. Today's ATC system is restraining aviation growth, and in doing so is restraining economic growth as well.

The Air Traffic Control System in the United States is outdated. While it is safe, it cannot handle current and projected demand adequately nor efficiently. The delays, congestion, and inconveniences resulting from this are obvious, well documented, and are experienced by millions of consumers each year. Worse, the unseen economic impacts - loss of jobs, slowed economic growth, loss of productivity, even higher pollution due to unnecessary excess flying - are costing the nation additional billions of dollars each year.

Clearly, there is no question that the system cannot remain as it is today. It must be reinvented. Not "upgraded" - but *reinvented.*

General Economic Impacts

From the results of the RMB/ASRC study, the following facts are quite clear:

- *The current approach to ATC in the US is a <u>primary cause</u> of the billions in losses experienced by the US airline industry. The US airline industry is being forced to operate within an ATC system that unnecessarily adds billions to operational costs, and as a result has contributed in a material way to the continuing loss of thousands of airline jobs.*

- *The current approach to ATC in the US is a hindrance to economic growth. Many communities are deprived of the air service levels they truly need because of the costs that the current approach to ATC imposes on aviation.*

- *The true growth potential of aviation - commercial and general - is being suppressed by the continued imposition of an ATC system that in concept is essentially four decades out of date.*

- *Upgrading the present system, as currently proposed, will only serve to continue a system that is obsolete in methodology and approach. Only a complete reinvention of the system will meet the needs of the 21st century.*

Need For A New Approach

The current approach used is one based on the concept of *control.* Airliners are forced in most cases to operate within thin pre-defined "airways". Often these airways are not the most efficient routing for an individual aircraft. In the 1950s, this worked. Today, we must *manage aircraft separation*, instead of *controlling aircraft.* The technology exists to allow this to happen safely and with enormous increases in aviation efficiency.

Free Flight is an alternative to the existing outdated approach. It is a system wherein aircraft are allowed to operate using the flight path that is determined to be best suited by each individual operator. No pre-defined airways or altitudes would be used. Each operator would take the path and altitudes that maximized efficiency for its particular needs. Capacity would be increased so that slots, delays and system limitations to aviation growth would be removed. Admittedly, this sounds radical. It questions some of the basic assumptions now held regarding how air traffic should be handled. But many of these "basic assumptions" used today are simply not valid.

Each airline must begin to optimize each individual flight as it relates to their system that day. There is no valid reason for ATM to dictate every phase of flight based on its interpretation of capacity constraints, as it does today. In fact, these constraints are not physical constraints, but ones placed on the system by ATC.

Basic Conclusions

In the RMB/ASRC "Free Flight" document, we have reviewed the entire range of ATM (air traffic management) issues. We started with open minds and unanswered questions. In the forum of ideas regarding the need to craft an ATM system for the future, the following factors are critical to understand. Virtually none of these are seriously being considered, and until they are, no meaningful solutions will be found to solve today's ATM challenges.

Conclusion One: The US airline industry would have seen robust profits in the past five years if a reinvented air traffic management system had been in place. *Thousands of high paying jobs have been lost* and are continuing to be lost as a result of the FAA insistence upon keeping outdated ATC methodology in place.

Conclusion Two: The current approach to Air Traffic Control in the US is not just part of the problem, it *is* the problem. It is root cause of much of the congestion, delays, and capacity constraints we today witness. It is obsolete and inappropriate to the needs of today and of the future. Upgrading this approach will only waste more taxpayer dollars. It must be replaced.

Conclusion Three: Proposals to add additional technology to the current system do not address the core problems that exist today. Adding more computers and technology to the current approach to air traffic control will only make an obsolete system marginally more effective, and do little to prepare for long term growth.

Conclusion Four: ***There is no shortage of airspace***. The corollary to this is that ***the sky is not crowded.*** There is enormous airspace available, but the current approach to ATC does not make efficient use of it.

Conclusion Five: Analysis of the financial projections for a "privatized" ATM system indicates that the income stream is questionable. The assumptions made regarding traffic growth and yield increases are not consistent with reality. Disturbingly, no significant analysis has been given to downside risks. It is likely that revenues would fall short of those projected by the DOT.

Conclusion Six: Privatization (alternatively called "corporatization") is eyewash - a political Trojan Horse that has nothing to do with increasing capacity. It merely relieves the federal government of the costs of funding ATM, and dumps it into the laps of the consumer. Furthermore, it does so without any corresponding reduction in current taxes.

Conclusion Seven: It is not *if* a Free Flight system approach will replace the current one. The question is ***when***. The US can continue to wear blinders that restrict wider consideration of new concepts, but eventually the current approach to ATC will be replaced.

Defining The Challenge & The Need

As the original ATC system evolved over the last 50 years to its present state the only requirement put on its developers was the safety of the system. Even today safety is still the only significant requirement. Although obvious that safety is paramount, we must also address the fact that an inadequate *ATC system is an economic millstone for the nation*. The nation can and must develop an ATM approach that is both safe and allows materially higher capacities and efficiencies.

To date, the majority of proposals regarding ATM improvement have centered around merely updating the current approach. *Insufficient consideration has been given to the investigation of other near-term approaches to ATM beyond that which has been in place since the 1950s.* Of even more concern is the fact that the current approach is not even being questioned regarding its ability to meet the future needs of aviation.

These two assumptions - that the current approach "works," and that the near term solution lies in merely "upgrading" it - are invalid. Wrong. Inaccurate. Yet they are the foundation of today's thought patterns regarding air traffic control.

Vacuum Tubes and Privatization

Within the Administration, there seems to be a fascination with vacuum tubes, as if replacing them will solve the problems we face. Somehow the vacuum tube has become a rallying point - a craven idol that suddenly must be vanquished to save the system. Even the documents produced by the FAA of late regarding ATM have a vacuum tube emblazoned on the cover. In "Air Traffic Control Corporation Study" published by the FAA, and dated May 3, 1994, the term "vacuum tube" is used over and over again as an example of the problem. But replacing this equipment is not a singular solution.

This needs to be put into perspective: the use of vacuum tubes in today's ATC equipment is an indictment of incredibly poor management and incompetent planning on the part of the FAA. It is not, as some claim, a mere result of the Byzantine bureaucracy of the federal government. Were this the case, all federal agencies would still be using vacuum tubes, which they are not.

Along with vacuum tubes, privatization is another rallying cry - a panacea that will somehow relieve the ATM system of its problems. Will privatization fix the system? No. Will privatization allow more aircraft to operate more safely across the sky. No. Privatizing the ATM system will only change helmsmen at the wheel of a lumbering and leaking ship. It is a political side-show that makes great press and great photo opportunities. America needs a reinvented ATM system. Attempting to turn the process into a political bandwagon is not consistent with this goal.

As will be outlined in the RMB/ASRC study, the financial projections made to support corporatizing ATM are not consistent with the realities of the US airline industry. The report, "Air Traffic Control: Analysis of Illustrative Corporate Financial Scenarios" dated May 3, 1994 is little more than a blind advocacy document - a public relations piece that outlines glowingly the projected benefits of corporatization. But it provides little or no hard discussion of the unpleasant potential downsides. What if traffic does not expand as it projects? What if yields do not increase as is projected? What happens then? Essentially, this is ignored.

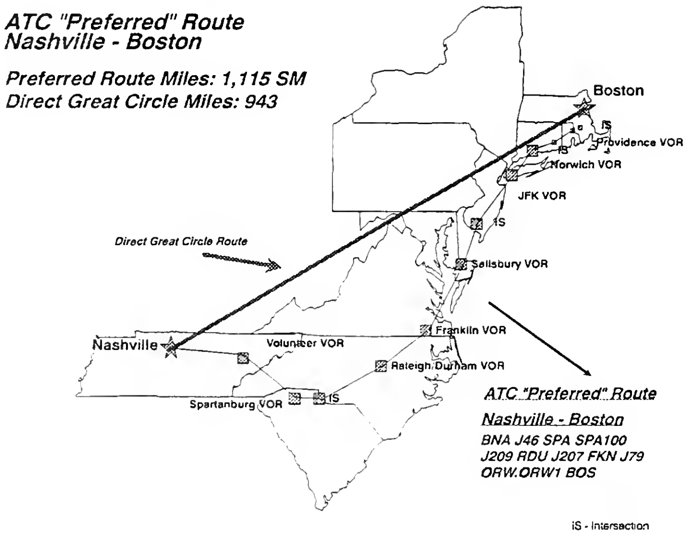
It is claimed that corporatizing will move the ATM system away from massive bureaucracy, and allow it to become more efficient. Aside from the fact that this argument is not supported by the facts, nor by the GAO, proposals for privatization evade the real problems. *Who* is running the system is not the key question. It is *how* the system is running that is paramount.

Defining ATM Requirements For The 21st Century

In the RMB/ASRC study, we review an approach to ATM that steps outside the confines of 1950s thinking and the 1950s environment. Free Flight is a concept where the technology of the 1990s is applied to an ATM system of the 1990s and beyond. The economic impact is substantial. The savings to the taxpayer and consumer are substantial. It is an approach that takes ATM out of the 1950s and allows aviation to take its full place in assisting economic growth in the US and worldwide.

The answer is not more technology applied to an outdated system. It is not simply adding computers, or replacing vacuum tubes. And it won't be found in attempts to cram more airplanes into more airborne highways. The answer - *and it can be implemented safely* - is to allow today's aircraft to use *all* resources available, including the entire sky.

Example of Today's Approach To ATC



Using just one example of the current system, the "preferred" ATC route causes the airline to fly about 18% farther than a direct great circle route.

Adding computers to this type of system, and replacing vacuum tubes will not change geography. We can "privatize" ATC, but unless the entire approach to the system is reinvented, the net improvements to the US air transportation system will be marginal.

Template For A New Air Traffic Management System

Unfortunately, the requirements for a new ATM system have not been adequately defined. The following requirements are stated regarding what must be accomplished in rebuilding the ATM system:

- ***Provide absolute safety;***

- ***Reduce restrictions on usage of airspace, which is the production line for air transportation;***

- ***Accommodate projected traffic growth safely and cost-efficiently, particularly at hub site airports;***

- ***Encourage and accommodate additional efficient expansion of the air transportation system.***

This last point is critical: *Today's traffic projections are based upon the accepted assumptions and constraints attendant to the present costs and approach to ATC. Removal of the current ATC restrictions will result in demand far above projections.* What must be developed is a system that provides an environment where aviation is much more free to grow and expand safely, efficiently and economically.

Clearly, the current approach to ATC, and the current proposals to "upgrade" it do not meet this template.

Overall Conclusion

The basic conclusion of the RMB/ASRC study is that the current ATC approach and methodology must be replaced, not upgraded, because it is hopelessly incapable of efficiently handling the traffic demands that are expected in the future, and is based on hopelessly outdated assumptions regarding air traffic management.

This must be done quickly. Otherwise the costs to ATM, the users, and the economy as a whole will be enormous.

As was stated in the RMB/ASRC study, we must break out of the confines of today's thinking and today's assumptions regarding ATM. We can no longer accept proposals that merely attempt the catch up with the past. Instead we must build a system that is compatible with the future.

Operational "Free Flight" System Implementation Plan

Norman W. Watts

BACKGROUND

A major question concerning the "Free Flight" concept is the degree to which existing technology supports it, and, if so, how quickly and costly would it be to implement. The two crucial technology requirements for implementing a "Free Flight" oriented system are: 1) a comprehensive, relatively frequently updated, real-time source of information on all aircraft using the airspace; 2) a computer program to process this data in absolute accord with the intent of "Free Flight", namely user preferred routing as dictated by such things as winds and temperatures aloft, weather, i.e., all factors that influence and/or dictate the best (most efficient and expeditious) user preferred flight profiles - all in absolute accord with total system safety, capacity and demands for its attendant services.

In the CONtinental US (CONUS) airspace, there exists an extensive source of data on the exact position of all aircraft in the sky at a given instant of time, a.k.a., Peak Instantaneous Airborne Count (PIAC). This data, called Aircraft Situation Display (ASD) data, is obtained once per minute (currently somewhat longer) from the radars at all Air Route Traffic Control Centers (ARTCCs), processed for use by Traffic Management System (TMS), and distributed to the Command Center at Herndon, VA and to all the ARTCCs. ASD data is supplemented with Flight Plan type information including: aircraft intent, the requested/assigned routing (Jet Airways or Victor Airways), the requested/assigned altitude, any route changes, etc. It is contended that ASD data is comprehensive enough to support technical assessment of the "Free Flight" concept. Additionally, it will also support an adjunct-type (background or shadowed) operational implementation of a "Free Flight" oriented Air Traffic Service (ATS) for en route airspace, eventually supporting implementation of a proven operationally ready en route "Free Flight" system.

To this end, the ASD data could be input to an existing FAA Technical Center R&D program developed by Norman W. Watts. The program, called Projected FLow ANalysis (PFLAN), uses Cybernetic modeling to perform airspace management with emphasis on safe, orderly and expeditious use of the managed airspace. Mr. Watts and others contend that PFLAN has already demonstrated the viability of "Free Flight.." A technical report on the PFLAN test results that substantiates this contention will be released shortly. Because PFLAN rigidly adheres to Objected Oriented Design & Programming (OOD&P) principles, rapid-prototyping of ever-more real-world versions is automatically supported. PFLAN is also built around a comprehensive and rigidly OOD&P disciplined COTS software package, called AERALIB. This package, developed by Aerospace Engineering and Research Associates, Inc., Landover, MD, consists of an all inclusive mathematical CORE library of functions needed to compute aircraft motions along great-arcs or segments thereof, an Air Traffic Control Toolkit wherein ICAO-type Flight Plans are defined with emphasis on Routes and Segments (recently expanded to support multi-segment altitude profiles), and, finally a Development Environment that probes for conflicts in the horizontal and the vertical plane (latitude, longitude, altitude), and now for those aircraft with multi-segment altitude profiles.

SOLVE THE RIGHT PROBLEM - KEEP THE SOLUTION SIMPLE DESIGN OBJECTIVES

A software trade journal recently described a special breed of computer programmers, called 'super programmers' who characteristically "solved the right problem" and "kept the solution simple." It is contended that "Solving the right problem is invariably the simplest solution." The essence of "Free Flight" can only be satisfied by pursuing an airspace management oriented solution to our nation's airspace management problem. If such a solution is pursued, then the base intent of "Free Flight" will automatically be an integral part of the solution. The best interests of all airspace users will invariably be foremost in any airspace management oriented solution, "Free Flight" is merely one way of defining these best interests. Because Solving the right problem inherently results in a solution that is simpler, more user friendly and less costly, a "Free Flight" oriented solution to managing our Nation's airspace will invariably have the same attributes. This short dissertation on solving the right problem is made to give credence to this paper's under-lying theme of doing so much so quickly for so little.

DEVELOPMENT ENVIRONMENT

The development environment for this "Free Flight" implementation plan is predicated on PFLAN's real-time processing of en route related ASD data for extended periods of time. The en route phase of flight was selected because of the existence of the Center TRACON Automation System (CTAS) to service the relatively complex terminal area traffic flows. It is envisioned that CTAS, or a derivative thereof, will interface with PFLAN to set up en route arrival sequences. In this role as a sequence provider to CTAS, PFLAN would always coordinate final sequences with air carrier dispatchers to guarantee the most economical and desired use of the airport by all. Integrating PFLAN into this environment will not be difficult, primarily because PFLAN's implementation rigidly adheres to OOD&P principles, i.e., rapid-prototyping of enhancements are quick and inexpensive. The current PFLAN was developed to run on a mid-range engineering workstations and is sufficient to simulate, track and display around 500 aircraft at a reasonable operational pace. PFLAN has also shown that working with 22,000 aircraft presents no technological problem other than requiring a faster engineering workstation with considerably more memory. Availability of workstations with ever-increasing computational power and unlimited storage capabilities at ever-decreasing cost renders computer resources to be a non-issue.

It is also essential that a free-thinking atmosphere permeate this development environment. One must refrain from dictating that every aspect of the intent of "Free Flight" be understood and clearly defined in specifications before the first line of computer code can be written, i.e., one must not be driven by a set of preconceived notions as to the exact nature of "Free Flight". Rather, a tiger team of all aviation interest groups should be formed for the purpose of insuring that no one group's best interests take precedence over any other interest group's best interests. Those responsible for developing the software for an operational "Free Flight" oriented system will then rapid-prototype these ever-changing, ever-refining, ever-growing sets of requirements until the end-state system has been attained. The consequence of this grow-as-you-go development process is that the resultant end-state system will maximally satisfy the best "Free Flight" interests of all users of our Nation's airspace.

PHASE 1 - INITIAL PROTOTYPE

The first step in this "Free Flight" rapid- prototyping evaluation is to modify PFLAN and possibly enhance its resident computer to receive in real-time all pertinent ASD data. The primary intent of this phase is to validate interfaces and to prove program viability by getting real-time experience with PFLAN's constant probing of all aircraft flows for the purpose of establishing that every potential conflict was detected prior to its resolution by controllers. Because the received ASD aircraft position data may reflect short-term flow changes made by airspace managers and air traffic controllers without revising the Flight Plan intent, it may be difficult to totally assess PFLAN's flow processing. Regardless, the results of this initial phase will establish the viability of this "Free Flight" implementation and whether or not subsequent phases should be pursued.

PHASE 2 - THE SHADOWING PHASE

The purpose of the shadowing phase is the real-time execution of PFLAN in conjunction with operational ATC and TMS programs. No attempt will be made to have PFLAN actively participate in the operational real-time processes that currently oversee use of our Nation's total airspace. The primary intent is to evaluate PFLAN in an operational environment. One way of viewing this phase is that it is a confidence builder for those who actively manage our Nation's airspace. It will, upon request, present conflict probe information initially to traffic management specialists and eventually to air traffic controllers. Although the exact nature of this presentation is unknown at this time, an auxiliary small screen display is a good candidate, again, first at an airspace manager's console, then at a controller's workstation. Getting these operational personnel to actively use this information may well be one of the most difficult task in this entire "Free Flight" evaluation. This difficulty does not negate the intent of the phase, nor is it an insurmountable problem, it is merely one that assuredly must be addressed. This phase may best be conducted in an ARTCC.

PHASE 3 - PILOT OPERATIONAL PROJECT

This phase will involve putting PFLAN in charge of some segment of an ARTCC's traffic, say, all aircraft above Flight level 370. The center's controllers would communicate PFLAN's conflict resolutions to those aircraft on their Sector's frequency. PFLAN would be solely responsible for safety-of-flight of its assigned segment of aircraft. Lest one conclude that this could in some way compromise safety, remember that the shadow phase has already conclusively proven that PFLAN probed and detected all conflicts. Additionally, TCAS procedures, to avert any potential conflict from becoming a reality, would be an integral of this phase. As success in this phase continues, an ever-increasing number of flight levels in en route airspace could be placed under the PFLAN umbrella.

PHASE 4 - TRANSITION PHASE

Given that phase 3 conclusively shows that PFLAN promotes absolutely safe, orderly and expeditious use of our Nation's airspace in accord with the "Free Flight" intent, the transition to a totally airspace management solution to an airspace management problem can proceed on a national scale. Hopefully, while the "Free Flight" evaluation and implementation was in progress, human factors experts were actively redefining the current roles of airspace controllers to their new roles as airspace managers. This is a critical issue because human nature inherently resists minor role changes - an all encompassing role change from being an air traffic controller to being an airspace manager is certain to become a major issue in the transition process.

CONCLUSION

The author does not intend this paper to be a complete technical treatise on PFLAN. While PFLAN is simple when compared to most ATC systems, its under-lying design is also very different at many levels. Rather than write a discourse on the advantages embedded in PFLAN's base design differences, let the accomplishments made during execution of this PFLAN implementation plan be a testimonial on its inherent higher degree of simplicity and greater level of airspace user friendliness. Completion of this evaluation will provide a timely and inexpensive assessment of the "Free Flight" concept. The four phases constitute a road map that insures that the end-state system does not compromise safety and is the most comprehensive and user friendly "Free Flight" oriented system implementation afforded by existing technologies. Furthermore, the OOD&P aspects of this implementation will facilitate more refined versions of PFLAN as new technologies come available. Finally, this PFLAN implementation uses existing Communications, Navigation, Surveillance (CNS) systems. As additional CNS technologies become available (SATNAV, SATCOM, etc.) all "Free Flight" economic benefits dependent on them (closer spacing, higher landing rates under IFR conditions, longer range communications, etc.) will immediately be passed on to all airspace users. Conversely, folding the same new CNS technologies into the current ATC control based system probably will not allow most of those "Free Flight" benefits dependent them to be fully realized. The total cost of the PFLAN implementation plan put forth herein is extremely minuscule when compared to the ten digit numbers associated with the on-going ATC automation effort. In fact, the total cost to execute this plan is probably less than the cost to incorporate one or two of the myriad of design changes experienced to date in the ATC automation effort.

SUMMARY OF TESTIMONY

Michael Boyd and Michael Baiada, ASRC & RMB

The present air traffic control (ATC) system results in lost money, hindered economic and aviation growth, and limited capacity. Upgrading this present system only continues an obsolete, inefficient system.

Instead of the current ATC "control" approach, Free Flight technology offers an alternative. It would eliminate ATC-dictated movement based on airspace and airport capacity limits that exist mainly because of how ATC operates.

FAA has given insufficient thought to forms of air traffic management other than current ATC system. Contrary to what FAA says, the current ATC system does not work and upgrading it won't solve the real problems.

ATC problems, from vacuum tubes on up, aren't caused by procurement problems; they're caused by poor management and incompetent planning.

(the following is a summary of a paper, attached to their testimony, "Operational Free Flight System Implementation Plan," by Norman Watts, who will also accompany them)

The technology needed for Free Flight includes a frequently updated real-time information source on aircraft and a computer program to process data in conjunction with user-preferred route profiles.

The Aircraft Situation Display (ASD) compiles data from all en route radar centers. This ASD data is supplemented with pilots' filed flight plans.

ASD could support a technical test of Free Flight, as well as some operational testing of Free Flight for en route traffic.

ASD could be integrated into an existing R&D program developed at by Watts (Projected Flow Analysis or PFLAN). An FAA technical report on PFLAN, to be released soon, supports the viability of Free Flight.

PFLAN is built on a software package (AERALIB) that coordinates information with carrier dispatchers to guarantee greatest flight efficiency and route preferences of carriers.

Recommends 4-phase process to test Free Flight: establish Free Flight's validity, test real-time execution against current ATC, allow pilot testing in some en route sectors, and transition to full implementation.

Mr. PETERSON. Mr. Watts.

Mr. WATTS. I didn't have prepared testimony, but I would just like to say that free flight is not a technology. Free flight is a better way to use our Nation's airspace. To support user-preferred flight profiles, we need to reorient our thinking on control of airspace to that of management of airspace.

The controllers in the current system envision a lot of problems happening up there that only happen in their mind. I think that for a very, very small amount of money with far less complication, free flight is a simpler solution to the right problem. Because it is a simpler solution, it is a better solution and is one that certainly could work tomorrow.

Thank you.

Mr. PETERSON. Thank you.

Next, Capt. William Cotton with United Airlines.

Mr. COTTON. Thank you, Mr. Chairman.

I am Bill Cotton. I am the manager of air traffic and flight systems for United Airlines, one of the Nation's leading carriers and the one that provided the finale at the Oshkosh air show just over a week ago. I hope that maybe you were able to see that, Mr. Chairman.

Mr. PETERSON. No. I had to leave before the—before that happened.

Mr. COTTON. It was a good show.

Mr. PETERSON. I heard it was.

Mr. COTTON. Several years ago, the member nations of the International Civil Aviation Organization, ICAO, agreed to establish new systems to support air navigation worldwide. Known as the FANS, for Future Air Navigation Systems, this new concept for navigation, communications, and air traffic management makes use of satellite technologies for functions that are now performed by terrestrial systems. These new systems provide for more accurate navigation and rapid, high-integrity data communications which together can be used as the basis for a far more efficient system of air traffic management.

The driving force behind the FANS concept is economic. Both users of the airspace and providers of air traffic services can realize dramatic savings from the proper implementation of FANS. For the users, these savings come from removing most of the current restrictions to flight which now prevent us from flying the most efficient path between airports. The term user preferred trajectories is used by ICAO to describe this capability.

We at United coined the term "Free Flight" to mean this ability to routinely fly user preferred trajectories without unnecessary restrictions. Free flight is simpler to say and to remember than user-preferred trajectories.

The losses to airspace users created by an unnecessarily restrictive ATC system are staggering. At United alone, inadequate air traffic system capacity and flexibility cost us well over $600 million last year, and the potential productivity of those wasted hours of airplane and crew time amount to more than twice that amount.

This staggering loss was more than enough motivation for us to get involved in trying to shape the evolution of ATC and, using the FANS concept, into a system that would, first, provide the necessary flight safety but simultaneously accommodate free flight by making much more flexible, and therefore efficient, use of the air-space.

Air traffic control performs two basic functions. The first is separation of aircraft, simply keeping airplanes within their jurisdiction from running together. The second function is traffic flow management, the process of getting aircraft in line for the runways spaced at a rate the airport can accommodate.

The problem lately has been that the second function overrides the first so that aircraft bound for New York are literally getting in line while still over the Pacific Northwest. This is because our present air traffic system lacks both the capacity and the flexibility for efficient operations.

The free flight concept would have ATC separate aircraft on a tactical basis as conflicts arise among aircraft flying their most efficient flight paths. Traffic flow management should be accomplished by insuring that the numbers of aircraft entering a terminal area will not exceed what it can handle, but on the basis of timing, not forcing airplanes of different speeds to fly single file all the way across the country.

Administrator Hinson has recognized the ATA-sponsored industry GNSS/CNS team as the proper forum for FAA to work with the airspace users to define the operational requirements for U.S. air traffic management under the FANS concept. The support of this committee would be most valuable in ensuring that FAA does, in fact, respond to user input as they try to recover from the cancellation of the Advanced Automation System.

We, the users, cannot afford a repeat of the Advanced Automation System mistake any more than the people of the United States can afford to pay for it. There must be near-term automation improvements that provide user operating benefits. It will not take nor can we wait for a complete replacement of the FAA's automation infrastructure for this to occur. We need free flight as soon as possible. The viability of the air transport industry is at stake.

In the written testimony, Mr. Chairman, there is a copy of air traffic management in the future air navigation system which describes the free flight concept in more detail by each phase of flight.

Thank you.

Mr. PETERSON. Thank you, Mr. Cotton.

[The prepared statement of Mr. Cotton follows:]

Statement of Captain William B. Cotton
FANS Program Director
United Airlines, Inc.
Before the House Committee on Government Operations
Subcommittee on Employment, Housing, and Aviation
Opportunities for Expanded Free Flight or User Preferred Routing
August 9, 1994

Several years ago, the member nations of the International Civil Aviation Organization (ICAO) agreed to establish new systems to support air navigation worldwide. Known as the FANS, for Future Air Navigation systems, this new concept for communications, navigation, surveillance and air traffic management makes use of satellite technologies for functions now performed using terrestrial systems. These new systems provide for more accurate navigation and rapid, high integrity data communications which can be used as the basis for a far more efficient system of air traffic management.

