

103

# THE NATIONAL UNDERSEA RESEARCH PROGRAM

Y 4. M 53:103-6

## RING

The National Undersea Research Prog... RE THE

SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF  
MEXICO, AND THE OUTER CONTINENTAL SHELF  
OF THE

COMMITTEE ON  
MERCHANT MARINE AND FISHERIES  
HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

ON

ESTABLISHING THE NATIONAL UNDERSEA  
RESEARCH PROGRAM BY STATUTE

MARCH 24, 1993

Serial No. 103-6

Printed for the use of the Committee on Merchant Marine and Fisheries

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# THE NATIONAL UNDERSEA RESEARCH PROGRAM

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WEDNESDAY, MARCH 24, 1993

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO, AND THE OUTER CONTINENTAL SHELF, COMMITTEE ON MERCHANT MARINE AND FISHERIES,

*Washington, DC.*

The subcommittee met, pursuant to call, at 2:05 p.m., in room 1334, Longworth House Office Building, Hon. Solomon P. Ortiz [chairman of the subcommittee] presiding.

Present: Representatives Ortiz, Green, and Weldon.

Staff Present: Robert Wharton, Sheila McCready, Tom Kitsos, Sue Waldron, Dino Esparza, Terry Schaff, Chris Mann, Eunice Groark, Lisa Pittman, and Harry Burroughs.

## STATEMENT OF HON. SOLOMON P. ORTIZ, A U.S. REPRESENTATIVE FROM TEXAS, AND CHAIRMAN, SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO, AND THE OUTER CONTINENTAL SHELF

Mr. ORTIZ. Good afternoon. I would like to welcome all of you to the first hearing of the Subcommittee on Oceanography, Gulf of Mexico, and the Outer Continental Shelf for this congressional session.

Today, our focus will be on the National Undersea Research Program of the National Oceanic and Atmospheric Administration. In 1980, NOAA replaced its Manned Undersea Science and Technology Office with the Office of Undersea Research and the National Undersea Research Program, commonly referred to as NURP. With the creation of NURP, the Federal Government became involved in civilian research of the ocean. The program was designed to support undersea research in the ocean and Great Lakes environment, and to improve diver safety and performance.

Originally, the program was supported by the Administration. However, since 1983, NURP has been zero funded in each budget request and has been maintained only by Congress through annual appropriations. I am sure our witnesses will emphasize the importance of NURP and its role in benefiting the science, academic, and social community.

During the last Congress, this committee provided a detailed plan for the formal establishment and administration of NURP through H.R. 3247. Though the legislation passed the House, it did

not pass the Senate. Today, we will discuss the possible framework for establishing NURP by statute.

Throughout the hearing today, we will examine the NURP program and the need to continue undersea research to better understand ocean and large lake ecosystems as well as our planet as a whole. The subcommittee will also consider the possible need to expand the program. We will attempt to determine whether the current center structure adequately meets our nation's research needs, or if we need to establish additional centers to ensure geographic balance and research exposure. Additionally, we will consider the need for more deep submergence research platforms and a national strategy in this important field.

Congress has recognized the value of NURP for over a decade. I hope this hearing will enlighten us to ways to continue to get the maximum benefit from this program.

Before I go any further, I would like to welcome the ranking member of this subcommittee, my good friend, Mr. Weldon. I yield to him to make any comments or statements he wishes to share with us today.

#### STATEMENT OF HON. CURT WELDON, A U.S. REPRESENTATIVE FROM PENNSYLVANIA

Mr. WELDON. Thank you, Mr. Chairman. To begin with, it is an honor and a pleasure to serve with you. I think we will have an excellent working relationship this session of Congress on issues affecting our oceans and undersea research.

The hearing that you are holding today, which I think is very important, will focus on the National Undersea Research Program. Programs, such as NURP, played a vital role in developing a better understanding of our marine ecosystem. I certainly appreciate your leadership in this area. This includes both global and coastal oceanic processes, mineral resources, submersible platform technology, and marine pollution issues.

While Pennsylvania, my home state, does not have a NURP Center, the New York Bight NURP headquartered at Rutgers University in New Jersey has done a very commendable job especially for the Mid Atlantic region in dealing with the issue of sewage sludge and the dumpsite that is 106 miles offshore of New York City.

I am particularly looking forward to hearing from our witnesses today and learning about the ongoing research underway. Mr. Chairman, I propose that we consider trips for members and staffs to visit some of the sites where ongoing research is taking place. This will provide members of Congress a better understanding of the importance of programs like NURP so that when we have to vote on the House floor, members can't trivialize the importance of the efforts underway through these types of programs. Today's hearing and the excellent panel of witnesses that we have scheduled for today should serve as a beginning to this process. I want to thank you for holding this hearing.

I apologize for our colleagues who will be in and out during the afternoon. Besides floor votes, there is a very heavy schedule of work today and tomorrow for the members. You will be seeing us

come and go, and we apologize for that. This should not be the case, but, unfortunately, all of the hearings are scheduled at the same point in time which is why this confusion takes place on a day like today. With that, I would also ask unanimous consent to include the statement of the Honorable Jack Fields of Texas, Mr. Chairman.

**STATEMENT OF HON. JACK FIELDS, A U.S. REPRESENTATIVE FROM TEXAS, AND  
RANKING MINORITY MEMBER, COMMITTEE ON MERCHANT MARINE AND FISHERIES**

Mr. Chairman, I commend you on your first hearing as Chairman of the Subcommittee, and look forward to continuing our strong working relationship to benefit the great State of Texas. With all due respect to former Congressmen Hertel and Davis, I also applaud the change in the Subcommittee's name.

The National Undersea Research Program has maintained a low profile at the National Oceanic and Atmospheric Administration. While targeted for elimination in past budget proposals, the program has proved to be surprisingly resilient. This is no doubt due to the valuable research on undersea productivity and habitat characteristics, marine mineral resources, and diving safety and technology it has produced.

However, I am concerned that there is little geographic parity within the program, given the concentration of NURP Centers and funding in the Atlantic Ocean. NURP activities for the Gulf of Mexico are currently conducted through the University of North Carolina at Wilmington, which also has responsibility for the entire mid- to south-Atlantic region. This strikes me as quite thinly spread. Although NURP has funded research in the Gulf of Mexico at Texas A&M University and others, certainly the Gulf could benefit from additional deep water exploration and research. This is especially true given its tremendous natural undersea resources, including the northernmost coral reef in the United States, a seven-billion-dollar fishery, and abundant offshore oil and gas deposits.

I would also like to welcome Dr. Bright of Texas A&M University to the witness table. No stranger to NURP, Texas A&M is one of the preeminent marine research institutions in the country and Dr. Bright is one of its most powerful assets. In fact, he is perhaps the foremost expert on the Flower Gardens Bank in the Gulf of Mexico.

Mr. Chairman, again, thank you for holding this hearing and I am confident that together we can correct the geographic parity problems with the National Undersea Research Program.

**STATEMENT OF HON. WILLIAM J. HUGHES, A U.S. REPRESENTATIVE FROM NEW JERSEY**

Good afternoon, Mr. Chairman. Thank you for allowing me to join your hearing today.

Mr. Chairman, I am very pleased that we are beginning proceedings on the National Undersea Research Program, commonly referred to as NURP. I have been involved in this program for several years, both in restoring funding after the Administration had reduced the Program's budget or eliminated the Program altogether and in the form of legislation which I sponsored to formally establish the NURP within the National Oceanic and Atmospheric Administration.

NURP has been in effect for over a decade. Research from the six regional centers has consistently proven the important role NURP plays in providing opportunities for the scientific community to conduct research not possible within the limits of traditional ship-based research and laboratories.

NURP assists leading scientists with research in the Great Lakes, the oceans, and on the sea floor using the most modern technology and undersea habitats. Undersea research has enhanced our knowledge of the dynamic processes governing our oceans, increased our understanding of recruitment to fisheries, and expanded our general knowledge of the deep sea environment. NURP has also contributed to advances in biotechnology and gear design, advanced underwater technology, and fostered the development of small businesses.

I am very proud that the New York Bight Center is located at Rutgers University in New Jersey. In addition to conducting important undersea research in the Mid-Atlantic region, this center performs the critical task of monitoring the 106-mile ocean dumping site.

I intend to work with you, Mr. Chairman, to pass into law this Congress legislation to statutorily establish the National Undersea Research Program within the

Department of Commerce. This legislation is essential to demonstrate not only the value and importance of the Undersea Research Program, but our intention to strengthen and expand it as well.

Thank you, Mr. Chairman, for holding this hearing today and inviting me to attend.

Mr. ORTIZ. Thank you. I am like my good friend says, we will have to be going in and out and conducting some votes. But before we go to vote, I feel a brief introduction of our witness panel is in order. Our first witness is Dr. Ned Ostenso, Assistant Administrator for Oceanic and Atmospheric Research, at NOAA. He is accompanied by Dr. David Duane, Deputy Assistant Administrator for Extramural Programs and the director of the NURP program.

Next is Dr. Thomas Bright. He is the Executive Director for the Sea Grant College Program at Texas A&M University which is interested in a broad range of marine issues relating to coastal resource use, conservation, and management. Dr. Bright has specialized in coral reef ecology for over two decades, and presently he serves as biological oceanographer at Texas A&M University.

We have Dr. Sylvia Earle who is a former chief scientist at NOAA and a renowned marine scientist. She is one of the few people who have piloted small submersibles deeper than 1000 meters.

We have Dr. Jeff Fox. He is a Professor of Oceanography at the University of Rhode Island and a representative of the University-National Oceanography Laboratory System. He has over 20 years of oceanography research experience and is currently serving as Chair of the Deep Sea Submergence Science Committee.

Finally, we have Dr. Robert Wicklund who is associated with NURP as the Director of the Caribbean Marine Research Center, a position he has held since 1984. He is also a professor at the University of South Carolina. Dr. Wicklund has been involved in the undersea research for 31 years and is here to share his views with us today.

Since we do have a vote, I guess we might as well just go ahead and go vote, and then hopefully we will be able to get to listen to the testimony. I know it is going to be very enlightening. I understand that we are going to have two consecutive votes so we will have to recess for about 20 minutes. But, I can assure we will be right back.

Mr. WELDON. We apologize.

[Recess.]

**STATEMENT OF NED A. OSTENSO, ASSISTANT ADMINISTRATOR FOR OCEANIC AND ATMOSPHERIC RESEARCH; ACCOMPANIED BY DAVID B. DUANE, DEPUTY ASSISTANT ADMINISTRATOR FOR EXTRAMURAL PROGRAMS**

**STATEMENT OF NED OSTENSO**

Dr. OSTENSO. Thank you very much, Mr. Chairman. I have a mercifully short prepared testimony but it is filled with information, and with your permission, I will submit it for the record. It stands on its own, and I will use my oral time to make a few of my own observations.

Mr. ORTIZ. Without objection. All the testimonies that the witnesses have will be included in the record.

Dr. OSTENSO. Very well. Thank you. The roots of the National Undersea Research Program go back to the late 1970's when there was a growing need and an awareness of the need for scientists to gather data in situ throughout the water column of the ocean. Also about that time there was an, unfortunately, tragic accident associated with german habitat off the East Coast of the United States.

As a result of this growing pressure and that accident, it was determined that the nation's civil oceanographic community would best be served by having a central source of support for its capacity to work at sea. And that is when the NOAA Manned Undersea Science and Technology (MUST) program was converted to the National Undersea Research Program. That conversion was based on a number of principles that we have adhered to throughout the history of the program and that I think are fundamentally sound.

One of those principles was that it would basically be a support mechanism, not a research funding mechanism and would support the broader based research community. It would support the entire civilian research community based on the principle of peer review and competition. Also, the operation of the program would be through university managed regional centers, and, finally, to the extent possible, we would rely upon leased assets rather than developing an in-house federal capability except for the most exotic technology that we couldn't get from the open marketplace. This would help do two things: Support a broadly based industry and provide us a research capability that met the research agenda rather than torquing research around to meet our existing hardware.

These are principles that I think have held us in good stead throughout the history of the program. Many of my fellow panelists at this table took part in developing these history-setting guidelines. Since then, over 5,000 scientists participated in the use of this capability, including participants from 20 foreign countries. Within the United States, this participation has included 23 Federal and 7 state agencies, in addition to 36 independent laboratories such as the American Museum of Natural History. And, finally, it has involved the active participation of 96 academic institutions. So as you can see, it is not exactly a parochial program.

This, along with my prepared testimony, concludes the remarks I have. I would be happy to answer any questions now or after the panel discussion.

[The prepared statement of Dr. Osteno may be found at the end of the hearing.]

Mr. ORTIZ. Thank you very much, Doctor. Now, we will have Dr. Bright's testimony.

#### STATEMENT OF THOMAS J. BRIGHT, EXECUTIVE DIRECTOR, SEA GRANT COLLEGE PROGRAM, TEXAS A&M UNIVERSITY

Dr. BRIGHT. Thank you, Mr. Chairman. I will telegraph my testimony as well and hope you will recognize that I have submitted this in written form.

The Gulf of Mexico, as you know, is subject to increasing environmental pressure. To address the need to manage the resources of the Gulf of Mexico, there are a considerable number of research requirements and needs. These include the study of ecological processes relating to habitat, use and degradation, nutrient enrichment, freshwater input, dynamics of living, marine resources, toxic materials, coastal erosion, hydrodynamics, catastrophic events, global change, nuisance species, human health, and just a whole host of others. We have in the Gulf of Mexico identified these as the major issues.

There are a number of existing Federal research programs which are addressing components of these research needs. Many of these programs have received help and logistic support from NURP, and many of them would benefit from logistic support from NURP. Among these programs, the U.S. Minerals Management Service Environmental Studies Program is pursuing some very essential research on the physical oceanography of the northern Gulf of Mexico. The NOAA Coastal Ocean Program is involved in a study of the effects of nutrient input from the Atchafalaya and Mississippi Rivers and the influence of that input on productivity and mortality and the establishment of hypoxic zones offshore of Mississippi, Louisiana, and Texas.

The National Marine Sanctuaries Program has recently established the first marine sanctuary within the Gulf of Mexico proper and administers at the Flower Garden Banks a research and monitoring program who foster wise use of that resource. The EPA Gulf of Mexico Program is involved in identifying research needs in pursuit of wise management of marine resources in the Gulf and is starting to solicit proposals for research to approach these needs.

The NOAA/EPA Regional Marine Research Program is engaged in producing a plan which would identify and describe essential research necessary for good water quality and healthy marine ecosystem in the Gulf of Mexico. And then, finally, the four Sea Grant Programs in the Gulf of Mexico have a 20-year record of marine education, research, and extension in pursuit of wise use of our marine resources.

Environmental research needs in the Gulf are so massive that only through the collective and cooperative efforts of these and other Federal and state programs can we ever hope to generate the information we need to wisely manage the Gulf of Mexico marine resources and marine ecosystem. The highest priority this committee can consider, I suggest, is enhancing Federal support for these programs, bringing the programs up to the authorized levels—levels authorized by Congress—and generally support these research programs across the board.

The NOAA Office of Oceanic Research Programs coordinates and provides funding and support for the NOAA Extramural Research Programs. This includes Sea Grant, the Regional Marine Research Program, and NURP. These programs are national programs, but they are exercised regionally through peer review and competitive grants and so on. NURP, though, as I understand it, not designed to provide specifically research support but to provide logistic support for research programs, does have a significant role to play in this process. There is no NURP Center in the Gulf of Mexico at the

present time, but many of these programs have already received in the past logistic support from NURP, and we can benefit from receiving NURP support in the future for those components of our regional research efforts that involve undersea research.

I might suggest that one excellent opportunity for NURP in the Gulf of Mexico is to join forces with the National Marine Sanctuary Program in their effort to utilize a gas platform—offshore platform that is actually within the boundaries of the new National Marine Sanctuary in support of ecosystem research, deep sea research, and environmental monitoring in the Gulf of Mexico.

A point I would like to make in reference to these several programs, the NOAA Office of Oceanic Research houses NURP, Sea Grant, and Regional Marine. If NURP is going to be expanded and new centers are going to be located, I personally feel it should be with additional funds appropriated, and it should not result in a situation which would put NURP in competition with the other extramural research programs of NOAA.

Basically, that is my message, and I make a plea for the committee to support the NOAA Extramural Programs across the board and also to support, in general, the basic research programs that are approaching the research needs for environmental quality in the Gulf of Mexico.

[The prepared statement of Dr. Bright may be found at the end of the hearing.]

Mr. ORTIZ. Thank you, Dr. Bright. Again, we have another vote, and I hate to leave again and be interrupted. But let me go vote, and I will be right back, and I am hoping there won't be any more interruptions. Thank you. I will be right back.

[Recess.]

Mr. ORTIZ. Well, here we are. We are back again. We hope we don't have any more interruptions, but who knows? Right, Curt?

Mr. WELDON. Hopefully for an hour at least.

Mr. ORTIZ. Dr. Earle, whenever you are ready, you can commence on your testimony.

#### STATEMENT OF SYLVIA A. EARLE, MARINE SCIENTIST

Dr. EARLE. Mr. Chairman, and members of this subcommittee, it is an honor to appear before you and to have an opportunity to speak on behalf of those who favor a strong national commitment to underwater exploration research and technology and who believe that substantial consistent funding for the National Underwater Research Program—

Mr. ORTIZ. Doctor, can you get closer to your mike please so we can—

Dr. EARLE. How is this?

Mr. ORTIZ. That is better. Thank you.

Dr. EARLE. That substantial funding is one of the best investments this country can make for the environment, for the economy, for science, for technology, for the present and for the future of the United States of America. Despite the famous zero funding syndrome that you described in your opening remarks, NURP has survived and accomplished near miracles with respect to keeping alive this nation's reputation as a serious participant in civilian under-

water activities that many equate with some of the much better-supported programs of the National Aeronautic and Space Administration.

The comment<sup>1</sup> "much better supported" is relative so to clarify, it may be useful to consider the current level of funding for NURP, about \$16 million supporting six regional centers and several cross-cutting programs. This is accomplished for significantly less than the price tag of the space shuttle's famous new toilet, \$23 million.

Despite the efforts of Congress to save NURP and the various programs associated with it, this aspect of our nation has a tenuous hold on the future—the apparently unwanted offspring of an agency mandated to oversee the nation's oceanic and atmospheric interests. Private industry has recognized the need for undersea technology and research especially in connection with the development of offshore oil and gas interests. But for the investment made by industry, domestic and international and by foreign governments, technology available for civilian use would be at about the level that aerospace technology was a half a century ago.

Of course, U.S. taxpayers have put forward billions of dollars to implement significant advances in underwater technology for military applications, but little of the resulting technology or the knowledge derived from it has been made available for civilian use. I will avoid the temptation to speculate about what we could do with the cost of one nuclear submarine or any other significant piece of military hardware, but I do reflect sometimes on what might have been accomplished if NURP and its predecessors had been appropriately supported over the years. I try to imagine what we might now know about the nature of the planet, about how much better prepared we could be to cope with the global environmental changes that are now taking place. Instead, NURP's mission has been neglected at precisely the time costly questions about ocean systems beg to be answered.

An example of this neglect was apparent soon after I joined NOAA as Chief Scientist in 1990. Budget recommendations at the time included significant sums for ocean research from satellites that would look at water masses from high above and for fleet modernization so that the ocean could be more effectively explored from the surface. Ships support traditional oceanography, and certainly a great deal of important information has been gained about the ocean by staring into a bucket of material that has been snagged fortuitously from areas that we would know perhaps on the same scale if we used a standard oceanographic technique to explore Washington, DC, or my backyard in San Francisco, that is, by flying in the sky several thousand feet above and dragging a net and grabbing bits of this and that and taking it back to the surface and from that try to piece together detective-like about what is happening below.