The driving force behind the FANS concept is economics. Both users of the airspace and providers of air traffic services can realize dramatic savings from the proper implementation of the FANS. For the users, these savings come from removing most of the current restrictions to flight which now prevent us from flying the most efficient path between airports. The term "user preferred trajectories" is used by ICAO to describe this capability. We at United coined the term "Free Flight" to mean this ability to routinely fly user preferred trajectories. Free Flight is simpler to say and to remember than "user preferred trajectories."

The losses to airspace users created by an unnecessarily restrictive ATC system are staggering. At United alone, inadequate air traffic system capacity and flexibility cost us well over $600M last year and the potential productivity of those wasted hours of airplane and crew time amount to more than twice that amount. This staggering loss was more than enough motivation for us to get involved in trying to shape the evolution of ATC, using the FANS concepts, into a system that would first provide the necessary flight safety, but simultaneously accommodate free flight by making much more flexible, and therefore efficient, use of the airspace.

Air traffic control performs two basic functions: the first is separation of aircraft -- keeping airplanes within their jurisdiction from running together; the second function is traffic flow management -- the process of getting aircraft in line for the runways spaced at a rate the airport can accommodate. The problem to date has been that the second function overrides the first, so that aircraft bound for New York are literally getting in line while still over the Pacific Northwest. Our free flight concept would have ATC separate aircraft on a tactical basis as conflicts arise among aircraft flying their most efficient flight paths. Traffic flow management should be accomplished by ensuring that the numbers of aircraft entering a terminal area will not exceed what it can handle, but on the basis of timing, not forcing airplanes of different speed to fly single file all the way across the country.

Administrator Hinson has recognized the ATA sponsored, Industry GNSS/CNS Team as the proper forum for FAA to work with the airspace users to define the operational requirements for U.S. air traffic management under the FANS concept. The support of this committee would be most valuable in ensuring that FAA does, in fact, respond to airspace user input as they try to recover from the cancellation of the Advanced Automation System (AAS).

We, the users cannot afford a repeat of the AAS mistake any more than the people of the United States can afford to pay for it. There must be near term automation improvements that provide user operating benefits. It will not take, nor can we wait for, a complete replacement of the FAA's automation infrastructure for this to occur.

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AIR TRAFFIC MANAGEMENT IN THE FUTURE AIR NAVIGATION SYSTEM

Air Transport Association
June 16, 1994

This document sets forth the ATA member airlines' vision of dramatic improvements in air traffic management, operational efficiency, and flight safety resulting from the implementation of new communications, navigation and surveillance (CNS) technologies in the next ten years. Collectively, these new technologies, and the essential improvements in Air Traffic Management (ATM) they enable, are referred to as the Future Air Navigation System (FANS). FANS was developed in International Civil Aviation Organization (ICAO) panel activity, and the concept was endorsed by ICAO as the new world standard in September 1991. Transition to the future end-system around the world will take a decade or more because FANS is highly dependent on the development and installation of automated ground and flight systems and the application of concepts that will change air traffic control in the most fundamental way. In spite of the magnitude of this transition, there is a very strong economic incentive for the air traffic service providers, the airspace users, and the traveling and shipping public to make the necessary changes quickly.

FANS is intended to be an accurate, highly reliable, consistent, worldwide system for air navigation, communications, and separation of air traffic. The breakthrough technologies that permit development and implementation of these revolutionary new capabilities are satellite-based communications and navigation, as well as high-speed digital data links for most routine aeronautical communications. Surveillance will ultimately shift from ground-based primary and secondary radars and airborne transponders to aircraft-derived position and velocity reports that will be transmitted to the ground for separation of air traffic and to other proximate aircraft for enhanced situational awareness and collision avoidance. For the first time, highly accurate position and flight path intent data will be available from all suitably equipped aircraft around the globe, including over the oceans and in remote areas where no surveillance coverage existed before. Much of the existing communications, navigation and surveillance infrastructure will be replaced with systems that are more cost effective and the VOR, ILS, MLS, ADF, OMEGA, LORAN, High Frequency (HF) radio, and enroute radars in current use will be withdrawn.

LOSSES IN THE CURRENT SYSTEM

ATA member airlines are currently losing about $3.5 billion per year because of limitations in the air traffic control system (see Table 1). The present system has not kept pace with air traffic requirements, and most of the existing equipment and procedures for the separation of aircraft and for traffic flow management are based on obsolete, manual systems and human intervention. There is no shortage of navigable airspace any place in the entire world -- even in the busiest terminal areas. The present air traffic system with its inflexibility and excessive separation standards, as opposed to the airspace itself, has simply run out of capacity. Furthermore, the current methods of manual traffic control routinely waste landing and takeoff opportunities at the busiest airports. Direct losses to the airlines result from:

- the requirement to fly circuitous departure and arrival procedures;
- indirect VOR-based routes between destinations;
- excessive ground and enroute delays;
- mandatory ATC-directed operation of aircraft at inefficient altitudes, speeds, and in unfavorable winds;
- less than optimum management of weather related diverts, cancellations and misconnects.

Most of these problems manifest themselves as increased flight time with direct increases in operating costs for crew, maintenance and fuel and as a significant reduction in airline productivity. Diversions, cancellations and misconnects represent a tremendous financial loss to the airlines as well as a personal hardship to their customers.

Additionally, the delays mentioned above represent lost productivity annually for the industry's extensive aircraft fleet, ground infrastructure and employee base. In other words, if the time lost to indirect routes, operational delays, and inefficient flight operations could be recovered, airlines could produce additional revenue by carrying additional passengers and cargo to more destinations. The value of this lost productivity for one of our members on our domestic routes alone is estimated at $1.2 billion per year (see Table 2). This loss is exacerbated by operations into and out of large metropolitan areas with major hubs. For that airline, studies have consistently identified this productivity factor as a key difference between the profitability of its operations and those of smaller point-to-point carriers who do not serve the largest airports and therefore avoid delays and inefficient procedures.

COMMUNICATIONS, NAVIGATION, SURVEILLANCE -- THE TOOLS

In the Future Air Navigation System, current VHF voice and Aircraft Communications Addressing and Reporting System (ACARS) data link communications will be replaced by high-speed data links handling all routine aeronautical communications among the company, the aircraft and the air traffic service providers. A backup voice capability will be retained for non-routine or emergency situations. With data link, the current delay, frequency congestion, interference, and misunderstanding typical of voice communications will be eliminated. The data link will handle large amounts of information reliably, accurately, and quickly. Direct communications between the aircraft and company, the aircraft and air traffic service (ATS), and the company and ATS will be possible. The requirement for HF voice radio for beyond-line-of-sight communication, i.e., in oceanic and remote areas, will be replaced by near instantaneous satellite-based voice communications and data link. Although VHF, Mode S, HF, satellite links and land lines may all be part of the communications subsystem, data messages will be sent using the standards and protocols of the Aeronautical Telecommunications Network (ATN) providing reliable communications between all existing and future user end systems.

Future navigation capabilities will be based on highly accurate Global Positioning System (GPS) signals with augmentation from special transmitters placed on communications satellites, some ground stations and possibly from the Russian Global Orbiting Satellite System (GLONASS). The generic ICAO name for the complete system is Global Navigation Satellite System (GNSS), and it implies a system with guaranteed accuracy, availability, coverage, and integrity appropriate for all aeronautical needs. Where current enroute radar can only determine the position of an aircraft within about five miles, today's GPS system itself provides a nominal position accuracy of less than 100 meters. With differential augmentation, or application of other special techniques, the accuracy can be improved to the sub-meter range in latitude, longitude and altitude. It is generally acknowledged that a GNSS based on GPS and suitable augmentation can provide a guidance signal accurate enough to replace all of the current functions of ILS and MLS, including a CAT IIIB autoland capability.

The positioning accuracy and common worldwide time reference of GPS, plus velocity and wind information from onboard inertial reference and flight management systems, will replace today's radar surveillance. In the future, each aircraft will be able to provide far more accurate and complete data than can be measured by radar today. This concept, called Automatic Dependent Surveillance (ADS), will be available worldwide. Highly accurate position information from all aircraft will allow significant reductions in aircraft separation standards and thus dramatic increases in capacity of the air traffic system. A form of ADS using the ATN data link for messages will prove this especially true in oceanic and other regions that lack radar coverage today and thus must resort to procedural means and huge distances between aircraft to assure separation. In domestic airspace, where line of sight communications are available, ADS-Broadcast (ADS-B) messages will be sent at frequent intervals to provide the basis for situational awareness and collision avoidance.

IMPROVED AIR TRAFFIC MANAGEMENT - THE PAYOFF

The improved CNS technologies outlined above are only the tools that enable a highly advantageous air traffic management concept for the future. It should be noted that all FANS benefits for the airspace users flow from a new ATM concept, not directly from any of the CNS technologies. Although data link communications, for example, will be more convenient for a crew, and therefore desirable, all of the monetary benefits from FANS come from the elimination of delays, the ability to fly direct routes, and from more efficient aircraft operations.

The new CNS technologies will require considerable investment on the part of the airlines--estimated at roughly $400 million over ten years for one major airline alone. Without direct monetary benefit to pay for this investment, however, the FANS transition will not take place. Because of the direct linkage between benefits and improved air traffic management, it is essential that the airlines, other airspace users, and the traffic service providers reach an early consensus on the future air traffic management concept. They also must agree on specific transition plans with attendant benefits. If the U.S. airlines and the FAA reach an agreement on future ATM, the U.S. is in a position to lead the transition to a consistent, worldwide ATM concept thus meeting one of the major objectives of FANS.

It is unlikely any airline will accept a long period of major investment in new systems with benefits deferred to some point in the future when the new ATM system is finally completed. The only acceptable scenario is one in which the airspace users and the service providers agree to implement future airborne and ground systems and improved standards and procedures simultaneously to ensure incremental benefits throughout the transition period. A fundamental requirement is for operations with varying performance levels of airborne systems during the transition (the concept of mixed operations), since various operators are likely to equip to different levels and at different rates. The decision to equip is an economic one; benefits will have different values to individual airlines and to each segment of the user community. It is essential that the new ATM system benefit all users, but depending on the level of required investment, a greater benefit may be needed to provide an incentive for significant investments. For example, it may be necessary to reserve the most favorable routes, or the most efficient procedures, for those carriers that have invested most heavily in new flight systems.

One immediate requirement for the future ATM system is to make better use of existing aircraft capabilities to provide greater economy of operations in the near term. Most modern aircraft are capable of point-to-point navigation and highly efficient vertical profiles using airborne Flight Management Systems. Routine use of these capabilities in the current airspace, however, is severely restricted by Air Traffic Control (ATC) and thus is the exception rather than the rule.

The future ATM system must be highly automated to allow maximum flexibility, optimized individual routings and maximum system throughput. The old methods of manual control, linear traffic flows, and human interaction need to be replaced to maximize benefits to airspace users. The following basic facts should be used to guide creation of the new system:

- The current trend toward tighter ATC control of aircraft has increased delay and inefficiency.

- The atmosphere is a fluid medium, and as such, is constantly changing (weather, winds, temperature, turbulence) and impossible to forecast with precision. Therefore, a deterministic four-dimensional flight path (latitude, longitude, altitude and time) from takeoff to landing, for aircraft separation, is neither efficient nor desirable.

- Operators have lost the flexibility to operate their aircraft efficiently, and in many cases the present system has even usurped the operator's dispatch prerogative.

Major elements, then, of the airline vision for future air traffic management include drastic improvements in both system capacity and flexibility. The initiative to operate the airline and conduct flight operations efficiently needs to be returned to the operators. To the maximum extent possible, aircraft should be separated tactically using knowledge of short-term aircraft intent, available directly for the first time through ADS. It is mandatory that fixed routes, assigned altitudes, and directed speeds, other than for short-term conflict resolution, are eliminated. Further, traffic flow management decisions must be based on shared, accurate, real-time knowledge of destination runway capacity and availability. In short, telling the airlines only what to avoid (other aircraft, special use airspace, etc.), not where, when, and how to operate their aircraft will assure the desired benefits.

VISION -- ENROUTE AIRSPACE

The basic premise of future operations in enroute airspace (domestic or oceanic) is "free flight." This means the operator has the freedom to determine his path in real time in four dimensions -- laterally, vertically, and in speed --without prior clearance from the air traffic service provider. The pilot's responsibility is limited to periodically informing air traffic of his position and near term intent. A flight plan filed with the service provider does not constitute a contract between the operator and service provider. Its purpose is to inform the service provider of the planned route of flight and estimated time of arrival at destination for flow management or air defense identification purposes only. "Free Flight" as defined here is synonymous with "user preferred trajectories" which is the ICAO terminology with the same meaning.

The combination of GNSS, ATN, and ADS will permit a much smaller bubble of protected airspace around each aircraft. The air traffic service provider will separate aircraft tactically, i.e., intervene only when there is a high probability one aircraft will penetrate another's "separation bubble" in the near term. Intervention in the flight path of an aircraft should be delayed as long as possible (to within several minutes of conflict), but not so long as to require an unacceptable avoidance maneuver, i.e., don't spill any coffee. The process of conflict detection and resolution must be automated, and with controller approval, resolution commands can go directly to involved aircraft. Conflict resolution should involve a minimum disruption to the flight path of each aircraft, and following an encounter all aircraft should be released quickly to resume free flight.

Because of the extensive automation and redundancy required, and because of the need for center-to-center and center to TRACON coordination, it is anticipated that separation of aircraft will remain a ground-based responsibility in most airspace for quite some time. During this period it is expected that an airborne "advanced" Traffic Collision and Alerting System (TCAS) capability will be available for backup in the event of failure of ground automation or communication systems. Ultimately, conflict identification and resolution could be accomplished with airborne systems, perhaps backed up by ground automation.

VISION -- TERMINAL AIRSPACE

Terminal airspace differs from enroute airspace because of the higher traffic densities and greater complexity of the traffic flow. Both arriving and departing aircraft share the terminal airspace, and often aircraft of widely different performance characteristics operate to the same or closely-spaced runways. From the pilot's standpoint, the most significant feature of the terminal airspace is the need to reconfigure the aircraft, to accelerate following takeoff and to slow and "dirty-up" in preparation for landing. While the aircraft is slow and with slats, flaps and possibly gear extended, extensive maneuvering may not be desirable. There might be weather, terrain, noise, obstacle or workload considerations that also limit the ability to maneuver freely in the terminal area.

Nevertheless, the terminal area objective is the same as enroute -- to move aircraft into and out of the airport with a minimum of delay and along routes that are as direct as possible. The desired method of traffic separation in the terminal area is free flight, but in limited special cases, defined arrival and departure paths may be required. On departure, the aircraft should be cleared on course (free flight) as soon as it has attained a safe altitude and speed.

On arrival, landing aircraft must be sequenced and spaced (metered) so as to ensure efficient landing rates. The best VFR rates should be maintained down to the lowest visibilities that will still permit any landings. The arriving traffic flow should be merged as close to the landing runway as possible (ideally 3-5 miles on final approach) on the extended runway centerline. A highly automated system with functions similar to the Center/TRACON Automation System (CTAS) will be required to perform this arrival sequencing and metering accurately. It is anticipated all aircraft will be capable of arriving at the merge point within plus or minus five seconds of the assigned approach time. Destination time of arrival (for the purpose of sequencing) and descent performance should be calculated onboard individual arriving aircraft. With this information as a starting point, the ground system will then negotiate with arriving aircraft to minimize total system delay and assign approach slots via data link.

The terminal area automation must be flexible enough to allow arrivals and departures to and from all points of the compass and to adapt immediately to severe weather conditions that deny use of one or more quadrants of the airspace. A key feature of this system will be the ability to apply wake vortex separation standards only when there is an actual vortex threat. Further, the system must adapt quickly to changes in runway configuration or runway availability. A system of this type has the ability to increase the capacity of the busiest airports by 30-50%, perhaps more in restricted visibility -- all without building additional runways. Standard arrival and departure routes with fixed ground tracks should be avoided except in the most extreme or restrictive situations.

VISION -- APPROACH

The airlines strongly desire "zero-zero" precision guidance to all runway ends normally served. This can be based on GNSS, initially augmented by a differential ground station at or in the vicinity of each of these airports. Obstacle and terrain clearance standards should be modified to give full credit for increased navigation accuracy of GNSS-based flight management systems. Further, a GNSS-based system will provide more than enough flexibility to permit operations into and out of closely spaced airports and runways. The same system should facilitate procedures to avoid noise sensitive areas in the airport vicinity.

Precision guidance (localizer and glidepath), but not necessarily "zero-zero" capability, is desired for all other usable runways worldwide without using local facilities. Approach minima to these "other-than-normal" runways would be determined by ground and aircraft equipment, and by crew qualification. Regardless of the approach minima, there is a tremendous advantage in situation awareness and consistency of procedures from having a single, uniform approach for all operations. The elimination of training requirements for non-precision approaches would represent a major savings to the airlines. Further, the all too frequent, "controlled flight into terrain" accidents could be reduced.

Spacing on final approach should be the minimum that allows one aircraft to clear the runway before another touches down. Again, real-time knowledge of and appropriate spacing adjustments for wake vortices are mandatory. As with arrival sequencing, the objective is to maintain a visual landing rate in all ceiling and visibility conditions. Enhanced or synthetic vision systems for approach, landing, taxi and takeoff will probably be essential if visual rates are to be preserved under the most demanding low visibility conditions.

VISION -- AIRPORT SURFACE

Airport surface operations at busy hubs is an area that will benefit from advanced automation to smooth aircraft flow and speed movements. Studies have identified ground and taxi delays as a major source of operational losses (second only to losses from indirect routings). A fully automated system that organizes surface traffic flow and deconflicts aircraft movements both to and from runways would not only provide direct savings to airlines, it would further enhance capacity and safety at busy airports.

At large hubs, low visibility movement capability will be based on differential GNSS signals. Position and velocity information will be broadcast from all aircraft and surface vehicles in aircraft movement area. Low visibility capability may be further improved with cockpit enhanced vision systems using onboard sensors such as radar or infrared. Surface movement automation requires accurate knowledge of position and velocity of all obstacles, vehicles, and aircraft. Again, the end objective is to maintain visual movement rates even in the worst visibility conditions.

With special cockpit and controller displays and data link, completely automated taxi clearance, guidance, and position monitoring will be possible. Runway incursion accidents and other ground collisions could be virtually eliminated. Minimum time taxi routings will be possible while still maintaining a small reservoir of demand at the takeoff end of the runway during periods of heavy demand to protect against lost takeoff slots.

To maintain visual landing rates, each aircraft must be able to clear the landing runway expeditiously and taxi to the assigned gate at visual speeds. The same ground movement automation and taxi guidance systems discussed previously would permit this "inbound" taxi capability. Both departing and arriving taxi movements need to be coordinated by ground automation, and the system must provide optimum ground flow patterns during changes in runway configuration and availability.

It is worth noting that some weather related hazards cannot be mitigated, and these conditions will impact the rate of airport operations. Snow or ice on the runway, excessive crosswinds, or a thunderstorm over the field, for example, will all slow or stop operations for a period of time. Further, there is always the possibility of a disabled aircraft on the runway or aborted takeoff for mechanical problems. All automation must be designed to operate with safety and efficiency in spite of these rare but unavoidable situations.

VISION -- TRAFFIC FLOW MANAGEMENT

The present concept of traffic flow management is based on today's airspace system with significant capacity constraints on the airport surface, and during the departure, enroute, arrival and approach phases of flight. As capacity and efficiency increase in the new system, flow management will only be routinely necessary during periods of peak loading at the busiest airports. There will be no need for flow control based on enroute or other "system" limitations.

In the FANS environment traffic flow management will evolve to a system based on destination runway occupancy and availability limitations only. Artificial system constraints, such as enroute bottlenecks or sector capacity constraints should be eliminated. All parties should have access to a dynamic data base of runway capacity and airborne demand. Modest reservoirs of demand should be maintained throughout the system to prevent loss of takeoff and landing slots due to short term changes in capacity, availability, or demand. Ground delays should be allocated equitably among operators, and the operators themselves should decide which flights to operate during restricted periods.

In summary, under the "Free Flight" concept, ATC does not interfere with an aircraft's flight path except to resolve a near-term, tactical conflict, to manage traffic flow to the end of the destination runway, or to ensure safety of flight, e.g., avoidance of special use airspace.

TIMING

The transition to a future air navigation system has already started. Many areas of the world are in advanced planning for application of the new CNS technologies, and some, including countries in the South Pacific and Canada, are already making use of procedures based on GPS navigation, data link communications, and automatic position reporting. Unfortunately, the transition to date has focused on the CNS tools with only a hazy concept for future air traffic management. This is a backward and high-risk approach since benefits flow from ATM not from CNS directly. Further, major decisions on CNS systems architecture, performance and capacity are dependent on the "end-state" ATM concept.

The FANS goal is global interoperability for ATM, but many different regional concepts, some highly inflexible and disadvantageous for airspace users, are evolving. ICAO is not moving fast enough, and again it has not focused adequate attention on ATM. The concept of "user preferred trajectories" has not been fully defined nor advocated consistently. Without real-world benefits the airlines should be skeptical about paying additional user charges. Under current planning, there is also a real risk that airlines will be required to fund redundant flight systems as well as maintain crew proficiency for different procedures to operate in different regions of the world.

It is essential that the ATA and IATA airlines quickly define a common future ATM concept that provides benefits in terms of "seats and miles." All airlines must insist on a worldwide system, common equipment, and consistent procedures. If increased user fees are needed to fund new ground infrastructure, the airlines must be provided real benefits to offset the required investments.

The FAA and other Civil Aviation Authorities (CAAs) should be brought into the process of ATM concept development on the ground floor. Engineering, air traffic, and flight standards participation is needed to complete the planning task. When the airlines, CAAs and other airspace users all reach a consensus on the future ATM concept, then the probability of achieving a consistent and beneficial system is enhanced considerably.

Near-term planning should focus on defining a benefit-based transition sequence that outlines required ground and airborne functionality (not black boxes), improved procedures and regulations, and technically and politically realistic timing. FANS transition plans will vary by geographic area of the world and by specific aircraft fleet. When all parties commit to the required transition schedules, essential cost/benefit analysis can proceed and system design can be initiated.

We will only realize the full potential of FANS and the total benefits of the new ATM concept through actual practice. Therefore, demonstration programs and early deployment of interim systems and procedures will speed development of a mature system with maximum utility. Full development of an agreed worldwide ATM concept must be completed in 1994 because regional CNS initiatives are already underway.

SUMMARY

In conclusion, a future ATM concept that maximizes the payoff from available FANS communications, navigation, and surveillance technologies has not been developed. The primary objective of this new concept needs to be highest flexibility leading to increased capacity and efficiency. It must eliminate delays, decrease operating costs and provide improved safety and service to our customers.

Rapid development of a strong government, airline, and industry consensus is mandatory, and benefit-based transition planning must start immediately. Cooperative development of the necessary transition roadmaps will ensure complete, realistic planning and provide the broadest consensus.

Only agreed benefits will motivate the necessary government and industry investments. Further, with required functionality outlined, systems performance requirements and actual CNS systems definition can begin. These two steps (benefits identification and systems definition) will provide the foundation for essential cost-benefit analyses. The required FANS investments will be difficult to justify on an individual "black-box" basis because most of the benefits flow from multiple CNS and ATM capabilities. There is a strong need for an overall FANS transition program coordinated by geographic area and for strategic funding commitments from governments and airlines.

Only individual airlines can determine the dollar value of specific benefits to their own operation. Nevertheless, a necessary starting point for cost-benefit analysis by the airlines is a clear, widely accepted and committed concept of future Air Traffic Management. Development of the future ATM concept should receive highest priority. The magnitude of the losses outlined earlier in this paper indicate clearly the future of the air transport industry is at stake.

ESTIMATED ANNUAL SOURCE AND VALUE OF ATC LOSSES
ATA MEMBER AIRLINES

	FOUR REPORTING AIRLINES	TWELVE ESTIMATED AIRLINES	TOTAL	ATA DELAY COST ESTIMATE
Gate Delays				117,382,349
Flow Control	49,176,392	45,960,830	95,137,222	
Air Traffic	38,200,175	35,702,329	73,902,504	
Airport	3,820,005	3,570,221	7,390,226	
Taxi Delays				
Outbound	628,316,080	587,231,542	1,215,547,822	639,314,533
Inbound	186,618,765	174,416,076	361,034,841	168,530,709
Enroute Losses				576,589,796
Indirect Routes	663,029,831	619,675,419	1,282,705,250	
Execution & Delays	50,298,861	47,009,903	97,308,764	
Cruise Inefficiency				
Altitude	18,799,936	17,570,639	36,370,574	
Winds	18,799,936	17,570,639	36,370,574	
Weather				
Diversions	24,707,840	23,092,236	47,800,076	
Cancellations	114,759,528	107,256,594	222,016,122	
Misconnects	8,867,216	8,287,404	17,154,620	
Total	1,805,394,563	1,687,342,830	3,492,737,393	1,501,817,386
DEPARTURES IN U.S.	3,088,854	2,886,879	5,975,733	6,032,500

Reporting Airlines:
American, Delta, Northwest, United

Estimated Airlines:
Alaska, Aloha, American Trans Air, Continental, Evergreen, Federal Express, Hawaiian, Reeve, Southwest, Trans World, UPS, USAir

TABLE 1

DELAY DEFINITION

Gate delays: (Minutes)

Gate delays were calculated by subtracting the scheduled out time from the actual for the gate delays identified in the following categories:

* Flow Control: Delays where the flight was held in the gate due to Flow Control restrictions into destination airport.

* Air Traffic: Flights that were held in the gates by Air Traffic control due to airport congestion or capacity constraints.

* Airport: Flights that were held in the gate due to airport congestion that was non ATC related.

Taxi delays: (minutes)

Taxi delays were calculated by subtracting the **Historical Figure of Merit** (out to off time [50% percentile]) taxi times from the actual (approximately 12 mins.).

* Outbound: Time from when the aircraft was electronically logged off the gate until airborne.

* Inbound: Time from when the aircraft was electronically logged on the ground until in the gate.

Enroute Losses: (minutes)

Enroute delays were calculated by subtracting the actual enroute time from a time determined by taking the great circle mileage between two city pairs and dividing by 7 miles per minute to derive enroute time.

* Indirect Routes: Time between great circle and actual.

* Execution and Delays: Time between the flight plan time and enroute time.

TABLE 1 (Cont'd)

ATA DELAY COST ESTIMATES vs AIRLINE VALUE OF ATC LOSSES

There is a difference in the airline value of losses and the ATA delay cost estimates. The difference is primarily due to the fact that the ATA data is used to determine actual ATC delays reported by many of our member airlines. The purpose of including the ATA delay cost estimates is to support the airline estimates with the actual recorded and reported delays.

1. The ATA cost estimates are purely ATC delay data. There is no loss of operating efficiency estimates in the ATA data.

2. Many of the airline schedules are padded to assure the airlines are able to meet the on time reporting required by DOT. This inefficiency remains in the airline data even when they report on time.

3. There is no attempt in the ATA data to estimate loss of productivity due to ATC delays and inefficiency.

Sample Value of Productivity Gains

Domestic Aircraft Only (727, 737, 757, DC10-10)	411 aircraft
Average Daily Flight Hours (Block)	10.85 hours/day
Average Number of Flights	4.92 flts/day
Average Hours per Flight (Block)	2.21 hrs/flt
Average Time Savings (all sources)	17.09 mins/flt

17.09 mins/flt x 4.92 flts/day x 1 hour/60 mins = 1.40 hrs/day/airplane

1.40 hrs/day x 1flt/1.93hrs x 411 airplanes = 298 flights per day

100 pax/flight x $160/pax = $16,000 per flight (does not include cargo)

$16,000 revenue/flt - $5,000 direct cost/flt = $11,000 contribution per flight

$11,000 contribution/flight x 298 flts/day x 365 days/year =

$ 1.2 Billion per year additional contribution

TABLE 2

SUMMARY OF TESTIMONY

Captain Bill Cotton, United Air Lines

The international aviation authority (ICAO) has presented a new system for global navigation, the Future Air Navigation System (FANS). This new system is built on satellite-based communications, navigation and air traffic management; they would replace current ground-based systems.

Great savings are expected from this new system that would result in eliminating current flight restrictions that now prevent more efficient user-preferred routing (or broadly defined Free Flight).

Staggering losses have resulted from the current air traffic control (ATC) system. At United, current ATC incapacity and inflexibility cost over $600 million last year. And adding the lost productivity of aircraft and crew, the $600 million almost doubles.

ATC basically manages aircraft separation and flow management. Flow management predicts runway need at airports (or demand) based on the number of flights en route; it eventually gets aircraft in line for arrival at airports, with them spaced for landing on runways. But ATC's flow management function is now overriding ATC's separation function, so that aircraft headed for NYC are literally in line for landing while still in the Pacific Northwest.

Free Flight would let ATC handle separation, to avoid conflicts, as aircraft fly their most efficient routes (or fly Free Flight). And traffic flow management would ensure that aircraft entering the airport's airspace would not exceed airport capacity, but this would be based on timing (rather than the distance-separation that ATC now imposes on landing aircraft). Now, aircraft of different engine efficiencies are forced to fly single file across the country's empty airspace.

Users and taxpayers can't afford another Advance Automation System (AAS) fiasco. We need near-term automation improvements that provide user benefits. We do not need a complete replacement of FAA's automation infrastructure for this to occur.

ICAO/FANS document attached to Cotton's testimony

Mr. PETERSON. Next we will have Roger Fleming, Senior Vice President of Operations and Services of the Air Transport Association of America.

Mr. FLEMING. Thank you, Mr. Chairman, and good morning.

As I am sure you know, U.S. air carriers have lost more than $12.8 billion during the past 4 years. Airlines have been forced to take aggressive steps to stem these losses. They have reduced capacity, they have reduced capital expenditures, and, regrettably, over 100,000 people have lost their jobs.

That brings me to the central focus of this testimony. A major contribution to airline operating costs that cannot be controlled by the airlines at the present time is inefficiency in the ATC system. And as you yourself and several of your colleagues have pointed out, we at ATA have estimated that those inefficiencies in the air traffic control system approximate $3½ billion a year, and, as has already been stated, we believe that is a conservative estimate.

We also realize it is not possible to hope to save all of that excess operating cost, but we think it is reasonable to set as a goal saving half of it.

As to the matter of airline CEO's being concerned about this level of cost, I can assure you that they are. And, in fact, Captain Cotton has been assigned by airline chief operating officers of ATA to head this effort, and I am the ATA officer responsible for working with him on these matters.

The present ATC system has not kept pace with growth in the air transportation industry. Most of the existing equipment procedures for the separation of aircraft for traffic flow management are based on obsolete manual systems and human intervention. There is no shortage of navigable airspace, even in the busiest terminal areas. The present system, with its inflexibility and excessive separation standards, has simply run out of capacity. Furthermore, the current methods of manual traffic control routinely waste landing and takeoff opportunities at the busiest airports.

The foundation for a viable and efficient ATC system is reliable and efficient equipment for communications, navigation, and surveillance, as well as automation and the other tools the air traffic controllers need to manage the Nation's air transportation system. These are the improvements needed in the FAA infrastructure to provide the airlines and other users the free flight concept that was described already by several witnesses.

The most important and vital program for improving the ATC system is the Advanced Automation System, which provides the hardware for capacity-improving programs known as Automated Enroute ATC and Center-TRACON Automation System.

The recent FAA announcements concerning the Advanced Automation System [AAS], have placed the entire program in jeopardy and demonstrate the past inability of FAA and the contractor to manage the AAS requirements process.

FAA has now made decisions regarding redirection of the AAS program which are contrary to the recommendations that the airlines made after having reviewed the status of the program with FAA and with IBM and the successor, LORAL.

The recent FAA decisions to restructure the program have caused the airlines serious concern that the effort put forth so far by FAA and the ATAAS contractor will have provided the ATC system users virtually nothing after more than 10 years and $2.5 billion of expenditure.

We believe that the phases of the AAS program which can still be implemented are the initial sector suite system and the terminal advanced automation system. These phases of the AAS are important to replacing old technology and providing the base system for future expansion.

The transition to the future air traffic management system has already started. Unfortunately, the transition to date is focused on technology with only a hazy concept for the future air traffic management concept. This is a backward and high-risk approach since benefits flow from air traffic management, not directly from technology.

Further, major decisions on systems architecture, performance and capacity are dependent on the end-state concept, and that end-state concept is described in some detail in the attachment to Captain Cotton's paper that he just referred to.

FAA is not moving fast enough, and it has not focused adequate attention on air traffic management issues. The concept of user-preferred routes or free flight must be pursued cooperatively by FAA and the airlines and other users. Without real-world benefits, the airlines will be skeptical of user charges paid by passengers and shippers for systems that are planned but never delivered or systems that do not satisfy the needs of the users.

In summary, Mr. Chairman, a future air traffic management concept that maximizes the payoff from available technology has not yet been developed. The primary objective of this new free flight concept must be designed for the greatest flexibility leading to increased capacity and efficiency. It must significantly reduce delays, decrease operating costs and provide improved safety and service for the passengers and shippers using the national air transportation system.

Rapid development of a strong government and industry consensus on an air traffic management plan is needed, and benefit-based transition planning must start immediately.

I note in taking a cursory look at the testimony planned by Mr. Steve Brown of AOPA for your third panel discussion this morning that he includes recommendations on pursuing airport capacity studies and—implementation of the recommendations from those studies. Airlines certainly strongly support that kind of action, and I am sure Mr. Brown will address it in his comments.

Finally, Mr. Chairman, we need your help as well as the assistance of your committee colleagues to effect changes in procurement and FAA acquisition practices needed to reduce the time required to implement new ATC systems. We cannot satisfy the public need for safe and efficient air transportation without major improvements in the procurement process.

That completes my statement this morning, Mr. Chairman. I am sure all of us are prepared to answer any questions you may have.

[The prepared statement of Mr. Fleming follows:]

Statement of the Air Transport Association of America
Before the House Committee on Government Operations
Subcommittee on Employment, Housing, and Aviation
Opportunities for Expanded Free Flight or User Preferred Routing
August 9, 1994

Mr. Chairman, my name is J. Roger Fleming. I am Senior Vice President, Operations & Services of the Air Transport Association of America (ATA). ATA represents 18 U.S. air carriers that transport passengers, cargo and packages. The ATA member carriers produce about 96% of the revenue passenger miles and cargo ton miles flown by the U.S. scheduled air transport industry. I appreciate this opportunity to appear before the Committee to present the views of these carriers on the need for more flexibility in the air traffic control system to improve operational efficiency and reduce costs.

As I am sure you know, Mr. Chairman, U.S. air carriers have lost more than $12.8 billion during the past four years. Airlines have been forced to take aggressive steps to stem these losses. Airlines have reduced capacity and tailored their route networks and hub operations to focus on the markets where the profit potential is best. They have reduced capital expenditures. Aircraft orders have been cancelled or deliveries delayed. Regrettably, over 100,000 individuals have lost their airline jobs over the past four years.

All of these cost reduction steps are being taken in a concerted effort to help return the industry to sustainable profitability, and we are beginning to see some benefit from these efforts. That brings me to the central focus of this testimony. A major contributor to airline operating costs that cannot be controlled by the airlines is inefficiency in the air traffic control system.

THE COST OF INEFFICIENCIES IN THE CURRENT ATC SYSTEM

Inefficiencies in the ATC system are costing the ATA member airlines about $3.5 billion per year. While it will never be possible to eliminate all these inefficiencies, due primarily to the adverse effects of weather, it is a reasonable objective, we believe, to eliminate one half of the unnecessary costs imposed on airlines by ATC system limitations. Achievement of this objective would greatly improve the competitive position of the airlines and accelerate their return to profitability.

The present ATC system has not kept pace with growth in the air transportation industry. Most of the existing equipment and procedures for the separation of aircraft and for traffic flow management are based on obsolete, manual systems and human intervention. There is no shortage of navigable airspace -- even in the busiest terminal areas. The present air traffic system with its inflexibility and excessive separation standards has simply run out of capacity. Furthermore, the current methods of manual traffic control routinely waste landing and takeoff opportunities at the busiest airports. Direct losses to the airlines result from:

- the requirement to fly circuitous departure and arrival procedures;

- indirect VOR-based routes between destinations;

- excessive ground and enroute delays;

- mandatory ATC-directed operation of aircraft at inefficient altitudes, speeds, and in unfavorable winds;

- less than optimum management of weather related diverts, cancellations and misconnects.

Most of these problems manifest themselves as increased flight time with direct increases in operating costs for crew, maintenance and fuel and as a significant reduction in airline productivity. Diversions, cancellations and misconnects represent a tremendous financial loss to the airlines as well as a personal hardship to their customers.

Additionally, the delays mentioned above represent lost productivity annually for the industry's extensive aircraft fleet, ground infrastructure and employee base. In other words, if the time lost to indirect routes, operational delays, and inefficient flight operations could be recovered, airlines could produce additional revenue by carrying additional passengers and cargo to more destinations. The value of this lost productivity for one of our members on our domestic routes alone is estimated at $1.2 billion per year. This loss is exacerbated by operations into and out of large metropolitan areas with major hubs. For that airline, studies have consistently identified this productivity factor as a key difference between the profitability of its operations and those of smaller point-to-point carriers who do not serve the largest airports and therefore avoid delays and inefficient procedures.

FAA ATC SYSTEM NEEDS

The foundation for a viable and efficient ATC system is reliable and efficient equipment for communications, navigation and surveillance, as well as automation and the other tools air traffic controllers need to manage the nation's air transportation system safely and without excessive delay. These are the improvements needed in the FAA infrastructure to provide the airlines and other users the "free flight" concept they desire.

The most important and vital program for improving the Air Traffic Control System is the AAS or Advanced Automation System which provides the hardware for capacity improving programs know as Automated Enroute ATC (AERA) and Center - TRACON Automation System (CTAS).

The recent announcements concerning the Advanced Automation System have placed the program in jeopardy and demonstrate the past inability of FAA and the contractor to manage the AAS requirements process. A program of this magnitude and importance requires the dedicated effort of the best that the government and industry have to offer and it is clear that in order to successfully implement such a program, increased oversight by top FAA and contractor management is necessary, including the introduction of tight discipline in the requirements setting process. FAA has been unable to manage the requirements setting process which has contributed significantly to the need to redirect the Advanced Automation Program.

FAA has made decisions regarding the redirection of the AAS program which are contrary to the recommendations that the airlines made after having reviewed the status of the program with FAA and IBM/LORAL. The recent FAA decisions to restructure the Advanced Automation System program have caused the airlines serious concern that the effort put forth so far by FAA and the AAS contract or will have provided the ATC system users virtually nothing after more than ten years and nearly $2.5 billion of expenditure.

ATA airlines have supported the AAS program since its inception and have been dismayed by some of the recent FAA decisions regarding the program. Some of the decisions FAA has made regarding AAS appear to be more political than logical and are insensitive to the users needs.

Cancellation of the Terminal Advanced Automation System (TAAS) is unwarranted, in our view. The contractor, LORAL, estimates that FAA will have spent $370M including $79M for termination and the users of the ATC system will have received no new capabilities. FAA currently has no revised plan in place to assure that replacement of the existing terminal automation system is timely and satisfies the needs of the users. Initiating new major system procurements will not help resolve the past difficulties FAA has had since no changes have been made in the procurement process FAA must follow. Cancelling the TAAS program means that the old equipment used at most of our important airports must be used for at least another 5 years. Improvements needed for the airport terminals important to the national airspace system, such as Center/TRACON automation and data link, will be delayed significantly.

Further delay of the decision on Initial Sector Suite System (ISSS) for enroute facilities is also troubling since there is a possibility that it too will be cancelled. Without ISSS, FAA has no platform to implement the early AERA (automated enroute air traffic control) function they have been promising to the users.

The inadequacies in the current antiquated system will increase as it is unable to accommodate the traffic growth resulting from the nation's economic recovery, and the old equipment will become less reliable and harder to repair causing added costs and loss of system capacity.

It is difficult to believe that nothing can be salvaged from the AAS program to at least provide the enroute and terminal facilities with an automation base from which to build improved functionality and resolve the concern of continuing to operate with the old equipment for at least 5 more years. Perhaps FAA has a response to these concerns that they have not yet made public. If so, FAA should inform to the Committee and the public of their revised program and assure all of us that they have considered the importance of gaining some benefit from the money and time that has been invested in AAS. It is crucial that the most important phases of the Advanced Automation System continue to be supported by the industry and Congress. FAA should not cancel the entire program and start all over.

We believe that the phases of the program which still can be implemented are the initial sector suite system (ISSS) and the terminal advanced automation system (TAAS).

These phases of the AAS are important to replacing old technology and providing the base system for future expansion. The first meaningful productivity improvement to the enroute portion of AAS -- from the viewpoint of the airlines and other users -- is the advanced enroute automation phase known as AERA. The software program known as "Initial AERA Services" should be pursued in parallel with the ISSS, to be ready for implementation as soon as possible after ISSS is delivered.

There is also an urgent need to expedite the implementation of new automation technology at many terminal locations. These improvements have been on hold, due to the delay in the automation of enroute air traffic control facilities. Advanced automation for terminal airspace is now scheduled for 1999 at the earliest. The existing terminal facility automation equipment is 1960-vintage, capacity-constrained technology. The equipment is increasingly difficult to maintain, and must be replaced. The TAAS element of the Advanced Automation System is fundamental to the need for terminal automation and must be continued and accelerated, so that FAA can implement the technology at major, high priority terminal airspace facilities. In addition, a decision must be made soon on modifications that may be needed to TAAS to satisfy requirements of the 170 smaller TRACONS.

The transition to a future air traffic management system has already started. Unfortunately, the transition to date has focused on technology with only a hazy concept for future air traffic management. This is a backward and high-risk approach since benefits flow from air traffic management not directly from technology. Further, major decisions on systems architecture, performance and capacity are dependent on the "end-state" concept.

FAA is not moving fast enough, and it has not focused adequate attention on air traffic management issues. The concept of user preferred routes or "free flight" must be pursued cooperatively by FAA and the airlines and other users. Without real-world benefits the airlines will be skeptical of user charges for systems that are planned but never delivered, or systems that do not satisfy the needs of the users.

Airlines and other airspace users could receive some benefits of a free flight structure today without additional technology, if the National Route Program (NRP) were liberalized and made a high priority by the FAA. The NRP was started in 1990 as an ATA/FAA initiative, and has been expanded over the four year period to include more than one-hundred city pair flight segments. Unfortunately, as the list of NRP city pairs has grown, the FAA has applied limitations on the route of flight that users can select. The result has been that many of the NRP routes are not much different than FAA's preferred routes. In addition, use of NRP routes is restricted to hours when airline traffic is relatively light.

The airlines need flexibility in the selection of route of flight to avoid the economic penalties of the FAA Preferred Route System. For example, the FAA preferred route from Dallas-Ft. Worth (DFW) to Kennedy International airport is more than 100 miles longer than the FAA preferred route from DFW to LaGuardia, which is a significant economic penalty.

The NRP should be changed to permit aircraft to fly fuel efficient routes from Standard Instrument Departure (SID) to Standard Instrument Arrival (STAR) without regard to circuitous preferred routes. This change could be effected gradually by permitting users to select their own route of flight for flights above Flight Level 350 that are 1000 miles or more in length. This should be done immediately, and a schedule should be adopted to further reduce the altitude and distance requirements.

SUMMARY

In conclusion, a future air traffic management concept that maximizes the payoff from available technology has not been developed. The primary objective of this new concept must be designed for the greatest flexibility leading to increased capacity and efficiency. It must significantly reduce delays, decrease operating costs and provide improved safety and service for the passengers and shippers using the national air transportation system.

Rapid development of a strong government and industry consensus on an air traffic management plan is needed, and benefit-based transition planning must start immediately. Cooperative development of the necessary transition plan will ensure complete, realistic planning and provide the broadest consensus for a "free flight" ATC system that satisfies the common objectives of FAA and the users for a safe and efficient system.

Only mutually agreed benefits and a government commitment to implementation milestones will motivate the necessary industry investments. Individual airlines will make decisions on investment in airborne systems modifications that will be needed based upon the dollar value of specific benefits to their own operation. A necessary starting point for cost-benefit analysis by the airlines is a clear, widely accepted and committed concept of future air traffic system management. Development of the future "free flight" air traffic management concept should receive high priority. Efficiency and safety of the national airspace system is at stake.

Finally, Mr. Chairman, we need your help, as well as the assistance of your Committee colleagues, to effect changes in procurement law and FAA acquisition practices needed to reduce the time required to implement new ATC systems. We cannot satisfy the public need for safe and efficient air transportation services without major improvement in the procurement process.

SUMMARY OF TESTIMONY

Roger Fleming, Air Transport Association

Air traffic control's (ATC) inefficiency imposes uncontrolled costs on carriers because the system is obsolete, manual, and inflexible, wasting time and opportunities for greater productivity.

The most important program for upgrading ATC is the Advanced Automation System (AAS), which provides hardware for AERA and CTAS (Center Tracon Automation System that handles complex terminal traffic). FAA's major problem with AAS was its requirement-setting process.

FAA's recent decision to cutback AAS was more political than practical, and could mean zero benefits from 10 years and $2.5 billion. And FAA's decisions on the future program to rectify AAS problems are not in line with carriers' recommendations.

Cancelling TAAS and ISSS (components of AAS) is wrong; it creates more problems, and further delays automation, AERA, and needed datalinks. There must be a better way to rectify problems, yet get something for all the money and time already invested. ISSS and TAAS are very important to users, because automation at terminal areas is needed to improve efficiency.

FAA's transition efforts to automate the ATC system focuses on technology with little thought to the desired end product and future of air traffic management. This approach is too high risk. Instead, FAA's focus should be on user benefits.

Free Flight as implemented in FAA's National Route Program (NRP) has too many restrictions: FAA's own preferred routes (ATC routes) are not much different from NRP routes, and NRP is allowed when traffic is light. Further, Free Flight should also be allowed for departure and arrival routes.

Recommendations: new air traffic management concept that emphasizes efficiency, flexibility and capacity; government-industry consensus on future air traffic management system; a benefit-based transition to new system and upgrades; and reforms of FAA procurement and acquisition.

Mr. PETERSON. I want to thank all of you for your testimony. Mr. Boyd, do you know how much airport capacity could be added if we do this right?

Mr. BOYD. Well, we think a significant amount.

Mr. PETERSON. Do you have a number on it?

Mr. BOYD. Depends on the airport and where you are.

Mr. BAIADA. Allow me, sir.

The current airport capacity is limited to the runway acceptance rate and the final approach segments. We are talking, at the Chicago airport, probably in the neighborhood of 110, on a good VFR day with good weather like it is today outside, to 120 aircraft per hour.

In fact, with a flow management system, as Captain Cotton has addressed, we can increase the acceptance rate of the runways in all types of weather. Adding some of the newer technologies such as GPS and other philosophies can in fact allow landing an aircraft on the runway at 1-minute thresholds, raising the acceptance rate to somewhere in the neighborhood of 55 to 60 aircraft per hour. In a three-runway operation, this would approach 180 aircraft per hour, well above the demand of the airport, which is driven by the gates available.

Mr. PETERSON. On a bad day, with a 200-foot ceiling, how many aircraft land at O'Hare?

Mr. BAIADA. Captain Cotton probably has a better idea of that, but I am guessing it is probably—they go to two runways?

Mr. COTTON. It is about 60.

Mr. PETERSON. So it would be about triple, if it all worked right, which is a significant increase.

Mr. BAIADA. Right.

Mr. PETERSON. What role would GPS play in all of this? We are going to have this aircraft situation display, or whatever this thing is called here—displayed.

When I was looking at it in Oshkosh, it looked like it could be linked together with GPS. How would GPS integrate all of this?

Mr. BAIADA. GPS is part of the solution. But as Mr. Fleming said, the benefits from all the technology flow from the application of air traffic management.

Currently, in a control-oriented philosophy, the limitations are not navigation capability. Most of the airlines today have a flight management system with accuracies one-tenth of a mile or 600 feet. GPS increases that to 300 feet. That is not the issue in here.

Will it, in fact, benefit the airlines and the whole aviation community as it is doing today in GA? Absolutely. No question. But you have to get through the ATM issues first.

Mr. PETERSON. Well, if we got the change in philosophy, would it be possible to provide every airplane in America with a GPS code, beam this code up to the satellite and beam it back into the airplane and you would know where every plane was, its altitude, and which direction it was flying; and you could have it displayed in your cockpit. Is that where we are heading, or is that where we should be heading?

Mr. COTTON. Yes. Mr. Chairman, you have just described a concept that is known as Automatic Dependent Surveillance [ADS], broadcast in which the position of each aircraft is determined on

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board using GPS as the best source and then broadcast at an interval, such as once per second, to every aircraft in the vicinity and also to the control system on the ground. In concept and in fact, in the future, this could replace radar as a surveillance system for air traffic control.

Mr. PETERSON. Is that being studied?

Mr. COTTON. It has been suggested. I am sure that the FAA is also aware of it. It has not yet been studied to the degree that it must in order to become an implemented system.

Mr. PETERSON. But clearly it can be done?

Mr. COTTON. Yes, sir.

Mr. PETERSON. I don't think there is any question about that, right?

Mr. COTTON. That's right.

Mr. PETERSON. Explain this to me. You, apparently want part of the Advanced Automated System to be kept, Mr. Fleming?

Mr. FLEMING. Mr. Chairman, we recommended that, of the total program, we believe that the Initial Sector Suite System can be completed successfully, as well as——

Mr. PETERSON. Explain what that is.

Mr. FLEMING. Those—the ISSS portion of that program is intended to produce the new work stations that would be made available for controllers at the enroute air traffic control centers as well as the major terminal control facilities.

Mr. PETERSON. So these are new screens and new computer boards, I imagine?

Mr. FLEMING. And local area network and eventually software.

Mr. PETERSON. Is this going to be compatible with this other new technology? Or are we going to be locked into something that isn't going to work with new technology; will we get limited to some obsolete system? Or can this be incorporated into some of these other ideas we are talking about?

Mr. FLEMING. The automation capabilities that would be introduced by the key segments of the AAS—ISSS sorry—would provide the base upon which these new capabilities could be introduced. Changes would clearly be required.

Mr. PETERSON. Right. But it isn't going to lock us into something that will preclude us from going farther?

Mr. FLEMING. Absolutely not intended to do so.

Mr. WATTS. I would like to make an addition to Mr. Fleming's comment, namely that we have a means of doing something in the background as described in my operational free flight system implementation plan. I don't think you should stop doing anything. Whatever we are doing now we should continue, but we have to be aware that we can do something in addition. We should just let it free think its way in, that is, let the free flight concept mature itself into what the users want. The FAA and others people should give them as much as they can safely have—maybe 98 percent or 99 percent. It is certainly going to be a lot more than what they are going to get in the AAS system. Again, do it in the background.

Then at some point in time, you folks, Congress, are going to look at this free flight thing and say, my goodness, it is simpler, it is more user friendly, it is doable. Let's go with it. But I think it would be foolish to stop AAS, but it is not foolish to look at something in the background.

Mr. PETERSON. Right. It seems like so often with these computer systems, we get locked into some mainframe or some kind of technology that precludes us from getting to where we need to get, and that is what I was concerned about; that we don't get into that kind of a situation.

Mr. FLEMING. Mr. Chairman, that is intended to be an open systems design capable of the kind of expansion Mr. Watts is talking about.

Mr. PETERSON. We are going about 5 minutes. We couldn't find a light, Mr. Zeliff. Evidently, reform hasn't gotten to the aviation, employment subcommittee, but we will.

Mr. ZELIFF. Thank you, Mr. Chairman.

On the AAS system, with the amount of money that we have already put forward, with all the changes and the recent sale and the mismanagement of the project, at least it appears to be, what is it that we need to do to get that back on track and can it get put back on track?

Mr. Fleming.

Mr. FLEMING. In response to your question, the FAA has to come forward with a plan for recovery, which they have not yet done. We, as you can see from our statement and our commentary in response to the chairman's questions, favor retaining at least the key elements of AAS and building upon them. We did not agree that the whole AAS system as originally conceived should survive. That, clearly, is not in the cards, and it is not justified.

The administrator and his key managers—and you will have several of them before you shortly—are busily engaged, I am quite confident, in developing such a plan, but it hasn't been made known to the users. And I thought Mr. Clinger made a very astute observation in his opening comments about having the opportunity at the present time to rethink the approach to air traffic control and, in the concept of an open system design, having the capability to add on new functionality, as Mr. Watts just suggested. I think those are some of the key points.

The airlines realize full well that without the automation base in the air traffic control system we will never realize most of the benefits of GPS, as operators that have to comply with the instrument flight rules. General aviation will be able to realize many of the benefits, airlines will not, absent that automation base.

Mr. ZELIFF. And you indicated in your testimony that over the past 4 years we lost $12.8 billion, I guess, in cumulative losses for the industry. And with the free flight system potentially a tremendous savings.

I believe, Michael Boyd, you indicated that we would have—we would see robust profits if we could change the system. Are you telling me that if we could move to free flight and we could move to better automation, getting computer systems up, that we then will have a profitable industry?

Mr. FLEMING. I would not make such a claim.

Mr. Boyd has addressed the cost side of the equation. He did not address the revenue side of the equation. If, in fact, airlines elect to compete away the savings in the marketplace, they can still lose money. So can any other business, I would add.

Mr. ZELIFF. I think you are probably going to be absolutely correct.