Certainly, there are techniques today that are much more sophisticated than the so-called traditional oceanographic techniques, but ocean scientists are still limited very much by looking at the sea from the sky above and from ships on the surface. Many have for

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<sup>1</sup> Slides were used to illustrate these comments.

years longed to go beneath the surface and actually get into that three-dimensional realm. In 1990, although there were appropriations recommended for the view from above and from the surface, recommended funding for NURP, and thus for getting to know the ocean by getting in the ocean, was zero.

This attitude is somewhat puzzling, but it may relate to a widely held assumption that earth, including the ocean, is already known. In fact, what we have been able to learn by getting into the sea has, in just the last few years, transformed our understanding not only about the nature of the ocean as a living system but about the creatures there seen in three dimensions instead of squished in nets.

Some have a view that only beyond the atmosphere of this planet are there significant new discoveries to be made, but, in fact, most of the earth has yet to be explored or even seen for the first time by human beings, if the entire liquid, three-dimensional ocean with its 40,000 kilometers of mountains and more than 90 percent of earth's living space (if you take all creatures into consideration) if that is taken into account.

What are the costs of our ignorance about the ocean—ignorance that might be dispelled but for the lack of appropriate technology, and appropriate support for NURP? What are the costs of have technology available but idle because of the lack of supporting funds as in the case of NURP's multimillion dollar underwater laboratory, Aquarius, intended for use in the Florida Keys in 1991 but beached since its transfer from the Virgin Islands? Perhaps there would be more information concerning the decline of Florida's valuable coral reefs if research had been conducted there using Aquarius in the midst of the reefs during the past two years on a regular basis.

A lot of work has been conducted in the Florida keys in recent years, of course, but imagine what could be learned if we had a focal point there dedicated to understanding our own coral reef systems from an on-location laboratory. Also what would be known concerning the decline and loss of oxygen-producing, carbon dioxide-absorbing seagrass meadows in Florida Bay, Tampa Bay, and elsewhere in the Gulf of Mexico if this nation were supporting a vigorous national underwater research program?

Will we allow more time to pass with no clear understanding, no clear national mandate concerning underwater exploration and research while other nations move swiftly forward in terms of access to and understanding of earth's dominant feature? That is a hauntingly familiar kind of comment. This may sound like something that we were talking about back in the '50's or '60's, "other nations moving swiftly forward" in another realm—the space race. Many of the same reasons that the United States has given for years in support of development and use of technology to gain effective working access to the skies above and space beyond can certainly be made for access to the depths of the sea.

Sea-space parallels are wonderfully real, whether seeking answers to questions about the origin of life or knowledge of how the planet works, whether in terms of solving technological challenges related to working in environments considered hostile to human beings, or whether we are talking about matters that involve mili-

tary or diplomatic strength, the sea and the space have much in common. Certainly, technology is the key to both. On our own, we are as earthbound as elephants, whether the goals are high in the sky or into the depths.

Technologically and scientifically, the sea-space relationship was demonstrated eloquently less than a month ago when NASA used an underwater vehicle, a system called Phantom, built with private funds by a company that I co-founded some years ago, Deep Ocean Engineering. It was used in a NASA project as a part of a program of technological development for access to Mars in the most Mars-like habitat on earth, Antarctica.

What was done by the NASA scientists was fascinating. They used a helmet remarkably like a virtual reality helmet, but in this case it was equipped with television monitors inside the helmet that responded to cameras that were thousands of miles away, and the effect was reality reality, not virtual reality because the pilot, as he turned his head and caused cameras in Antarctica to respond, was getting a real-time view of what was actually happening at the other side of earth. The idea is that this same approach can be used from spacecraft exploring Mars or even governed from here on earth.

This may not sound like a big technological breakthrough. We get so inundated with new technology that this may seem a little ho-hum, but to keep things in perspective, the first ever live television broadcast from Antarctica occurred only a few months before—last November—during a Good Morning America program, again, involving NASA scientists using an underwater vehicle.

Actually, to keep this sea-space parallel in perspective, and I will give a little historic view as well, I think it is useful to recall the history of NOAA and NURP and my introduction to an early iteration of NURP that occurred in part courtesy of NASA back in 1970. I was the leader of a team of aquanauts living in an underwater laboratory in the U.S. Virgin Islands. It was called the Tektite underwater habitat. It then operated underwater programs for this country under the auspices of the Department of Interior and in this case with support from the Navy and from NASA.

There was considerable interest in the behavior of those living and working in isolation underwater for 10 days to 2 months because of the relevance of experience gained to future programs such as Skylab for the space shuttle and the space station. We were monitored continuously by video cameras and NASA psychologists seeking insight into how men and—there was some talk about how maybe even women might be effectively supported while in more distant, hostile environments. Remember, this was 23 years ago.

Even the equipment we used had parallels in space gear. In addition to using conventional scuba, Tektite aquanauts were supplied with rebreathers, the concept first developed for underwater applications but refined to a high degree, and I am confident with a high price tag, for astronauts to make possible excursions lasting many hours, much more so than are possible with something like scuba or a scuba equivalent.

Since that time, underwater operations have continued. You will hear perhaps a bit more about HYDROLAB operated under the

auspices of NURP and its predecessor under NOAA—very effective program that kept that spirit alive but now, alas, dead.

When I entered the Tektite underwater laboratory as an aquanaut in July of 1970, NURP-like programs for this country were being channeled through the Department of Interior, but when I emerged two weeks later, the decision had been made to create NOAA and move these programs and the many other things now embraced by NOAA into the Department of Commerce. What has evolved is not at all like what was anticipated by those who explained at the time that NOAA was intended to be a “wet NASA”.

Naturally, I am a strong supporter of this country's commitment to the space program, and but I am also among those who believe that justification for exploration and research of the vast unknowns of this planet from the inside out are at least as urgent and compelling. I certainly do not favor reducing NASA's funding to increase ocean efforts, but there is some justification for equality. I trust that it is clear that I do not mean to imply that NASA should henceforth be limited to the equivalent of NOAA's budget for undersea science and technology considering especially that one toothbrush holder for the space shuttle may cost \$200,000.

As an example of the disparity between the rapid development of aerospace capability as compared to ocean access, it is useful to recall how much progress has been made upward and downward in the last six and a half decades since the time that Charles Lindbergh made his historic first solo crossing of the Atlantic. Soon thereafter, in the early 1930's, William Beebe and Otis Barton made the first successful descents in history to about half a mile beneath the surface of that same ocean.

Today, it is still considered remarkable to be able to work at that depth—a half a mile beneath the surface. We can, of course, go deeper, but it is still not an easy or ordinary thing. I am among one of the privileged few who have piloted small submersibles that deep and have participated as a scientific researcher in others including a dive that I made while serving as Chief Scientist of NOAA in the deepest diving submersible operating today. It is not a U.S. submersible. It is the Japanese Shinkai 6500.

This three-person system is one of a global fleet of but five manned submersibles capable of traveling to as much as about half the ocean's depth. France has one, the Nautilus. The U.S. Navy operates the Sea Cliff. Occasionally, the Sea Cliff allows civilian scientists aboard usually under the auspices of NURP. Russia has two launched in 1987 and from the beginning dedicated to scientific research and exploration and rather often allows U.S. scientists to participate. Some are right now participating in a project in the Pacific. Too often U.S. scientists must go to other countries asking for access to their technology. Where is ours and where is our leadership?

The Shinkai 6500 is the deepest diving submersible now in operation. The U.S. submarine, Alvin, has been in operation since 1964 at Woods Hole Oceanographic Institution. It is a proven workhorse that continues to produce an astonishingly rich track record of performance in depths to 4,000 meters, about the average depth of the ocean—not by any means half the ocean's depth. NURP contributes to its operation in collaboration with NSF and the U.S. Navy,

and there is also an active and effective program involving remotely operated vehicle technology and development of such systems at Woods Hole.

Two Johnson-Sea-Link submersibles have been operated for undersea research by Harbor Branch Oceanographic Institution since about 1970, 23 years ago, sometimes using funds provided by NURP. Funding for operation of other small submersibles and remotely operated vehicles is provided through our national agency.

At the Monterey Bay Aquarium Research Institute, something new has come about in just the last few years—important developments in remotely operated vehicle technology supported with private funds largely contributed by industrialist and philanthropist David Packard. Hundreds of small ROVs have been produced in the past decade by U.S. companies. This has been possible largely because of the market provided by national and international industry and military interests. Is it not ironic that we do not have in parallel a substantial Federal commitment to capitalize on, cooperate with and provide encouragement for these effective and largely private endeavors through a vigorous National Underwater Research Program? Rather, world leadership for underwater technology and research has moved to Japan.

Back in 1960, I think it is fair to say, that the U.S. had the lead. This was illustrated in a dramatic way when the Trieste was operated by the U.S. Navy for once-and-never-more descent to the deepest part of the ocean, to the bottom of the Mariana Trench, about seven miles down. Soon, however, Japan will have the only working access to full ocean depth. The Trieste vehicles, and there were three, have been retired for several years. But this year, an unmanned vehicle operating from a dedicated support ship will be launched by JAMSTEC, Japan's reasonably well-funded national facility for undersea technology and research. And within the next year or two, a manned system capable of going all the way to 11,000 meters will be produced, giving Japan unique access to an area in the deep sea about the size of the United States, a place where no other country will have working access.

The deep trenches harbor a high-pressure environment unlike anywhere—on this planet or any other. Geologists are as eager to understand grand earth processes that occur in the subduction areas at the bottom of these deep trenches as are the biologists who want to know what lives there and how? With luck, Japan will be generous and allow U.S. participation in JAMSTEC's bold and commendable ventures.

Meanwhile, the U.S. counterpart agency to JAMSTEC—NURP—faces an uncertain future as does the overall role of the United States with respect to undersea research and exploration. While the future of Russia's advanced systems, the deep diving MIR I and MIR II, and the programs that support them, also face uncertainties. Other countries in addition to Japan are moving strongly forward. The first distinctively new design in more than a decade for a deep-manned research submersible was built by a U.S. company in 1984 but using funds from Canada for a Canadian company. The latest new design is also being produced and two advanced submersibles built by the same U.S. company with funding from a communications firm not in the U.S. but in France. This is not surprising

in a way since France has an ongoing tradition of national support for underwater research and exploration and for the underlying technology. That is on a national scale as well as through commercial means.

Recently, our tradition in these matters has been one of tragic indifference. There is little doubt that the oceans are in trouble in ways that are economically and environmentally damaging. Concerns range from the decline and destruction of once thriving fisheries that this committee has no doubt heard much about to the decline and destruction of entire ecosystems such as coral reefs and productive seagrass meadows in Florida and the Gulf of Mexico. What are the consequences of deep sea dumping and how do ocean ecosystems respond to oil spills, trash, toxic chemicals? What can we do to restore damaged areas underwater? And how can places in good condition such as the National Marine Sanctuaries that were described by Dr. Bright—how can these be evaluated and how do we understand them and then protect them effectively considering that these are, in fact, three-dimensional realms? By what means can the nation's overall ocean assets be assessed?

Knowledge gained through the National Underwater Research Program can help, but to do so, this program needs help. I am among a growing constituency including a great many creatures in the ocean who cannot speak for themselves who sincerely hope that you will act. You know the motto of those of us who are enthusiastic about support for NURP—"As we look skyward and support our efforts in space, at the same time, onward and downward." Thank you.

[The prepared statement of Dr. Earle may be found at the end of the hearing.]

Mr. ORTIZ. Thank you, Dr. Earle, for your very enlightening and interesting testimony. Now we will hear from Dr. Fox. Doctor, you can proceed.

#### **STATEMENT OF PAUL JEFF FOX, UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM, UNIVERSITY OF RHODE ISLAND**

Dr. Fox. Thank you, Mr. Chairman, members of the subcommittee, a pleasure to be here. I speak to you today on behalf of the deep submergence science community. By deep submergence I mean those of us that conduct research in water depths in excess of 1,000 meters, and I speak to you in my capacity as Chair of the Deep Submergence Science Committee.

I will just touch upon subjects brought up in my written testimony in the interest of time, and in so doing, I will point out where I think NURP has made a substantial contribution to our efforts in the abyss.

If we for a moment could pretend that we were aliens orbiting this planet and before us was the question how to assess its properties, I don't think it would take an intellectual greyhound to decide, if we only had one probe to make, that this probe would be designed to investigate our ocean. 70 percent of the earth's surface is covered by water. You can assess the properties of the continents

relatively well indirectly, but except for the upper few meters of the oceans, you must enter it.

Ironically, as we stand on the threshold of the 21st century, the inhabitants of the earth are faced with a similar situation. We have learned in the last 20 years enough about the innerspace to realize that fundamental questions in chemistry, biology, and geology can only be answered unless we develop and utilize technologies to enter the vast global innerspace and the seabed that lies beneath it.

To give you one example of the nature of the compelling scientific questions that face us, let me just say that we know enough about the biology of our planet and of the oceans to realize that our biggest gap in our understanding of its biology is the biology of the innerspace. We have learned enough to know that the greatest biomass and the greatest diversity of communities exists within the ocean. Significant solutions to fundamental societal questions such as toxic waste dumping or the global carbon cycle will be inadequately addressed if we don't properly characterize and understand the dynamics of this biomass that exists within our inner-space.

We are fortunate in this country to have on our side to address these significant scientific questions a robust scientific community of trained investigators in chemistry, biology, and geology scattered at several hundred U.S. academic institutions. For example, in the last five years, over 1,200 of these investigators have made dives on our submersible Alvin addressing significant scientific questions. The technological assets that are so necessary to provide the cognitive, manipulative and interactive capabilities needed to carry out scientific experiments in the abyss are fortunately in place in the U.S. community. On one hand, we have the tried-and-true workhorse Alvin, which Sylvia talked about, with a limitation of 4,000 meters. This workhorse has been serving U.S. scientists for over 20 years and has made over 2,000 dives. It is a national facility. It is funded by a tripartite agreement from the Office of Naval Research, NOAA-NURP Program, and NSF. It was recognized by these agencies some 20 years ago that if this facility was going to survive, it had to be a national facility, and Woods Hole Oceanographic Institution has ably managed that facility in the succeeding years.

We have two other deep diving submersibles in our quiver. They are managed by the U.S. Navy, and historically, unfortunately, they have been not particularly productive in terms of the needs of the research community. The submersible Turtle has a depth limitation of 3,000 meters; the submersible Sea Cliff, 6,000 meters. Fortunately, in the last couple of years, NOAA-NURP has been working with the Navy to better manage those assets, and there is a real hope and expectation on the part of the scientific community that with NURP's involvement, access and reliability of the Sea Cliff and its 6,000 meter capability will be available to the community. It is important to keep in mind that those 2,000 meters of additional depth capability that we gain with Sea Cliff over Alvin permits us to access 98 percent of the watery abyss with that 6,000 meter capability, whereas with Alvin and its 4,000 meter capability, we can only access approximately 42 percent of the watery

abyss. Those 2,000 meters buy us a great deal in terms of opening up our last frontier.

We are also on the threshold of the addition of a new technology to deep submergence science. In the last few years, engineers and scientists have successfully hardened the capabilities of remotely operated vehicles which, for the last two decades, have been so successful in shallow water applications both in industry and in science. They are now hardened to depths that can take us to the deepest parts of the ocean. These new ROVs hold tremendous potential for us in that they open up horizons in terms of greater access to the depths, time in the water, and time on the bottom.

To manage these technologies, whether they be manned or unmanned, takes a tremendous infrastructure in terms of the expertise of the scientists and engineers; without that infrastructure, the systems cannot be properly maintained, and developed so they remain on the cutting edge of their capabilities. It was, I think, largely for this reason that the tripartite agreement some 20 years ago between the Office of Naval Research, NOAA, and NSF was created. They recognized that Alvin could not succeed unless there were some sort of safety net that would ensure that this intellectual reservoir was on hand to see that the Alvin system was there and properly maintained. I think it is very important to consider when we look at these assets that we must have centers of excellence with continuity because this expertise, once it leaves, is not easily rehired. It is not easily found on the street.

To conclude, let me just point out what I think are some of the problems facing us with respect to deep submergence science; I think there is a short-term problem and a longer-term problem. The short-term problem is that the national facility represented presently by the submersible Alvin, and recently added to with an ROV capability, the Jason-Medea system, each year hangs by a thread in terms of its funding future because of vagaries in the way the three agencies are funded.

To give you the most recent example, this past year in '93, the NOAA-NURP budget was partitioned, and in so doing, it essentially compromised NOAA's contribution to the Alvin such that NOAA administrators, who had their hands tied by this partitioning, could not commit to a level of support, or even say that they could make a contribution to Alvin in '93. That in itself is serious, but you must realize that the program is like a string of pearls, and you start to remove one or two of those pearls, and the string loses its continuity. So the whole program was held hostage right up until the last moment, making it very hard to develop the nationally and internationally competitive program that is necessary.

In addition, we have recently, as I mentioned, added this marvelous new ROV capability in the national facility, the Jason-Medea system, but the bottom line has remained the same. We are faced with an almost Solomon-like decision, at a time when we are faced with exciting, societally compelling scientific questions, we have a new tool added to our capabilities to address these questions, and yet we have to decide whether we use the Alvin and its reliable capabilities or we use the ROV.

Those are short-term problems. I think the longer-term problem, and Sylvia touched upon this, is that we really need, I think, a na-

tional policy—a national commitment to investigate this planet's last and best frontier. I think the scientific questions are profound. I think the societal rewards, both in terms of societal needs as well as something more intangible, and that is the sense of excitement, the sense of the unknown, the sense of exploration which has driven mankind through history and evolution, are there standing before us. In addition, the abyss is a lever for training students in science and education. All of those issues, I think, go hand in hand and follow in the wake of a vigorous national program.

So, I close with a challenge for you to think beyond these near-term problems and concerns, and try to look ahead and think of a solution to this longer-term need which faces us. Thank you.

[The prepared statement of Dr. Fox may be found at the end of the hearing.]

Mr. ORTIZ. Thank you very much, Dr. Fox, for your testimony. We have been joined by another colleague of ours, a member of the subcommittee, Congressman Green, from the Houston area. Last, but certainly not least, we will hear from Dr. Wicklund. Doctor.

#### STATEMENT OF ROBERT I. WICKLUND, DIRECTOR, CARIBBEAN MARINE RESEARCH CENTER

Dr. WICKLUND. Thank you, Mr. Chairman. It is certainly a pleasure to be here today to express my views on undersea research. I would first like to say that you may hear some things that you have already heard before, and it is not that we plagiarize each other's testimony, we just think alike.

I first would like to offer some background information on undersea research, its contribution to our knowledge of the oceans, and our ultimate ability to properly protect, manage, and utilize the resources. I remember back in the '60's, when I think we were far ahead in some respects than we are right now in undersea technology, there was a large anticipation that undersea research and study in the oceans from an unseen vantage point was going to pay off in large dividends.

Companies such as Grumman, Lockheed, General Dynamics were all building submersibles at that time. There must have been over 100 built during the early to late '60's. Even General Mills, a cereal company, had a submarine on the drawing boards. The Navy undersea habitat *Sealab* was launched in over 200 feet of water with some great promise that people were going to be studying the oceans from an undersea vantage point for long periods of time. And as Sylvia pointed out, the *Trieste* made a dive to the deepest part of the ocean in the Marianas Trench one time and was never done again.

Unfortunately—I don't like to pick again on the space program, but at that time it was underway, and even though the country was in fairly good economic times, we couldn't compete with the former Soviets for space and build an oceans program at the same time. Therefore, for lack of an undersea Sputnik, we were left behind. It seems that the space people have a lot better capability to find these kind of things to push the program than we do.

In the '70's, NOAA was founded, and the Stratton Commission—that was the body that recommended that NOAA be formed—rec-

ommended also that there be a small undersea research program which was called MUST. MUST lasted for a few years and then was reorganized in 1980, as Dr. Ostendo explained before. The new program, National Undersea Research Program, had at that time four regional projects in Hawaii, North Carolina, California, and the Virgin Islands. Connecticut was added in 1984, my own center in 1986, Alaska in 1990, and New Jersey in 1991. With the closing of the Virgin Island lab and the moving of California, there are now six centers throughout the country.

During NURP's tenure, the quality of research and researchers have grown steadily, the science having evolved from mainly observational, natural history-type programs in the past to now sophisticated studies and experimentation. Over 1,000 papers have been published by NURP-supported projects over the past nine years. Just to give you some statistics, in 1992 alone, NURP supported research that involved over 8,000 scuba/nitrox dives, 706 submersible dives, and 407 ROV dives. I will talk a little bit about the science in a second. In addition to NOAA's research mission, each center has developed its own research agenda that responds to regional needs in its geographic region of responsibility. Sometimes these overlap a bit, but in most cases, that works out very well.

I can't even begin to list the accomplishments of the NURP Program, but just to point out a few that NURP has taken the lead, is studies of the 106-mile dumpsite in New York Bight, inspection of deep oil and gas wells off the southeast coast and in the Gulf of Mexico, monitoring of the health of coral reefs which are in bad shape right now, in situ fisheries research that lead to management of species, and deep sea geological processes.

Studies at my own laboratory that I can speak a little bit more about includes development of a low-cost system for measuring ultraviolet light underwater using DNA. There is very little expense, costing just a few cents to get a measurement. We have four years of study on the Queen conch which is a very important species throughout the Caribbean and in Florida. It is now declared endangered by the International Commission on Trade in Endangered Species, and we are working toward enhancing these stocks. We studied recruitment processes of grouper, conch, and lobster toward the predicting year-class strengths essential to the management of the species in the future.

Mr. Chairman, NURP has matured quite a bit over the years in terms of scientific capability, but it is still considered the stepchild of the Administration. If it wasn't for Congress, NURP would not exist right now. As you know, over the past 10 years or so, NURP has been zeroed out, and Congress has put the money back in, allowing NURP to not only survive but to prosper over the last 10 years. We don't believe that national undersea programs should be an invisible one, and believe it should be supported by the Administration. We have high hopes that this may happen in the future. But, in the meantime, we are still hopeful that Congress will remain our friends as they have for so many years.

I was on a panel several years ago in 1986 that produced the report "New Directions for NOAA's Undersea Research" in which we recommended fairly high appropriations, as well as to build two systems, one, a 10,000 meter system that would go to the deepest

part of the ocean, going along with some of the other testimony you have heard.

We, the scientists and the centers, applaud the House of Representatives and the Senate both for their efforts in trying to get through a bill. Last year, the National Undersea Research Program Act of 1992 passed the House, almost got through the Senate, and, unfortunately, was killed in the last minutes of the last Congress. This legislation is absolutely essential to assure stability in the programs, both nationally and regionally, and we hope that a new bill will be introduced this year. We feel that it is absolutely essential to give a message that undersea research is here to stay.

I have some comments on the bill, and hopefully we can work with your staff later on if a bill is introduced with some specific information that we would like to give them. And I would just like to say that, again, we really do appreciate the foresight and support of undersea research by Congress over the years and feel that if it wasn't for Congress, we basically would be studying the oceans from a glass-bottom bucket. Thank you.

[The prepared statement of Dr. Wicklund may be found at the end of the hearing.]

Mr. ORTIZ. Doctor, thank you very much for sharing with us your ideas and, of course, your views. Certainly, this has been very, very interesting testimony. At this time, I would like to ask a few brief questions and then open the floor to members to see if they might have questions from this panel.

I would like to address this question to the entire panel. Do you feel that the \$16 million appropriated last year for NURP is adequate to support the needs of the civilian undersea research community? If not, how much more additional funding is needed so that you all can adequately do the job that has to be done?

Dr. EARLE. The answer to the question is no—inadequate. How much? What is it that we want to accomplish? It is easy to dream. The price tag can be small, and the accomplishment small. The price tag can be large, and the accomplishment small depending on how it is used. The funding needs to be coupled, of course, with a wise plan. There are many people eager to contribute to such a plan, and many people have been working toward that end.

You have heard in this testimony of earnest efforts to try to address what the National Underwater Research Program should be, and we are far short of the goals that are set out as defined by these various studies, and it isn't just what we have heard in discussions today. I mean, the National Academies have had various times in the past few years looking at issues, but the funding stays low, and it seems to be a low priority. And I don't mean to pick on poor NOAA or the Department of Commerce.

I think it is a national issue, that if we as a nation are committed to a strong national underwater research program, the agencies responsible for this will follow and take the lead that the Nation as a whole gives. But we have struggled with this profile that people take for granted perhaps that we already have the answers to the questions that NURP is addressing. The truth is we don't have the answers. We really need to draw on the expertise and develop a strong national plan and the funding to go with it.

I could certainly imagine using to good advantage the level of funding that is appropriated for NASA, turn it inward. We could not do it overnight, but NASA didn't grow up overnight either.

Mr. ORTIZ. Thank you. Anybody else? Go ahead, Dr. Bright.

Dr. BRIGHT. I think there are around the country holes in the services that NURP supplies. For example, our region, the Gulf of Mexico, is served by the North Carolina program. And whereas that program has, indeed, supplied a great deal of support for our undersea research in the Gulf of Mexico, it hasn't been sufficient to cover the needs by any means. And I think you will find California may have a similar problem.

If we are to cover these needs that the research community has, it is going to require additional funds. For example, if we establish new centers in the regions that have demonstrated needs for NURP services, it is going to require additional funds. And insofar as the current funding level, it is barely adequate. It just follows that any expansion of the program will require a larger budget.

Mr. ORTIZ. Thank you. Now, what can we do as a committee to facilitate the development of a national strategic and commitment to deep submergence research? Maybe you can add as to what this committee can do and how we can help as well? Who would like to follow with those two questions?

Dr. Fox. That is a very good question, and I think it is a lot easier to identify the need than it is to identify the solution within the fabric of the American political system, if you will, and I don't have the answer to that question. I think it is an answer though that has got to come from a mix of perspectives that involves scientists within academia, within those Federal agencies that have strong commitments already to understanding our innerspace, as well as representatives from industry. Out of that, I think we first have to identify the compelling reasons why we have to do what we wish to do—identify the strong and robust rationale and then construct a plan that works within the existing Federal agencies and within the political system.

Now, I don't think it is something, as much as I would like, that can, for example, come from this subcommittee in one legislative session. I think you can do an awful lot to shore up and maintain the health of, for example, the NURP Program in the short-term and give the community an opportunity to harness its arguments and its capabilities to construct the rationale which would then be found compelling here in the halls of power in Washington. I don't know if others at the table—

Mr. ORTIZ. Anybody else? Dr. Earle?

Dr. EARLE. Just one additional comment, that the oceans—and this program is one example—need champions—individuals who will take the leadership, make that extra effort, work with the people who care and who will just work their hearts out to make something happen. But the doors could be opened by individuals who can extend the invitation for people to provide the information and develop a plan. The vision is there. I have heard it many times in the scientific and technological community and elsewhere. I think that this is the opportune time to move strongly forward, but we need leaders. We need individuals who will be the champions.

Mr. ORTIZ. Thank you. Doctor, go right ahead.

Dr. OSTENSO. Yes. We in the Administration are faced with the same awesome task that you in the Legislative Branch are and that is there are more important things to do than there are resources available to do them all and do them as well as you would like. It is true that under existing funding meritorious proposals are going unfunded—that is a true statement—but that is true in other parts of governmental endeavor too.

Our management philosophy is to take what funds are available and use them as effectively as possible. The design of the program was purposely intended to allow the flexibility that comes with change in research priorities in both a short and a longer term. Accordingly, over the years, we have, as appropriate, closed down operations and started new ones and so forth. So aside from the total availability of resources, which are scarce for everyone in every endeavor of life, is the issue that to the degree that funding is earmarked, it does erode upon the ability of the research community to set its own priorities and of the administrative office of the NURP Program to try and use the funds that are available as effectively as possible.

Mr. ORTIZ. Anybody else?

Dr. WICKLUND. Yes.

Mr. ORTIZ. Go ahead, Doctor.

Dr. WICKLUND. Your question was what the subcommittee could do to help the deep submergence program and NURP in general. I think the only way that the program is going to grow and reach the point where we can actually start building deep submergence systems is there has to be a joint effort between Congress and the Administration, and I think the only way that is going to happen is if we do get an authorization bill, I think that is going to go a long way to help us with the Administration, with OMB. I mean, that is where the problem has been right along. Once the budget gets down to OMB, they cut NURP Program money out, and there is just not a high enough priority back in the Department of Commerce to put it back in. So even though an authorization bill is not going to guarantee that we are going to get in the budget, it is certainly going to help a lot. Thank you.

Dr. EARLE. Hear; hear.

Mr. ORTIZ. Thank you. Anybody else? If not, I would like to yield to my good friend, the ranking minority member, Mr. Weldon, for questions that he might have.

Mr. WELDON. Thank you, Mr. Chairman, and let me thank all of you for your testimony. For those of you who I missed, I apologize. I did read your testimony and appreciate your comments. Mr. Chairman, I have a number of questions I would like to submit for the record, and if it is agreeable with you, I would like to ask you all if you could respond to us because a lot of the data that we will collect will be helpful to us as this debate proceeds throughout this session of Congress.

I do have some specific things I would like to discuss, and one of them follows your lead, Mr. Chairman, about what we can do on this committee. I spoke to the Council on Ocean Affairs several weeks ago about how we can focus more attention on our marine ecosystem and how we can provide more visibility on those issues within Congress. That is what we are talking about.

I think you have made the case very well today. Inside the beltway, you not only need to present the logic, but also you need to stimulate interest and get the attention and the imagination of the American people and this institution. You must help us accomplish that, and there are a number of ways that you can do that. I would say to you that you are not going to have a more cooperative bipartisan effort than you have in this session of this Congress.

The way we can accomplish this is by getting members out to see some of the specific projects that you are working on. We will be happy to host that—perhaps to see the Jason project, which I happened to see a special on, on national television several weeks ago. As a former educator, I was very impressed with what I saw. It is important to get out and see some of the programs underway and see, feel, touch and bring the media along with us in an effort to heighten awareness. Also, we could conduct workshops for staff members on this subcommittee, the full committee, and perhaps in Congress—to learn more about what is going on and what needs to be done. Also, you could help us write ibid pieces to focus the attention on what the leadership of Congress is doing. This would encourage the media across the country to get involved because, as you know, even though we are all pushing for funding on important issues, there is a tight squeeze of dollars now. However, we always manage to find a way to fund those things that capture the attention and the imagination of the American people.

And I agree with the witness today. While we continue to put the amount of money that we are putting into NASA, it does not indicate that the initiatives you have put forth today, and have been working on for the last two decades, are no less important than NASA initiatives. In fact, the same people who get on the floor and talk about more government funding for NASA are the same ones who criticize the government for funding submergence research. I think we have got to help you turn that around. I would say to you starting out, use us. I think we can be there for you over the next two years—as a voice and a tool for you to carry that message forward and to be the champions of your cause, if you will.

You have done the research. You are the experts. Your knowledge in your testimony was right on the mark. Now you must allow this subcommittee and its members to take your message to the other members of Congress to ensure that the importance of undersea research is realized. I think that this is doable; not only through an authorization bill, but also through an awareness process that has got to occur along with legislation. Education is clearly needed. Clearly, NASA and the space program have done that very successfully, and in turn, have grabbed the attention of the Congress.

In regard to the issues being discussed today—both Dr. Fox and Dr. Earle discussed the need for a national strategy. Dr. Fox, in your testimony, you discussed the need for a deep submergence strategy and implementation plan. Who should be the lead agency? Should it be NOAA? Should it be a consortium? Should we as the members of this committee get the full Merchant Marine Committee to encourage a panel to come together and prepare a national plan? Could this serve as a rallying point for where undersea research is going and what amount of money we should request to

fund research? I would like to open this first question to all of you for discussion. Who should be doing a plan, and how should it be convened? Should it be NOAA, or should it be an academic consortium, or the research world coming together with government, and what role should the policymakers play in that process?

Dr. Fox. I think it should cast a wider net than NOAA, although NOAA and the other Federal agencies that have a presence in this research should all be involved. From my own perspective, and it may just reflect my roots, I think the National Academy of Sciences historically has often played a role serving as a medium in which studies like this could take place. They serve, I believe, at the invitation of Congress and the Senate, and so maybe requests from you to them to sponsor such an analysis would be the appropriate way to go. And that, of course, should involve Federal agencies, members of academia, industry representation, and policy people as well, I believe, because ultimately it is an integrated solution. That is my perspective.

Mr. WELDON. Dr. Fox, I am interested in your response. Perhaps, Mr. Chairman, this subcommittee could, along with the support of the full committee, request the individuals here and the research community to help us identify and to come together to begin to lay the groundwork for development of such a comprehensive strategy that would allow us to better do job in terms of networking with our colleagues. Perhaps this is something we could work on in this session of Congress. By working with you and the individuals here today, we could begin to identify who the players are. I assume everyone at this table would be a part of that process. Would anyone else care to comment on that?

Dr. EARLE. I would just like to make the observation about how effective the recommendations of the Stratton Commission were back in the '60's, and that was a cross-cutting group with a lot of influence. It was organized at a high level. Perhaps a Stratton Commission for the '90's could emerge and be really listened to, not just—I mean, there are a lot of committees that have met and made recommendations, but they have not been organized at the level where what they say has an appropriate audience so it has not been as effective as what you are proposing here.

Mr. WELDON. I agree with that. I suggest that we develop a work group to discuss the beginnings of a comprehensive plan; and along with the support of the Chairman, who has the ear of the Administration, we could take that plan to the White House and elicit their support in making this a national priority. This would give it the visibility that you all have so eloquently stated is necessary here today. I think that is doable, Mr. Chairman. However, it is only doable if you all are willing to work with us in that regard.

Dr. Fox. I think you would find no shortage of enthusiasm from those of us here today and a host of colleagues that stand behind us.

Mr. WELDON. Mr. Chairman, I have another line of questioning I would like to discuss briefly. I have a thousand things I could ask. One particular area that struck me, Dr. Earle, in your testimony, was your discussion about the millions of dollars, probably tens and hundreds of millions of dollars that we have spent through the military for underwater technology.

Dr. EARLE. Big B—billions.

Mr. WELDON. Mr. Ortiz and I both sit on the Armed Services Committee so we have joint friendship—

Mr. ORTIZ. And we know that \$16 million doesn't go far.

Mr. WELDON. We sneeze and spend more in the military than you have spent in the entire undersea program, and that is an unfortunate statement. But I think we both share an interest in wanting to know how we can better help you, not just from our leadership position on this subcommittee, but also through our leadership on the Armed Services Committee. We also want to help you access some of the existing military undersea technology. This includes equipment, hardware, and access to some research capabilities. I don't mean to speak for you, Mr. Chairman, but I know I am ready to take that issue up.

We are looking for the kinds of conversion of R & D that has been gained through the military and, in turn, applying it in the private sector. That is the big buzzword down here. There is a golden opportunity this session of Congress if you are willing to help us identify those areas. Even though we are on the Armed Services Committee, to be very honest and frank with you, I am not aware of the amount of money we have spent in this area and would like to learn more about that.

Perhaps you could help us access some of the funding that has been provided through the military for materials and research labs and make them available for the undersea research community that you all represent. I would be very interested in working with you on that as well. Would you like to respond to that, Dr. Earle?

Dr. EARLE. Yes. I am really pleased with the win-win potential that is there, and there are signs already that this may be in the process of happening with some of the developments that are now becoming open to a wider community, that some of the acoustic information, for example, that has been tightly classified for good reasons in the past may now become available for a wider use.

A very modest example—I had a personal experience with when I was Chief Scientist of NOAA, I had an opportunity to try out some night-vision goggles that the Army has developed for use in the Gulf War—well, for other applications as well, but as a result of that introduction, it has been possible on a number of occasions to essentially borrow those tools for observing dolphins at night, for example, with insights gained that otherwise would simply be impossible. I also used them in the Shinkai 6500 looking at bioluminescence because they intensify the small amount of light that is available at great depths through natural sources. Looking at turtle behavior at night is another example. So much happens that we are normally blind to that this extraordinary equipment makes visible.

That is a tiny fraction of the technology that is there, but it is one personal example. If the door is opened even on a modest scale there could be great gains. Perhaps more than just the technology—perhaps some facilities as well—could be shared.

Mr. WELDON. Before Dr. Fox responds, I appreciate your comments, and again, I think, you should use us as a vehicle to go to the military to access funding and equipment. You are the experts and know where this work has been done and where the focus is

within the Pentagon establishment. We are the ones who can help you access that information, and help determine the availability of the equipment, the hardware, the programs, the technologies—please use us for that.

I would make that same point to the entire undersea research community so we can help you in your effort to get the military to be more responsive and more open in sharing what information and what programs they have. Also, we can examine a shift in funding. With the redownsize of the military, there may be some shifting of dollars rather than eliminate programs wholesale. Perhaps we can keep the research programs intact but shift it to a civilian sector because it has application for the kinds of needs you are talking about. That type of movement is very much the in thing here in the beltway now, and we want to help you take advantage of that. Now, I am sorry. Dr. Fox, you wanted to respond.

Dr. Fox. Well, I am absolutely thrilled with your comments because you have put your finger on a marvelous opportunity, and may I just give you an example or two. Last fall, we hosted a meeting here in Washington that brought together engineers and scientists to look at the state of technology in deep submergence science. I happened to be the Chair in my capacity as Chair of the Deep Submergence Science Committee, and I got a call from a fellow who was with one of the Navy—what I call the dark side of the Navy—labs in San Diego that historically we never hear of on the civilian side, and he asked if he could attend, that he would like to present some information about an autonomous underwater vehicle. I said, "Certainly." I was somewhat skeptical.

He arrived and he made a presentation about a dazzling piece of technology that the Navy had developed that was essentially an autonomous vehicle that could go to 6,500 meters, travel at six knots, image the sea floor at a resolution that was state-of-the-art, and had a telemetering system to the surface so that you could program and interrogate the system. You could zoom in, and hover over the object if you saw a target. I mean, it represented a system that we had only dreamed of. The Navy had spent \$24 million developing this system, and now the need had gone away, and they were about to mothball it. Here is an example of a tool that if we could transit it over into the private sector and find a way to create infrastructure support, it could begin to open up this inner-space frontier in a way that just wasn't possible before.

So I am very heartened by your comments, and, indeed, again, I think it comes as no surprise to you if you hear us say we will definitely work with you. This is just one example of a number. Nuclear submarines under the arctic ice—a vast opportunity. The Navy SOSUS array—I mean, we have the oceans wired for sound. They are about to turn this system off. It is a system that we can use to assess properties of the ocean that can't be addressed in any other way.

Mr. WELDON. That is exciting, and perhaps, Mr. Chairman, we can, through this subcommittee and the full committee, bring together the Navy, the appropriate groups, and R & D labs and operatives, that you all I am sure know, with representatives of the research community, such as yourselves, and provide for that interface. The fact that we make the commitment to be there ourselves

as members would give you the kind of access that you have not had and perhaps will open new doors. I think in the end everyone would see it is a win. And I think the military would see it as a win, especially in these tight times where their budgets are being reduced.