Mr. BOYD. If I can add to that, the revenue side is there and the management side is there. This would not solve all the airline industry problems because they are somewhat endemic problems as I stated, in the way they do business, so they have to change in addition to this. But it certainly would put them in a better position to compete. Lower costs always do.

So the revenue side we don't know, depending on certain issues, but Mr. Fleming does have a point. My issue is, if we had this system, we would have a more efficient airline industry. That is all there is to it.

Mr. FLEMING. I completely agree with Mr. Boyd's point.

Mr. ZELIFF. In discussion, the administration has talked about privatizing the FAA. When you look back at the computer system and other things, do you think that there has been mismanagement? And what are your comments on privatization of FAA and how would you see that affect the things we are talking about today?

Mr. FLEMING. In response to your question, I closed with a plea for the assistance of the committee on procurement reform, and that is one of the key elements that we all wistfully hoped privatization or reform or, for that matter, governmentwide reform might produce.

As you know, the secretary has not come forward with a specific legislative proposal yet. I expect that he will do that in due course, and it is very difficult for—to critique or even make intelligent comments about a proposal that hasn't been put to the Congress, in this case.

Mr. BOYD. If I may, sir, I would add that there is no need to be doctrinaire about privatization versus staying the way it is. I think it is kind of a non sequitur in terms of getting what we are talking about here today done. I don't see where privatization would accelerate that process in any way, shape or form. Certainly, the documents I have seen seem a little rosy rather than—shall I say—realistic about it. So I really think—at this point, it is sort of a non sequitur in terms of getting where we need to go.

Mr. PETERSON. Mr. Clinger.

Mr. CLINGER. Thank you, Mr. Chairman, and thank the panel for your very interesting and helpful testimony. Just a couple of points.

Does everybody—Mr. Fleming indicated that, you know, there has been a lot of problems with AAS. And, heaven knows, ever since this plan and all through this whole sorry saga of being assured that things were on track and under budget, you know, meeting the time line and everything and then being told time after time that, whoops, we miscalculated, it is going to cost more money and it is going to be late, that whole saga——

I guess the question really is, Mr. Fleming thinks that we can preserve and, you know, save part of this investment, and it is an enormous investment that we have thus far in the AAS system. Do you all share that belief that you—in other words, if we were to go to a free flight concept, are parts of the AAS program compatible with that and—or do we have to scrap the whole thing?

Some of you seem to be suggesting that the whole thing has been a waste and we should just forget it and start all over again. Isn't that going to be an expensive proposition?

Mr. BAIADA. I don't agree completely with AAS. I never have. Because I think, as Mr. Fleming said, it is 10 years and billions of dollars behind schedule. But at this stage of the game, it really is the only game in town, and the conservative approach is, in fact, to continue with that.

But, beyond that, AAS will not give us free flight. The change in air traffic philosophy will give us free flight. Technology will not give us free flight. Once again it is the change in ATC philosophy that will give us free flight.

So AAS does not guarantee free flight, and I take somewhat of a simplest approach that if the problem is, in fact, keeping air frames from running into each other, maybe the AAS and the whole command and control functions that AAS continues to keep in the system, will not allow free flight.

So I conservatively support the AAS and what needs to be done to continue that. We need to look at other solutions to the problem that put it in a much simpler light, that is, solve the right problem. And, to be honest, I am not sure AAS does. But given the only game in town, we have to move forward with it, but let's look at other things.

The proposal that we came forward with to prove the viability of that program would be under a million dollars. In fact, if it worked, would provide free flight much simpler, much quicker than AAS could ever do. It would have a major impact on what the final AAS is in the air traffic world.

Mr. CLINGER. Let me ask you this. As I understand the concept, the decision of how to get from point A to point B rests with the pilot in this instance, under the free flight concept, and that, at some point, I would presume as you near the airport you must come under active control; is that correct?

Mr. COTTON. Yes.

Could I comment on that, sir? The decision rests with the pilot or, in the case of an airline, the pilot and/or his company at all times. But, in fact, throughout the flight, it is proposed, even in the free flight concept, that the control system is capable of intervening when and as necessary to resolve conflicts among airplanes and to do the traffic flow management function throughout the flight. It is just that the freedom of action is an order of magnitude greater under the free flight concept.

Mr. CLINGER. OK, two questions I have then. We are anticipating not an exponential growth in air travel, but certainly a steady growth, and all—Boeing and everybody projects a rather substantial increase in aircraft as well as travel. Are there safety implications involved with this concept if you keep——

I mean, I think you alluded to the fact that you could go up on the roof and find very few planes out there. That may not be the case. Ten years from now we may have—in other words, the airspace is going to get a little more crowded. Does this become a little more difficult concept where you have a vast increase in air traffic?

Mr. BAIADA. I think—you are right. Will traffic increase under free flight? Absolutely. And I think it is the only way we will get the rosy FAA traffic projections to, in fact, come true. But at some point, there will be limited resources.

Currently, the resources are constrained by the air traffic control, the control environment, not the physics of the equation. At some point you will come into contact with, or come up against a physical restraint or constraint where the solution as Captain Cotton has said, is flow management. And we view flow management as being done by the airlines or by the operators to maximize or choreograph the entrance or arrivals into the restricted or limited resource, that is, the runway resources. Probably the most limiting factor in the near term.

So the flow management will control arrivals and manage them safely, once again, supporting air traffic management. And I use the word management rather than control, purposely, because it is the function of separating aircraft in the whole airspace environment.

Mr. CLINGER. Let me ask you this. You have indicated—well, being an air traffic controller is a high-stress operation. Burnout is a common problem there. And it seems to me that this might exacerbate that because you are basically taking the control away from the controller. He is going to be a reactor rather than having control of the situation at any given time. He is going to be asked to monitor a segment where he does not really dictate how that segment is going to be managed. It is going to be in the pilot's control or the company's control. Doesn't this raise the threshold of angst on the part of an air traffic controller?

Mr. COTTON. No, sir, I don't believe that it does. The concept would have the automation actually be involved in the process of separating airplanes. Right now, when we talk about advanced automation systems, we are talking about a new computer for the controller's display and for processing of data for, but the computers at this point have never been involved in the actual separating of aircraft themselves, and that is where the angst comes, as you mentioned, for controllers.

Under the free flight concept, he is removed to a very significant degree from that process by the automation. He becomes more of a system manager, and, therefore, his level of stress should be greatly reduced.

Mr. CLINGER. Just one final question. You alluded to the fact that they should be beating down the doors here or the FAA by the CEO's of the major companies. Why aren't they doing that? Mr. Fleming, do you have a comment? Mr. Boyd?

Mr. FLEMING. Mr. Clinger, I intentionally mentioned that Captain Cotton and I are the designated hitters of the CEO's to accomplish that objective.

The action happens to be with the chief operating officers for the most part on this particular subject, rather than the chief executive officers, but, in fact, the industry GNSS/CNS team effort that was referred to in Captain Cotton's testimony is chaired by Captain Cotton, and I am the principal ATA staff officer that pursues these matters, and we are working with our colleagues at the FAA in the early stages of pursuing this free flight concept.

Our focus in recent months has been primarily on GPS and GNSS, but that program we all believe is well on track, and the objective now is to realize the benefits from air traffic management, which is where the potential cost savings are for the airlines.

Mr. BOYD. I think my point was that despite the distinguished credentials of the folks at this table, this needs to be elevated to where CEO's are directly involved, as they are in labor negotiations, as they are in terms of other negotiations, to buy airplanes or sell airplanes or lease airplanes. It is that critical. So I think that the presence and the direct involvement of CEO's would elevate this to a higher level where I think we might be able to get more done, where the importance of it would be a little more obvious. I believe it needs to be elevated to the level where the CEO's of these airlines are taking an active and aggressive stance on this, as well as going through industry organization.

Mr. CLINGER. Thank you, Mr. Chairman.

Mr. PETERSON. Thank you.

Mr. Lucas.

Mr. LUCAS. Thank you, Mr. Chairman.

I suppose more in the way of a comment instead of a question, as the Chairman alluded to earlier, having only been a Member of this fine body for slightly over 2 months now, I find the one comment about competing away the cost savings most fascinating. Coming from a background in agriculture where we work diligently to adopt the newest technology so that we can then compete for the resources and run the rate of return down to its lowest conceivable level, I can identify with that statement.

Thank you, Mr. Chairman.

Mr. PETERSON. Mr. Shays.

Mr. SHAYS. My sense is that the issues involved here are safety, time and cost. In other words, I care first about safety, then I care about time, then I care about cost. We are looking at a plan that was supposed to be completed in 1992 that is going to be maybe finished in 1998. We are looking at a program that cost basically $2 billion now up to $7 billion. Is this accurate, in so many words?

Mr. WATTS. I would like to say that I think if we stay with ATC or control, we are definitely going to have a problem, and the problem is not going to go away, why? Because we are solving the wrong problem. If you want to manage air space, then you don't develop software predicated on controlling it.

So, to me, as long as we keep our "control" hats on in the FAA, we are going to pour good money on top of bad money until eventually it overwhelms us. That is why I think we have to look at free flight by setting up a group of people within the FAA to work with the industry, to work with the airlines, work with ATA, work with the pilots, the people who want to use the air space, and make sure that their wishes and desires are maximally satisfied without compromising safety. I think we can do that.

Again, I don't think we should stop doing what we are doing. We have to do free flight a little bit differently. We have to say let these people consider free flight and see where we get.

I think we will get there. I think if we said we were going to make free flight a part of AAS, it would be wrong. It is not going to work. You are not going to get there. As long as you say free flight is going to be a subset of AAS, the control, aspect of AAS is not going to get us where we want to go. Because control and management of airspace are two diametric opposites.

Mr. COTTON. Could I comment on that, too, sir?

The Advanced Automation System I think is what you were referring to as the costs and the timing, cannot be considered as an alternative to what is being proposed here. It is just a computer platform, in computer parlance. It doesn't necessarily encompass any particular operating philosophy.

We are talking about air traffic management which is the way airplanes are controlled. That is where there has been no focus. We have concentrated on the technologies, on the hardware, without talking about how we are going to manage air traffic. That is what is being proposed here, a new way to manage air traffic using whatever computer platform we can most economically and in a timely fashion get into place.

Mr. SHAYS. One of the messages I am getting—is that the FAA's paradigms totally need to change. That is basically the message I am getting from everyone here, is that correct?

Mr. COTTON. That is correct. They have the seeds of this paradigm in something they call the national route program, but it is very limited in scope, needs to be greatly expanded and improved in the direction of the free flight concept that we have described.

Mr. SHAYS. One of the other things that I sense here is that since so much money was spent on the AAS that there are some who are going to want to defend it and show that it can ultimately work. I also feel that, obviously, when we are dealing with the FAA, safety is going to be overriding, and you are not going to have a sense of taking risk with safety at all. So the safer route, it seems to me, sometimes for a bureaucrat in FAA, is to basically take the status quo and move extraordinarily slowly. I mean, is that a mind set that you sense exists?

Mr. COTTON. It does indeed exist, and it is a tricky one because, of course, safety must be paramount, regardless of the operating paradigm, but there is nothing in this concept that would ever reduce—in fact, it could increase safety over what we experience today in today's system.

Mr. BAIADA. I would tend to agree that the philosophical change and the paradigm shift is one of the major tasks that we face. As Mr. Watts said, to go from the control orientation to the air space management orientation is the major task. And safety, as both Captain Cotton and I, sitting in the front of airplanes understand, is the ultimate responsibility of all of the users and managers of the air space.

But there are methodologies that you can look at, rapid prototypes, and philosophies or different theories outside of the ATC system. These would not impact safety and could either be proven true or not true, as the operating system to provide this air traffic management. That is what we are proposing today.

Mr. SHAYS. OK. My last question if I could, I guess what I am really wondering what is the big restraint here, just to have you comment on it. It seems to me that, obviously, the free flight would be less costly in the long term. It would save a lot of time. Would it, in fact, be safer?

Mr. WATTS. I don't think it would compromise safety at all. Free flight is a way of letting people use the air space. You can manage it safely. It is as safe as a controller looking at a scope saying, go there, do this, do that.

Mr. SHAYS. Let me just say to the person who isn't behind the controls, free flight—you know, you have this vision of people and planes flying any which way. That is the sense of it. The term is a very interesting one. I wonder if we could think of another term.

Mr. WATTS. I think free flight would entail getting the best wind profile, getting the best altitude profile, if they are going to get in a true Free flight profile.

Mr. SHAYS. It sounds like do your own thing. That is the problem.

Mr. WATTS. It is not doing your own thing. They would have to tell you in advance what they want to do if they want to be kept safe. In other words, they couldn't just roll a plane over and say make it safe.

Mr. SHAYS. I hear you. Thank you.

Thank you, Mr. Chairman.

Mr. PETERSON. Mr. McHugh.

Mr. MCHUGH. Thank you, Mr. Chairman.

Continuing on with the thoughts of Mr. Shays, obviously safety is the primary concern of us all, certainly, as you said, sir, those in the front of the cabin.

Captain Cotton, in your discussion, you mentioned that you foresaw those instances where air traffic control would intervene during conflict. If this is such a perfect system, what kinds of conflicts are we talking about?

Mr. COTTON. They do intervene during conflict today. Even though we fly with a flight plan, with a clearance, that clearance is not deconflicted. Conflicts are resolved as they occur, even on a fixed-route structure.

Mr. MCHUGH. That is today.

Mr. COTTON. That is today.

Mr. MCHUGH. What about during free flight?

Mr. COTTON. We would not have a fixed-route structure. They would still resolve conflicts as they occur. There would be fewer of them because we would be more spread out through the air space than we are today with the same number of airplanes.

Mr. BAIADA. In fact, one of the analyses that Mr. Watts did was under a Free-Flight environment. He ran a computer simulation to determine the conflict rate. That is a very critical issue.

If you go to a Free-Flight environment where there are not random actions, there are random routings—and there is a big difference between the two, as we discussed earlier. The conflict rate is on the order of somewhere between four to five conflicts per hour per controller. That is an order of magnitude, and that is not a definitive analysis, but it gives you the probable conflict rate.

The conflict rate is probably not much less than that in the current environment, given the current structuralized, linearized air traffic control system today.

So we are not talking about a quantum leap in controller action. What we are talking about is using technology and the management of the forecasting, what we call conflict probe. This is the ability of technology to look forward on the path in the near term; not the long term; a tactical separation that would allow the controller to visualize, not with his eyes, but with the computer, if a conflict would occur and to resolve it. So the workload or the conflict rate by the controller would not go up significantly under the Free-Flight environment based on initial studies.

Mr. McHugh. But it would go up in your——

Mr. Baiada. As I said, it is on the same order of magnitude, and that is all we can say today until we do a more definitive study. Just plug in Mr. Watts' computer to a real time data flow coming from FAA and determine those kind of questions.

Mr. McHugh. So it might not go up?

Mr. Watts. I think it would be wrong to conclude that the free flight automation program would let someone say I want to make a free flight intent change and immediately change something. They must give you a little bit of an advance notice. You probe and then you find out what you can give to them. You may talk to the dispatcher or the pilot, whichever one is in the loop, and resolve and give them close to what they want. The free flight program would approve something and then two seconds later say you are going to crash.

I don't think that only the controller's role is going to change. The free flight computer says do this because. If somebody worries what if the computer fails? My answer is: "With the ever-expanding speed and the processing power of a computer, ever decreasing costs, you could have 10 computers for one controller if that is what you felt you had to have for fail-safe redundancy."

You are always probing ahead. You are not waiting until "do this right now", like we are now. A controller looks at his scope and says, my God, they are coming too close together. And he yells something at both pilots or one of the pilots. The free flight program would never let that happen. You would be probing far enough in advance so that you avoid giving "right-now directives."

So you are not increasing the controller role. You are changing his role to communicate what the computer detects based on what aircraft are now doing but far enough in advance.

The free flight program will not say "three hours from now you are going to have a conflict", but it will look 10 minutes or 20 minutes ahead. Whether it is 20 minutes or 25, that is what you have to establish through analysis of real time data.

But you would never wait until it is actually happening before you resolve it. You would never have a controller yelling that two aircraft are coming together. The computer would have predicted that long before the controller would have to react in such a manner.

Mr. McHugh. I am just trying to understand what was said originally by Captain Cotton. Do you foresee intervention during conflicts under free flight, in flight during free flight?

Mr. Watts. Do we have a communication system now that could uplink information to the cockpit without voice communication to tell the air traffic what has to be done? No. So you would have to have someone communicating over the voice channel, saying change your rate of climb or change your heading a little bit. It is not going to increase the number of conflicts. He is not resolving conflicts. He is merely communicating a potential conflict and a resolution detected and selected by the free flight computer.

Mr. McHugh. So free flight you just said will not decrease the number of conflicts?

Mr. Watts. I don't know if it increases the number, either.

Mr. Peterson. I think we maybe need to go back to square one and get people to understand how the current system works and what this new system will do.

The current system puts everybody into one space, you know. I mean, it basically puts a highway across the sky and puts everybody on to this highway, and it limits the air space. And so what we are talking about is changing the concept to allow people to fly the route that would be best for them to fly. And it is really, as I said, just changing the role of the air traffic controller because we are going about this in a different way.

But what everybody on this committee should do is go up and fly an instrument flight rule flight and see what happens under the current system and then you would have a lot better understanding of what we are talking about here.

I mean, one of the things that is brought up is it is going to overload the pilots if we give them this information and all this other stuff. If you have ever flown on these flights you are so bored that you don't know what to do half the time, and most of the activity that takes place is one controller trading you off to the next controller. I mean, 90 percent of your time is a complete waste just talking to these controllers so they know where you are and you know where they are. That is back in the 1950's when we were doing that stuff.

Mr. McHugh. We can assume you have a position on this, Mr. Chairman. That is good to know.

I am trying to understand from what I admit is my total lack of knowledge on the system. What I was trying to do was to followup on what I understood Mr. Shays' question to be and one of the responses and to understand the differences, if any, between the current system and what we are moving into with respect to AAS and free flight. And that is not just the role of the controller but, as Captain Cotton said, the level of intervention.

That is all I was trying to do. I am not for or against anything here. I am just trying to understand that. I appreciate your help.

In the background material, Mr. Chairman, that your people—or someone on the committee; I should be careful—gave us, there is a comment about—and I would direct this to the panel, talking about the free flight system. This is one result of free flight which would give control of the air carrier, quote, production line, end quote, back to the carriers, letting them decide how to reschedule or delay flights due to bad weather at destination airports. Presently, air traffic control changes flight priorities for carriers during bad weather.

Would you care to expand on that for me? We are not talking about who lands or who takes off at an airport experiencing bad weather, are we? We are talking about the rerouting of those affected flights, yes?

Mr. BAIADA. Actually, I think you are talking about both.

In fact, what happens is, when bad weather goes through a major hub operation for a major airline today, you have catastrophic delays for a minor change in the weather pattern that, as Captain Cotton said, could line you up all the way from New York to Seattle. So what happens, ATC decides the traffic flows, who is in line.

Many times, as a slower aircraft, ATC will speed me up and will put a faster aircraft behind me, both of the same carrier. That may not be operationally beneficial to that carrier. That airplane behind me may have 13 connections to Hong Kong or Seattle or New York, so it would be more economically feasible for that aircraft to land first.

There is no control over that by the operators, so the production line theory basically says the airlines produce a product, the movement of that aircraft seat through the sky, the controller now controls it basically from cradle to grave. Not only do they route you along what they call ATC preferred routes, which are significantly longer. In one case in our study it is 18 percent longer. I think the United documentation says that 18.8 minutes are wasted in terms of ATC per flight in the domestic system today.

But then you also have the choreographing of the arrival flows by ATC, rather than the operator, which has a significant impact on the operations also.

Mr. MCHUGH. Thank you.

One last question. There was a reference to the National Route Program as the seeds of a free-flight system. Understanding that that covers very few flights, like 700 as I understand it, how has that seed worked, in your opinion? Is it an all-encompassing free-flight program on a very small scale or is it just a hybrid or—recognizing you want to see this go further and quicker—is it a good program? Has it worked?

Mr. COTTON. It is a good program. It has worked very well for us. And in the first few months it was saving us on the order of $2 million a month in direct operating expenses.

What it does is it allows us between certain city pairs to fly a route that is not the FAA preferred route. It needs to be expanded because it is limited in the altitude in which it can be used; it is limited in the city pairs that you can fly. It is also limited in the amount of that time from takeoff to landing where you are relatively free to plan the route that you would like to fly. It needs to be brought closer to your takeoff point and to your landing point as well as expanded to more cities and to more altitudes.

Mr. MCHUGH. Thank you.

Mr. PETERSON. Mr. Cotton, the reason it—the current system—is limited is because of the controllers, right?

Mr. COTTON. The FAA has told us that they are taking a very cautious approach to expanding this because what it does is, by taking the aircraft off of the preferred routes, it allows the conflicts to occur in some other part of a controller's sector than he is normally accustomed to seeing them.

Mr. PETERSON. So, again, the system is restricting it?

Mr. COTTON. That is correct.

Mr. PETERSON. You need to explain how the aircraft would be separated and how this would work under this new system. I don't think that everybody has got a clear understanding of that.

Mr. BAIADA. Basically, under the current system—and I would probably start with that.

First, the controllers linearize the traffic on the highways as you mentioned. Then they see the conflicts as the highways cross. But they know where the highways cross, so they have a better idea of where the conflicts are. And, as I said, it is probably on the order of three to four conflicts an hour per controller—I am guessing at that—under the current environment.

But the controller has to visualize the conflict as the aircraft are 40 to 55 miles apart, look and see the aircraft that that controller thinks will conflict. Then they must devise some resolution somewhere on the order of a 10 to 15 degree turn or an altitude change.

At numerous times you will find that if you get an altitude change with the current TCAS environment, you can see that you never came within 20 miles of the aircraft. In fact minimum separation today en route is 5 nautical miles. With a snitch patch and other alarms, things the controllers have to work under, we are probably looking at an average of 8 to 10 miles en route and, typically, as I said, sometimes up to 15 to 20 miles.

But it is relying on the controller's visualization of the traffic. That is where the stress comes in, in my mind. But I am not a controller so I can't really speak for them.

Under the free-flight environment, you put the intent of the aircraft into a computer and allow that computer to generate the flight pattern forward to determine if there is a conflict to be resolved. Once that happens, you can actually have the computer give you the resolution. But that would be a major change, the philosophical change that the computer now takes over the task of the visualization of the conflicts rather than relying on the controller's mental capabilities to do that.

Mr. PETERSON. But the controller would still separate aircraft—he could intervene, call you up and say "make a 15 degree turn," just like he does now?

Mr. BAIADA. The controller, in fact, would have the same—maybe not the same radar scope, but some visual display that they could use to visualize the traffic. So you haven't really changed anything. You have actually added a level of safety because you now have a first-tier computerized conflict probe.

Mr. PETERSON. Now, if you put this into the cockpit as well, some people have said that this is going to overload the pilots, that this is going to put too much workload on them. What is your response to that?

Mr. COTTON. Mr. Chairman, the same thing was said about TCAS before that was added to our aircraft. It is just simply not true. In fact, it is one—TCAS has provided us a display of traffic around our airplanes that is probably the single greatest improvement to safety that we have seen in a generation.

Mr. PETERSON. It would continue to be part of the system?

Mr. COTTON. Yes, sir, it would.

Mr. WATTS. I would like to add that if you have data link, and if you had FMSs in a glass cockpit aircraft, then it may do the probing and show the pilot what the computer on the ground is saying, so the load may go to the airborne computer instead of the pilot. But, again, that is not an issue because computer power is going up and up almost every day.

Mr. PETERSON. Where do these comments come from, that this is going to overload the pilots and there is going to be too much information for them?

Mr. COTTON. Generally, from nonpilots.

Mr. WATTS. I think another thing people feel is if you put the information in the cockpit you are going to have pilots second-guessing the controller. If you continue to have a control-oriented system, you will invariably have somebody on the ground who you are going to hang from the yardarm if he makes a mistake.

Mr. PETERSON. That is why we have to change this whole perspective in order to make this work. Because if you limit it, if one person is going to be a controller of this thing, that becomes a restriction point. That is really what we are talking about here.

I think the other thing that everybody should know is that pilots, of visual flight rules [VFR] aircraft, fly around all the time totally uncontrolled, totally on their own; and this is a lot more traffic than there is with the commercial system in a lot of places, and there are very few problems. And all we are doing is looking at each other and talking to each other on the radio to keep ourselves separated. I think there is a lot of fear on the part of people that don't fly, that don't understand how the system works just in general aviation or in aviation altogether. People are——

Mr. SHAYS. Would the gentleman just yield for a second?

I can visualize the roadway as you describe it in the air, and I can visualize that now we let them go over the fields and whatever else in that sense, but when they get near the airport do they lock into a—once they get closer I would think they would lock in and then have their time——

Mr. WATTS. We now have a program called CTAS. I think it is operational in Denver. CTAS can set up safe sequences to airports from 20 to 40 miles out. You could have the en route free flight program, making sure CTAS sequence does happen, that is, making sure the right aircraft get there at the right time. The sequence could be dictated by the major airline using that hub so that he gets the right plane in at the right time.

I once saw simulation results of CTAS and ATC on the same traffic example. If they showed both using the trombone approach, where aircraft fly downwind and then make a turn onto final. When CTAS landed this sequence of aircraft everybody turned at about the same point, one a little earlier, one a little late.

The same sequence when controlled by the controller looked less organized. The trombone was full.

I think the concerns about what happens at the terminal area may not be real. If CTAS can do as good a job as I think it can do, then there is no reason to think that it cannot say to some en route free flight program, "give me these type of aircraft in this sequence." And then if that sequence—if United Airlines had a 747, 757——

Mr. SHAYS. I get the gist on that.

Mr. Cotton and Mr. Boyd, could you respond to that question? I mean, once you get in.

Mr. BAIADA. I think in the terminal area we currently rely on a distance-based separation on final approach and then linearization of the traffic so the controller can visualize the problem. That is the only way they can do that today.

By using CTAS or some other time management system you move to a time-based separation system where you say I want an aircraft over the end of the runway every minute. And as they approach the airport or the runway, they are actually sequenced based on time which equates to a distance.

So you have safe separation based on time sequencing, not distance-based separation. So you could, in fact, have aircraft going right to somewhere about three miles from the end of the runway. And every minute an aircraft goes over that point in space. If there is noise problem or other restriction you would have them avoid those areas.

Mr. SHAYS. Thank you, Mr. Chairman.

Mr. PETERSON. Mr. Zeliff.

Mr. ZELIFF. I just have one quick—I assume FAA is a supporter of free flight and is supporting phasing in on a gradual basis except for the safety concerns; is that correct?

Mr. COTTON. That is correct. We are looking for the proper venue, the proper organization for the FAA to understand and work with the air space user community to ensure that our operating needs will be met as they move forward with these plans.

Mr. ZELIFF. Based on what is now happening, when do you think—what would be your guess—best guess—of when we will see free flight phased in across the board? Or is it not going to happen?