I am excited about the possibilities. There are a lot of other questions I would like to ask of all of our witnesses. I have questions for each of the witnesses here. I will submit them for the record because I don't want to dominate the questions today. Thank you all and remember this is a beginning. I think there is unlimited potential here. We are telling you we want to work with you in a very productive way. We have a new Administration that I think is going to be open to these kinds of new R & D opportunities and economic opportunities. It is really on us as to whether or not we will succeed. We are going to rely on you to work with us as we call upon you for that interaction. Thank you.

[Questions by Mr. Weldon may be found at the end of the hearing.]

Mr. ORTIZ. Thank you. This is very true. Not too long ago we were able to transfer a couple of vessels to Texas A&M and the State of Maine. You would be surprised as to how much equipment is sitting in many, many places outside of the United States. And maybe the staff can look at the equipment that is there and make it accessible to you so that you can put it to good use. We support you. We believe in what you do. You are committed. You are dedicated. And we do not want to fall behind. And this is—you know, to some it is a new frontier. The stakes are very, very high. We do not and we cannot afford to stay behind. You have got the support of this committee. We might have another vote in a few minutes, but I would like to pass on now to my good friend and another leader from the State of Texas who will have questions for you. Mr. Green.

Mr. GREEN. Thank you, Mr. Chairman. I appreciate the opportunity. First, I would like to associate myself with the comments from Congressman Weldon. I have only served here for three months, but I can understand the frustration of putting it all together except for the NASA. Coming from Houston, you can understand where I wouldn't want to try and transfer any of that funding from NASA.

One of the concerns I have though, and I think it was discussed a little bit on what I would call cross-pollination between the Navy and the other agencies that have undersea responsibilities, whether it be Sea Grant or National Science Foundation or NURP, to make sure that there is coordination between all the agencies. And I know there is not as much between the Navy, you know, from this hearing that we would like, and I think the suggestions are much better. But is there a coordination between all the agencies so we can really speak with one voice when we are talking about issues of undersea? Dr. Bright or any panel?

Dr. BRIGHT. I think there is not adequate coordination at this point in time, and I don't know exactly how to approach that, but there are, as we know, a number of agencies, a number of programs that are being continually started and cranked up, and a lot of times they have overlapping objectives. In the Gulf of Mexico,

we are trying to coordinate that insofar as is possible through the EPA Gulf of Mexico Program and just kind of forcing these programs together. We haven't had total success. I think that is a problem that needs to be worked on. I don't know exactly how to approach it, but certainly on a regional basis, coordination for environmental studies and the marine environment that involve all the programs is something that is very desirable.

We could come up with some schemes. A strong recommendation from a committee such as this might be helpful in forcing something like that to happen. I am pretty sure it could be done even on an interstate basis, but exactly what the mechanism is, I don't know, but I think you put your finger on a very important need at least on a regional basis.

Mr. GREEN. I think, you know, when you compare it to NASA, you know, we don't have a whole lot of different agencies or groups. You know, they speak with one voice, and I think we would probably get more attention if that were the case.

Dr. BRIGHT. Well, you know, you talk about NASA. There is a Space Grant Program. There is a Sea Grant Program—Land Grant—and EPA and all these programs. I happen to know that probably this weekend, I believe, the Space Grant Programs in cooperation with the NASA group in base St. Louis are having a meeting to assess what space science can do to approach some of the environmental research needs in the Gulf of Mexico.

When you all were talking about utilizing the military, the first thing that popped into my mind—I am not involved so much in the very deep submergence aspect of marine underwater research as in the shallower aspect above—

Mr. GREEN. Like we have in the Gulf of Mexico.

Dr. BRIGHT [continuing]. like coral reefs and things like. Well, the military has some very superb satellite remote sensing capabilities that can give excellent resolution, and I have heard about reading license plates from space or something. I don't know. We don't need quite that good, but to get some of that superb resolution would be phenomenal—if we could recognize a turtle from space or a dolphin from space, or if we could get something that penetrates deep enough for us to recognize bleached areas on a coral reef. That links directly into this undersea research program and could give us a fantastic ability to cover a lot of ground at least in the shallow waters. So I think we have to look beyond even the underwater programs into the environmental programs and into the space programs and see where all this fits together, and you can't do that without some kind of plan, some kind of coordination. And I think there is a need there.

Dr. OSTENSO. First of all, perception is probably based on the reality of sometime back, and this is a dramatically changed world, and sometimes the world changes faster than we can catch up. I say that by way of introduction to not agree with Dr. Bright on coordination. First of all, a lot of systems are being substantially opened up for dual usage. There are formalized mechanisms for doing it. I think those mechanisms are going to be successful. You can't pass judgment on what hasn't happened yet though.

NOAA itself has two deputy administrators, one of whom is also the Naval Deputy—the oceanographer of the Navy. The interaction

between us and the Navy in this and a variety of things goes on daily as that is how I spent this morning. The Navy, among other things, has made their submersibles available for management through the NURP Program for the civilian community. The Navy is massively engaged in finding civilian use of their classified Integrated Underwater Surveillance System. This was a Federal investment of \$15 billion over 35 years to do some very sophisticated stuff.

The DOD and the Department of Energy, through the encouragement of the Legislative Branch, have created a Strategic Environmental Research Program. It has a legislatively mandated Science Advisory Board, which requires that there be a member from NOAA and OSTP, and I represent NOAA on that panel as a formal mechanism to coordinate our activities.

And, finally, there has been ongoing for the last six months now a massive effort under the euphemism of the Environmental Task Force that was originated by a letter from then Senator Gore to the then Director of the CIA to look at the conversion of intelligence and defense assets to civilian application. This is in the near final stages of wrapping up a long patient deliberation by the leaderships of the research community and our DOD communities, and we have plans for implementing these requests. So I think there are well-intended people who have set formal mechanisms in place to make this transition to dual use, and to recognize that we are living in a substantially different world from the one we have been living in for the last 50 years.

Dr. WICKLUND. At the level that we work at the centers, we have some coordination with other Federal agencies. Just to give you an example, when we conducted our ultraviolet light studies, we worked with EPA and the Department of Energy. The Department of Energy actually did all the analyses of the program that we conducted. We have a memorandum of understanding with the Department of Interior to do our geology studies, and the National Science Foundation co-funds a lot of the programs that we work on. I can't say that is a lot of coordination, but we do do some, and by the time it gets down to our level of actually working in the field, we have to coordinate with the other agencies as the need arises.

One thing I can add to that is in reference to the system that Dr. Fox described earlier. Each center was asked to write a three-page proposal on the use of that system in our regions and how we best could use it which we have done and submitted. Thank you.

Mr. GREEN. Dr. Bright.

Dr. BRIGHT. One more thing about coordination. As Dr. Ostenson points out, there well may be mechanisms in place that if used could provide that, and one thing I would like to suggest not be done is create another entity to coordinate. I think that it is best to use existing entities to accomplish the goals, and, indeed, as Bob points out, there is a great deal of coordination specifically between programs. It is just we do, indeed, have to do a little better job somehow.

Mr. GREEN. I would like to do that within the current structures just because having served a lot of years in the Texas legislature, we have more coordinating councils than we know what to do with,

and you find out 10 years later you have to abolish them because, you know, they just weren't doing what you expected them to do.

**Dr. DUANE.** Mr. Green, if I could make one perhaps final comment on this topic. Coordination, as you have heard, does occur on a variety of levels. And it is important also to understand that the science that is conducted is peer reviewed, which is also a mechanism of coordination. NSF funds support science in the oceans; so does DOE and EPA as well as NOAA—and that process also at the working level does accomplish coordination. Clearly, I think with respect to the joint operation of the Alvin, there is marvelous coordination between the Office of Naval Research, NSF, and NOAA. So you can always do better, and we try to do that, but to think that coordination isn't underway is not correct.

**Mr. GREEN.** Yes, Doctor?

**Dr. EARLE.** I just would like to reflect a moment on the opportunity that we have to quickly move forward in terms of a leadership role with access to technology that exists but is not currently available to the civilian community. Maybe that is about to change. There is one thing that we need to be mindful on in this respect. I served on NACOA, the National Advisory Committee on Oceans and Atmosphere, and there was an issue—a recurrent one—about recommending support for new technology, and always there was much discussion about how science should be in the leadership role that first of all define the problem and then build the technology to solve that problem.

In this case, we are faced with an opportunity to be—well, have available a fantastic new level of technology, and it may take a little while before the scientific use of that technology can, in a sense, catch up. We can dream a lot about how we can make use of SOSAS, for example. Some of the information about whale migrations is very obvious. But there may in time be some things that we can't even guess right now because we have not become well-enough acquainted with the technology that is there to imagine how to make the best use of it.

I am not suggesting anything more than that we need to approach this with our eyes open, that the expectations need to be just kept in line with where we are at. We may suddenly be walking into an era of technology that has enormous potential, and we should be very careful to use it wisely and not just waste this opportunity to throw something away because we cannot immediately perceive its application with our current level of understanding. Thank you.

**Mr. GREEN.** Mr. Chairman, just one other short question. Dr. Bright, I enjoyed your testimony, particularly your concern that the Gulf of Mexico may not be served as well, and I know we have benefited particularly in our part of the Gulf of Mexico. We have fished it. We have drilled it. We have polluted it. And I would like to make sure we know everything we can to either restore it or to continue its viability, and I appreciate your testimony that maybe we need some more attention particularly since this committee is also the Gulf of Mexico Committee thanks to Mr. Chairman but that we provide that attention to that.

**Mr. ORTIZ.** Thank you very much. We have really enjoyed your testimony. It has been very enlightening, very educational. Like

my good friend, Mr. Weldon says, I am the new subcommittee Chairman. He is the new ranking member. I can assure you we want to work with you. I know that several subcommittee members and I have questions for the witnesses, and we would appreciate it if you could reply in writing to the questions that we are going to submit to you. Excuse us for the inconveniences that we have had this afternoon. We had some votes—interruptions that we had. Anybody who can go through this process becomes a six-star expert witness before this committee. We appreciate you being with us today, and if there are no further questions, the Subcommittee stands adjourned. Thank you very much.

[Questions by Mr. Ortiz may be found at the end of the hearing.]

[Whereupon, at 4:35 p.m., the Subcommittee was adjourned, and the following was submitted for the record:]

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**U.S. House of Representatives**

## Committee on

## Merchant Marine and Fisheries

Room 1334, Longworth House Office Building  
 Washington, DC 20515-6230

March 17, 1993

## BACKGROUND MEMORANDUM

TO: Members, Subcommittee on Oceanography, Gulf of Mexico,  
 and the Outer Continental Shelf

FROM: Subcommittee and Committee Staff

SUBJ: Hearing on National Undersea Research Program (NURP)

On Wednesday, March 24, at 2:00 PM in Room 1334 of the Longworth House Office Building, the Subcommittee will meet to: 1. review U.S. civilian undersea research efforts; and 2. evaluate how NURP is meeting U.S. civilian undersea research needs. Witnesses will include representatives of the National Oceanic and Atmospheric Administration (NOAA), NURP academic users, and other oceanographic and academic representatives.

## BACKGROUND

History of U.S. Undersea Research Efforts

NOAA's involvement in undersea research began in 1971 with the establishment of the Manned Undersea Science and Technology Office (MUS&T). The purpose of this office was: (1) to provide operational support for NOAA investigations that required manned subsurface observations and data collection; (2) to foster and coordinate manned undersea projects with other federal and state agencies, industry, research institutions, and universities; and (3) to develop scientific and technical criteria for civilian undersea facilities and platforms, through the experience gained by using available habitats and submersibles.

Early MUS&T studies made extensive use of existing public and private deep-diving submersibles, including PC-8, DEEP DIVER, DEEP STAR 2000, DEEP QUEST, NEKTON GAMMA, and ALVIN. These submersibles were used to survey the Outer Continental Shelf, assess the distribution and abundance of marine resources, and study the fate and effects of toxic wastes disposal at sea. The primary submersible used by MUS&T was ALVIN, which is operated by

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Woods Hole Oceanographic Institution, and owned by the U.S. Navy. Research carried out with ALVIN included investigations of sediment and pollutant pathways in the Hudson River Canyon, studies of deepwater radioactive and hazardous waste dump sites, the Galapagos Rift Thermal Vent Area Study, and studies of the Mid-Atlantic Ridge hydrothermal fields, which identified the largest submarine polymetallic sulfide deposits ever found. Submersibles were essential for these studies because they allowed scientists to perform delicate experiments and operations, accurately relocate sites to perform the same operations on multiple dives, and most importantly, to observe the environment directly and be able to make immediate decisions concerning operations.

Throughout the early 1970's, MUS&T conducted several undersea research programs in conjunction with the Office of Naval Research, the Federal Republic of Germany, the Perry Foundation, and the Harbor Branch Foundation. These programs centered around the use of the manned undersea laboratories (also called habitats) HYDROLAB and HELGOLAND. The habitats provided an underwater living and working arrangement that enabled researchers, for the first time, to work safely and effectively for a full eight hour day without concern for the time constraints associated with conventional diving operations.

The HYDROLAB habitat, built by the Perry Foundation and purchased by NOAA in 1977, was the focal point of many of MUS&T's major research efforts. The Bahama Banks Research Program was a series of marine science and technology projects which used HYDROLAB between 1971 and 1975. For that project, HYDROLAB was positioned at a depth of 45 feet off the southern coast of Grand Bahama Island near Freeport. More than 300 extended time (or saturation) dives were made from the HYDROLAB, allowing scientists to study the ecology of coral reefs first hand and to determine the effects of pollutants on the reefs. In addition, the habitat was used to train scientists and aquanauts.

#### Creation of the National Undersea Research Program

In December 1975, NOAA submitted to Congress a report entitled "Concept Paper for the Development and Utilization of an American Underwater Laboratory OCEANLAB". This report concluded that existing facilities were inadequate for undersea research needs and recommended that a highly sophisticated system be developed. In July 1976, Congress appropriated funds to begin the cooperative undersea programs necessary to develop expertise for future OCEANLAB operations. This cooperative undersea program was initiated in 1977 with NOAA's purchase of HYDROLAB and its placement in the U.S. Virgin Islands. HYDROLAB was operated in the Virgin Islands until 1985 and is now on permanent exhibit at the Smithsonian Institution.

By early 1978, engineering designs for OCEANLAB indicated that construction and outfitting costs would be approximately \$50 million, with a total 20-year operational cost of about \$250 million. The high cost of OCEANLAB, coupled with a growing concern within the scientific community that research

requirements could not be met by a single facility, caused NOAA to reevaluate the MUS&T program. Included in this evaluation was an analysis of the scientific requirements of the research community conducted by the National Research Council's Ocean Studies Board.

As a result of this review, NOAA replaced MUS&T with the Office of Undersea Research and the National Undersea Research Program (NURP) in 1980. The purpose of this action was to develop an undersea research program, in cooperation with university-based research institutions, which would utilize existing facilities, and would encourage scientists to use underwater tools and techniques such as saturation diving, submersibles, and remotely operated vehicles. The objective of NURP is to support research on processes in the world's oceans and large lake ecosystems and their role in global systems. This objective is addressed by a network of National Undersea Research Centers that serve as extensions of NURP and field programs.

#### Current NURP Structure

As stated above, NURP is one program within the Office of Undersea Research. Headed by a Director, this office reviews research proposals submitted through the National Undersea Research Centers (NURC) and acts as a scheduler for NOAA-provided undersea research equipment and vessels. The majority of the funds appropriated for NURP are made available for research conducted through the NURC's.

Under the current program, there are six NURCs. These centers advance the objectives of NURP by conducting and funding scientific research through a competitive, peer-reviewed grant process. Research is funded in the following areas: (1) global oceanic processes; (2) pathways and fate of materials in the ocean; (3) productivity and habitat characteristics; (4) coastal ocean processes; (5) ocean lithosphere and mineral resources; (6) submersible platform technology; and (7) diving safety and physiology. The NURCs provide underwater research tools including submersibles, remotely operated vehicles, and specialized SCUBA systems through a combination of leased and in-house capabilities. In addition, the centers provide technical expertise in the operation of these tools. This allows scientists access to the newest undersea technologies and methods, as well as guidance in the application of these tools to complex research projects. Each center is primarily responsible for research conducted within a defined geographic area. Attached is a map of existing NURCS (Appendix I), a brief summary of each center's research missions (Appendix II), and a map highlighting principal regional research themes (Appendix III).

#### FUNDING HISTORY

A review of funding for the NURP program from 1989 to present is included in Appendix IV. During NURP's first three years (1980 through 1982), funds were included in the President's budget. Since that time, the Administration has not supported the

program. The program, however, has had the continuous support of Congress and has seen its appropriations increase from \$3.3 million in Fiscal Year 1980 to approximately \$16 million in Fiscal Year 1993. During that period, the program has expanded from one center to six, and the number of researchers participating in NURP sponsored research programs has increased from 48 to 1,361. For further information see NURP statistics chart in Appendix V.

#### NURP LEGISLATION

During the 102nd Congress, Congressman Dennis Hertel introduced legislation (H.R. 3247) to establish NURP by statute. H.R. 3247 directed the Under Secretary of Commerce for Oceans and Atmosphere to establish a NURP within NOAA. In the Bill, NURP was charged with carrying out scientific research in priority research areas. An Office of Undersea Research headed by a Program Director was established to administer the Program.

Additional oversight of the Program was provided by a Steering Committee appointed by the Under Secretary on: (1) the quality of undersea research performed under the program; (2) designation and establishment of undersea regions; (3) designation and operation of undersea research centers; and (4) the need to revise the priority research areas.

The Director and the Steering Committee, using procedures established in the bill would determine whether new undersea research regions are necessary and where new centers should be located in the newly-created regions designated by the bill. However, the legislation did not allow new centers to be created using funds previously allocated for existing centers. Also a periodic review (every five years) was mandated to evaluate the performance of each center and to make recommendations for changes at the center. Finally, the bill authorized appropriations for the program for \$23 million for Fiscal Year 1993 up to \$31.4 million for Fiscal Year 1997.

H.R. 3247 passed the House on June 29, 1992, but no action was taken in the Senate.

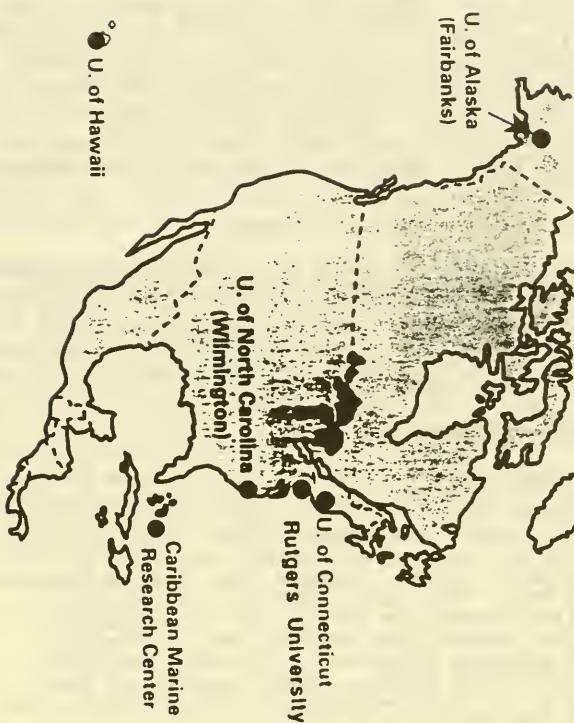
#### ISSUES

- \* Is the current geographic distribution of NURP-sponsored research fair?
- \* Underwater research is a portion of the research funded by the National Science Foundation, the Office of Naval Research, and Sea Grant. Do we need a separate research program to fund just undersea research?
- \* Does the current National Undersea Research Program meet the needs of the U.S. civilian undersea research community?
- \* Is there adequate deep submergence capability available to civilian researchers? How could funding for this be stabilized?

- \* Questions have been raised by some in the academic community about the fairness of NURP's current research grant peer review and distribution process. Are these questions legitimate? If so, what changes are necessary?
- \* Is NURP's current level of funding (about \$16,000,000 in FY 93) adequate to meet the needs of the U.S. civilian undersea research community?
- \* The National Science Foundation spends about \$160 million per year on oceanographic research and Sea Grant spends about \$40 million per year on research and extension activities. Is NURP's funding adequate in comparison with these programs? What is an adequate level of funding?
- \* Does Congress need to establish NURP by Statute?
- \* Is the current NURP program functioning properly? Does the program need a statute framework? If so, what should that framework be?

## Appendix I

# NOAA'S OFFICE OF UNDERSEA RESEARCH CENTERS



## APPENDIX II

National Undersea Research Centers and their missions:

University of Connecticut

The National Under Research Center at the University of Connecticut at Avery Point (NURC-UCAP) conducts undersea research off the New England Coast, the Mid-Atlantic, and the Great Lakes. The Center uses a combination of wet diving, remotely-operated vehicles, and submersibles to conduct research including hard habitat studies in the Gulf of Maine, behavior of mid-water animals, and research and development of remotely operated vehicles (ROVs). In addition, NURC-UCAP is conducting cooperative research on the large lakes of the world, including Lake Baikal (Soviet Union), Lake Malawi (Africa), Lake Kinneret (Israel), and the U.S. Great Lakes.

University of North Carolina at Wilmington

The National Undersea Research Center at the University of North Carolina at Wilmington (NURC-UNCW) has responsibilities for the Southeastern Atlantic Coast, the Florida Keys, and the Gulf of Mexico. NURC-UNCW uses shallow and deep submersibles, ROVs, mixed gas (NITROX) diving to carry out research in this area. In addition, the submersible habitat, AQUARIUS, is scheduled to be deployed in the Florida Keys in April, 1993.

Caribbean Marine Research Center

The National Undersea Research Center at the Caribbean Marine Research Center (NURC-CMRC) is located on Lee Stocking Island in the Exuma Cays, Bahama Islands. This center primarily conducts research in the Caribbean. The Center's location provides easy access to a variety of tropical environments including coral reefs, shoals, mangrove swamps, seagrass beds, deep hardgrounds, and carbonate mud beds. The Center utilizes two research vessels, the shallow submersible PC-401, and ROV along with extensive laboratory capabilities to carry out its research program. Current research conducted by NURC-CMRC includes fisheries studies on spiny lobster, Nassau grouper and queen conch, monitoring of ocean temperature and coral bleaching, and investigations of the geology of the Bahama Islands.

University of Hawaii

Undersea research in the Hawaiian Islands and Western Pacific are the responsibility of the National Undersea Research Center at the University of Hawaii (NURC-UH). This Center is located on Oahu Island and conducts research on the ecosystems and mineral resources of the Hawaiian Archipelago. The Hawaiian Center owns one shallow submersible, the MAKALI'I, and the deep submersible PISCES V. In addition, the Center operates on ROV and a towed camera sled. The Center is currently renovating the 220-foot research vessel R/V KAIMIKAI-O-KANALOA. When completed this vessel will be used to deploy the PISCES V and to investigate the

biology and geology of seamounts in the Western Pacific. For the present, the Center concentrates on studies of volcanic processes, marine mineral formation, mapping of marine minerals, and investigating the effects of mineral mining. The Center is also leading a multidisciplinary team in studying Loihi, the newest Hawaiian island, which is an active submarine volcano emerging south of the Island of Hawaii.

University of Alaska at Fairbanks

The National Undersea Research Center at the University of Alaska at Fairbanks (NURC-UAF) was established in 1990. NURC-UAF is responsible for undersea research in Alaska, the West Coast of the United States, and the Antarctica. The Center utilizes leased submersible and ROV systems. Specific research includes observation of humpback whale behavior, studies of flatfish recruitment, habitat studies of rockfish and disposal on habitat quality, and studies of active methane vents on the Oregon Continental Shelf.

Rutgers University

The newest NURC, the New York Bight National Undersea Research Center at Rutgers University was established in 1992 by language contained in the Fiscal Year 1991 appropriations bill for NOAA. Rutgers oversees NURP-sponsored research for the Mid-Atlantic area. One of the Center's primary concerns is the sewage sludge dumpsite 106 miles offshore of New York. More specifically, these investigations concern whether the sludge is reaching the ocean bottom; where it is carried subsequently; and whether this material affects the animal community within the sludge plume.

## Appendix III

# NATIONAL UNDERSEA RESEARCH PROGRAM PRINCIPAL SCIENCE THEMES BY REGION

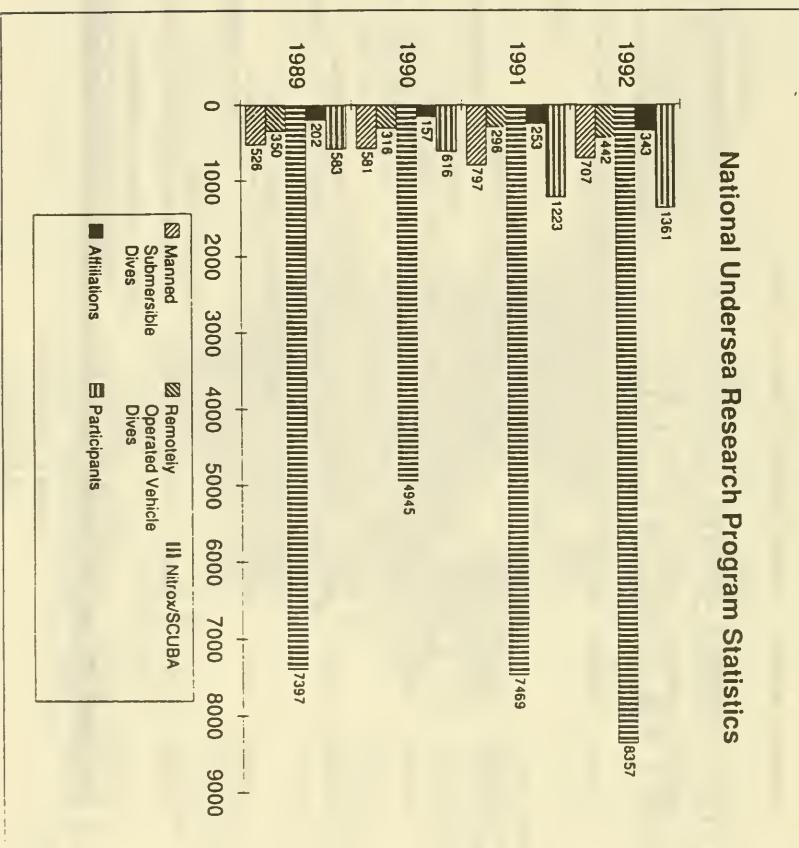
- 
- The map illustrates research themes across various US coastal and oceanic regions:
- WEST COAST**
    - Recruitment Processes
    - Primary Productivity & Nutrient Cycling
    - Effects of Oil Spills
    - Vent Processes
  - GULF OF MAINE**
    - Flux of Particulate Matter
    - Benthic Productivity
    - Recruitment Processes
    - Coastal Geology
  - MID-ATLANTIC BIGHT**
    - Effects of Ocean Dumping
    - Midwater Ecology
    - Benthic Productivity
  - SOUTH ATLANTIC BIGHT**
    - Benthic Productivity
    - Artificial Reef Dynamics
    - Shell-Slope Processes
  - HAWAII**
    - Ecology of Seamounts
    - Vent Processes
    - Midwater Ecology
  - CARIBBEAN**
    - Recruitment Processes
    - Paleo-Oceanography
    - Midwater Ecology
    - Primary Productivity & Nutrient Cycling
    - Boundary Layer Dynamics
    - Global Warming Processes

## Appendix IV

**NURP FUNDING  
HISTORY**

	<b>Fiscal Years 1989-93</b>				
	<b>FY 89</b>	<b>FY 90</b>	<b>FY 91</b>	<b>FY 92</b>	<b>FY 93</b>
<b>NORTHEAST AND GREAT LAKES REGION</b> (University of Connecticut - Avery Point)	2,780,000	3,318,000	2,865,100	2,664,540	2,478,022
<b>CENTRAL AND WESTERN PACIFIC REGION</b> (University of Hawaii)	3,140,000	3,000,000	2,500,000	3,093,000	3,072,000
<b>CARIBBEAN REGION</b> (Caribbean Marine Research Center) (Fairleigh Dickinson University)	1,305,000 2,814,000	1,517,000 241,000	2,073,380	2,160,760	2,099,500
<b>SOUTHEAST ATLANTIC AND GULF OF MEXICO REGION</b> (University of North Carolina - Wilmington) (Aquaarius 1990)	1,323,000	1,286,000	1,747,136	1,838,110	1,570,269
<b>WEST COAST REGION</b> (University of Alaska 1990) (National 1989)	800,000	794,000	978,000	909,340	1,000,000
<b>NEW YORK BIGHT</b> (Rutgers University 1992) (National 1991)		1,531,000	1,869,000	1,730,000	
<b>NATIONAL</b>					
Deep submergence (includes Alvin)	788,000	940,000	599,100	682,205	772,724
Technology, Physiology Research	512,000	632,000	357,300	259,000	
Management and Administration	862,000	816,000	1,575,000	1,569,000	1,365,485
Other Science Projects Key Largo	338,000 473,000	375,000	5,000 160,000		
<b>TOTAL</b>	<b>14,662,000</b>	<b>13,639,000</b>	<b>16,986,016</b>	<b>17,202,155</b>	<b>15,998,000</b>

## Appendix V

**National Undersea Research Program Statistics**

TESTIMONY OF  
DR. NED A. OSTENSO  
ASSISTANT ADMINISTRATOR FOR OCEANIC AND ATMOSPHERIC RESEARCH  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO,  
AND THE OUTER CONTINENTAL SHELF  
COMMITTEE ON MERCHANT MARINE AND FISHERIES  
U.S. HOUSE OF REPRESENTATIVES

MARCH 24, 1993

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to testify on behalf of the National Oceanic and Atmospheric Administration's (NOAA) National Undersea Research Program (NURP).

NURP is the Federal government's civilian program which places the scientist in the ocean. NURP's mission is threefold: 1) providing support and safety for research in the sea and on the seafloor; 2) enhancing knowledge of biological, chemical, geological and physical processes affecting natural resources and the ocean and Great Lakes environment; and 3) developing new techniques and technologies to improve diver safety and performance (supporting Section 21 (a) of the Outer Continental Shelf Lands Act of 1978).

During fiscal year 1992, NURP supported research and operations on both a regional and national scale. NURP's regional program operates primarily through a network of six undersea research

centers. These centers are located at the University of Connecticut at Avery Point, Rutgers University in New Jersey, the University of North Carolina at Wilmington, the Caribbean Marine Research Center at Vero Beach, Florida, the University of Alaska at Fairbanks, and the University of Hawaii at Honolulu. Research programs which are conducted primarily outside of the U.S. exclusive economic zone, at great depth, or without geographic specificity are managed through NURP's National Office. NURP utilizes various interagency and international agreements to assure civilian access to unique deep submergence vehicles. This includes the 4000m (13,000 ft) capable ALVIN (through an agreement between NOAA, the National Science Foundation, and the Office of Naval Research), the Navy's 6000m (20,000 ft) SEA CLIFF, and the Japanese 6500m (21,300 ft) SHINKAI.

In 1992, research operations facilitated by NURP occurred in areas from the Gulf of Alaska south to the Caribbean, and from the Gulf of Maine to Hawaii as well as the far Western Pacific. More than 1300 scientists from over 300 institutions participated in research operations which resulted in over 700 submersible dives, nearly 450 remotely operated vehicle missions and more than 8000 wet dives using air and mixed gasses. These undersea operations represent a majority of the scientific research dives conducted throughout the world. I am proud to report that no injuries resulted from these operations.

Operations in FY 1992 involved many diverse activities which included examination of the health effects of diving in polluted waters, development of innovative methods to assess fisheries in untrawlable areas, understanding the fate of anthropogenic pollutants dumped into the sea and their effects on marine resources, and investigation of the highly unusual hydrocarbon seep and methane vent communities in the Gulf of Mexico. NURP, in conjunction with NOAA's Pacific Marine Environmental Laboratory, also supported development of a 'manifold sampler' for obtaining unadulterated hydrothermal vent fluids. This device is now used routinely by the U.S. research community on the submersible ALVIN to allow advanced study of the unique chemistry of hydrothermal vents.

The NURP program's proposal request and review process for the centers has evolved over 10 years. The National Office annually updates its guidance for identifying high priority research and technology themes. This guidance is integrated with the capabilities of the individual regional centers to produce announcements of proposal opportunities for the general scientific community. Funded proposals are then selected by a national peer review process which determines which proposals have merit.

Unfortunately, this process was seriously constrained in fiscal year 1993 when minimum funding for each center was earmarked in the appropriations bill. Peer review of individual proposals continued; however, allocation of funds between the regional centers took place in a non-competitive manner as mandated.

I would be happy to address any questions you have concerning my testimony. I appreciate the opportunity to testify before the Subcommittee.

Testimony before the  
Committee on Merchant Marine and Fisheries  
Subcommittee on Oceanography, Gulf of Mexico and Outer Continental Shelf  
by  
Dr. Thomas J. Bright, Executive Director  
Texas A&M University Sea Grant College Program  
March 24, 1993

Thank you Mr. Chairman and Members of the Committee, my name is Thomas Bright. I am a professor of oceanography and director of the Texas A&M University Sea Grant College Program. My research has focused on the ecology of coral reefs and hard bank ecosystems in the Gulf of Mexico, Florida, the Caribbean and mideast. Some of my underwater research has been supported logically by the National Undersea Research Program (NURP) of NOAA. NURP's mission is to provide competitively awarded field support for high quality undersea research projects which are primarily funded through other federal programs.

Today, I wish to address marine environmental research needs for the Gulf of Mexico and how various existing federal programs, including NURP, contribute to accomplishing them. The Gulf of Mexico supports the most valuable commercial and recreational fisheries in the nation. It is the site of the country's largest concentration of offshore oil and gas facilities and petrochemical industries. It receives massive riverine inputs which drain nearly 2 million square miles from Canada to Guatemala. It contains a major portion of the Atlantic coral reef ecosystem, and is subject to growing environmental pressures from industrial and domestic development, pollution, and increased demands on limited living resources.

To address the management goal of assuring the health of the Gulf's marine ecosystem, the region's marine science, management and environmental communities have identified critical needs for research through several years of committee work with the EPA Gulf of Mexico Program, Sea Grant, and the Gulf of Mexico Regional Marine Research Program. The needs include study of ecological processes related to habitat use and degradation, nutrient enrichment, freshwater input, population and trophic dynamics of living marine resources, toxic materials, coastal erosion, hydrodynamics, catastrophic events, global change, nuisance species, human health, and a host of other topics.

Although there is no NURP center in the Gulf of Mexico, several major federal programs are currently addressing various components of the region's research needs and most of them have received, or could benefit from, collaborative NURP support. These include:

- The U.S. Minerals Management Service Environmental Studies Program, which is supporting university based physical oceanography, descriptive ecology and environmental monitoring in the northern Gulf. NURP has supported MMS research by providing time on the Johnson Sea-Link and Alvin research submersibles to Texas A&M and Louisiana State University in their study of unique biota and carbonate structures at deep-sea hydrocarbon seeps and the chemistry, geology and biology of deep-sea brine basins.
- The NOAA Coastal Ocean Program Nutrient Enhanced Coastal Ocean Project (NECOP) is assessing the impact of anthropogenic nutrient inflow from the Mississippi/Atchafalaya rivers on offshore productivity and water quality. NURP has assisted NECOP researchers from Texas A&M and the Louisiana University Marine Consortium with remotely operated vehicles, electronic surveillance and diving programs necessary to document impacts of massive hypoxia on fishery resources off Louisiana and Texas.
- The NOAA National Marine Sanctuaries Program administers environmental research and monitoring at the newly designated Flower Garden Banks National Marine Sanctuary in the northwestern Gulf. Years ago, NURP provided research submersible time to explore and describe deep reef communities and brine seeps at the Flower Garden Banks.
- The EPA Gulf of Mexico Program has identified major environmental management and research needs for the Gulf and is commencing to solicit proposals to fill these needs.

- The NOAA/EPA Regional Marine Research Program (RMRP) is producing a research plan for the Gulf of Mexico to define critical research needs to assure good water quality and marine ecosystem health in the Gulf of Mexico. If funded as authorized, it will pursue the research defined.
- The four Sea Grant College Programs in the Gulf States have an excellent, 20 year, record of research, education and extension in pursuit of wise use of our regional marine resources and have engaged in a number of cooperative research efforts with NURP. The Sea Grant Programs are key to coordination and funding of NECOP and RMRP in the Gulf and provide hard support for the Marine Sanctuary effort (Please see Attachment 1).

Environmental research needs for the Gulf are so massive that only through the collective and cooperative efforts of these and other federal and state programs dealing with high priority, real world problems can we hope to generate the knowledge necessary to facilitate wise management of Gulf of Mexico resources. Unfortunately, due to budget constraints over the past 12 years, Congress has never been able to fund these programs at the full capacity levels authorized. In particular, Sea Grant, though extremely successful, has fallen far behind in buying power due to a combination of inflation and a stagnant budget, and RMRP (Attachment 2) has been given only token funding everywhere except in the state of Maine, where it was fully funded. The highest priority your committee should consider is enhancing the federal support base for the aforementioned programs to bring them up to the full funding levels authorized by Congress. This is essential to maintaining and advancing the necessary marine environmental research effort in the Gulf.

The NOAA Office of Oceanic Research Programs coordinates and provides funding for Sea Grant, RMRP and NURP. These programs are national in scope but are conducted regionally on a competitive award basis. NURP, though not designed to provide direct research funding, can contribute in the Gulf, as it has in the past, by providing logistic support for undersea research components of the collective regional studies effort. If newly appropriated funds are anticipated, which would not place NURP in competition for Sea Grant or RMRP appropriations within the NOAA Office of Oceanic Research Programs, then, under the guidelines of the authorization bill, HR 3247, as passed by the House last Congress, the Gulf of Mexico should be considered a candidate site for a NURP center to assist and enhance regional marine research efforts.

An excellent opportunity exists in the Gulf for NURP to economically join forces with the NOAA National Marine Sanctuary Program, Sea Grant, the academic community, and MOBIL Corporation in their cooperative agreement to utilize the offshore gas platform currently in place within the Flower Garden National Marine Sanctuary (Attachment 3). This would be a timely and much needed cooperative effort in support of coastal oceanography, deep-sea research, coral reef ecosystem studies, and environmental monitoring in the Gulf of Mexico (Attachment 4).

An issue requiring immediate undersea research attention in the northwestern Gulf of Mexico is the fishery and environmental consequence of removal of large numbers of offshore oil and gas platforms over the next few decades as the offshore petroleum industry scales down. Some of these platforms are being left on the seabed as artificial reefs, with the concurrence of the adjacent states. There is opposition to this from the shrimp fishery but support from recreational fishermen and support divers. We need to know how effective these artificial reefs are in increasing fishery populations and recreational opportunities so that mistakes are not made which will impair our resource base over the long term. NURP can play a very effective part in addressing this need.