Mr. COTTON. It certainly better happen, and the sooner the better.

Mr. ZELIFF. I guess the challenge is how do we get you all, the rest of the industry, and FAA to sit down and put together a plan that phases it in over a period of time and satisfies their safety concerns, puts a time certain and said phase one, assuming no problems, you go to phase two and phase three and eventually you get it done.

It seems like that is our challenge, that we recognize the safety concerns. And if they don't materialize then you move forward to the next step. But you force somehow—it seems like there is a pretty darn strong consensus including FAA that it is the right program.

Mr. COTTON. With the mandate from this committee to make sure that that focus is not lost, I think we can accomplish that.

Mr. PETERSON. We are going to have the FAA on the next panel. I am not so sure that they are all that enthusiastic, from some of my experiences and conversations I have had, but we will find out here shortly I guess.

Any other Members have questions?

If not, we thank you all very much for being with us, and you helped illuminate this subject quite a lot. We appreciate it.

Next we have Mr. Bill Jeffers, the Associate Administrator with the FAA, who is accompanied by David Hurley, Director of the Office of Air Traffic System Management. Do you have a couple other folks with you?

Mr. JEFFERS. Yes, I do, Mr. Chairman. In light of some of the questions that were asked about advanced automation and those types of things, we had some people available, and I did invite them to sit at the table in case those questions come back up.

Mr. PETERSON. It is the custom in these Government Operations Committee hearings to swear in all witnesses, so do any of you have any objection to that? If not, could you please stand and raise your right hand?

[Witnesses sworn.]

Mr. PETERSON. Mr. Jeffers, your written statement will be entered in its entirety into the record. We welcome you to the hearing. Please begin.

STATEMENTS OF BILL F. JEFFERS, ASSOCIATE ADMINISTRATOR FOR AIR TRAFFIC, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY DAVID HURLEY, DIRECTOR, OFFICE OF AIR TRAFFIC SYSTEM MANAGEMENT, FEDERAL AVIATION ADMINISTRATION; NEIL PLANZER, DIRECTOR, OFFICE OF AIR TRAFFIC SYSTEM REQUIREMENTS; AND MICHAEL BALL, OFFICE OF SYSTEMS ENGINEERING

Mr. JEFFERS. Thank you, Mr. Chairman, members of the subcommittee. I welcome the opportunity to appear before you today to discuss free flight, or user-preferred routings.

Accompanying me is Dave Hurley, Director of the Office of Air Traffic System Management. I have also asked Neil Planzer, Director of the Office of Air Traffic System Requirements, and Mike Ball from our System Development Organization, to accompany me this morning.

Mr. Chairman, I would like to enter my formal statement, which focuses primarily on the extent to which we employ user-preferred routing, free flight, or what I will now refer to as user-preferred trajectories in today's air traffic management system, into the record. I would like to summarize its contents and then spend a few minutes talking about what we, the FAA, see in the future in terms of air traffic management.

In my prepared remarks I tell you about a system of placing air traffic on well-defined airways in a nose-to-tail configuration that was developed as a result of the air traffic controllers strike back in 1981. During that period, we developed a regional system to ensure a safe environment for the flying public at a time when recovery and restaffing of the system was taking place. Since that time, we have worked consistently to remove static restrictions imposed during that period.

As recovery and restaffing occurred, it became possible to experiment with user-preferred trajectories. Since 1990, we have moved from the experimental stage of user-preferred trajectories to a well-established program now known as the National Route Program. That allows operators to fly self-directed routes that are more cost-effective, fuel-efficient or that otherwise meet corporate goals while maintaining the highest levels of safety.

Over 700 flights per day are eligible to fly at the National Route Program. Between 50 and 60 percent of those flights elect to do so. Estimated savings under this program are substantial.

Although we in the FAA have yet to define what free flight means to us, I think it is absolutely accurate to say that we share to a very great extent a vision of a future where user-preferred trajectories are the norm. We in particular find ourselves in general agreement with the Air Transport Association with whom we met last Friday to discuss these issues.

Much of what we do in terms of changing the culture of air traffic system management will depend on several ongoing technology development initiatives. I have several examples of our activities to create opportunities for expanded system user interaction, input and, ultimately, greater change than we are currently capable of providing.

We are proceeding with a request for proposals on a Wide Area Augmentation System that will provide the added assurance of signal availability and reliability to expand use of GPS for more phases of flight operations.

Mr. Chairman, because of your interest in GPS, if you are interested in flying a GPS approach, we would be happy to facilitate that for you and make it available any time you would desire.

Mr. PETERSON. I already did that about a year ago, but I appreciate the offer. Maybe I will do another one.

Mr. JEFFERS. We are also working toward the introduction of more data link services and Automatic Dependent Surveillance while mindful of the pace of user equipage and the development of the Aeronautical Telecommunications Network to provide more information directly to the pilot in the cockpit. All of these initiatives will promote the cultural change that is necessary to make user-preferred trajectories a reality.

We are currently experimenting with Automatic Dependent Surveillance in areas not serviced by radar to determine the possibility of reducing current separation standards and improved automation with actual decision support automation such as that provided by the Advanced En Route Automation, AERA, to provide users of the National Air Space System much greater access to their preferred trajectories.

When these technologies mature, transfer of more and more separation and sequencing responsibilities to the cockpit will gradually become feasible in all but the most densely populated air space.

Mr. Chairman, the long-term goal of user-preferred trajectories whenever possible—and I emphasize this morning that the possibilities are recognized by all as constantly expanding with research and development of new technologies ongoing—is a mutual FAA-industry goal. We look forward to working together with the Air Transport Association, other pilot groups, other aviation groups, any users of the national air space system, to develop the full potential of the world's safest air traffic control system.

This concludes my remarks, sir. At this point, we would like to give you and the members of your subcommittee about a 3- to 5-minute demonstration of the Aircraft Situation Display [ASD]. It is kind of a baseline on the aircraft operations over a 1-day period in the United States that will give you an idea of the transition that we would have to make in going from today's system into a, quote, free-flight, unquote, system. We would be happy to answer any questions after that presentation.

Thank you.

[The prepared statement of Mr. Jeffers follows:]

STATEMENT OF BILL F. JEFFERS, ASSOCIATE ADMINISTRATOR FOR AIR TRAFFIC, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON GOVERNMENT OPERATIONS, SUBCOMMITTEE ON EMPLOYMENT, HOUSING, AND AVIATION, CONCERNING FREE FLIGHT. AUGUST 9, 1994.

Mr. Chairman and Members of the Subcommittee:

I welcome the opportunity to appear before the Subcommittee today to discuss free flight, or user-preferred routing. Accompanying me is David J. Hurley, Director of the Office of Air Traffic System Management. In my testimony this morning, I will be providing you with a brief overview of FAA's National Route Program (NRP), which is a significant step toward free flight, and now provides the option of user-preferred routing to over 700 scheduled flights per day.

In the 1980's, as I am sure you will recall, the air traffic control system saw significant changes. During this period of change, FAA found that control of the flow of air traffic, as well as placement of aircraft on well-defined airways, represented the safest approach to air traffic control. This system of air traffic control is known as "preferred routing", and it enables simplified separation and sequencing of major flows of aircraft. Over the next decade, we employed preferred routing in day-to-day air traffic management activities involving literally hundred of millions of operations, safely moving passengers and cargo through the National Airspace System.

As we moved into the 1990's, however, the FAA, in conjunction with the Air Transport Association, began to explore the concept of user-preferred routing, an idea that presented opportunities for saving time and fuel costs by permitting operators to take into account weather conditions and natural weather allies, such as prevailing winds. This effort resulted in the National Route Program, an agency/industry joint effort to achieve time and fuel economies by allowing the most cost-effective flight, rather than FAA-mandated routing.

First implemented in December of 1990, the early predecessor to the National Route Program permitted operators, flying west-bound between nine city pairs on opposite sides of the continent, to file and fly direct, user-preferred routes between those cities at altitudes above 35,000 feet, with minimal air traffic control intervention. Some 60 flights per day were eligible under this fledgling program; and approximately 50% of those eligible participated, resulting in an estimated savings of one million pounds of fuel and 70 hours of flight time for each month the program was in operation.

Based on our successes with this program, we expanded the parameters in 1991, building upon earlier efforts. This phase of the program permitted operators to file and fly direct, user-preferred routes between city pairs, provided the phase of direct flight took place during finite portions of the route, and at or above 39,000 feet. We also expanded the program to 16 city-pairs and reduced the minimum altitude requirement to 31,000 feet. Of the 110 flights per day eligible for this program, some 50 to 60 participated, resulting in over a million pounds of fuel savings, and some 85 hours per month of flight time. By the end of 1991, the Air Transport Association estimated that of the 40,000 flights eligible for these two programs, 20,000 took advantage, netting fuel savings of approximately 4.3 million dollars.

Another component of the National Route Program was also implemented in 1991, affording even greater flexibility to operators within the system, regardless of altitude, route of flight, or departure and destination points. Known as the non-preferred route request, the program enables operators to request FAA approval for custom-tailored flight plans designed to meet individual needs. Requests for non-preferred route approvals have increased exponentially each year since the program's inception, jumping 248% in the first year alone. Based on the pattern of growth, we expect to process some 65,000 requests in 1994, of which 70% or more will likely be approved.

This is a relatively small portion of the total traffic the system sees on a yearly basis. In 1993, over 37 million aircraft operated in our National Airspace, an increase of almost two million over a two-year period. While traffic has increased, delays are down to just under 280,000 in 1993, from a high of almost 400,000 in 1989.

Like the overall number of operations in the system, the National Route Program continues to grow. In consultation with our air traffic controllers, other system experts, and ATA, we have expanded the number of participating city-pairs to 104 from the original 9 in less than 3 years. Flights of at least 1500 nautical miles at or above 37,000 feet between any location are now eligible for participation in the Program. International traffic is also permitted to take advantage of the Program. Aircraft entering domestic airspace from North Atlantic Routes via 7 inland navigation points, at or above 39,000 feet, and bound for 11 U.S. destinations, may avail themselves of the National Route Program. Every day, over 700 flights are eligible to participate in the Program, and on average, approximately 50 to 60% of these flights do elect to utilize the National Route Program. Estimated savings under the Program are expected to add up to 10 million dollars in 1994 alone.

We feel comfortable in saying that the National Route Program has been a success, creating significant fuel cost savings and reducing flight time in increasingly larger amounts, while maintaining the safety of the passengers flying in the system. We also know that if there is a criticism of our initiatives to expahd user-preferred routing, that criticism is the program's application, which is, while constantly expanding, narrower in scope than users might prefer.

Our plans are to continue to judiciously expand application of the National Route Program to provide for inclusion of additional city-pairs, expand eligibility for Trans-Atlantic Flights, reduce the 1500 nautical mile minimum stage length, and reduce altitude requirements.

We recognize that the National Route Program is not the end of the story as regards the future of air traffic control. However, there are certain present-day limitations we perceive in terms of movement toward a free flight system. Certainly, in terms of today's present system, we must make certain that the expansion of free flight opportunities respects the need not to exceed acceptable traffic loads in the various areas of the air traffic system.

To a large extent, the expansion possibilities are dependent on emerging technologies, such as high-speed data links, advanced collision avoidance systems, and navigational improvements the Global Positioning System and on-board flight management systems may offer. As the air traffic control workforce and the air fleet become equipped with more advanced technology, including sophisticated automation to enable a full evaluation of the free flight concept, reductions in separation while maintaining the present margin of safety will be possible, with resulting increases in system capacity.

The present configuration and management of airspace will also need to be examined in the coming years. We do envision a system that is capable of permitting near-total routing flexibility. As new air traffic control automation and traffic management tools emerge, such as the Aircraft Situation Display, we stand ready to continue our work to expand user-preferred routing programs within the context of the current system and to work together toward a system structure with routing constraints only within a relatively small radius of high-activity airports.

That completes my statement, Mr. Chairman. I would be pleased to answer any questions you may have.

SUMMARY OF TESTIMONY

BILL JEFFERS, FAA ASSOCIATE ADMINISTRATOR FOR AIR TRAFFIC

FAA's National Route Program (NRP) is a significant step to Free Flight. Typical air traffic control routing in defined airways is known as "preferred routing." In contrast to ATC-mandated routes, user-preferred routing, through the National route Program, offers time and fuel savings for carriers.

The National Route Program is being expanded by reducing the required altitude and allowing these routes over other flight segments.

Another component of the National Route Program, called "non-preferred route requests," lets carriers ask ATC for a custom-tailored flight plan to meet their individual needs.

But these NRP routings cover a relatively small proportion of the total airspace system traffic. Every day over 700 flights are eligible for the program, and on average about 50-60% participate.

We know critics complain that our program is too narrow in scope. But there are problems in moving faster toward Free Flight. One limitation is that we must not exceed the acceptable traffic loads in various areas of the air traffic system. And expansion is also dependent on emerging technologies like GPS, highspeed datalinks, advanced collision avoidance systems, and on-board flight management systems. As new technology is applied, we can decrease separation between aircraft and increase system capacity.

The present system of air traffic management will also be re-examined in the coming years. We envision eventually a system of near-total routing flexibility. Leaving routing limitations only where there is congested airspace over busy airports.

Mr. HURLEY. Gentlemen, what you are seeing on the screen there——

Mr. PETERSON. Can we put one of these in the middle so everybody could see it. And could we turn one of these around so the audience can see what is going on? Maybe set it up at the end of the table there. Do we have a line to do that?

I think it would be good for the audience to see. We can all see on this one here, can't we?

Do the television people care if we kill the lights a little bit? Why don't we turn down the room lights? Do we need those television lights on? Can we turn those off?

We are ready to go.

Mr. HURLEY. Good morning, Mr. Chairman. My name is Dave Hurley, Air Traffic Management with the FAA traffic organization.

What we are going to show you today is something we call ASD, Aircraft Situation Display. Basically, what that is it is a culmination of long-range radars, 113 of them spread throughout the United States, all the data brought into a central location, mosaicked together, then back out into the controller work field, as ASD, Aircraft Situation Display.

What we are going to do this morning, give you an idea what is actually out in the environment, we are going to start this machine at 8 a.m. in the morning, and you will see the east coast essentially with no airplanes. As we progress across to the west coast, you will see the east coast wake up, the central part of the United States, then, ultimately, the western part.

What you are looking at is the United States. Every one of those white dots represents an airplane operating on the IFR system, and you are looking at 8 p.m. in the evening—and now midnight, 1 a.m., 3 a.m. You will notice there is very few except on the west coast. Now what you see out here probably are predominantly the box haulers that are operating in the midnight shifts.

It is now 5 in the morning, and the east coast is starting to come alive; 6, you can see a significant increase in the number of flights; 7, you can truly see—now you will see it move westward into the central part of the United States at 9, and the western part is just starting to come alive, if you will.

And we move further across. This is now 11 eastern time, moving toward noontime, if you will, in the system. Now, again, those dots represent aircraft that are operating in this system today. And the number of aircraft—we will tell you how many actual airplanes are out there in this system. As we speak 4,236 flights are operating in the system This was on August 4 this last week.

Mr. PETERSON. This is the data that has accumulated in Cambridge?

Mr. HURLEY. Yes, sir. This is what you saw also out at Oshkosh when you were out there.

Again, what this is, 113 long-range radars brought to Cambridge, MA, mosaicked together, satellite back out to the air traffic control system command center, the centers such as Boston.

Mr. PETERSON. If every airplane had a GPS code, could we satellite these GPS codes and put it on a screen like this?

Mr. HURLEY. Technology could probably be done that way, yes.

Mr. PETERSON. But that is not the way the system works now?

Mr. HURLEY. At the moment, what you are looking at is today's system, driven by radar, and to some degree position reports in the North Atlantic and Pacific. The system is looking all the way to Europe and all the way to Japan, I might also add.

OK. We are going to give you a show now of the Chicago area and the number of aircraft that would appear to be in proximity to each other.

Mr. SHAYS. Does that represent the biggest area, the most traffic?

Mr. HURLEY. Chicago is a good sampling of the largest area. Between Chicago, Atlanta, and the New York metropolitan area, it will give you a classic idea of the number of airplanes that we are working.

This is Chicago and Midway Airport. The blue is Chicago, and they are departure aircraft. The yellow are arrivals. The rings you see—the outer rings are hundreds of miles. And in the center of the screen you see ORD partially obliterated.

Now, we can zoom down on to Chicago, much smaller scale. We can go even further. And, again, the blue are departures, and the yellow is arrivals. Here we are down to a scale just under 100 miles. And, again, this is the mosaicking of multiple radars around the Chicago area.

Mr. PETERSON. This represents how much of a delay in real time? How far behind?

Mr. HURLEY. In the worst-case scenario with the current technology, 5 minutes. We are moving toward a 1-minute display. We have achieved it in a test bed prototype system in the West Coast. We are now looking at how to feed it into the overall system.

Mr. PETERSON. This is fed back to your controllers in the centers?

Mr. HURLEY. Into the traffic management units, not the controllers who separate the airplanes. They provide oversight, if you will.

Mr. PETERSON. And they use this to restrict, to decide whether to let planes go or not based on what is out there in this information, right?

Mr. HURLEY. Basically, this is a tool to look beyond your particular air space or your boundary to see what is coming at you. It is used as a coordination tool and a decisionmaking tool, but the actual separation is the radar control.

Mr. PETERSON. They use this information, and that is why they might stop somebody in Seattle from going to New York based on this information?

Mr. HURLEY. Or pieces of this information fed together to a communal determination.

Mr. PETERSON. Right.

Mr. HURLEY. OK, you are now looking at the East Coast, just about in the center of the New York metropolitan area, with Philadelphia just below the 100-mile range. We can again move into the area. This is Kennedy, LaGuardia, and Newark traffic, and I can go through the colors if need be, but I think you get the point.

Mr. PETERSON. Now, you are going to be down to a minute. It was my understanding that you could probably get this almost up to real time, is that——

Mr. HURLEY. The technology is there to do that. However, we have not progressed to that point.

Mr. PETERSON. As I understand it, there is also a display that allows this, theoretically, to be fed up to the satellite and into the cockpit of the airplane on a real-time basis, right?

Mr. HURLEY. It could be, yes. As a matter of fact, there is a study under way by a private university to do just that kind of thing, a cockpit display that takes this data and synthesizes it for display within the cockpit itself.

What you are looking at is the routes through the system, and the data blocks that identify each and every one of those particular aircraft that are being tracked by the system. The same thing for the DFW area, Dallas/Fort Worth, 100-mile range, arrivals and departures, yellow and blue. The odd colors are the smaller airports surrounding the outer areas of Dallas/Fort Worth complex.

Mr. PETERSON. And you have the altitude of these airplanes?

Mr. HURLEY. We have the altitude. We have the time remaining in flight and when they will arrive at the destination airport.

Mr. PETERSON. You can zero in on one of those planes, and you can tell what its flight plan is?

Mr. HURLEY. We will do that for you right now.

The system can also go in and find an airplane. If you know what the call sign or the identification of the aircraft is, they can come in and locate it.

In the extreme left-hand bottom corner of the screen you can see American flight 1573. He is an MD–80, he is climbing to 31,000 feet, and his air speed is 450 knots. And the route of flight is listed across the bottom of the screen, Fort Worth, J66, J4, J50.

Mr. PETERSON. Right now you are just working to speed this up and make this work better.

Mr. Jeffers, are you or is anybody within the FAA looking at making this real time, making this available to pilots in the cockpit?

Mr. JEFFERS. Yes, sir. We are exploring the possibility of providing this information to the cockpit. The relevant information is very similar to the information that would be provided by TCAS at the present time. The display of other aircraft in proximity to the resident aircraft or the home aircraft is already on the TCAS display, but we are looking at that and making it real time, yes.

Mr. PETERSON. But the TCAS display is looking out from that aircraft to what is around it?

Mr. JEFFERS. That is correct.

Mr. PETERSON. This would be coming from a different source, so it is backup information.

Mr. JEFFERS. It would be a backup information, and it would be very relevant as you get in close to congested areas.

Mr. PETERSON. Then you also can put the weather, as I understand it, into this. And that seems to me to be one of the things that would really be valuable, if that could be displayed in the cockpit, current weather information, showing how to get through the thunderstorms and so forth. Is there weather that you can put on here? Can it be overlaid?

Mr. HURLEY. We are going to bring you weather that is taken out of the NWS system versus what you would see in the cockpit.

Mr. PETERSON. But you could eventually put that real-time weather into this system, too, right? The technology is there to do it?

Mr. HURLEY. Yes, most definitely.

Mr. JEFFERS. Eventually, we should be able to put all of the Doppler radar information into the system. Delivery of this information to the aircraft is dependent upon our development of a data link network that we are working on.

Mr. PETERSON. Through satellites?

Mr. JEFFERS. Yes.

Mr. PETERSON. But that can be done technologically?

Mr. JEFFERS. And it is being done right now, sir. It is a matter of getting a two-way data link and getting the ground equipment and aircraft equipage that will accommodate it.

Mr. PETERSON. How long of a process is that going to be?

Mr. BALL. Next year in Orlando, there will be two-way air link experiments, uplinking weather information. It doesn't necessarily have to be funneled through the Aircraft Situation Display system but can be done directly via data link. It doesn't necessarily have to go via satellite. It could be a line-of-sight VHS data link, for example.

The information can be put in a digital form in a computer, it can be put through some communication if the airplane has a data link capability and some means of displaying it.

Mr. PETERSON. However this is done, we are not limiting ourselves?

Mr. BALL. No, sir. The whole sequence on the data link deployment is to focus on those services that aircraft and pilots want first. Some of the early data link applications right now are clearance delivery, the ATIS information, the Airport Terminal Information Service and weather information as we are able to do that.

Mr. PETERSON. Do you have anything else you want to show us here?

Mr. HURLEY. One other item we want to show is something we call monitor alert. Basically, this is a piece of software that senses or determines the number of aircraft into the future in a given piece of air space that we call a sector.

If the parameter for that sector is going to be violated as much as 20 minutes—and out to, literally, 12 hours if you chose to, but 20 minutes is normally where we operate—what will happen is your screen will show, as it does there with the yellow hash marks, red—and, obviously, the yellow is for the lesser condition versus the red is for something more stronger in terms of that. This is in the immediate area of the Philadelphia area.

Mr. PETERSON. This goes to the people that are in the traffic management?

Mr. HURLEY. That is correct.

Mr. PETERSON. Not the controllers?

Mr. HURLEY. No.

Mr. PETERSON. Why wouldn't you give this to the controllers, too?

Mr. HURLEY. Well, first of all, the degree of accuracy is not the same as the radar.

Mr. PETERSON. If we got to the point where this is real time and we speed so it was within a second, would you not want to give this to the controllers?

Mr. HURLEY. I would assume if we could get to that kind of technology we would probably integrate the old and the new both. At this particular point in time we don't have a project under way to do that, though.

Mr. PETERSON. You don't?

Mr. HURLEY. No, just to get down to 1-minute updates. Then we will pursue it after that. The situation there is the radar system provides the controller with the depth of knowledge that he needs in order to execute his primary function. These are augment tools and ordinarily are put at supervisory positions or traffic management position.

Mr. PETERSON. This is as long as we keep the system where the controller is in charge of everything. If we are going to go to some other paradigm, you know——

Mr. HURLEY. Exactly. The issue really is that I don't think anyone in our group particularly takes any disagreement with the concept of free flight. As a matter of fact, we have been in a modified version of that for some number of years. The issue is the technology and how to go about it. And we have started some dialog with the airlines and the air transport association to do so.

This is a bar chart on the bottom which gives you specific information in 15-minute increments about those saturated areas and what number of aircraft will be there, what timeframe.

Again, this is something you wouldn't want a controller to be involved in while he is simultaneously controlling an airplane.

Mr. PETERSON. This takes into consideration the speed of the airplane and all that?

Mr. HURLEY. Yes, it does. It does trajectory forward. We can go out to as much as 12 hours in the future. However, like I said, our experience has been that 20 minutes there is so much change going on in the system that going out that far really is a questionable benefit.

Mr. PETERSON. Well, thank you very much. Is that it?

Mr. JEFFERS. Yes, sir.

Mr. PETERSON. I guess my question is, are you seriously looking at this issue of giving up a system where the controllers are in charge of everything and putting them in some other capacity: making this change of mind frame about how we do this? Is that being looked at seriously or are you not in favor of that? Where are you?

Mr. JEFFERS. I can assure you that it is being looked at seriously, sir. We see it as an evolving process, one that goes through the system as it used to be, where we are today, to more participatory separation tomorrow.

I think we can give you another example where we have started using TCAS. In participation with the pilots out over the ocean where we have no radar coverage, we have done some trials with United and, Delta Airlines. It has proven to be quite effective where we participate with the pilots in climbing and descending aircraft in those environments, and I see it doing nothing but evolving to a more participatory process, on the way to settling into an end state.

Mr. PETERSON. But in all of the dialog I have heard, the way you refer to this type thing, it is clear that your position is that you guys, the FAA, the controllers, are in charge. If we stay in that mind frame, you know, then the whole thing gets limited by the amount of time and what the controllers can do. Am I not right about what I am hearing?

Mr. JEFFERS. I hope that that is not what you are hearing. I hope what you are hearing from us is our commitment to the safety of the system. When we move in the direction of changing the system as dramatically as we are talking about changing the system, we want to be very deliberate, go about it in a very cautious, very well-studied manner.

I hope that you are not hearing any reluctance on our part to move away from a philosophy that we have had for years into a new philosophy, to a new concept, because I don't believe that exists. I think the willingness to move is there. The desire to make sure that we maintain the levels of safety is a commitment that we take very highly.

Mr. PETERSON. Is that why you are restricting the use of the National Route Program? Because you are concerned about safety, you are moving slowly. Is that why?

Mr. JEFFERS. Yes, sir, that is the exact reason.

We started with very few city pairs at higher altitudes. We have lowered the altitude, and increased the numbers of city pairs where user-preferred trajectories are available to, 104 as of July 8.

We are looking now at whether we should continue to lower the altitude or should shorten the distance between the city pairs to something less than 1,500 miles to increase use of this program. Our commitment is to continue to expand this program as we move toward user-preferred trajectories, but we want to make sure we know what the impact is as we do this.

Mr. PETERSON. My sense is that ATA and others think you are moving too slow and you are being too cautious. How do you respond to that?

Mr. JEFFERS. I understand their concern. I would hope that they understand our wanting to be very deliberate in being very, cautious, I guess is the right term for me to use, as we do this to make sure that we are not having an impact on the safety of the system. I certainly would like to be able to more nearly meet their expectations in this area and will work very hard to do that.

Mr. PETERSON. Does the FAA have any stated policy on the extent that you will share this surveillance data with users? Do you have any official policy written down?

Mr. JEFFERS. This data that you have seen, we share that now with the airlines. I believe that we share it with 14 different airlines. They use it in their operations for flight planning and we have daily communications with them where we discuss this information as we both look at the same display.