NOAA's role in coordinating and facilitating cooperative environmental research in the Gulf of Mexico and other regions is essential. I hope the committee will support and enhance the NOAA extramural research programs across-the-board.

The following materials describe or relate to the NOAA programs referred to above. Thank you for the opportunity to express my opinion to the committee.

Dr. Thomas J. Bright, Executive Director  
 Texas A&M University Sea Grant College Program  
 1716 Briarcrest, Suite 702  
 Bryan, TX 77802  
 (409)845-3854, (FAX) 845-7525

## SEA GRANT

The National Sea Grant College Program was created by statute in 1966, and currently resides within the Office of Oceanic and Atmospheric Research, having been transferred from the National Science Foundation to the Department of Commerce when NOAA was created. Sea Grant consists of 29 university-based programs involving over 300 institutions of higher education nationwide. Sea Grant is the largest academic program within the Department of Commerce, and serves as NOAA's principal link to the academic community and to education at all levels. This national program was reauthorized by Congress in 1991 (P.L. 102-106), and enjoys widespread bipartisan support. Nearly half the cost of Sea Grant is provided by state and local governments, industry, and citizens. The current federal funding level is \$41 million for the core program, with an additional \$2 million mandated by Congress for zebra mussel research.

Sea Grant was targeted for elimination by the Reagan Administration starting in 1981. Congress has maintained the Sea Grant program at essentially level appropriations for more than a decade, but this has diminished the program's "buying power" by 37 percent since 1979. The continued viability of Sea Grant is a serious issue if this trend is allowed to continue. (A chart depicting Sea Grant's funding history is attached).

Even with the lack of recent Administration commitment, Sea Grant has amassed a remarkable record of accomplishment. A recent report showed that by stimulating new business opportunities and implementing cost-saving techniques and other productivity improvements, Sea Grant helped businesses generate an \$842 million annual impact on the national economy relative to the federal budget of about \$48 million annually. That the impact more than tripled from a decade earlier was a remarkable achievement, especially in the face of declining program resources throughout the 1980's. Sea Grant has the capacity to do much more.

Sea Grant is the nation's principal source of university research and technology transfer in the coastal oceans and estuaries, and is a primary national resource on water quality, aquaculture, biotechnology, seafood and other marine products, fisheries recruitment and productivity, ocean and coastal engineering and technology, and ocean policy. Its mission with respect to education, technology transfer and public service is unique among marine programs. The geographic scope of Sea Grant encompasses the Gulf of Mexico, the Atlantic, Pacific, Arctic, and Great Lakes, and Sea Grant maintains active contacts in the international arena as well.

Sea Grant plays an important service role to other programs within NOAA, including the Coastal Ocean Science Program, the Climate and Global Change Research Program, and the Regional Marine Research Boards. Sea Grant facilitates interagency interactions, particularly with the Environmental Protection Agency, by serving as manager for collaborative programs and funding to academia.

Through grassroots exchanges between scientists and users, Sea Grant is a program that creates jobs, transfers science and technology developments to industry, protects the marine environment, and helps ensure the sustainable use of coastal and marine resources. Sea Grant is making major contributions to the competitiveness of the nation's marine economy, to a skilled labor force, to scientific achievement, to technology transfer, and to public education on critical resource and environmental issues.

### THE SEA GRANT CORE PROGRAM

At the heart of Sea Grant is its core program of university research, education, and outreach. Sea Grant operates on the basis of competitive, merit-reviewed proposals which are developed and evaluated by each of the 23 Sea Grant Colleges, and submitted to NOAA for final review and funding. Sea Grant maintains a balanced program of (1) research on a broad array of marine issues, (2) education at all levels, and (3) outreach through a network of marine extension agents who are employed by universities and located in the coastal communities they serve. This structure enables Sea Grant to respond rapidly to problems as they arise. The core program is Sea Grant's highest priority, and its erosion is cause for serious concern.

### SEA GRANT INITIATIVES

In addition to a balanced core program, Sea Grant is prepared to address thematic issues through a series of initiatives which build upon some of the most promising Sea Grant projects to date. In each of these areas, Sea Grant is providing global leadership on a topic that is not being addressed by any other program:

- marine biotechnology to develop new materials, better seafood products, environmental remediation, and new pharmaceuticals from the sea. This is widely regarded as the most promising area for applied marine research, with remarkable benefits already having been shown in the following areas:
  - o disease prevention, both in humans and in marine organisms;
  - o aquaculture to produce both new and improved products from the sea,
  - o seafood safety and human health, to rapidly detect contaminated seafood and enhance its shelf life;
  - o protection and restoration of the aquatic environment;
  - o reduction of fouling and corrosion of ships and marine structures; and
  - o biomaterials and bioprocessing to exploit marine natural products for human benefit.

Largely because of the work of Sea Grant, the U.S. is currently the world leader in marine biotechnology. However, a significant new effort will be required to train researchers, and to promote cooperation between industry, academia, and government in marine biotechnology. Other countries are capitalizing on the opportunity which marine biotechnology represents: Japan is spending \$1 billion annually on biotechnology, in sharp contrast to the meager U.S. investment of less than \$30 million a year. Biotechnology represents for the marine community what the computer chip did to the electronics industry a few decades ago.

-- seafood safety to ensure that consumers have a safe and high quality supply of seafood and that seafood businesses can be more competitive. Sea Grant is working closely with Congress to convene a workshop in May 1993 which will bring together representatives of the seafood processing industry, consumer groups, the fishing industry, and researchers with the goal of adopting a plan to improve the quality and safety of our nation's seafood supply.

-- coastal climate and hazard research to assist coastal residents in preparing for hurricanes, storm surges and tsunamis, coastal erosion and subsidence, and sea level rise, with proven savings in the billions of dollars.

## Page 3

-- ~~extinct and nonindigenous species~~ research to understand and mitigate invasions of species such as the zebra mussel in the Great Lakes, which represent a billion-dollar threat to water supplies and ecosystem quality. It is estimated that over 350 non-native species of marine and estuarine organisms have been introduced to U.S. waters, many of which are known to compete against indigenous species, altering ecosystems and contributing to the decline of important fisheries. A significant effort will be required to stop the introduction of such species and to identify ways of controlling harmful populations that have already been introduced.

-- ~~sustainable coastal~~ development to empower small businesses and local governments to foster environmentally-sound economic growth. It is estimated that by the year 2000, more than half the U.S. population will live in coastal areas. Sea Grant is uniquely prepared to assist coastal communities in responding to development pressures, to assist businesses and local governments in economically disadvantaged areas, to promote new marine technologies, and to foster management practices that are consistent with a sound coastal environment.

#### MAJOR ISSUES

After more than a decade of neglect, Sea Grant is badly in need of revitalization and support by the new Administration. Sea Grant responds directly to many of the objectives that have been outlined by the Clinton/Gore campaign in the areas of technology transfer, environmental protection, and economic growth. Its participating universities are unlikely to accept the burden of a persistent decline in federal support, and without a renewed commitment Sea Grant is at serious risk.

Sea Grant has the infrastructure to respond to the initiatives of the new Administration. To revitalize Sea Grant and provide adequate funding for the core program, including the new initiatives described above, an increase of the current Sea Grant appropriation from \$41 million to at least \$60 million is required. Although resources are scarce, this investment would be well justified by Sea Grant's demonstrated excellence in research, its commitment to environmental protection, and its history of extraordinary economic returns.

#### RECOMMENDATIONS FOR THE NEW ADMINISTRATION

1. Emphasize a renewed commitment to the National Sea Grant College Program as an Administration priority.
2. Fully utilize the National Sea Grant Review Panel, a group of outside advisors established in the Sea Grant Act whose members are appointed by the Secretary of Commerce, and who can play an important advisory role.
3. Use Sea Grant as a vehicle for improved Commerce Department interaction with academia, particularly in the area of industry/government/academic partnerships.
4. Forge close ties between Sea Grant and the National Institutes for Standards and Technology (NIST), particularly to foster the transfer of marine technologies.

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## Gulf of Mexico Regional Marine Research Program

The NOAA/EPA Regional Marine Research Program (RMRP) will enable the research community to engage in long term, regional research on ecosystem health, water quality and ecological processes relating to human impacts and management of the Gulf of Mexico. The RMRP was authorized by the 101st Congress in Public Law 101-593, through amendment of the marine Protection, Research and Sanctuaries Act (33 U.S.C. 1401, Title IV). The purpose of this amendment is to establish regional research programs, under effective Federal oversight to (1) set priorities for regional marine and coastal research in support of efforts to safeguard the water quality and ecosystem health of each region; and (2) carry out such research through grants and improved coordination.

The Gulf of Mexico Regional Marine Research Board, chaired by the Texas Sea Grant Director and with appointees from EPA, NOAA and the Gulf State Governors, is charged with development of a Gulf of Mexico Regional Marine Research Plan as the first step in implementing the Program. The geographical area to be considered incorporates the marine and coastal waters off the States of Florida, Alabama, Mississippi, Louisiana, and Texas along the Gulf coast from and including the Florida Keys to the Mexican border.

Attachment 3



UNITED STATES DEPARTMENT OF COMMERCE  
 National Oceanic and Atmospheric Administration  
 NATIONAL OCEAN SERVICE  
 OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT  
 Washington, D.C. 20583

**Fact Sheet**  
**Flower Garden Banks National Marine Sanctuary**

**Location** - 110 mi SSE of Galveston, TX (shallowest areas of the East Flower Garden Bank: 27°54.5'N, 93°36.0'W; shallowest areas of the West Flower Garden Bank: 27°52.5'N, 93°49.0'W).

**Habitat and Resources** - Shelf-edge topographic features capped by the northernmost coral reefs in North America. Roughly 300 acres of coral reefs, home to more than 80 species of algae, 250 species of invertebrates, and 175 species of fish; important habitat to sharks, sea turtles, and manta rays. Other visitors include spotted dolphins and whale sharks.

**Primary Users** - Sport divers, sport and commercial fishermen, boaters, scientists.

**Designation Date** - January 17, 1992; the Nation's 10th of 13 national marine sanctuaries.

**Authority** - Marine Protection, Research, and Sanctuaries Act of 1972; to designate as national marine sanctuaries discrete areas of the marine environment of special national significance due to their conservation, recreational, ecological, historical, research, educational, or esthetic value in order to promote comprehensive conservation and management of the areas.

**Administrative Agency** - National Oceanic & Atmospheric Administration, Office of Ocean and Coastal Resource Management, Sanctuaries and Reserves Division.

**Goals** - Long-term resource protection; support, promote, and coordinate scientific research and monitoring; enhance public awareness; management tailored to Sanctuary needs and goals; facilitate environmentally sound multiple use.

**Concerns** - unrestricted anchoring; long-term effects of offshore oil and gas development activities; overfishing; increasing use by recreational divers and boaters.

**Size of Sanctuary** - 41.7 square nautical miles (19.2 square nautical miles at the East Flower Garden Bank, and 22.5 square nautical miles at the West Flower Garden Bank). Boundaries include all areas less than 100 m deep, and those areas greater than 100 m within the "no activity" zone around each bank established by the Minerals Management Service, rounded out to allow easy identification of Sanctuary boundaries for enforcement purposes.

For further information, contact:

Dr. Stephen R. Glings, Manager  
 Flower Garden Banks National Marine Sanctuary  
 1716 Briarcrest Drive  
 Suite 702  
 Bryan, Texas 77802  
 (409) 847-9296 FAX (409) 845-7525



## CORPUS CHRISTI STATE UNIVERSITY

### FLOWER GARDENS OCEAN RESEARCH PROJECT

#### INTRODUCTION

The current efforts of the Flower Gardens Ocean Research Project (FGORP) began in 1990 when Mobil Exploration and Producing Inc. offered to provide support to oceanographic research scientists working in the Gulf of Mexico. Mobil offered to: 1) allow researchers to use Mobil production platforms as research stations, 2) provide transportation to and from the platforms, and 3) provide room and board for the research personnel stationed on the platforms.

The initial efforts to start such a program occurred in the late 60's - early 70's time period. However, at that time there existed between the exploration/production industry and the marine research community a great deal of misunderstanding and mistrust. The success of the current FGORP efforts is indicative of the progress towards understanding that both camps have made over the last twenty years.

In response to Mobil's generous offer, a consortium of oceanographic research professionals and agencies was formed to take advantage of the opportunity. Today the consortium steering committee includes representatives of: Mobil Exploration and Producing Inc., Corpus Christi State University, University of Texas Marine Science Institute, Texas A&M University, Mineral Management Service, National Marine Sanctuaries Program, Sea Grant College Program, Texas State Aquarium, Texas Parks and Wildlife Department, Environmental Protection Agency, and Louisiana Universities Marine Research Consortium.

FGORP is non-exclusive and encourages research scientists from through-out the Gulf of Mexico to submit research proposals to work off of Mobil platforms. Research topics are not restricted other than to not interfere with the daily operations of the platform(s) being utilized.

In addition to the support provided by Mobil this project is producing other significant benefits. Through the existence of a successful consortium, manpower and expertise

Center for Coastal Studies  
College of Science and Technology  
6300 Ocean Drive, Corpus Christi, Texas 78412 512-994-2736 FAX 512-994-2770  
A Campus of The Texas A&M University System

from a myriad of agencies is brought together to study and discuss issues and challenges of resource management in the Gulf of Mexico. Industry and science are working together toward common objectives and goals - sitting at the same table striving to communicate, understand, and develop solutions to challenges. And, through coordination of research projects, duplication of effort is reduced and projects can be better designed to look at the comprehensive "big picture." In the long run this will produce greater return for each research dollar spent.

Thanks to Mobil's support, the Flower Gardens Ocean Research Project is off to a productive start. The potential of this program for expanding our knowledge of the complexities of the Gulf of Mexico, the most productive body of water bordering the United States, is unlimited. It simply requires the continued commitment and energies of industry and science.

For more information contact Dr. Quenton Dokken, Associate Director, Center for Coastal Studies/CCSU, 6300 Ocean Drive, Corpus Christi, TX 78412; (512) 994-2736.

f9orp.692

TESTIMONY  
to the  
**SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO  
AND THE OUTER CONTINENTAL SHELF**  
of the  
**COMMITTEE ON MERCHANT MARINE AND FISHERIES**  
**UNITED STATES HOUSE OF REPRESENTATIVES**  
on the  
**NATIONAL UNDERSEA RESEARCH PROGRAM (NURP)**  
by  
**DR. SYLVIA A. EARLE**  
**DEEP OCEAN ENGINEERING, INC.**  
1431 Doolittle Drive  
San Leandro, California  
94577  
(510-562-9300)

2:00 PM

March 24, 1993

TESTIMONY OF  
DR. SYLVIA A. EARLE, FOUNDER,  
DEEP OCEAN ENGINEERING, INC. AND FORMER CHIEF SCIENTIST OF NOAA,

BEFORE THE SUBCOMMITTEE ON OCEANOGRAPHY,  
GULF OF MEXICO AND OUTER CONTINENTAL SHELF  
OF THE COMMITTEE ON MERCHANT MARINE AND FISHERIES

U. S. HOUSE OF REPRESENTATIVES

MARCH 24, 1993

Mr. Chairman and Members of this Subcommittee:

It is an honor to appear before you, and to have an opportunity to speak on behalf of those who favor a strong national commitment to underwater exploration, research and technology, and who believe that substantial, consistent funding for the National Undersea Research Program (NURP) is one of the best investments this country can make for the environment, for the economy, for science, for technology . . . for the present and for the future strength of the United States of America.

Despite years of budget recommendations for zero funding by the Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA), NURP has survived and accomplished near-miracles with respect to keeping alive this nation's reputation as a serious participant in civilian underwater, and especially undersea activities that many equate with some of the much better supported programs of the National Aeronautic and Space Administration (NASA).

The phrase "much better supported" is relative, so to clarify, it may be useful to consider the current level of funding for NURP -- about \$16 million to support six regional centers and a headquarters office in Washington, plus funding for a broad range of cross-cutting research efforts. This is accomplished for significantly less than the price tag of the space shuttle's famous new toilet -- \$23 million.

Each year, Congress has acted to save NURP, but the program's six regional centers have a tenuous hold on the future, the apparently unwanted offspring of an Agency mandated to oversee the nation's oceanic and atmospheric interests.

Private industry has recognized the need for undersea technology and research, especially in connection with development of the offshore oil and gas industry. But for the investment made by industry-- domestic and international and by foreign governments -- technology available for civilian use would be about at the level that aerospace technology was half a century ago.

U. S. taxpayers have provided billions of dollars to implement significant advances in underwater technology, for military applications. However, little of the resulting technology -- or resulting knowledge -- has been made available for civilian use, and not all of it is appropriate for benign applications. I will spare you speculative remarks about what could be done by NURP and thus the nation with the cost of one nuclear submarine.

Rather, I will focus on the positive effort a year ago to help secure more than a catch-as-catch-can budget for NURP --the "National Undersea Research Program Act of 1992," introduced by the Merchant Marine and Fisheries Committee and passed the House. The bill was an earnest effort to put knowledge of our underwater assets firmly on the balance sheet, but was not approved by the Senate, so this year, once again, the question is before you -- and before the nation: Will this country have a continuing *national* commitment for civilian underwater research and exploration?

I do reflect, sometimes, on what might have been accomplished if NURP and its predecessor, Manned Undersea Science and Technology (MUST) had been appropriately supported over the years, and try to imagine what we might now know about the nature of the planet and about how much better prepared we could be to cope with the global environmental changes that are now taking place. Instead, NURP's mission -- to conduct underwater research and use appropriate technology to develop an understanding of the physical, biological and chemical processes in the ocean and large lakes that are fundamental to wise use of these systems -- has been neglected at precisely the time that costly questions beg to be answered.

An example of this neglect was apparent soon after I joined NOAA as Chief Scientist in 1990. Budget recommendations at the time included significant sums for ocean research from satellites that would look at water masses from high above and for fleet modernization so that the ocean could be more effectively explored from the *surface*. Recommended funding for NURP -- and thus for getting to know the ocean by getting *in* the ocean -- was zero..

The attitude is puzzling, but may relate to a widely held assumption that earth, including the ocean, is already known, that what is out of sight, underwater, is not very important to non-military human affairs -- and that only beyond the atmosphere of this planet are there significant new discoveries to be made. In fact, most of earth has yet to be explored -- or even seen for the first time by human beings, if the entire liquid three dimensional ocean realm, with its 40,000 kilometers of mountains and more than 90 per cent of earth's living space (all creatures considered) is taken into account.

What are the costs of our ignorance about the ocean -- ignorance that might be dispelled, but for lack of appropriate technology? What are the costs of having technology available but idle because of lack of supporting funds -- as in the case of NURP's multi-million dollar underwater laboratory, Aquarius, intended for use in the Florida Keys in 1991, but beached since its transfer from the Virgin Islands.. Perhaps more would be understood concerning the decline of Florida's valuable coral reefs had teams of scientists been conducting research in their midst for the past two years. What might be known concerning the decline and loss of oxygen-producing, carbon-dioxide absorbing seagrass meadows in Florida Bay, Tampa Bay, and elsewhere in the Gulf of Mexico -- if this nation were supporting a vigorous national underwater research program ?

Will we allow more time to pass with no clear national mandate concerning underwater exploration and research while other nations move swiftly forward in terms of access to and understanding of earth's dominant feature?

Concern about "other nations moving swiftly forward"has a hauntingly familiar ring, reminiscent of the space race. Many of the same reasons that the United States has for years supported development and use of technology to gain effective working access to the skies above -- and space beyond -- can be made for access to the depths of the sea.