Mr. PETERSON. Is there a written policy written, or is this something that is developed on a case-by-case basis? How does that work?

Mr. HURLEY. We have 11 air carriers and parcel carriers who currently have the Aircraft Situation Display in their facility.

Mr. PETERSON. And they have signed a contract?

Mr. HURLEY. They have signed an agreement with us on how they would use it and what the vehicle is, what the data is.

Mr. PETERSON. How does somebody go about getting one of these letters of agreement, come and talk to you or——

Mr. HURLEY. Yes.

Mr. PETERSON. Can people other than airlines have access to it?

Mr. HURLEY. The data we provide to the airlines is not exactly that seen here on the display. We do limit and restrict display of military aircraft, military operations and law enforcement kind of support operations that are not on there, but they are on the air traffic control unit display.

Mr. PETERSON. And can nonairlines get access to this?

Mr. JEFFERS. At this point, we have not given it to nonairlines. We have had discussions with people who run bus services, who run limousine services and those types of ancillary businesses that would, I guess, benefit from knowing what the position of an aircraft is and the landing times and those types of things, but to this point, we have limited it to aviation.

Mr. PETERSON. Anybody in aviation can sign one of these?

Mr. HURLEY. Well, they can, but there is also an investment for them in terms of either the hardware or leasing time on a machine, so it is not a freebie type——

Mr. PETERSON. But if they are willing to do that, they can have access to it?

Mr. JEFFERS. Yes, sir.

Mr. PETERSON. Mr. Zeliff, Mr. Shays, do you have any——

Mr. ZELIFF. Yes. I apologize. I had to leave for a minute, but you know, one of the things that I am torn with is that in the other panel, it makes so much sense from what you hear from the industry to go toward the free flight, and then I also sympathize with the FAA in wanting to do it, but do it on a gradual basis so that you are able to do it in a safe way, and then seeing some of the things on the computer here before us in terms of the density, is there a way that you can somehow compromise where you—not compromise safety, but compromise in terms of coming to grips with a logical phase-in, and do you do it geographically or do you do it by time of day?

I mean, have you thought about—if, in fact, you are in agreement with the new technology, but you only want to do it in a way that provides safe access to air travel, have you looked at the next step in how you are going to be able to do this? Are you going to do it on a day-by-day basis? What is the plan? Maybe you have already answered it, but——

Mr. JEFFERS. No, sir, I don't think I have answered it. First of all, I think it will be very much a phased-in process. I don't think that we would agree that all of the technology that is needed is available today to do this. It is a very complex set of technologies, one of which we have had in development for almost 11 years, and are still a couple, 3 years away from coming to fruition, one that probes for conflict and offers the controllers resolutions.

You heard this morning that there is belief that the technology is available and we are exploring with those individuals the technology that they are discussing. We in air traffic right now are in the process of developing, and will be in full cooperation with the users of the system, a service plan that allows us to sit down with people who use the system and develop a plan for phasing these in.

This was started about 3 months ago, and will probably be another 3 to 5 months in development. At that time we should have, if you will, a contract with the users of the system that says, given the development of these technologies, these are the services, this is the way you can expect the system to operate in this timeframe.

This will allow us to proceed with development of the procedures and policies that we need to support the system, as well as allow the airlines to equip in a very cost-efficient way to obtain these services.

Mr. ZELIFF. And in rough—and that makes sense to me, at least. I am just wondering if—what is the general—I mean, if you had to come up with a date, are you talking 5, 10, 20 years?

Mr. JEFFERS. For full implementation of free flight?

Mr. ZELIFF. Right.

Mr. JEFFERS. Please understand that this is a guess. I would guess that a substantial portion of the benefits that will be derived from this concept will be available in the 8 to 12-year timeframe. Full implementation may be as much as 15 to 20 years away.

Mr. ZELIFF. And then I suppose if you need to have all of the technology that needs to—that you need in order to make that happen, you feel better about getting that done than the advanced automation system?

Mr. JEFFERS. Well, a major portion of the technologies that we need to accomplish the predominant part of free flight have been in development for several years. They were put into development as an integral part of the Advanced Automation System, as an ancillary part of the Advanced Automation System, so they are well underway as far as development.

The eventual outcome of the Advanced Automation System certainly plays a part in this, but they are not totally dependent on the Advanced Automation System as we knew it.

Mr. ZELIFF. You say it is quite a few years out assuming certain things take place. What would you say would accelerate that? New technology?

Mr. JEFFERS. Most or all of the hardware-type technology—is available to us today, depending upon how the Advanced Automation System ullimately works out.

The process we are going through now is development that allows us to use other technologies that are available in the marketplace, such as data link, such as the ability to use Automatic Dependent Surveillance to replace radar display. It is a matter of adapting it to the use of the air traffic control system, developing some very complex software applications that will give us the conflict probes and resolutions that we need to have free flight in the en route environment.

We are well on the way. You heard a gentleman this morning talk about CTAS, the spacing tools that will be used. Those are in development. They are still in prototype, but we are very hopeful. They are very promising. We have other software in development now, converging runway displays that will allow us to optimize the use of approaches to converging runways. This has been installed and implemented in a couple of locations.

We have technology being developed that will allow us not only to increase the acceptance rate of airports during poor weather, but to allow for better ground movement of aircraft during poor weather.

As the Chairman with his pilot experience would tell you, in some of the lowest weather conditions, it becomes not only important for an aircraft to be able to land with zero—zero visibility; it is also a problem to get that aircraft to the gate, and we are developing some technologies now that will help us with that. We have an awful lot of activity going on in this area, any one of which plays a role in being able to provide the Air Transport Association and other users of the system with the end state that they desire.

Mr. ZELIFF. Thank you. Thank you, Mr. Chairman.

Mr. PETERSON. Mr. Shays, do you have questions?

Mr. SHAYS. I just—since we do have bells and I know we would like to finish up. But the basic message coming through loud and clear is the industry wants free flight. Not having it is costing them a bundle. They want it as soon as possible, and the message I am getting from the FAA is that you are moving along, but you don't really have a timetable. You don't really have a sense of where—candidly, you haven't said it this way, but this is the feeling I am getting—you don't have a sense of how quickly you can get there and how you are going to get there or even agreement on what it will take to get there.

You know, that is the message I am getting, and I do not think it is money. It is just the approach that the FAA is following. I am wondering if there is—I would love to know what the solution is to this because I don't like what I see.

Mr. JEFFERS. I think you are correct in your perception that we do lack complete agreement. There are some things that we haven't sat down and talked about. I think it is important that we agree on a concept, that we agree that we will move as rapidly as possible, technology and procedures allowing, and that is a commitment that I will make to you today.

It is not a matter of money. There are some areas where we do not know how we are going to accomplish our goals at the present time, but I am confident that given the will to do that and the technology that is available to us today, that as those difficulties arise, we will be able to overcome them. I cannot assure you that I know when exactly we can do that, other than to commit to you and the users of the system that we will work very diligently and do this as rapidly as we can.

Mr. SHAYS. I guess it raises the question of why you can't, and let me just ask you this. Have you involved the carriers in this process in a very active way? Or have you kind of insulated them from this practice?

Mr. JEFFERS. I think the carriers have been involved in any number of system development activities. We have total involvement of the air carriers and other users of the system in developing uses for the satellite system, GPS, for example. Free flight, per se, is a relatively new concept that has been introduced over the last 3 to 4 months.

Mr. SHAYS. Well, given the numbers that are involved, the claim on the carriers' part of $3½ billion a year, it seems to me there has got to be a tremendous incentive to deal with this, and it seems to me that I don't see the energy, even in your description of what it will take to get us there.

I know you have the goodwill to do it. I just don't know if it is going to happen and it seems to me that this is an extraordinarily important hearing to introduce this problem to us, because I frankly haven't been aware of it, and maybe we can help provide some energy.

Mr. JEFFERS. I am sorry we don't portray the energy. We work with the carriers very closely. We try to optimize their operation. Aside from our safety obligation, our next obligation is to an efficient system. We empathize with them a great deal and work with them as much as we possibly can to make the system as efficient as we can.

Mr. SHAYS. But do you think it is possible that we would have carriers that would come to us and tell us that, in fact, that is the case? In other words, you are telling us what you are doing with the carriers, but do we have any testimony that the carriers feel that we are doing—that there is this kind of relationship?

Mr. PETERSON. I would say that they give it mixed marks at best. I have to tell you that 8 to 12 years is not acceptable. I mean, that is crazy. There is no reason that we need to wait 8 to 12 years to get this done, you know?

Mr. JEFFERS. Mr. Chairman——

Mr. PETERSON. If I have anything to say about it, it is not going to take 8 to 12 years.

Mr. SHAYS. It seems to me that we have a built-in disincentive for a carrier to be critical of the FAA. Basically, you run the system, but you have extraordinary control over the carriers. My sense is that the carriers are not pleased at all, aside from what the pilots have said as well.

Mr. JEFFERS. Mr. Chairman, the 8 to 12 years was a best guess. That is when we will have a substantial amount of this. There will be incremental improvement. I think it is——

Mr. PETERSON. I understand that, and I don't think it is going to take 8 to 12 years.

When will the FAA's report on Mr. Watt's program testing free flight be available and when will you have recommendations? Mr. Watt's program, PFLAN, have you looked at that?

Mr. JEFFERS. The first time and only time I have seen any reference to his program was in the document that was prepared by Mr. Boyd and Mr. Baiada on free flight published in June of this year.

Mr. PETERSON. Are you looking at that?

Mr. JEFFERS. We will look at that. No, sir, we are not at this time.

Mr. PETERSON. Well, when you can get a chance to look at that, I would like you to respond to me when—you know, any report that you have would be available and when you would have recommendations. Also, do you agree with Mr. Watts and the ASRC's statement that Mr. Watt's program shows that their version of free flight is valid, or haven't you looked at it enough?

Mr. JEFFERS. I have not looked at his program so I could not comment on that, sir.

Mr. PETERSON. When will you be able to?

Mr. JEFFERS. As soon as we can get a copy of his program, we would be happy to start looking at it. I will ask Mr. Planzer to start looking at it along with Mr. Hurley and we should be able to get back to you within 30 days.

Mr. PETERSON. OK, I would appreciate that, and just for your information, there are carriers telling us that the FAA will not allow them to participate in this. Some of them are telling us that, so they feel that they are not being included in this as much as they would like. So take that for whatever it is worth.

I appreciate very much you being with us today, and we, as you could probably tell, will be communicating with you on this. And I do want to say that, in the area of the GPS landings, you really have done an excellent job. I commend the administrator for taking hold of that and moving and now we need to get focused on some of this other stuff and get that moving as well as we got GPS moving, so thank you.

Mr. JEFFERS. Thank you very much, sir.

Mr. PETERSON. We will recess briefly and then we will call the last panel as soon as we get back from voting.

[Recess.]

Mr. PETERSON. We are going to reconvene the subcommittee. I have got a meeting with the Secretary of Agriculture so I am going to have to be done by 1:15, but we should make that without any problem.

Our final panel today is Steven Brown, the Senior Vice President of Government and Technical Affairs of the AOPA, welcome. James Coyne, the President of the National Air Transportation Association, welcome, and Paul Fiduccia, President of the Small Aircraft Manufacturers Association. I want to thank you all for appearing today and being with us. As you probably heard, it is a custom of the Government Operations Committee investigative hearings to swear in all witnesses. Do any of you have any problem with that?

[Witnesses sworn.]

Mr. PETERSON. All of your statements will be entered in the record in their entirety, so you can summarize and editorialize based on what you have heard here today and we appreciate you being with us, Mr. Brown.

STATEMENTS OF STEVEN J. BROWN, SENIOR VICE PRESIDENT, GOVERNMENT AND TECHNICAL AFFAIRS, AIRCRAFT OWNERS AND PILOTS ASSOCIATION; JAMES COYNE, PRESIDENT, NATIONAL AIR TRANSPORTATION ASSOCIATION; AND PAUL C. FIDUCCIA, PRESIDENT, SMALL AIRCRAFT MANUFACTURERS ASSOCIATION

Mr. BROWN. Thank you, Mr. Chairman. I am Steve Brown, Senior Vice President for the Aircraft Owners and Pilots Association. As the Chairman knows, we represent 330,000 individual aircraft owners and pilots and that is about two-thirds of all of the general aviation pilots in the country.

Mr. Chairman, in our view, the concept of free flight will require two fundamental changes to occur in our aviation system. First, emerging technologies, such as LORAN C and GPS for navigation will have to be certified and successfully deployed by the FAA. As a pilot, I think you know that GPS is widely available.

Units that are very light and compact, such as this one, are now available for far less than a thousand dollars, and those that are not portable as this one is, but rather installed in the cockpit of a general aviation aircraft are available for $3,000 or $4,000. So this kind of technology has become affordable in general aviation and this kind of navigation capability will enable at least half of the benefits that we talked about under free flight to become widely available in our aviation system.

The second key factor, though, that must occur and FAA must develop in order to have the concept of free flight become a reality in our airspace system is the automation capability within the air traffic control system, and it is that area that I think we need to focus our attention.

For all users to be able to fly customized or user-preferred routes, it is going to require a great increase in the computing capacity that FAA has to resolve conflicts and deploy the technology that they need to insure safety in the system.

In our view, as a result of this, free flight will require a higher degree of air traffic control automation than FAA has been able to achieve thus far, and there has been testimony earlier today, as you know, about AAS and the other software problems that FAA has encountered thus far.

For us in general aviation, though, the news is good, when you think about how we fly and the flight patterns that are most important to us. General aviation pilots and aircraft owners fly about 62 percent of all the flight hours in the country and we fly 75 percent of all of the flights we make in VFR conditions.

As a pilot, you know that essentially what this means is we access the airspace in an unrestricted way and fly essentially user-preferred trajectory and flight path when we are operating VFR. So 75 percent of general aviation has those benefits when they can fly in good weather conditions like we have today. However, 25 percent of general aviation flights are in the IFR system and are flying in methods and patterns and under procedures similar to those used by the airlines and therefore, in that case, have a far less efficient flight profile as has been testified to earlier today.

And so it is clearly that part of aviation that would benefit dramatically from the concept of free flight if it could become a reality in our airspace system.

Almost all of FAA's navigation technology programs are on track, on schedule and on budget and are heavily supported by other congressional appropriating committees. However, in contrast, most of their automation programs are exceeding planned budget levels and, in fact, are delayed by many years.

As you heard this morning, in our view, the AAS program is in complete disarray and its future prospects appear bleak at best. FAA has conducted reviews of the program and is trying to shake it up and repair the program, but the benefits that would have come from this advanced automation system appear distant at best.

As you heard also in previous testimony, Mr. Chairman, and I would just like to highlight this, many of the software capabilities that are resident in other programs like AERA and TATCA and AMASS that require the integration of advanced navigation like GPS with new ground facilities and also new FAA computing capabilities have been slow in development and many are facing technology barriers.

As pilots, therefore, we believe that the benefits of free flight may never materialize if, in fact, we cannot achieve some higher level of air traffic control automation.

There is one other element that is important that I would like to stress to you that I think hasn't been emphasized adequately enough, at least from a general aviation perspective in earlier testimony.

Communications technology also will have to be updated. You heard about data link earlier today in testimony when the airlines and FAA spoke on this issue, and what is important to remember is that while data link exists today, we will need a more capable, higher volume data link system to do many of the things that would enable the free flight concept.

Certainly, that is achievable, and as was mentioned by FAA, there are prototype programs underway, but the key thing that is important for general aviation is that this data link capability be affordable and be able to be installed in general aviation aircraft. Clearly, the air carriers can spend higher levels of funds on this type of equipment, but for general aviation to participate in a data link system, we are going to have to have lightweight, small affordable avionics, not unlike we have in navigation in the communications arena as well.

One particular group that works very closely with FAA on many of these areas is RTCA, the Radio Technical Commission for Aeronautics. Last year, RTCA published a 200-page document which I will leave for the committee if you are interested. It is entitled, "The Transition To Digital Communications, Urgent Needs and Practical Means" and it made recommendations to FAA on just how this achievable and affordable data link transmission could be made for all users, general aviation as well as the airlines.

We believe that FAA should followup on many of those recommendations and act on them similar to how the members of the committee this morning were pressing FAA to do additional research and implementation in this area.

Last, Mr. Chairman, I would like to highlight the fact that while technology is a key part of the future system that would enable flight, free flight to occur in this country, there are a number of capacity-increasing programs that FAA has developed and has formed recommendations on in concert with users that offer immediate capacity increases in the system.

Those have been formulated at specific major airports and at reliever airports in urban areas of the country. Those particular capacity-increasing items are things that are relatively simple and cost-effective and they come from items like runway extensions, taxiway construction, ramp, lighting and navigation system improvements at major airports. However, in many cases these projects are stalled by local politics and by zoning decisions that are often not made.

So I hope that this committee could help us in not only pursuing the kinds of capacity benefits that exist in the concept of free flight and additional air traffic control automation, but maybe some of the more near-term items that could be done very quickly that are already on the books at FAA in many of the other capacity areas.

In summary, Mr. Chairman, the user-preferred routes or free flight offer clear economic, as well as operational benefits, for both the airlines and general aviation. But they are currently hostage to some of the technology development that FAA has underway.

The implementation of advanced navigation, as well as communication and air traffic control automation all must occur together before flights in the national airspace will see dramatic time, fuel, and distance savings benefits. Those aircraft that fly IFR are the key beneficiaries, whether they are airline, military, or general aviation. It is the IFR system we are really talking about and thank goodness we have free flight in the VRF system.

So in spite of these technology challenges, general aviation would clearly benefit from the increased capacity and operational savings that have come available in the near term, and as I said, I hope that the committee can help us pursue more finite and detailed capacity increases as well. Thank you.

[The prepared statement of Mr. Brown follows:]

Mr. Chairman, my name is Steven J. Brown. I am Senior Vice President for Government & Technical Affairs with the Aircraft Owners and Pilots Association.

AOPA represents the interests of 330,000 individual members who own and fly general aviation aircraft to fulfill their personal and business transportation needs. That is 60% of the active pilots in the United States. AOPA members own or lease 62% of the aircraft in the general aviation fleet.

Mr. Chairman, the concept known as "Free Flight" will require two fundamental changes to occur in our aviation system. First, emerging navigation technologies like Loran C and especially GPS will have to be certified certified by the FAA for use throughout the national airspace system. Second, air traffic control automation technology will have to be developed and deployed. The automation capabilities must be able to safely provide separation for participating aircraft that are all flying "customized" or user-preferred routes. This achievement, in contrast to separation of today's traffic on fixed routes, will be a major computing task. Our current fixed route structure minimizes the number of potential traffic conflicts while a "free flight" system would dramatically increase the number of potential conflicts that controllers and computers would need to monitor and manage.

Impact on General Aviation

General aviation pilots fly 62% of the total hours flown each year. Nearly 75% of these flights are conducted in "VFR" or visual flight conditions and therefore involve little if any contact with the traditional air traffic control system. In effect, these VFR flights are "free flight" in today's system and represent the time, fuel, and route benefits that are achievable when the user is able to access airspace largely unrestricted. However, 25% of general aviation flights use the air traffic control system and rely on instrument flight rules or IFR procedures to conduct flights safely in reduced weather conditions. Because these flights are heavily controlled on a non-direct, fixed route system, they are far less efficient than VFR or free flight, but equally safe. Obviously, air traffic control automation and navigation advances that enable IFR flights to more closely resemble the efficiencies in VFR flights are improvements general aviation pilots would welcome.

Technology Applications

FAA has a wide range of air traffic control automation programs underway. In addition, the agency is working to implement new satellite navigation services through the use of

GPS. Virtually all of FAA's advanced navigation programs are on schedule and supported by aggressive appropriations from Congressional committees.

In contrast, many of FAA's air traffic control automation programs are significantly delayed and exceeding planned budget levels. The Advanced Automation System (AAS) is a multi-billion dollar program that is essential to achieving the benefits possible from "free flight." Unfortunately the AAS program is in complete disarray and its future prospects appear bleak. FAA has recently conducted extensive reviews of the program, appointed new management, and selected a new prime contractor. Whether this shake-up in the program will have any positive impact is unknown. Unfortunately previous attempts by FAA and IBM to correct AAS program deficiencies have been unsuccessful.

In addition to AAS, there are many other FAA programs that are targeted at modernizing the control of IFR aircraft. Most require the development of software and are years behind schedule. New capabilities like AERA, CRA, TATCA, ASTA, and AMASS require the integration of advanced navigation equipment in aircraft with new software and hardware in FAA facilities. Each of these FAA programs have been slow in development and many are facing technology barriers. As pilots, we believe the benefits may never materialize and the concept of "free flight" for IFR operations may be a goal that is unachievable

<u>Communications Technology</u>

Obtaining the potential benefits that the concept of "free flight" offers will also require advances in aviation communications. Transmitting information by voice and data channels is routine in commercial airline operations. However, only voice communications is used by general aviation and most military pilots. To ensure safety in an era when user-preferred flight routes dominate the IFR system, sophisticated, ground based computers would need rapid and frequent data from aircraft which could not be delivered by voice. As a result, a data link that is far more capable yet less expensive than today's airline system must be created. A major challenge will be to design affordable, light weight, compact equipment that could be installed in even the smallest general aviation aircraft.

Over the past two years FAA has worked hard to develop an advanced data communications plan. Much of the work is being performed by an FAA advisory committee known as RTCA. Special committees of technical experts are developing the standards for reliable data communications and are assessing the technology choices available. Last year during my tenure as the Chairman of RTCA, a report entitled "The Transition to Digital Communications - Urgent Needs, Practical Means" was submitted to the FAA. This two-hundred page report contained recommendations to FAA that are based on cost effective use of available technology while also focusing on the operational benefits that we as airspace users will need in the near future. I have a copy of the report for the committee if you believe these communications issues are going to be a part of your future considerations.

Capacity Improvements

The majority of the capacity shortfall and delay in the national airspace is caused by adverse weather conditions and airline scheduling priorities at the largest hub airports. Progress has been made in coping with the 60% of delays caused by weather. New radar and operational procedures have improved capacity even though severe weather will continue to occasionally disrupt airport operations. The airlines could adjust current schedules if their need for capacity improvements was severe enough. However, it is important to note that capacity constraints have resulted in general aviation activity at congested airports to decline dramatically. Today general aviation represents only 8% of the operations at the largest capacity strained airports.

The FAA has conducted capacity studies at major airports and has published specific recommendations for improvements. These recommendations are widely supported in the aviation community but often face resistance by local interests that do not appreciate the economic and safety benefits from additional system capacity. Simple and cost-effective capacity increases that could be obtained from runway extensions, taxiway construction, ramp expansion, or lighting and navigation improvements are frequently stalled by local politics. In many cases local officials resist making zoning decisions that will protect national aviation capacity or future growth even though it is a key national priority. Assistance from this committee in addressing the constraints outlined would be appreciated and unlike improvements hoped for with AAS could offer an immediate increase in capacity.

Summary

Mr. Chairman, user-preferred routes and the economic as well as operational benefits they offer are currently a hostage of technology development. Implementation of advanced navigation, communication, and air traffic control automation must occur before flights in the national airspace will realize dramatic time, fuel, and distance savings. Those aircraft that fly "IFR", whether airline, military or general aviation will benefit the most from these future advances.

In spite of the challenges technology development offers much can be done to generate capacity increases and operational savings in the near term. I hope this committee will assist the aviation community in pursuing the specific airport and airspace capacity recommendations that are "on the books" at FAA today.

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Mr. PETERSON. Thank you. Appreciate you being with us.

Jim Coyne, welcome to the committee and we look forward to your testimony.

Mr. COYNE. Thank you, Mr. Chairman. It is an honor to be with you today as you investigate changing Federal Aviation Administration systems, procedures, and related research and development programs to promote and foster free flight within America's airspace. Your investigation is timely and provides hope that recently developed technology can increase safety, reduce costs, and enhance efficiency for all elements of our Nation's aviation industry.

My name is James Coyne and I serve as president of the National Air Transportation Association, representing the interests of nearly 2,000 aviation businesses across America, large and small, that sell, charter, supply, service, and repair aircraft of all types, teach our citizens to fly, and operate airport-based facilities, FBO's, in cities, towns, and counties across the country. Our members are, in essence, the service infrastructure of aviation in America.

I also speak personally as a private pilot who has been flying for 20 years, visited 48 States by private aircraft and become intimately aware of the strengths and weaknesses of our ATC system. And finally, as a former Member of Congress, I appreciate your committee's important oversight role and the potential significance of your investigation into this issue.

Let me first begin with a prediction. Simply put, free flight is the future of aviation. The question is not if, but when? Furthermore, the question of when will depend most of all on the actions of Congress. Only Congress can overcome the natural tendency which we heard earlier today, of the FAA, like any large bureaucracy, to resist radical change for as long as possible.

As long as the FAA controls our airspace, it will prefer the status quo, although I suspect it will be willing to study free flight for decades.

Congress, fortunately, will be listening to its constituents, the users of controlled airspace, who increasingly will come to understand the advantages of safety, cost, and efficiency that free flight can provide. Already, the aviation community understands the technology of free flight, understands the inherent logic of autonomous cockpit-based control, and understands the tremendous economic and human advantages that free flight offers. Before long, such advantages will be obvious to everyone.

When analyzing any proposed change in our national aviation system, the first question should always be about safety. NATA supports free flight for many reasons, none more important than because it will improve safety.

Of course, our skies are already safe and they have been getting safer for decades, but recent statistics show that the long improvement in aviation safety has begun to level off. We seem to have reached a plateau using current technology. Free flight will help us move aviation safety to a higher plane.

It is analogous to the difference between a free market economy and a controlled economy. The free market economy succeeds because thousands of well-informed individual consumers can collectively make better decisions about the goods and services they want than some omnipotent, though well meaning, decisionmaker.

In a similar fashion, thousands of pilots with up-to-date information about the weather, their plane's performance, the potential conflicts with other aircraft, can provide better control and routing for their plane than a handful of omnipotent controllers.

Free flight will allow them to access the information that is most important to their safety, and give it to them sooner so that they can avoid problems long before they become serious.

Free flight will assist pilots with their two greatest safety concerns: Bad weather and equipment malfunction. The current system often limits a pilot's ability to respond quickly and decisively to changing weather conditions. Too often a pilot facing uncertain weather decides to plow ahead, following a routing that may take him into turbulence, ice, or worse.

Similarly, when something suddenly goes wrong with the airplane, it is better to have all the data you need to find a safe haven at your fingertips so the pilot can fly the airplane rather than get distracted by potentially confusing conversations with controllers.

Of course, nothing that I say should infer that all of us in aviation don't appreciate the often heroic efforts of controllers assisting planes that face an emergency of some kind. But just as you may appreciate the policeman who offers assistance with a flat tire, you wouldn't have wanted to have gotten his permission first before pulling off of a crowded freeway.

Safety will also be enhanced in a free flight system that includes TCAS or TCAD, that is traffic collision and avoidance displays for systems for all aircraft by improving aircraft separation, especially at uncontrolled fields or in areas where IFR and VFR traffic coexist in significant numbers.

The second primary reason NATA supports free flight is because of the potential it offers to increase efficiency and reduce costs. Aviation, after all, is designed to save time. Free flight will shorten the length of almost every flight, saving time and money.

For example, when President Clinton flies in Air Force One to Martha's Vineyard next week, if he were an ordinary citizen, he might be routed hundreds of miles out of his way to the west and north of New York City. A free flight route to the Vineyard could reduce his air time by as much as 30 percent.

Not all savings would be as dramatic, but even if the average time saved was only 3 to 5 percent per flight, the total saving would be hundreds and hundreds of millions of dollars per year.

Considering that the cost of almost every airplane are calculated in hours flown, from $30 or $40 per hour for the smallest planes to up to $5,000 to $10,000 per hour for the largest, free flight will give every aircraft owner or operator and every airline passenger a significant reduction in travel costs, not to mention the economic benefit of getting to a destination sooner.

Finally, free flight will make flying more affordable and easier to learn. Most instructors acknowledge that flying would be more attractive to students if it wasn't so difficult to get an IFR rating. Free flight would make IFR flying simpler and safer, thereby increasing the ranks of qualified student pilots.

In addition, it would encourage the development of a new generation of technically advanced aircraft of all sizes, fostering employment, exports, and a renaissance within the aviation industry.

The display that you saw earlier today showing 5,000 individual planes on a flat, TV-size screen very significantly distorts the potential of free flight. We are not talking about squeezing 5,000 planes into a small TV-screen one TV sized two-dimensional space. Instead think of the entire United States, a huge amount of airspace, 11 million cubic miles of airspace in three dimensions in which there are today, at most, 5,000 IFR planes at any one time.

That means we are talking about 2,000 cubic miles per plane. We have the space. We have the time. We have the technology to make free flight available today. This is not something that should take 8 to 20 years to create. This is something that can be done this year.

You have seen proposals before you to quickly authorize free flight as an option in U.S. airspace above 37,000 feet for commercial aircraft. Such a proposal could be implemented within a matter of months. Furthermore, all airspace above 18,000 feet, the so-called positive controlled air space, could be made available for free flight easily within a year.

So with this committee's direction and the support more broadly of Congress, we think that free flight can be made available within a matter of only a few years rather than decades.

In short, your committee's encouragement of free flight could be one of the most significant developments in aviation since the development of the radio. Computerized cockpits, data-linked GPS, moving maps, expert systems to identify traffic conflicts, down-linked and up-linked real time weather, and advanced airport traffic and sequencing techniques are the future of American aviation.

This hearing hopefully will lead to positive steps by the FAA that will make this future a reality sooner rather than later. America deserves to lead this era of aviation, just as it has led in all earlier eras. That, in the final analysis, is up to you and to the rest of Congress. Thank you.

[The prepared statement of Mr. Coyne follows:]

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Testimony of

James K. Coyne
President, National Air Transportation Association

Before the U.S. House of Representatives
Committee on Government Operations
Subcommittee on Employment, Housing, and Aviation

August 9, 1994

Mr. Chairman, members of the Committee, it is an honor to be with you today as you investigate changing Federal Aviation Administration systems, procedures, and related research and development programs to promote and foster "free flight" within America's airspace. Your investigation is timely and provides hope that recently developed technology can increase safety, reduce costs, and enhance efficiency for all elements of our nation's aviation industry.

My name is James K. Coyne and I serve as President of the National Air Transportation Association, representing the interests of nearly 2000 aviation businesses across America, large and small, that sell, charter, supply, service and repair aircraft of all types, teach our citizens to fly, and operate airport-based facilities (FBOs) in cities, towns, and counties across the country. Our members are, in essence, the service infrastructure of aviation in America.

I also speak personally as a private pilot who has been flying for 20 years, visited 48 states by private aircraft, and become intimately aware of the strengths and weaknesses of our air traffic control (ATC) system. Finally, as a Former Member of Congress, I appreciate your committee's important oversight role and the potential significance of your investigation into this issue.

Let me first begin with a prediction. Simply put, free flight is the future of aviation. The question is not "if" but "when?" Furthermore, the question of "when" will be depend most of all on the actions of the U.S. Congress. Only Congress can overcome the natural tendency of the FAA, like any large bureaucracy, to resist radical change for as long as possible. As long as the FAA "controls" our airspace, it will prefer the status quo (although I suspect it will be willing to "study" free flight for decades).

Congress, fortunately, will be listening to its constituents, the users of controlled airspace, who increasingly will come to understand the advantages in safety, cost, and efficiency that free flight can provide. Already, the aviation community understands the technology of free flight, understands the inherent logic of autonomous cockpit-based control, and understands the tremendous economic and human advantages that free flight offers. Before long, such advantages will be obvious to everyone.

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Mr. PETERSON. Thank you. We appreciate those remarks. And last but not least, we have Paul Fiduccia from the Small Aircraft Manufacturers Association. Welcome to the committee.

Mr. FIDUCCIA. Thank you, Mr. Chairman and members of the committee. I am Paul Fiduccia, president of the Small Aircraft Manufacturers Association [SAMA]. SAMA is a national trade association representing 40 producers of light general aviation aircraft kits and of piston engines, propellers, avionics, and other components.

SAMA's members produce kits for the production of experimental aircraft, which today constitute about 10 percent of the general aviation fleet and are the world's largest source of new general aviation airplanes and rotor craft.

These aircraft include the most advanced civil piston engine aircraft ever produced, with cruise speeds over 300 knots, incorporating the latest NASA-generated laminar flow aerodynamics, made of graphite and other advanced materials and employing the latest avionics.

General aviation as a whole, including piston engine powered personal and business transportation airplanes, is an important element of the national air transportation system. GA comprises 95 percent of the civil fleet, flies 80 percent of all trips, conducts 75 percent of all air traffic operations, flies 60 percent of all hours, 40 percent of all miles, and carries 20 percent of all air passengers. And it does this on only 6 percent of all aviation fuel.

General and commercial aviation have the same basic requirements for safe and efficient operation: Accurate navigation systems, real-time, on-board information on hazardous weather and potentially conflicting traffic, and the ability to use this information to fly the safest and most efficient trajectory.

However, there is currently an anomaly between the equipment capabilities and the operational rules for air carrier aircraft and our advanced light general aviation aircraft.

Air carrier aircraft are superbly equipped today. They have real-time weather information in the cockpit, cockpit displayed collision avoidance information, accurate position information, and sophisticated flight management systems to use this information to determine the most efficient trajectory for their flight.

However, the current concepts of air traffic control do not permit them to use this equipment to maximum advantage because of the inflexible clearances they must follow. Air carriers and other IFR operations are concentrated on the airways, creating congestion and delays, and often bringing the system to a complete standstill when these airways are blocked by hazardous weather.

Off the airways, the sky is not crowded, as Mr. Coyne just said. The Aircraft Situational Display [ASD] presentation by the FAA may have been unintentionally misleading in this regard. I have never seen a 50-mile diameter airplane, and that is what we were looking at on that screen. The aircraft were also shown at presumably at the same altitude.

In fact, if the ASD presentation had been made to scale, you wouldn't have seen any airplanes. They would have been too small to see.

On the other hand, light, general aviation aircraft lack on-board weather and traffic information or flight management systems to calculate their best route. But when equipped with GPS receivers and moving maps as is the aircraft I regularly fly, under VFR, we can fly virtually any trajectory while receiving collision avoidance advisories through flight-following services. This essentially is free flight. We are on trajectories, not on airways, and the controllers handle the separation routinely without any additional automation to do so, just as they do for IFR traffic deviating around bad weather.

Free flight is an opportunity for the FAA to increase the capacity, safety, and efficiency of the National Air Transportation System by combining the best attributes of both commercial and general aviation equipment and operations.

The FAA should enable the air carriers to exploit fully the advantages of their equipment; it should encourage large numbers of general aviation aircraft to equip with affordable systems for providing on-board weather and traffic information, and for broadcasting their position and weather data.

To achieve these objectives, we recommend the following actions by FAA: First, the FAA should immediately conduct an operational evaluation of the free flight system as proposed by the testimony of Mr. Baiada. This evaluation should include both air carrier and general aviation aircraft, including light general aviation aircraft. It should be conducted on an expedited basis employing currently available computer hardware and software, and should not be delayed until the system is 100 percent figured out, because that never happens.

This evaluation process is the best way to determine how the system should be configured to handle both air carriers and GA. Enough is known now to begin this evaluation immediately.

Second, the FAA and NASA should explore the creation of a cooperative industry-government-university project to demonstrate and validate the concepts of free flight. This would include onboard weather and traffic data applied across the entire spectrum of civil aircraft, to extend these equipment advantages to general aviation aircraft, and to investigate various low-cost equipment options and user friendly operational rules to implement free flight.

Free flight is the air carrier counterpart to a new program within NASA called the Advanced General Aviation Transport Experiment, which is to assist light general aviation in revitalizing itself. The two programs should proceed cooperatively.

Third, to maximize the benefits of free flight for both commercial and general aviation, the FAA should encourage the rapid, voluntary purchase by most GA operators of GPS receivers, data link transmitters to minimize the size of the GA aircraft bubble which will in fact determine how frequently controllers have to issue resolution advisories. This can be done by uplinking graphical weather data and surveillance radar traffic information, thus providing a large return on the GA operator's investment in this equipment.

GA aircraft equipped only with Mode C transponders are adequately equipped for the air carriers to operate under free flight today. However, if the GA aircraft are equipped to broadcast their GPS-derived location, the increased positional accuracy will result in a smaller bubble around the GA aircraft, allowing for fewer deviations by either the GA or the air carrier aircraft than if the GA aircraft were only operating with the Mode C transponder. Once the GA operator has purchased GPS and data link for his own navigation and weather and traffic information purposes, he has already equipped himself for GPS–ADS transmissions to make this happen.

In addition, GA can further improve the effectiveness of free flight by providing large numbers of aircraft with airborne weather censor platforms that are flying in the weather rather than above it, which can then data link this weather information down for inclusion in the gridded database. This would improve the accuracy of weather nowcasting and forecasting to help air carriers determine what their best trajectory indeed is.

Once GA is equipped with the data links to get the weather and traffic information into their aircraft, the cost of additional equipment to send weather data down will be small and could be subsidized by the National Weather Service as a less expensive way to gather airborne weather data than the current system.

All of this is technically feasible now. Later this month, for example, ARNAV Systems and Honeywell will demonstrate a data link system that accomplishes all of these functions that I discussed above, plus company messaging.

Next month ARNAV and Pan Am Weather Systems expect to have a general aviation weather and traffic information data link demonstration program operational through the State of Pennsylvania. What is required is FAA and NASA assistance to make this widely affordable and available, and we will need the FAA's cooperation in getting this surveillance radar information into the Pennsylvania program.

SAMA strongly supports free flight and the vision presented by the Air Transport Association. General aviation needs the technology that makes free flight possible to increase the safe utility of personal and business transportation flights, and allow general aviation to reach its full potential in the transportation system.

Free flight technologies applied to general aviation would result in increased national economic growth, increased competition with foreign competitor aircraft manufacturers, and the resurrection of a light general aviation industry in decline.

In addition, it will increase the access to major airports. At O'Hare airport for example, if you can land 180 flights an hour using free flight and there are 150 gates, that leaves 30 slots an hour open for general aviation with no impact on air carrier operations. In developing and evaluating free flight, there are three principles that should be observed to ensure the full participation of general aviation.

One, the technology must be able to accommodate not only 6,000 air carrier aircraft, but also a much larger number of GA aircraft, such as the 200,000 aircraft in the current fleet.

Two, the data links and displays to implement free flight must be affordable by virtually all general aviation aircraft.

And three, for a fast transition to free flight in its most useful form, the FAA must encourage GA operators to voluntarily equip their aircraft with these technologies by providing free weather and traffic data and the increased operational benefits of reduced separation sufficient to warrant the purchase of the GPS receivers, displays, and data links.

Mr. Chairman, this is an issue where this committee can make a big difference by immediately stimulating the FAA to do these things. The timeframes FAA expressed in their testimony are typical, but unfortunate. I think that the air carriers have exercised enormous patience and restraint. They have proposed a very cautious, phased-in program to evaluate this.

Another response by an industry losing $3.5 billion a year because of a problem that could be fixed as simply and as quickly as this would be to have their members instruct their pilots to regularly declare "economic emergencies," with a communication that would go something like this: "Washington center, United 114, we are declaring an economic emergency. Payday, Payday, Payday. We are going to do a free flight deviation around severe economic turbulence and widespread scheduling. We are proceeding: block attitude between flight levels 300 and 370, direct to the IAF at LAX." That would be the SAMA approach, it might not be the best one, but it would get this program kicked off.

In conclusion, Mr. Chairman, I would like to commend you and the subcommittee for holding this hearing and for considering our views in this matter. We wish you success in stimulating the FAA to faster action.

Thank you.

Mr. PETERSON. Well, thank you.

[The prepared statement of Mr. Fiduccia follows:]

PAUL C. FIDUCCIA,
President

EXECUTIVE SUMMARY

The Small Aircraft Manufacturers Association (SAMA) is a national trade association representing 40 producers of light general aviation aircraft, engine, propeller, avionics and supplier companies. SAMA's aircraft companies produce kits for the production of experimental aircraft, which constitute 10% of the general aviation fleet, and the largest source for new general aviation airplanes and rotorcraft, with over 2,300 kits produced by SAMA members in 1993. These aircraft range from two-seat entry-level airplanes to advanced technology pressurized, advanced composite construction, four-to-seven seat personal and business transportation airplanes with cruise speeds over 300 knots.

General aviation comprises 95% of the civil fleet, flies 80% of all air trips, 75% of all air traffic operations, 60% of all hours flown, 40% of all miles flown and of all IFR air traffic operations, and 20% of all passengers flown. It provides 4% of <u>all</u> inter-city passenger miles (including by automobile, bus, rail, and air carrier) over the mid-range distances (150-700 miles) suited to general aviation aircraft speeds. And it does this on only 6% of all aviation fuel. For these reasons, general aviation must be seamlessly incorporated into FANS / CNS / ATM and the "Free Flight" vision of the air carriers.

SAMA strongly supports FANS/Free Flight and the vision presented by the Air Transport Association in its June 16, 1994 paper, "Air Traffic Management in the Future Air Navigation System". General aviation needs the technology that makes Free Flight possible to increase the safe utility of personal and business transportation flights in order to allow general aviation to reach its full potential. FANS/Free Flight applied to general aviation would result in increased national economic growth, foreign competitiveness, and the resurrection of almost destroyed industry. Free Flight is the air carrier counterpart to the NASA Advanced General Aviation Transportation Experiment (AGATE) program and the two programs should proceed together.

SAMA believes that FANS/Free Flight can and should be rapidly expanded, in a form applicable to air carriers and to general aviation, including air charter, corporate, business, and personal transportation. SAMA urges that FANS/Free Flight be applied by the FAA to promote the full integration of virtually all general aviation aircraft.

> 1. FANS/Free Flight must accommodate not only 6,000 air carrier aircraft, but also at least the 200,000 aircraft in the current general aviation fleet.
>
> 2. It must be affordable for virtually all general aviation aircraft, including Part 135 and Part 91 operators.
>
> 3. The transition to FANS/Free Flight must encourage voluntary general aviation equipage by providing benefits sufficient to warrant the purchase of GPS, displays, and data links by the vast majority of general aviation aircraft.

To facilitate the rapid introduction of Free Flight, SAMA recommends:

1. Because both the air carriers and general aviation need the same technologies and same operational rules to survive and serve their passengers, and because all aircraft in transportation airspace must have some equipage to make free flight work, we believe that the air carriers and general aviation should work together to develop a system that works for both elements of our civil aviation system, and should begin to do so immediately.

2. Specifically, we propose that the air carriers, transport category aircraft manufacturers, general aviation users and aircraft manufacturers propose to FAA and NASA and cooperative industry/government/university project to demonstrate and validate the concepts of free flight applied across the spectrum of all aircraft in order to facilitate the early implementation of FANS/Free Flight.

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I. Introduction

A. The Small Aircraft Manufacturers Association

The Small Aircraft Manufacturers Association (SAMA) is a national trade association representing 40 companies. SAMA's aircraft companies produce kits for the production of experimental aircraft, which constitutes over 10% of the general aviation fleet, and the largest source for new general aviation airplanes and rotorcraft, with over 2,300 kits produced by SAMA members in 1993.

These aircraft include two-seat recreational, sport and flight training "entry level" airplanes, as well as advanced technology four-to-seven seat personal and business transportation airplanes with cruise speeds over 300 knots. Most of SAMA's aircraft companies are involved in FAA certification of new-design aircraft based on their experimental kit products. SAMA's members also include the leading producers of piston engines, propellers, avionics, and equipment for single-engine civil aircraft. The performance and efficiency of the new generation aircraft now produced by SAMA members, plus the new engines and avionics now under development or being introduced by SAMA members represent the dawning of a new day in general aviation.

SAMA was formed to enable its members to develop and certificate new aircraft designs to produce a new generation of safe, reliable, efficient and affordable general aviation aircraft. Its principal goals are to facilitate the timely and economical certification of new aircraft designs through improved operation of the aircraft certification process and to promote the early incorporation of new technologies into such aircraft through increased NASA and FAA R&D support for light general aviation aircraft.

SAMA has provided the industry leadership on two successful FAA/industry programs to reduce aircraft certification burdens while maintaining or improving safety: the Small Airplane Certification Compliance Program and the Intermittent Combustion Engine and Propeller Certification Compliance Program. Last week three new aircraft type certificates were issued by FAA Administrator Hinson under these programs. SAMA also was instrumental in the creation and successful operation of NASA's General Aviation Task Force, which recommended that NASA undertake a new program to support general aviation, the Advanced General Aviation Transportation Experiment (AGATE) program, and SAMA and its members are active participants in this program.

B. General Aviation Transportation System

Civil aviation is comprised of air carriers and general aviation. General aviation's role in national air transportation system is significant. General aviation aircraft account for:

- 95% of all aircraft;
- 80% of all trips;
- 75% of all air traffic operations;
- 60% of all hours flown;
- 40% of all miles flown and of all IFR air traffic operations; and
- 20% of all passengers flown.

And it does all this on only 6% of all aviation fuel consumed.

General aviation carries 130 million passengers, more than any single US airline, and more than 20 of the top 25 airlines combined.

It is predominantly used for business transportation and other commercial purposes (69% of hours flown, compared to 37% of air carrier trips which are for business purposes).

Compared to air carriers, general aviation transportation aircraft are smaller, usually slower aircraft providing short-haul, business and personal transportation to all of our nation's communities. They are an essential part of the national air transportation system and fill in the low-density, medium-haul route structure of that system.

II. Air Carrier and General Aviation Visions of the Future

A. ATA Vision

Today's hearing is about the air carrier's vision of an air traffic management (ATM) concept that would provide increased operational flexibility resulting in increased capacity and efficiency by eliminating avoidable delays, decreasing operating costs, and improving safety and service to their passengers.

We agree with the vision presented in the Air Transport Association's June 16, 1994 paper, "Air Traffic Management in the Future Air Navigation System"

B. SAMA General Aviation Vision

SAMA has a similar vision for the future of general aviation. This vision is of a new generation of personal and business transportation aircraft and related ground facilities that would enable a new mode of high utility, safe, reliable, fast, on-demand, random-access direct transportation linking thousands of smaller rural communities and suburban areas without scheduled air service to the mainstream of the nation's economic system -- the Advanced General Aviation Transportation System. This benefits of such a system would be an improved standard of living, more jobs, an improved balance of trade in aircraft products, and further diffusion of commerce and industry into every community in our nation.

From the Roman roads system linking the major cities in Europe to the current US commercial air transportation system, the most advanced transportation technology of the day provided the society employing it the highest standard of living of the day. The new general aviation system would improve the national air transportation system in the following ways:

a. Scope of the transportation system, by increasing the number of locations included in the transportation network to all 17,000 general aviation landing facilities;

b. Effectiveness of the system, by increasing the frequency of operation to serve demand schedules of travelers, with on-demand service being the most effective from a productivity standpoint; and

c. Efficiency of the system, by decreasing the cost per passenger-trip over low-density route, mid-range trips.

The scope, effectiveness and efficiency of the transportation system is especially important in a large county with many dispersed centers of industry and commerce, such as the US. The integrated transportation system, including the general aviation mid-range inter-city system for 150-700 mile trips serves predominantly suburban areas (which total 110 million persons) and rural areas (another 60 million persons), and connect them to large urban hub areas (with the remaining 80 million persons).

The immediate beneficiaries of this system would include:

- business persons with multi-city operations outside major hubs;
- rural doctors serving several communities and medical evacuation helicopters;
- construction industry engineers and managers;
- real estate developers and operators;

- sales persons with multi-city customers;
- farmers and ranchers;
- natural resource company workers and managers; and
- accountants, auditors, lawyers and other professionals.

The indirect beneficiaries are all those persons who need medical care, repair parts or other goods for their business, or professional services not provided in their immediate area, and need these quickly, and persons who want to keep in better contact with family and friends or go on vacations in remote areas. And the entire economy would benefit from the increased productivity of these persons.

For a more extensive description of an Advanced General Aviation Transportation System and its benefits, please see the Appendix.

III. Functional Requirements and Technology Needs

In the last 15 years, general aviation has suffered a precipitous decline in all of the measures of its vitality: numbers of aircraft in the fleet, pilots certificated, FBOs, new aircraft production, and hours flown. However, the reduction in hours flown occurred in only one area -- business flying -- all others types of hours (personal flying, instruction, etc.) were up slightly. We believe that this reduction was caused by a reduction in the value of general aviation aircraft for transportation purposes compared to alternative transportation modes, principally auto travel on the interstate highway system, and more attractive alternatives for recreational expenditures.

In order to reach its potential of service in the national air transportation system, general aviation must increase its value as an all-weather transportation system to all of the population with an need to travel over mid-range distances on low-density routes not well-served by scheduled air carrier service. The best way to accomplish this must consider the typical general aviation traveler-pilot and his mission:

- The pilot is a single-pilot crew with less total flying experience and who flies less frequently than salaried air carrier pilots, who is not paid to undertake expensive recurrency training or required to take periodic check-rides, who is making more frequent takeoffs and landing often at unfamiliar airports without precision approach guidance, who is flying in worse weather (rather than above it) in an airplane not equipped for hazardous weather avoidance or deicing.

- His mission is to move 1.7 persons over 150-700 nautical miles in virtually all weather conditions at a cost approximating a coach airline ticket.

For this pilot to accomplish this mission, he must have systems that provide:

- Accurate, graphical, real-time weather hazard information (convective activity, icing conditions, turbulence, low ceilings and visibilities);
- Traffic information for situational awareness and collision avoidance;
- Point-to-point moving map en route navigation, including special use airspace visualization;
- Simplified precision instrument approach guidance;

The concepts of free flight that bring the air carriers reduced delays bring general aviation greater safety and reliability with simplified operations and faster trip times. The technologies that will enable the general aviation vision and the same as those necessary to enable the air carrier vision:

- Microcomputers, for airspace and terrain data, pilot decision aiding on weather hazard determination and systems operation;

- High-resolution color displays, for "virtual VMC" flight in IMC, including graphical navigation, traffic, terrain and obstruction, weather hazard and special use airspace depiction;

- Data link, for real time gridded data base weather in the cockpit, and for automatic electronic pilot reports of in-flight conditions as well are route request/clearances;

- GPS, with moving map presentations for simplified enroute and precision approaches to all 17,000 general aviation landing facilities.

These are the same communications, navigation, and surveillance (CNS) technologies needed by the air carriers to implement free flight. Any transportation aviation operation has the same basic needs, regardless of the number of passengers or the speed of the aircraft. The pilot, either air carrier or general aviation, must know: where is the terrain, where is the runway, where is the hazardous weather, where is the traffic.

These systems can reduce the cost of equipping the aircraft for all-weather operations and of providing initial and proficiency training for the pilot. This is a principal premise of NASA's new program to support general aviation, the Advanced General Aviation Transport Experiment (AGATE). AGATE was created by a general aviation industry request to NASA, and recently has been supplemented by FAA acting in partnership with NASA. FAA is responsible for the airspace and ground infrastructure to support a system with technology needs virtually identical to Free Flight.

IV. Equipage -- Transition to FANS

General aviation is moving more rapidly to implement this system than is the air carriers, because of the lower costs of adapting to change in smaller aircraft. For example, in may airplane, I enjoy the benefits of GPS moving map, direct routing, and I will be getting data linked weather and traffic information as part of a demonstration this fall. When I can fly VFR, this will amount to "free flight" operations for me.

We believe the general aviation must be a full participant in FANS for free flight to both meet its full potential in meeting the air carriers objectives, and to achieve our vision for a new general aviation transportation system.

ATC is increasingly willing to give direct clearances in the "low-end GA airspace" environment, under 18,000 feet, at lease outside of the major hub areas. The benefits of even this limited "free flight" are readily apparent. For the aircraft operator, it means trip time reductions of typically 10 to 20 percent over airways routings. For ATC, it means less congestion on the airways and at VORs and intersections.

There is a danger that in equipping for free flight, the air carriers may choose airborne equipment or ground systems that do not have the capacity for large numbers of general aviation aircraft participants, or that are too expensive for most general aviation operators. There is also the danger that general aviation aircraft could be required to either purchase expensive equipment that does not provide proportionate benefits to the operator, or be denied access to large parts of the air space and many landing facilities.

This does not need to happen, and would interfere with the early implementation of free flight. We suggest the following scenario would best meet the needs of the air carriers for rapid implementation of the system and of general aviation for affordable access to the system.

1 Large numbers of general aviation aircraft should be encouraged to voluntarily equip with the essential elements of free flight GPS receivers, graphical displays, and data links. FAA can stimulate this equipage by:

a. speeding the process of developing precision GPS approaches;

b. quickly moving to broadcast graphical weather information via VHF data link;

c. quickly moving to broadcast graphical surveillance data via VHF data link;

d possibly subsidizing, through an FAA procurement or through a direct payment to operators, the purchase of GPS and a data link transmitter (General aviation aircraft flying in airspace where air carrier aircraft operate will in most cases need to have GPS and a data link transmitter to broadcast their position to the air carrier aircraft. Such a procurement would provide the air carriers a greatly reduced price on their equipment as well through the resulting economies of scale to meet the general aviation volume.

e. quickly moving to provide for the reception of down linked weather information from general aviation aircraft, and perhaps paying the operator for this information to offset his equipment purchase costs.

This program would pay for itself by shortening the time when en route surveillance radars and the NDB/VOR/DME/ILS system, or parts of it, can be decommissioned.

In addition, we believe that if these steps are taken, over 90% of the general aviation aircraft used for more than purely day, VFR local flights would voluntarily equip very rapidly to get the benefits of this system. These generally would not be adversely affected by restrictions on transportation airspace or busy landing facilities use for unequipped aircraft. Thus, at some point such restrictions could be imposed without significant opposition.