Sea-space parallels are wonderfully real, whether seeking answers to questions about the origin of life or knowledge of how the planet works; whether in terms of solving technological challenges of working in environments considered hostile to human beings or of mastering problems requiring diplomatic or military strength -- the sea and space have much in common. Certainly, technology is the key to both. On our own, we are as earth-bound as elephants, whether the goals are high in the sky or into the depths.

Technologically and scientifically, the sea-space relationship was demonstrated eloquently less than a month ago when an underwater vehicle called Phantom, designed and built with private funds by the company I founded, Deep Ocean Engineering, Inc. was used in a NASA project as a part of a program of technological development for access to Mars. More than 250 Phantom vehicles have been put into operation. Specifically, Phantom was being operated in the most Mars-like environment on earth, Antarctica, by a scientist sitting at the NASA Ames facility in California. He wore a virtual reality-type helmet, with built-in video screens for viewing *real* reality -- underwater, under the ice. As the pilot turned his head in California, the cameras on the vehicle in Antarctica responded and via microwave and satellite, a view of life beneath the ice was conveyed in real time through Phantom's "eyes." This may not sound like big technological breakthrough, but to keep things in perspective, the first ever live television broadcast from Antarctica occurred only a few months ago during a Good Morning America program, again involving NASA space scientists using a Phantom underwater vehicle.

Actually, my introduction to an early iteration of NURP occurred in part courtesy of NASA in 1970. I was leader of a team of aquanauts living in an underwater laboratory in the U.S. Virgin Islands operated under the auspices of the Department of the Interior, but with significant support, financial and moral, from NASA. Even the name of the program, the Tektite Project, was intended to symbolize the close relationship between the sea and space. (Tektites are glassy bits of matter from space that fall mostly in the sea.) There was considerable interest in the behavior of those of us living and working in isolation underwater for ten days to two months because of the relevance of experience gained to future programs such as Skylab, the Space Shuttle, and the Space Station. We were monitored continuously by video cameras and NASA psychologists seeking insight into how men -- and there was some talk about how maybe even women -- might be effectively supported while in more distant hostile environments.

Even the equipment we used had parallels in space gear. In addition to using conventional scuba for excursions from the underwater laboratory, Tektite aquanauts were supplied with rebreathers, a concept first developed for underwater applications, but refined to a high degree for use by astronauts to make possible excursions lasting many hours by literally *rebreathing* the same air, but with carbon dioxide chemically removed and oxygen added as required.

When I entered the Tektite underwater laboratory as an aquanaut in July, 1970, NURP-like programs for this country were being channeled through the Department of the Interior. When I emerged two weeks later, the decision had been made to create NOAA and to move these programs and the many others things now embraced by NOAA into the Department of Commerce. What has evolved is not at all like what was anticipated by those who explained at the time that NOAA was intended to be a "wet NASA."

Naturally, I am a strong supporter of this country's commitment to the space-program, but I am also among those who believe that justification for exploration and research of the vast unknowns of this planet from the inside out are at least as urgent and compelling !

certainly do not favor reducing NASA's funding to increase ocean efforts, but there is some justification for equality. I trust that it is clear that I do not mean to imply that NASA should henceforth be limited to the equivalent of NOAA's budget for undersea science and technology.

As an example of the disparity between the rapid development of aerospace capability as compared to ocean access -- and coincident research -- it is useful to recall how much progress has been made in both realms in the six and a half decades since Charles A. Lindbergh made his historic first solo crossing of the Atlantic Ocean. Soon after, in the early 1930's, William Beebe and Otis Barton made the first successful descents in history to as much as half a mile beneath the surface of that same ocean.

Today, it is still considered remarkable to be able to work at 1000 meters depth. I am among the privileged few who have piloted small submersibles that deep and have participated as a scientific researcher in others, including a dive that I made while serving as Chief Scientist of NOAA in the deepest-diving submersible operating today, Japan's Shinkai 6500. This three-person system is one of a global fleet of but five manned submersibles capable of travelling to as much as one half of the ocean's depth. France has one, the Nautile. The U. S. Navy operates Sea Cliff (capable of travelling to 6,000 m depth) and occasionally allows a civilian scientist aboard, usually under the auspices of the NURP program. Russia has two, Mir I and Mir II, launched in 1987 and from the beginning dedicated to scientific research and exploration. Significantly, these two subs are presently operating in the Pacific Ocean in support of a U.S. research project. To my knowledge, no Russian scientist has been aboard this nation's technological counterpart, Seacliff. Too often, U. S. scientists must go to other countries asking for access to their underwater technology. Where is ours?

The Alvin submersible, in operation since 1964 at Woods Hole Oceanographic Institution (WHOI), is a proven workhorse that continues to produce an astonishingly rich track record of performance in depths to 4000 meters. NURP contributes to its operation in collaboration with the National Science Foundation and the U. S. Navy. There is also an active and effective program involving remote vehicle operation and technology development at WHOI.

Two Johnson-Sea-Link submersibles have been operated for undersea research by Harbor Branch Oceanographic Institution since about 1970, sometimes using funds provided by NURP. Occasionally, funding for operation of other small submersibles and remotely operated vehicles (ROV's) is provided through NURP.

At the Monterey Bay Aquarium Research Institution (MBARI) in Monterey, California, important developments in remotely operated vehicle (ROV) systems have been supported with private funds, largely contributed by industrialist and philanthropist, David Packard. Development and use of hundreds of ROV's produced in the past decade by U. S. companies -- including more than 250 of Deep Ocean Engineering's Phantom systems -- has been possible largely because of the market provided by national and international industry and military interests. It is ironic that there is not, in parallel, a substantial federal commitment to capitalize on, cooperate with and provide encouragement for these effective and largely private endeavors through a vigorous National Underwater Research Program..

Rather, world leadership for underwater technology and research has moved to Japan. Soon, Japan will be the only nation to have working access to full ocean depth. This year, an unmanned vehicle operating from a dedicated support ship will be launched by JAMSTEC, Japan's well-funded national facility for undersea technology and research.

Plans are underway for construction of a manned system capable of operating to 11,000 meters depth. Japan thus will have unique access to an area in the deep sea about the size of the United States. The deep trenches harbor a high-pressure environment unlike anywhere else on this planet — or any other known place. Geologists are as eager to understand grand earth processes that occur in the subduction areas at the bottom of these deep trenches as are the biologists who want to know what lives there, and how. With luck, Japan will be generous and allow U.S. participation in JAMSTEC's bold and commendable ventures.

Meanwhile, the U. S. counterpart agency, to JAMSTEC — NURP — faces an uncertain future, as does the overall role of the U. S. with respect to undersea research and exploration. While the future of Russia's advanced systems, Mir I and Mir II, and the programs that support them, also face uncertainties, other countries, in addition to Japan, are moving strongly forward. The first distinctively new design in more than a decade for a deep manned research submersible was built by a U.S. company in 1984 — with funds from the Canadian government for a Canadian company. The latest new design is also being produced and two advanced submersibles are being built by the same U. S. company, Deep Ocean Engineering — with funding from a communications firm in France. In a way, this is not surprising, since France has an on-going tradition of national support for underwater research and exploration, and for the underlying technology required.

Recently, our "tradition" in these matters has been one of tragic indifference. There is little doubt that the oceans are in trouble in ways that are economically and environmentally damaging. Concerns range from the decline and destruction of once thriving fisheries to the decline and destruction of entire ecosystems such as coral reefs and productive sea grass meadows in Florida and the Gulf of Mexico. What are the consequences of deep sea dumping? How do ocean ecosystems respond to oil spills, trash and toxic chemicals? What can be done to restore damaged areas underwater? How can places in good condition, including the 12,000 square miles in U. S. waters designated as National Marine Sanctuaries be evaluated — and protected? By what means can the nation's ocean assets be assessed?

Knowledge gained through NURP can help, but to do so effectively, NURP needs help. I am among a growing constituency, including a great many creatures in the sea who cannot speak for themselves, who sincerely hope you will do so.

DR SYLVIA A. EARLE is a marine scientist with a B.S. degree from Florida State University (1955) and M.S. and Ph.D. degrees from Duke University (1956; 1966). She has served as Fellow at the California Academy of Sciences in San Francisco, California, since 1976 and was concurrently Curator of Phycology until 1986. From 1969 to 1981, she was Research Associate at the University of California, Berkeley, Radcliffe Institute Scholar from 1967 to 1969, and Research Fellow or Associate at the Farlow Herbarium, Harvard University, from 1967 to 1981. In 1981, Dr. Earle co-founded Deep Ocean Engineering, Inc. to design, develop, manufacture and operate equipment in the ocean and other remote environments. She was Chairman, President, and CEO when she accepted a Presidential appointment as Chief Scientist of the National Oceanic and Atmospheric Administration (NOAA) in 1990. From Feb. 1992 to Feb. 1993 she served as Advisor to NOAA and presently is Director and consultant for Deep Ocean Engineering, Inc. Dr. Earle has extensive field experience worldwide including leading more than 50 expeditions involving in excess of 5000 hours underwater in connection with her research. She led the first team of women aquanauts during the Tekite Project in 1970 and holds a depth record for solo deep diving (3000 ft). She has authored more than 80 publications concerning marine science and technology, has participated in numerous TV productions and given lectures in more than 50 countries. Dr. Earle is a member of various professional societies and has served on foundations, boards and committees relating to ocean research, ocean policy and global conservation including a long association with the Explorers Club, Charles A. Lindbergh Fund, World Wildlife Fund and World Wide Fund for Nature.

Honors and awards include the Director's Award, Natural Resources Council (1992); PACON International Award (1992); Golden Plate Award, American Academy of Achievement (1991); Doctorate in Science (Honorary), Duke University (1993); Doctorate in Science (Honorary), Washington College (1992); Doctorate of Science (Honorary), Ball State University (1991); Doctorate, Humane Letters (Honorary), Monterey Institute of International Studies (1990); 1991 DEMA Hall of Fame Award; Explorers Club Lowell Thomas Award (1980); US Department of Interior Conservation Service Award (1970); Order of the Golden Ark by the Prince of the Netherlands (1981); Los Angeles Times Woman of the Year (1970); New England Aquarium David B. Stone Medal (1989); Society of Women Geographers Gold Medal (1990); Radcliffe College Alumnae Association Medal (1990). She is a Fellow of the California Academy of Sciences (1976), the Explorers Club (1981), Marine Technology Society (1984), the American Association for the Advancement of Sciences (1986) and the World Academy of Art and Science (1992). From 1980 to 1984, she served on the President's Advisory Committee on Oceans and Atmosphere. She has been the subject of numerous articles and television programs including the National Geographic Explorer series (1987), Life Magazine (1987), The New Yorker (1989), the New York Times Magazine (1991), Parade Magazine (1991), Tomorrow Magazine (1991), Scientific American (1992) and ABC TV 20/20 (1992).

## SOME THOUGHTS ON THE STATE OF DEEP (&gt;1000M) SUBMERGENCE SCIENCE

TESTIMONY OF  
 PROFESSOR PAUL J. FOX  
 (GRADUATE SCHOOL OF OCEANOGRAPHY, URI)  
 CHAIR, DEEP SUBMERGENCE SCIENCE COMMITTEE  
 OF THE  
 UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

BEFORE THE  
 SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO,  
 AND OUTER CONTINENTAL SHELF  
 OF THE  
 COMMITTEE ON MERCHANT MARINE AND FISHERIES  
 U.S. HOUSE OF REPRESENTATIVES

March 24, 1993

Mr. Chairman and Members of the Subcommittees:

I appreciate the opportunity to testify on behalf of the community of investigators interested in deep submergence science. Others here today are much better qualified to offer comments specific to NOAA's National Undersea Research Program (NURP). Instead, I will focus my comments on the deep water component of submergence science and address a range of relevant issues. In so doing, I will show how a component of NURP contributes in significant ways to deep submergence science.

**RATIONALE:** The vast interior of the global ocean and the underlying seabed is arguably this planet's last frontier. This inner space holds answers to fundamental questions in biology, chemistry and geology, and these questions can only be addressed through the effective use of deep submergence assets that provide the investigator with a cognitive presence and a capability to carry out controlled, manipulative and interactive tasks. Presently, submersibles and remotely operated vehicles (ROVs) provide this capability; autonomous unmanned vehicles (AUVs) are still largely developmental, but hold great potential for the future.

**PRESENT STATE OF DEEP SUBMERGENCE SCIENCE:**

- Scientific Objectives - Although deep submergence science is still characterized by unexpected discoveries and each experiment has an element of exploration, we know enough to identify a host of challenging questions the answers to which are critical to our understanding of how the earth works. For example, the largest biomass and the greatest diversity of animal communities on this planet reside within the interior of the ocean. In addition, the benthic organisms that inhabit the sediments of the deep sea represent another vast habitat of great apparent diversity. These communities are complex and exceedingly dynamic and represent the greatest gap in our understanding of this planet's biology. The answers to questions of direct societal interest such as the global carbon cycle and waste disposal will be incomplete until the ecological processes of the ocean's interior and underlying sediments are understood. Another example of a natural system that can only be adequately investigated with deep submergence assets is the Mid-Oceanic Ridge, the most striking single feature on our planet that encircles the earth. The ridge system is in excess of 50,000 km in length and is the locus of 20 km<sup>3</sup> of new oceanic crustal production every year. In this dynamic environment, there are a host of physical, chemical and biological processes involved in the interactions between circulating seawater and newly created crust that have important implications for our understanding of the composition of seawater, origin mineral deposits and early life on this planet.

- Community of Deep Submergence Investigators - The robust, challenging, fundamental and exciting nature of research in the global abyss has created a large community of scholars in the biological, chemical, geological/geophysical and engineering sciences. These investigators are largely distributed throughout the U.S. university community with the greatest concentration of investigators found at institutions with an emphasis in the oceanographic sciences. Important centers of innovative technological scientific expertise are located at private marine centers such as Harbor Branch, the Monterey Bay Aquarium Research Institute (MBARI), as well as in industry. The exciting nature of deep submergence science attracts many of the very best graduate students to a broad range of thesis topics in this field. It is probably fair to say that the growth in deep submergence science is not so much restrained, as it is hobbled, by a lack of resources (i.e. the number of deep submergence assets and access to these assets).
- Technological Assets: Gateways To The Abyss - For U.S. scientists, manned presence in the deep sea (>1000m) over the last twenty years has been provided by the submersible ALVIN (4000m limit), operated by Woods Hole Oceanographic Institution (WHOI) as a National Facility that is funded jointly by ONR, NOAA and NSF, and to a much lesser extent by the U.S. Navy submersibles SEA CLIFF (6000m limit) and TURTLE (3000m limit). Access to deep inner space has been very effective, providing a cognitive presence and an ability to carry out manipulative and interactive experiments. Indeed, our knowledge of the abyss is largely constrained by over two decades of successful submersible operations (e.g. ALVIN has made in excess of 2000 dives). In the past, the two submersibles of the U.S. Navy have been available to scientists for a limited time each year, but the unreliability of these assets has seriously compromised their usefulness. Recently, NURP has worked with the Navy to improve this situation, holding out the possibility that U.S. scientists can use SEA CLIFF effectively in the future and take advantage of its capability to reach 6000m. A 2000m increase in depth capability allows an investigator to reach approximately 98% of the abyss as opposed to 42% with a 4000m capability. Manned presence in the abyss, however, does have limitations imposed by creating the necessary life support systems (i.e. bulky sphere, limited bottom time, large time and labor commitment to safety). Recently, technological innovations of ROVs developed over the last two decades to serve industrial and scientific needs in shallow water have been hardened for use in the hostile environments of the deep abyss. ROV systems in different states of development exist at WHOI, MBARI and Scripps Institution of Oceanography. These systems are just coming on line and offer a tremendous new investigative methodology that nicely complements, and greatly enhances, our existing potential to carry out investigations in the abyss and on the abyssal floor. Given the geographic and intellectual scale of the scientific problems to be answered and the discoveries to be made in the ocean's inner space, it is clear that ROVs will play a pivotal role in the next chapter of investigation. In the academic community, AUVs are still very much in the developmental stages, but they have a great potential to augment and extend our ability to conduct research in the deep sea.
- Deep Submergence Facilities: A Key Component To Success - The successful and routine implementation of experiments in the hostile environment of inner space, whether it be manned submersibles or ROVs, is dependent on teams of experts, scientists and engineers that are responsible for equipment maintenance and development. These teams take time to develop and represent valuable resources that must be maintained in a coherent fashion if our ability to carry out state of the art investigations in the deep sea is to continue. In order to maintain a reliable deep submergence asset that meets the needs of the scientific questions being addressed, a robust infrastructure must be in place that insures continuity over the long term. This need was recognized almost two decades ago when ONR, NOAA and NSF entered into an interagency agreement to create a National Deep Submergence Facility at WHOI, assuring that the submersible ALVIN would be available for civilian scientific purposes. This interagency agreement has been remarkably successful and has remained in place to the present, although the language of the agreement has just been expanded to include the newly developed JASON-MEDEA ROV system. Outside of this framework, and supported in a variety of ways, there are a few other centers of deep submergence

expertise - Scripps Institution of Oceanography, Deep Submergence Group, U.S. Navy, MBARI, and the NURP facility of the University of Hawaii - that are making, or hold a potential to make, contributions to deep submergence science.

**PROBLEMS FACING DEEP SUBMERGENCE SCIENCE:** I suggest that there is a short term problem facing our National Deep Submergence Facility located at WHOI, and a more general longer term problem facing the U.S. deep submergence effort as a whole.

- Short Term - The problem facing the community in the short term has two primary components. The nature of the tripartite interagency agreement that supports the National Deep Submergence Facility at WHOI is subject each year to vagaries of funding specific to each one of the three sponsoring agencies. For example, partitioning of the FY93 appropriation for NOAA/NURP resulted in a last minute reduction in the expected NOAA contribution to the ALVIN program, causing serious problems with the scheduling of the 1993 ALVIN program and allocation of resources. A last minute funding problem is not unique to 1993, nor is it restricted to NOAA's contributions; problems like this have been a recurrent theme for the last several years. The result is that it is all too common that this country's premier probe into the deep inner space of this planet has been seriously compromised. Such a recent history has not only effected usage of the vehicle by U.S. scientists, but also the ability of the Deep Submergence Group at WHOI to incorporate new and necessary technologies into the operational capability of the submersible. As a result, ALVIN does not offer to the U.S. community the benefits of advanced technology that have been incorporated into the deeper diving (6000-6500m) deep submergence systems operated by our foreign colleagues (France, Japan and Russia). ALVIN still is the premier system in toto because of its reliability, the nearly three decades of accumulated expertise that resides with the ALVIN team, and the innovative nature of the scientists using the submersible. Nevertheless, our manned presence in the deep sea is in jeopardy because we are loosing ground as other operators learn how to operate in the abyss. To compound matters, this precarious funding situation, which has characterized ALVIN for the last several years, is now made even more challenging because the new JASON-MEDEA ROV system has been added to capabilities/offerings of the National Deep Submergence Facility, but the bottom line has not significantly changed. On one hand, the community of deep submergence scientists is excited by the new and expanded research opportunities provided by this new ROV system, but on the other hand, it is not at all clear how these two systems can be supported in a way to maximize utilization. During this time of transition as the community grows into the new opportunities offered by ROVs and tries to upgrade the capabilities of our existing manned asset, ALVIN, the present funding mechanism does not constructively serve the needs of deep submergence science.
- Long Term - This country lacks a clear vision of how it wishes to go about probing the mysteries of this planet's inner space and a plan to carry it out. The creation of a National Deep Submergence Facility at WHOI approximately twenty years ago, and a tripartite agency agreement to make it happen, was an important step in giving this country a presence in the abyss. It is now time to develop a deep submergence strategy and implementation plan that will carry this country forward into the 21st century. This must be done if this country is to remain a leader in the exploration of the abyss.