Some of the concepts the air carriers have proposed regarding the transition for their members would also apply to general aviation, i.e., that operations of varying performance levels would be permitted, with the benefits of the system keyed to level of investment of each user.

V. Recommendations

Because both the air carriers and general aviation need the same technologies and same operational rules to survive and serve their passengers, and because all aircraft in transportation airspace must have some equipage to make free flight work, we believe that the air carriers and general aviation should work together to develop a system that works for both elements of our civil aviation system.

Specifically, we propose that the air carriers, transport category aircraft manufacturers, general aviation users and aircraft manufacturers join with the FAA, NASA and universities in a cooperative venture to demonstrate and validate the concepts of free flight applied across the spectrum of all aircraft in order to facilitate the early implementation of FANS/CNS/ATM.

APPENDIX
The Advanced General Aviation Transportation System

A. Integrated Transportation System

Our national integrated transportation system contains interleaved ground and air elements which predominate in service according to three criteria:

1) The number and size of destinations served;
2) the passenger volume per trip; and
3) the frequency of service.

Different ground and air elements predominate depending on these factors, as described in Table 1.

Integrated Transportation System
System Criteria and Elements
Table 1

SYSTEM ELEMENT CRITERIA			
Destination, number and size	Few: 124 large cities with 98% of passengers	More: several hundred large and medium cities	Many: Thousands of rural areas, and suburbs of large and medium cities
Passenger volume	High-volume	Medium-volume	Low-volume
Trip Frequency	High-frequency, scheduled	Medium-frequency, scheduled	On-demand, random access
PRIMARY SYSTEM ELEMENTS			
GROUND	Heavy and Light Rail	Inter-city Bus	Private Automobile
AIR	Large Air Carriers	Commuter Carriers	General Aviation

The integrated transportation system today, including our "short-haul" inter-city system for trips between 150 and 700 miles, is described in Table 2, in terms of the passenger-miles of service. This system serves predominantly suburban areas (which total 110 million persons) and rural areas (which total 60 million persons), and connect them to the large urban hub areas (with the remaining 80 million persons).

Today's Transportation System
Passenger Miles
Table 2

INTER-CITY PASSENGER MILES (Billion)	All Trips	%	>150 Mile Trips	%	150-700 Mile Trips	%
Automobiles	1660	80	250	40	90	20
Air Carriers	345	17	341	55	193	62
Bus	23	1	15	2	10	3
General Aviation	12	1	11	2	11	4
Rail	13	1	8	1	7	3
Total	2054	100	625	100	312	100

Notes:
- Sources (for all statistics in this study): Statistical Abstract of the US; tables 987, 1022; FAA Statistical Handbook of Aviation 1990, pages 4-1, 4-4,6-4, 6-5, 6-7, 6-13; FAA General Aviation Pilot and Activity Survey 1990, pages 3-4, 6-6, 3-13; Air Transport Association, Air Transport 1992; FAA General Aviation Activity and Avionics Survey, Table 3.2; FAA Aviation Forecasts, Fiscal Years 1992-2003. All statistics are for 1990 unless noted otherwise.
- Air Carriers include 339 billion Large Air Carrier passenger miles (P-Ms)and 6 billion Commuter Air Carrier P-Ms.
- Rail includes 4 billion commuter rail P-Ms.
- It is estimated that 150 miles is the maximum trip length for most (80%) car travel (three hours) and the minimum for most air travel. It is estimated that 700 miles is the maximum for most on-demand, random-access, low-volume service to smaller communities, and for most business transportation.
- The estimate of Air Carrier P-Ms for 150-700 NM trips is based on the ratio of narrow- body airliner P-Ms (less than 700 mile average trip) to wide body airliner P-Ms (over 700 mile average trip), and assumes that all narrow-bodies, and only narrow-bodies, fly the 150-700 mile trips.
- It is estimated that 50% of transportation by bus and rail is 150-700 mile trips, and that 92% of general aviation cross country travel is in this trip length category.
- The 1660 billion P-Ms in automobiles correspond to 1525 billion vehicle miles, for 1.1 passengers per vehicle. This demonstrates the strong preference people have for on-demand, random-access personal transportation.

The integrated air transportation system is composed of general aviation and air carriers, with important characteristics described in Table 3.

Today's Air Transportation System
General Aviation and Air Carriers
Table 3

	GENERAL AVIATION	AIR CARRIERS
Airports Served	5,200 public use airports, 7,700 private use airports, 4,700 heliports, stolports, seaplane bases.	560 in 483 Communities: 72% passengers in 50 airports for 27 communities; 90% passengers in 100 airports for 62 communities.
Aircraft	200,000	4,000
Miles Flown Per Year	4 Billion	4 Billion
IFR Operations Per Year	14 Million	19 Million
Purpose of Flight		
Business	69%	37%
Personal	31%	63%

Notes:

- Sources: See Above.
- Air Carriers include Certificated Air Carriers (interstate scheduled routes, operating airplanes of 30 or more passenger seats) and Commuter Air Carriers (at least five scheduled intestate trips per week, operating airplanes of less than 30 seats).
- Air Carrier airports are those open to Certificated Air Carriers. Commuter aircraft can operate out of other airports if certain operational requirements are met.
- General aviation is all civil aviation other than scheduled air carriers (including Certificated and Commuter Air Carriers). It is our inter-city, all-destination, on-demand, random-access, high-speed transportation system.
- General aviation transportation includes all cross-country, general aviation aircraft hours flown for the following uses:

1. Air taxi (under 30 passenger, unscheduled, for-hire service, including cargo);
2. Corporate (salaried-pilot(s), corporate ownership),;
3. Business (company-owned, non-salaried pilot); and
4. Personal (non-salaried pilot, including business use of personally-owned airplanes and personal travel).

Light General Aviation includes aircraft up to 6,000 pounds gross weight, and Heavy General Aviation are aircraft over this weight.

It does not include non-transportation uses of general aviation aircraft, i.e., other commercial purposes such as: agricultural application, mapping and environmental observation, law enforcement, flight instruction, medical emergency, disaster relief, fire spotting and control, pipeline and power line patrol, and construction.

The current general aviation transportation system is described by the type of aircraft in Table 4.

General Aviation Transportation by Type of Aircraft
1990
Table 4

	Total Fleet Size	Total Hours (Mil.)	Ave. Seats Occpd.	Ave. Speed (Kts)	Trans.Hours (Mil.)	Pass-Miles (Bil.)
Piston S-E, 1-3 Seats	60,000	9.0	1.4	95	2.9	.4
Piston S-E, 4+ Seats	105,000	14.7	2.4	124	9.9	3.0
Piston Twin	23,000	4.2	3.0	155	3.6	1.7
Turboprop	6,000	2.5	7.9	197	1.1	2.5
Turbojet	4,000	1.5	4.9	461	1.4	3.1
Rotorcraft	7,000	2.4	7.0	99	1.4	1.0
TOTAL	212,000	34.3			20.3	11.7

Notes:
Sources: See above.
- Total fleet size: there are 7,000 "other aircraft" included in the total.
- Trans. Hours do not include commuter air carrier use, and do not include non-transportation uses such as flight instruction, aerial application and observation, etc.

The general aviation transportation system is described by the use of aircraft in Table 5

General Aviation by Use (1990)
Table 5

USE	Fleet Size	Total Hours (Million)	Average Trip Distance (Miles)
ON-DEMAND TRANSPORTATION			
Air Taxi	6,000	2.4	303
Corporate	11,000	3.2	430
Business	36,000	4.7	331
Personal	121,000	10.1	258
OTHER COMMERCIAL	38,000	12.5	145-427
TOTAL	212,000	32.9	

Notes:
- Sources: See above.

B. Threats to Air Transportation System Capacity and Efficiency

The US air transportation system is currently threatened on several fronts:

1. Air and ground traffic growth and resulting congestion and delays at major airports;

2. The loss of market share to foreign competitors in both commercial and general aviation production;

3. The loss of technical superiority, and perhaps competitiveness, with a net import of high technology items, including certain aircraft;

4. The virtual loss of the light general aviation industry, with increasingly expensive products with limited market appeal;

5. Noise and environmental concems threaten even the successful heavy general aviation industry.

There are significant threats to the capacity of the general aviation system today. For "light general aviation", there is a significant threat of extinction of the domestic industry, with current production the lowest since WW. II, lower than the attrition rate, and 90% lower than 10 years ago at 500 piston engine aircraft projected for 1992. The fleet declined by 3% in 1991.

The light general aviation fleet age (average) is 25 years for piston single-engine airplanes and 22 years for piston multi-engine airplanes. The average technology of this fleet is even older at 40 years for all but avionics.

There is a general deterioration of the general aviation infrastructure of airports and fixed-base-operators who provide services for aircraft (43% of which operated unprofitably last year). If this deterioration advances, the capacity of general aviation to contribute to national transportation needs will be greatly reduced.

1980 - 1990 Deterioration of General Aviation Infrastructure
Table 6

Shipments	-90%
Active Fleet Size	-10%
Active Pilots	-15%
Hours Flown	-30%
Public Use Airports	-15%
Prices and Operating Costs	+75%

Notes
- The overall reductions in general aviation shipments and fleet size are caused by major declines occurring only in light general aviation, business jet production and fleet size have increased over this period.
- The increase in amateur built kit airplanes reflects the market demand for lower cost and new technology aircraft, with a high ratio of utility to cost, despite the difficulty in having to build the aircraft yourself. New technologies incorporated include natural laminar flow aerodynamics and newer smooth-running, fuel-efficient (combustion-balanced) engines.

For "heavy general aviation" (aircraft over 6,000 pounds gross weight), increasingly stringent noise and emissions requirements are threatening producers and operators.

C. Objectives of Advanced General Aviation Transportation System

1. Increase economic growth through improvements in the scope, effectiveness, and efficiency of the integrated transportation system, from the High Speed Civil Transport, to Subsonic Aircraft, Commuters, and General Aviation.

2. Extend to smaller communities the full benefits of the air transportation system. Connect these communities to each other directly and to large hub airports.

3. Extend the useful life of existing large airports and the ATC system in the face of increasing demand. Off-load congested large hub airports by providing direct service between suburban reliever airports of hub cities and avoiding hubs that are not destinations.

4. Enable US manufacturers to take a lead internationally in this system, which will have large world-wide demand. The production of 30,000 of these aircraft per year would create an estimated additional 20,000 jobs at airframe manufacturers alone.

5. Improve the economics of the air carriers by allowing them to operate their transport aircraft more efficiently at higher load factors over longer stage lengths.

6. All of this can be accomplished with less adverse environmental impact that other methods of improving the transportation system.

D. Opportunities for an Advanced General Aviation Transportation System

Although the general aviation system today is productive and efficient, it does not come close to realizing its full potential contribution to our transportation system. There are market requirements for a new generation of general aviation aircraft and related ground systems provided at market-based prices.

The market requirements for this system are:

- Safe, high-utility: high mechanical dispatch reliability and all weather operation, with portal-to-portal speed better than airlines for 150-700 mile trips, and requiring only an acceptable amount of pilot training time and cost.

- Economic: total cost per mile (including capital costs and training time-costs) comparable to airline ticket cost and related costs for the same trip, plus a premium for flexibility and convenience; efficient, low-drag airframe and fuel-efficient engine. (Based on an average projected load factor of 2 persons, the total cost per mile would be the airline coach ticket cost x 2 + 0.50 $/mile for business benefits and cost savings).

- Comfortable: noise and other comfort factors comparable to a new car.

The price for this system must be based on what the market is willing to pay for this capability. Total operating costs must be comparable to short-haul airline coach ticket price. The airplane must not cost more than currently available models despite the improvements in safe utility (note: GPS cost less than VOR).

Some trip city-pairs trips in this market, where there are congested large hub airports, megalopolises, and large suburban and ex urban areas that are economically connected., are:

- Suburban Los Angeles CA to suburban San Francisco CA or Phoenix AZ.

- North suburban Los Angeles (Santa Barbara) to South suburban Los Angeles (Orange County);

-Ex-urban New York (North Philadelphia) to New York;

- Chicago IL to Detroit MI;

- Frederick MD to Worcester MA;

- Blytheville AR to Peoria IL;

To provide an example of the benefits of general aviation travel, consider the Blytheville to Peoria trip.

Travel Options
Blytheville AR to Peoria IL
Table 7

	AUTOMOBILE	BUS	AIR CARRIER	GENERAL AVIATION
DISTANCE	450 miles	550 miles	700 miles	350 miles
TIME	8 hours	12 hours	5 hours	3 hours
COST	$100	$75	$250	$200

Notes:
- Time is portal-to-portal.
- General Aviation cost assumes a rented 1980 Cessna 172 @ $65/hr.

Currently available production aircraft do not meet these market needs because their operating costs, including the cost of attaining and maintaining pilot proficiency, exceed airline ticket costs by an amount too large to justify. The benefits in increased productivity (departure time and destination change flexibility, reduced travel time, work en route, etc.) and cost savings (from reduced travel time, reduced need for overnight accommodations, etc) do not justify the cost differential for many persons with travel needs well suited for general aviation.

The smaller companies that produce most light general aviation airplanes, especially the new generation of high-performance, high-efficiency kit aircraft, do not have the resources to develop and validate all of the technologies needed to create the new General Aviation Transportation System without substantial government cooperation. This new generation of high-performance kit aircraft (such as the five-place Cirrus VK-30 and four-place Lancair IV) have higher efficiencies (seat-miles per gallon of fuel) than a Boeing 747, at higher normal cruising speed than any production piston engine airplane, and approach the requirements for the new General Aviation Transportation System aircraft. But additional applied technology is needed to bring these designs to the market with the simplicity of operation and safety needed to meet all market needs.

By fully employing these technologies, in coordination with the development of new pilot training systems (described below) to reduce training time and cost to proficiency for high-utilization operations and new, decentralized air traffic control systems, general aviation could provide vastly more transportation services to the nation in the short-haul market. This increased capability is projected in Table 8.

New Transportation System
Projections
Table 8

	1990	2000	2010
Total Inter-city P-Ms All Trips (Current Trend) (Billion miles)	2054	2500 (trend)	3000 (trend)
Inter-city P-Ms, 150-700 Mile Trips (Current Trend) (Billion miles)	312	380 (trend)	460 (trend)
Inter-city P-Ms, 150-700 Mile Trips(with GATS) (Billion miles)	312	400 (trend +5%)	560 (trend +22%)
Gen. Av. P-Ms, 150-700 Mile Trips (Billion miles)	12	32 (current x 2.6)	112 (current x 9.3)
Gen. Av. % of Inter-city PMs 150-700 Mile Trips (Percent)	4	8	20

Notes:
- Research and concurrent development of aircraft and ground based systems: 1993-96; Concurrent aircraft certification 1993-1997; New aircraft production starting in 1997 at 5,000 per year and increasing to 30,000 per year in 2003.
- In 1979 the general aviation industry produced almost 18,000 airplanes; in 1945, the US produced over 100,000 airplanes, many large bombers. There are several companies in the GA business now and several others poised to enter it who could produce these aircraft.

The increased general aviation passenger miles (and consequent increased total inter-city short haul miles) are attributable to:

- substantially increased number of trips, with a much larger number of highly capable aircraft and a higher utilization of these aircraft, including more shared ownership arrangements;

- substantially higher speed, permitting more miles for the same flight time; and

- increased numbers of passengers per trip, as light general aviation aircraft become more reliable and safe and more persons other than the pilot use them.

The increased general aviation passenger miles not attributable to increased total transportation represents a reduction primarily in auto travel.

E. System Characteristics

The General Aviation Transportation System will provide business and personal transportation that is: safe, reliable, all-weather, moderate-speed, short-haul, low-cost, on-demand, and random-access to virtually any community.

General Aviation Transportation System
Table 9

ELEMENT	PRESENT SYSTEM	GATS ENVIRONMENT
Cockpit	Old technology instruments, displays and controls for flight and navigation data and systems monitoring.	Additional weather, winds aloft, and traffic avoidance information presented on simplified displays for reduced decision errors, simplified control concepts, and automatic systems monitoring and pre-fault warning.
Enroute Navigation System	Dog-leg VOR-based, on-airways.	Direct GPS-based, off-airways.
Terminal Guidance System	ILS, high-training-time-for - proficiency system, only at limited a number of higher-volume airports.	Simplified presentation GPS and CD-based system for all general aviation airports.
Collision Avoidance (plus see-and-avoid when able)	Ground based radar, verbal communications.	In-cockpit, GPS-based, data-link system.

Air Traffic Control/Collision Avoidance

GPS-based direct, departure-to-destination navigation off the airways will reduce aircraft operating in close proximity to each other en route. The addition of precision instrument approaches at all general aviation airports will reduce air congestion near busy airports, where virtually all mid-air collisions occur. Accurate GPS-based position and altitude information transmitted by data-links will permit an in cockpit collision avoidance system in all new generation aircraft. Together, these elements should reduce the load on the current ATC system even with a substantially increased number of aircraft.

Mr. PETERSON. I think all of you gave excellent testimony. It is too bad we lost some of our audience and Members, but we will try to make sure that they are aware of what you have brought to us.

I think that all of us are on the same wavelength here pretty much. But I do not quite understand what this data link portion of this system is and what kind of cost we are looking at.

Is that some kind of a separate box you need to put in the airplane or——

Mr. FIDUCCIA. It is, but fortunately it isn't a tremendously expensive box. Currently, in the quantities we are talking about for the Pennsylvania program, the cost is about $1,000 for what is called a "modem transreceiver". It is a two-way data link that is operating on a VHF frequency.

Mr. PETERSON. The airlines have these?

Mr. FIDUCCIA. The airlines have data link. They have, as I mentioned, all of these things. They have a system called ACARS that brings not graphic weather, but textual weather, into a cockpit. They have a system called MEDCARS that transmits weather information down to the ground.

The air carriers, in terms of equipment, have all of this. GA doesn't, but with the reductions in the cost of computers and displays and electronics, we finally have the ability for GA to realistically equip itself with these technologies. For aircraft that are regularly flying IFR, these technologies pay, and anyone who has flown with a GPS moving map will attest to the value of that equipment.

Mr. PETERSON. So you would have this data link, you would have your GPS, and then you would have one of these displays that you could put all this information in the cockpit.

That is right?

Mr. FIDUCCIA. That's right. The pilot should be encouraged to voluntarily equip, because when he purchases the GPS, he basically gets free flight when he uses it. If he has the display for navigation, he will equip with a, data link, if the FAA is providing weather and traffic information. Now, for the first time, he can get ground-based precipitation data from the mosaic of the radars. He can get ground-based lightening strike data. This is tremendously valuable in avoiding hazardous weather. With this same equipment he can also receive as a display the ground-based surveillance radar. Radar coverage is variable at the lower attitudes, but it provides information on nearby traffic. A low-cost form of TCAS to a wide range of pilots who can't afford current TCAS systems, which are well beyond the cost of an entire GA airplane in most cases.

Mr. BROWN. Mr. Chairman, I would like to respond to your question about price because it brings a bit of reality to all of these discussions. This unit, which you are well familiar with, the portable GPS, has come down in price dramatically, but the essence of GPS has been known and we have been working on it for about a decade, and it took about that long for the price to come down where it could really penetrate the general aviation marketplace.

A data link system that would be certified by FAA, not something that is available in another transport mode, would be significantly more expensive than $1,000 today, probably on the order of $10,000 to $15,000 for the type of general aviation use that would be involved. Will that come down in the future? Absolutely. But today, to talk about numbers, those are some numbers that are real, and I think you know, Mr. Chairman, there are many aircraft that are worth that. So——

Mr. PETERSON. And this display that is apparently being produced, or the prototypes or whatever, how much would that cost now, today? I mean, if it is available, what is the price of one of those?

Mr. BROWN. There are none that are certified yet, but the projections are that you are looking at a couple thousand dollars for a very high-end display. For a very simple display that you would find in a smaller airplane with a little less capability, you might be able to get in the $1,000 range.

Mr. PETERSON. So they are not too costly.

Mr. BROWN. No, they are not beyond reach.

Mr. PETERSON. And what makes them work is the data link. And isn't there some kind of computer in there too?

Mr. BROWN. There has to be a processor to go with it as well.

Mr. PETERSON. That is not a real expensive or complicated thing?

Mr. FIDUCCIA. The pricing question is somewhat difficult, and I would agree with Steve that currently a certified system cover cost of $10,000. However, the data link we are using in this test program doesn't have to be certified, because weather information is not flight critical, and we can provide data link for about $1,000. For the certified system also used for traffic information, it would be more like $10,000.

When you start talking about traffic information, it is going to have to be certified. So I wouldn't disagree with Steve that the data link price has to come down.

A color display appropriate for weather and of a size that you could see much is 5,000 plus right now. The prices for these displays need to come down.

One of the purposes of the NASA program is to enable the industry to transfer technology to bring the cost of flight-hardened, environmentally acceptable color flat panel displays down to where large numbers of GA aircraft can afford them.

Mr. PETERSON. And I think all of you are working at getting a new concept in general aviation airplanes—from power plants to the avionics—and I am convinced that what we are going to end up with is some kind of computer that is going to have all this stuff in it, rather than what we have now.

If you had this kind of a system, can this be displayed on the computer that you use to fly the airplane, or does it have to be in a separate display? Can they all be in one?

Mr. COYNE. Mr. Chairman, if I can answer, it can all be in one. One cockpit EFIS, or electronic flight instrument system, can display all this information. Typically, the one system, as I showed you out at Oshkosh, will have a series of buttons around it and when you press one button you might show all your engine instruments—the screen; press another button, get all the weather on that screen; press a different button, get all the conflicting traffic on that screen and press another button, have an artificial horizon appear on the screen. These can be very sophisticated.

For general aviation at this point, the prototypes are being developed that allow a great deal of different information to be put on the screen, thanks of course to the cost of flat panel displays that have come down so much in the last decade.

The important thing, though, is not just to be limited in our thinking by what is available right now. It is frustrating to hear our government officials say that 15 or 20 years into the future we might be able to have what is really available today.

A more imaginative look 15 or 20 years into the future promises real change. We could have airplanes that literally fly themselves with the help of computerized systems: the pilot gets into the plane, tells the computer where it wants to go, and the system, together with this kind of free flight capability, takes him straight to his destinations airport, providing much greater flexibility, control, and safety for airplanes using the technology of 20 years in the hence.

So I am pleased to look forward 20 years, but I don't want to see our Government look backwards when it should be looking ahead.

Mr. PETERSON. People that are in this business tell me that they think within 5 years, if everybody would get out of their way, they could have airplanes that wouldn't need pilots. They could take off and land without pilots, but that is never going to happen. You would never get the American people to get on a plane that didn't have a pilot. But literally, that is where they think that they could get with this technology without too much problem in 5 years.

Mr. COYNE. That's right.

Mr. PETERSON. If people would get out of their way.

Mr. BROWN. We would certainly like to keep a few pilots around, Mr. Chairman. And I think, though, your point is well taken, but the reality is, and you well know this, in general aviation the use of current technology in many cases is in excess of what happens in the airlines. The only trick is that it has to become affordable so it can be widely installed.

Mr. PETERSON. One of the reasons that I have never finished my IFR rating is that it is too slow, it just slows me down so much. I just fly VFR because it just saves me so much time, and I never got around to finishing my instrument rating. I think one result, of all of this is it is going to make it simpler, once we get these changes and if we can get these new aircraft designs in place, simpler to fly these planes. If we have got a flat panel display everything is included in there instead of having all these different instruments and all these other things that you have to figure out.

Then, I think we are going to have an easier time getting people into flying. They are going to feel more comfortable with it. It is going to be easier to learn how to fly. And that is where we need to go.

Mr. BROWN. And with your assistance, we now have the promise of manufacturing in general aviation again. We have had a barrier on that for so many years, and now we are going to see that kind of innovation in the avionics field.

Mr. PETERSON. I hope so. But if all that is going to happen is that we are going to build 172's again, that ain't going to cut it. I mean, we have got to get beyond that if we are going to actually get serious about getting people back into general aviation. But I'm hopeful that is what is going to happen because of groups such as yours.

Mr. FIDUCCIA. Mr. Chairman, the reason we are testifying today is because all these technologies that I discussed earlier are precisely the ones that will open up general aviation to a large segment of the population that today correctly perceives the large time and financial investment necessary to reliably and safely fly almost all weather operations and use an airplane as a transportation device.

The pilot needs to know where he is, where the airport is, where the terrain is, where the bad weather is, and where the traffic is. When flying VFR, you can look out the window and see it. What we are talking about is "electronic VFR," and I think the air carriers are using the same term for free flight.

Once you can "see" all of these things with the help of cockpit electronics flying in weather becomes much more intuitive. This would vastly shorten the amount of time it would take someone with a need to travel to progress from ground zero to being a competent pilot, operating in the national airspace system, along with air carriers in a totally safe, reliable, predictable way. These technologies would do that.

Mr. PETERSON. And then what we have to do is to get a system where you can go rent an airplane, fly it some other place, and leave it like you do with the rental cars. Today, it is impossible to rent airplanes in this current system because of insurance and everything else. You got to get checked out and, by the time you get done with everything, you have spent a whole day getting ready to fly that plane.

What we need is some kind of a card where that has all your information on what you can fly. Then to rent a plane, you stick the card in a machine and it says "welcome Mr. Peterson," and you fly the plane to wherever you are going and you leave it. That is what we need, a system that is simple to use and gets around all these obstacles that we have with insurance and ratings and all this other stuff.

I think all of you are working in this direction, from what I have heard, and that is where I would like to see us go. So if this committee can be of any help, we are going to be, if I have anything to say about it, and I am excited about the possibilities. I think general aviation is at the point where it could really take off, and we could make this as easy as driving a car if we do it right.

Mr. BROWN. Mr. Chairman, I think in many respects you are absolutely right about that, and the one thing that I hope you will watch for all of us in general aviation is that as the airlines and FAA get together and work out some of their difficulties, that whatever comes out of that, and we will participate as much as we can, is truly affordable for general aviation so that we are not locked out by price or procedure or any other element in the solution.

Mr. PETERSON. Rest assured I am going to be on your side in that. Yes.

Mr. COYNE. If I may, Mr. Chairman, one last point. I agree fully with your vision of the future, but here today, we have got our work cut out for us, because the FAA continues to plod along on many of these innovations that you have talked about.

General aviation has never been more affordable to the average American than it is today. General aviation has never been safer, and with help of all this new technology, planes are simpler to fly than ever before. This is a message we have to get out to Americans and we appreciate your help and the FAA's help in getting that message out.

Mr. PETERSON. Well, I am going to have to see the Secretary of Agriculture about barley problems, so I have to shift gears. But we appreciate you being with us and we are going to follow up on this. We'll keep FAA's feet to the fire and hopefully we can get that 8 to 12 years down to 8 to 12 months.

Thank you. The subcommittee is adjourned.

[Whereupon, at 1:15 p.m., the subcommittee was adjourned.]

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