**CHALLENGE FOR THE FUTURE:** I submit that, given the global scale of the ocean's inner space, the compelling nature of the scientific questions to be answered, and the societal gains to be harvested from deep submergence science, we need nothing short of a national commitment to this planet's last and best frontier. The scientific opportunities and the societal rewards are immense. Such a program should, however, be developed with care and thought involving representatives from industry, the research community, federal agencies and policy makers. To insure success, the emphasis would have to be on peer-reviewed science.

**TESTIMONY**

to the

**SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO  
AND THE OUTER CONTINENTAL SHELF**

of the

**COMMITTEE ON MERCHANT MARINE AND FISHERIES**

**UNITED STATES HOUSE OF REPRESENTATIVES**

on the

**NATIONAL UNDERSEA RESEARCH PROGRAM (NURP)**

by

**ROBERT I. WICKLUND**

*CARIBBEAN MARINE RESEARCH CENTER*  
**NATIONAL UNDERSEA RESEARCH PROGRAM**  
4905 Indian Draft Road  
Covington, VA 24426  
(703) 965-3990

2:00 pm

March 24, 1993

Thank you, Mr. Chairman:

It is a great honor to appear before the House Subcommittee on Oceanography, Gulf of Mexico and the Outer Continental Shelf of the Merchant Marine and Fisheries Committee. I find it particularly rewarding to be able to state my views on undersea research having been in the business for 31 years.

I would first like to offer some background information on undersea research through the years, its contribution to our knowledge of the oceans and large lakes of the world, and to our ultimate ability to properly protect, manage and utilize their resources.

In 1951 an eminent marine biologist, Dr. Lionel Walford, reported in *Scientific American* his studies on the deep ocean scattering layer of marine organisms in the Pacific. After towing a net for several hours and retrieving it aboard his research vessel, he wrote:

"What happens in the depth when a plankton net drops at the end of a wire ... is there any order of things down there or are the components of the plankton only randomly distributed ... We can only assume that as the net is hauled through the various swarms of animals, it takes from among them those so unwary, so inagile or simply so unfortunate as to get into it. When it is at last emptied into a pan on deck, how can anyone reconstruct from that chaotic jumble of organisms the pattern of life below ? How can anyone know ..."

These were the musings of a man with the foresight to know that there was a missing element in his and other ocean research, which relied only on blindly capturing organisms or measuring the depths from the deck of a ship.

By the early '60s the use of submersibles and diving was in the development stage. Anticipation was high that the ability to explore and conduct research from an undersea vantage point was going to pay off in large dividends. Large companies such as Grumman, Lockheed and General Dynamics built submersibles. Even General Mills had a submersible on the drawing board. The Navy undersea habitat *Sealab* promised that scientists were going to live for months and conduct research in deep water on the outer Continental Shelf. The only dive to the deepest part of the ocean was made in the *Trieste* during this period. Unfortunately, at least from the standpoint of the ocean community and in my opinion the country, the feverous race for space was also underway. Even though the United States was in relatively good economic times, we simply could not invest heavily in undersea exploration and at the same time compete with the former Soviets for space. For lack of an ocean *Sputnik*, undersea research was left in the dust by the space program.

In 1970, following the famous Stratton Commission report, the U.S. reorganized its oceans and atmospheric programs and founded the National Oceanic and Atmospheric Administration (NOAA), including a small undersea research component called the Manned Undersea Science and Technology (MUS&T) program. MUST served through much of the '70s with varying success, but its most valuable contribution was in the firsthand experience with undersea

research given many scientists and policymakers. My own involvement during these years included instituting a government diving science program at the Sandy Hook Marine Laboratory in New Jersey, and from 1971 through 1975 directing the Hydro-Lab Program that allowed 343 scientists to live and work on the bottom of the ocean for one-week periods.

The old MUST office was reorganized in 1980 and became the National Undersea Research Program (NURP) with four regional centers in Hawaii, North Carolina, California and the Virgin Islands. Connecticut was added in 1984, my own Center in Florida and the Caribbean in 1986, Alaska in 1990 and New Jersey in 1991.

With the closing of the Virgin Islands NURP Center and the move of the West Coast (California) Center to Alaska, there are now a total of six with wide capabilities in undersea research.

During NURP's tenure the quality of research and researchers has grown steadily, the science having evolved from mainly observational, natural-history type projects to sophisticated studies and experimentation. Over 1000 papers by NURP-supported projects have been published in the past nine years, covering such subjects as fisheries recruitment, deepsea benthic organisms, health of coral reefs, deepsea dumpsites, marine geology, effects of ultraviolet light on marine organisms, habitat characteristics and enhancement of marine organisms, to name a few. In 1992 alone, NURP supported research that involved over 8,000 scuba/nitrox dives, 706 occupied submersible dives and 442 ROV dives, serving over 1300 scientists from 336 institutions.

The overall stated goals of NURP are aimed at increasing our knowledge of the structure and processes of the global ocean in support of NOAA's undersea mission:

*To develop an understanding of how physical, chemical, biological and geological processes in the oceans and large lakes govern environments important to the nation in order to improve the wise use of our marine and lacustrine resources as well as predict change in those environments, either natural or human induced.*

The bulk of research and supporting field operations occur at specific selected sites. Because this research is process-oriented, the field site is usually representative of a geologic, oceanographic or ecologic "region." Research in these regions is managed by one or more of the National Undersea Research Centers (NURCs) that provide access to undersea systems by the research community, especially academic scientists. The largest number of NURP-supported investigators is from universities, but a significant number come from government (local, state and federal agencies) and non-academic institutes. To date, more than 3,000 individual research scientists have been supported by NURP to work on the seafloor and in the water column. Further, because NURP encourages investigators to have support for their research from other sources, NURP funds are leveraged each year to a level equal to or greater than its appropriation. Research themes that not only address NOAA's stated mission, but are also of interest to other agencies, include three areas of particular concern to NOAA: global change, recruitment of marine organisms and coastal oceanic processes. Projects that advance undersea technology or that involve hyperbaric (diving) physiology in humans are also supported by NURP.

In addition to NOAA's research mission, each Center has developed its own research agenda that responds to regional needs in its geographic region of responsibility. It would be impossible to describe here the vast array of research accomplished or being conducted by the NURP Centers, but the list is impressive and NURP is taking the lead in such research projects as: studies of the 106-mile dumpsite in the New York Bight, inspection of deep oil and gas wells off the southeast coast and in the Gulf of Mexico, monitoring of the health of coral reefs, *in situ* fisheries research aimed at the management of important food species, studies of anthropogenic effects on the Great Lakes and studies of deepsea geologic processes. Studies at my own Center include the development of a low-cost, highly accurate technique for monitoring subsurface UV(B) using pure DNA as a solar dosimeter. This allows the accurate prediction of damage to DNA by UV(B) at any depth. Four years of study of the Queen conch are leading toward our ability to enhance stocks in such places as the Florida Keys. This is important considering that the International Commission on Trade in Endangered Species has recently declared the Queen conch endangered. Studies on the recruitment processes of grouper, lobster and conch, as well as other marine species, will eventually allow us to establish principles of predicting year-class strengths essential to the management of the species based on sound scientific research.

Mr. Chairman, NURP has matured over the years in terms of scientific capability, but is still considered the stepchild of the Administration. As you know, if it were not for Congress, NURP would have been gone long ago. Indeed, during the past ten years the Administration has zeroed out NURP and Congress has appropriated the money to keep it alive and even allow it to prosper. The Nation does not deserve an "invisible" National undersea program. We put tremendous efforts and funding into the space program and basically ignored the importance of the oceans and our own ability to explore its resources. As a National program NURP should be supported not only by the Administration but with funding that reflects the needs of the Nation to lead the world in undersea research and exploration. We are already falling far behind the Japanese in this respect. In 1986, I served on an *ad hoc* undersea research study panel that produced the report "New Directions for NOAA's Undersea Research Program" in which we recommended that NURP's funding should be at \$47,800,000 in 1993, including \$25,000,000 for construction of a 6-7000-meter submersible. The remaining operating budget would increase to \$40,800,000 by the year 2000 with the construction, between 1997 and 1999, of a 10,000-meter submersible with a \$75,000,000 price tag. This would give us the capability to go to the deepest region of the oceans.

The "National Undersea Research Program Act of 1992," introduced by the Merchant Marine and Fisheries Committee and passed by the House last Congress, goes part of the way toward achieving some of the authorization recommendations made by the undersea panel. The bill authorized \$20,000,000 for FY1993 and \$28,000,000 for FY1997. I will discuss the rest of NURP Act further into this testimony.

As I mentioned before, NURP has not had the support of the previous Administration and this past year has taken a 7% cut. The breakdown of the FY1993 budget for NURP is as follows:

North Carolina	\$3,570,000
Hawaii	\$3,072,000
Connecticut	\$2,478,220

Caribbean	\$2,009,500
New Jersey	\$1,739,000
Alaska	\$1,000,000
Centers Total	\$13,868,500
National Office	\$2,129,500
<b>Program Total</b>	<b>\$15,998,000</b>

In addition, the Appropriations Committee allowed for some earmarking and protected each Center from receiving any less than 93% of its previous year's budget. This, coupled with an additional NOAA internal tax, reduced the National Office budget by 27%. In addition to administration, the National Office is responsible for diving safety studies (the only part of NURP that is presently mandated by law), support of the deep-diving submersible ALVIN and technology development.

Mr. Chairman, the Centers and hundreds of scientists applaud the efforts of the House of Representatives, and particularly this Committee and Subcommittee, to finally legitimize this Nation's undersea program. Were it not for some misunderstanding in the Senate last Congress, the "National Undersea Research Program Act of 1992" would now be law. We believe a new bill introduced this year and passed by both Houses of Congress will go a long way to help ensure the Program's inclusion in future budgets prepared by the Administration. This is absolutely essential to assure stability in the Program's and each individual Center's research projects. Of course, having an authorization number does not guarantee that the White House is going to include the Program in the next budget, but it does send a message that undersea research is here to stay.

There is one major point that I would like to be recorded concerning the draft bill based on the 1992 Act. Subsections (e)(3) and (f) of Section 106 address the establishment of a new Center at a different institution and the merger of Centers if believed to be necessary by the Secretary. Although the intent of this particular language is admirable, it puts the Centers in jeopardy of being merged or eliminated based on politics rather than sound scientific principles. It is too easy for a biased review committee, for instance, to make recommendations to establish or merge a Center that is in their favor, either geographically or programmatically. I would suggest eliminating this language or providing very specific and solid guidelines in a new bill that would give little reason for misinterpretation by the Undersecretary, Committee or the General Counsel. With the Committee's permission I would like to develop and submit, in cooperation with the other Center directors, additional language that would set guidelines for your consideration.

Mr. Chairman, I will close by complimenting both Houses of Congress for their foresight and support of undersea research over the years. Without the support of Congress we would now be conducting our work through a glass-bottom bucket. Thank you.

QUESTIONS AND ANSWERS FOR DR. NED OSTENSO - NOAA

1) Do you feel that the \$16 million appropriated last year for NURP is adequate to support the undersea research needs of the U.S. civilian undersea research community? How much more in additional funding do you feel the Program justifies?

Answer: The funds appropriated by the Congress last year were used to support a wide variety of research projects at six National Undersea Research Centers and two missions of the ALVIN research submersible under a multi-agency agreement. Those research projects addressed NOAA goals in: global change, fisheries management, living and non-living marine resources, biological productivity and recruitment, habitat assessment, and anthropogenically-induced pollution resulting from dumping of sewage sludge into the ocean. Projects in the fields normally supported by the National Office in diving safety and physiology and undersea technology could not be supported due to restrictions placed on the program by Appropriations Committee language.

2) You mention in your testimony that while individual proposals are approved through a peer review process, the funding that supports these proposals is allocated to Centers in a non-competitive manner.

a) Describe the difference between how projects were funded in 1993 with specific funding levels earmarked for centers and how funding was allocated in previous years.

Answer: Funding of individual research proposals in 1993 was implemented through a similar peer review process to that used in the past. Panels of expert scientists were convened at each center to review projects for their scientific merit, operational feasibility, and relevance to NOAA goals. Panel recommendations were used to select the most meritorious projects that could be included in the centers' omnibus proposals. Because the funding level for all centers was earmarked in Appropriations Committee language, the number and type of proposals that were supported was determined by the funds earmarked for each center. Because the amount for each Center was pre-determined, there was no flexibility to allow for funding of the highest priority research. As a result, some expensive submersible-based programs were not supported at one center while less expensive SCUBA projects with lower panel ratings were supported. Several projects of national significance (and not geographically specific) that the National Office traditionally supports in the areas of diving safety and physiology, undersea technology, and

deep submergence research could not be supported this year due to inequity in the way budget reductions were allocated in the earmark.

b) Does this create a situation where good proposals are left undone while other less deserving ones get funded simply because of the region in which they are proposed?

Answer: Yes. It removes the ability of the National Office program managers to allocate funds according to proposal quality identified in the peer review process. Some centers had to drastically reduce support or decline to support proposals with high panel rankings while other centers were allowed to support proposals with much lower rankings. This process could be enhanced by concordant reviews and ratings of proposals but that requires changing calendars, not possible with a heavily partitioned allocation.

c) Does NOAA make any effort to ensure that NURP funding is allocated in a manner that fairly meets the research needs of each region of the country?

Answer: Yes. The regions assigned to the six NURP centers include the coastal zone of every region of the country. Each center produces a yearly request for proposals (including a statement of research needs incorporating guidance developed by the National Office) that is widely distributed to institutions and researchers both within and beyond the specific region of the centers' responsibility. The recommendation to the centers by the National Office is to support the best proposals identified in the peer review process without any regional bias.

3) As you may recall, last year the House passed a bill officially authorizing NURP and designating regions for undersea research.

a) By using the designations from the bill, and using the FY 1993 appropriation of \$16 million, could you break down the amount of money spent on research in each region? Specifically, how much was used for undersea research in the Gulf of Mexico?

Answer: The table below lists the approximate level of support for projects in the 10 regions listed in the bill. In developing this table, the administrative costs and the cost of maintaining operations support staff are prorated based on the relative costs for science projects in each region. This reporting method is necessary due to the difficulty of assigning specific "fixed" administrative and operations costs to specific regional research projects in the cases where a center has responsibility for more than one region.

North Atlantic Region	\$ 1,816,700
Mid-Atlantic Region	\$ 1,729,800
South Atlantic Region	\$ 2,514,700
Gulf of Mexico Region	\$ 1,055,300
Great Lakes Region	\$ 661,300
Southern Pacific Region	\$ 537,800
Northern Pacific Region	\$ 409,300
Western Pacific Region	\$ 3,072,000
Alaskan Region	\$ 52,400
Caribbean Region	\$ 2,009,500

b) Do you feel that is an adequate and equitable amount, compared to other regions?

Answer: Yes. The average support for the ten regions is \$1,386,000. The Gulf of Mexico region received \$1,055,300 which is only slightly below the average. The peer review process is not expected to identify an equivalent support-level for each region in each funding cycle but to fund the highest ranked proposals. The disparity in funding impacted other regions to a greater extent than the Gulf of Mexico Region.

4) Do you feel that more proposals for undersea research are being submitted from institutions and individuals near existing NURP Centers because of the visibility that a physical Center gives to the Program? Would creating a network of Centers in a more geographically balanced manner than currently exists, create an increase in the number of research proposals from other regions of the country?

Answer: No. NURP centers were established at institutions and within regions where a large number of marine scientists are on staff and respond to the call for proposals. The centers, however, widely distribute their annual call for proposals to ensure that scientists throughout their region of responsibility have an equal opportunity to propose projects. Investigators from all parts of the country are eligible to compete for research funds in any region.

5) Does Congress need to establish NURP by statute, in a manner similar to last Congress's H.R. 3247?

Answer: No. NOAA can administer the program without further legislation.

6) How much money or what percentage of NOAA (NURP) funds is spent on research outside the U.S. exclusive economic zone?

Answer: In FY 1993 approximately 15% of NURP (center and National Office) funds will be used to support projects outside the U.S. EEZ. Approximately 15% of those funds were allocated by the National Office for ALVIN support.

7) In your testimony you mention that the National office annually updates its guidelines for identifying high priority research and technology themes. Could you describe in detail the process and list some of the factors which are weighed in determining guidelines for priorities?

Answer: A combination of factors are used to update the annual guidelines. Suggestions from the centers, peer review panels, National Office staff, interagency workshops, and NOAA goals are all used to identify the science and technology priorities. In FY 1993, funds permitting, NURP plans to have several workshops involving academic and NOAA scientists in order to continue to identify the most important and highest priority research themes for undersea research and technology.

8) You mention in your testimony that one of your primary missions is to develop new techniques and technologies in support of Section 21(a) of the Outer Continental Shelf Lands Act of 1978. Does NURP fund annual research in support of this mission? If so, what percentage of NURP funds are allocated to this mission, and what has historically been the geographical distribution of these funds?

Answer: NURP supported Diving Safety & Physiology studies through the UNCW Center and the National Office until 1992 when UNCW dropped their support. In descending order, the funds have gone to North Carolina, Maryland, New York, Rhode Island, Pennsylvania, and Florida.

	FY89	FY90	FY91	FY92	FY93
NURC-UNCW	\$ 73,200	\$ 181,700	\$ 390,700	\$ 0	\$ 0
National Of.	309,100	346,300	252,600	183,000	*

\* Not yet completed.

The decline in support after FY 1991 at both UNCW and the National Office was due to diminishing resources resulting from Congressional earmarking of funds for specific centers without a concomitant increase in the NURP budget. In FY 1993 NURP expects to support a few of the projects approved and continuing from previous years.

9) What percentage of overall NURP funds are used for administration of the Program and what percentage is dedicated to

research? How does this break down for each of the Centers and for the National office? Do we currently have a good balance in the use of funds between administration and research?

Answer: The following table summarizes the breakdown between administration, operations, and science support for the six Centers and the National Office for FY 1993.

	UNCW	UCAP	HURL	CMRC	UAF	NYB	OUR*	OUR**
Admin.	11%	21%	39%	26%	43%	19%	57%	8%
Ops.	50%	73%	49%	35%	34%	36%	33%	4%
Res.	39%	6%	12%	39%	22%	45%	10%	88%

Note: Some administrative expenses are allocated to operations.

\*Percentages for the National Office (OUR) are only for those funds that do not go to the Centers. \*\*Percentages for total OUR funds (Research is for Center and National Office projects).

The greatest expense at the Centers is the cost of providing operational support for field programs. Quality operations support is absolutely necessary for assuring safety and effectiveness in the operations and facilities leasing. NURP's unblemished record of safety is the direct result of qualified and experienced staff and adherence to established procedures.

The percentage of administrative costs vary at the Centers. The administrative costs at the University of Alaska are high on a percentage basis because there is a minimum staff required to operate a Center and their budget is the lowest. For a similar reason, the percentage at the University of North Carolina-Wilmington is low because they have the largest budget.

10) Should all of the regions be funded equitably through the Centers, with the National office funding research in critical areas that exceed individual Center funding levels? That is, should all regions receive equal funding regardless of Center locations?

Answer: No. All regions should not receive equal funding. Regions are not of equal geographic size nor do they all have the same, or in some case even similar problems. Those regions that have deeper water require the use of expensive submersibles while regions in shallow water can use less expensive SCUBA techniques. Therefore it is not appropriate to fund them all equally and thereby reduce the flexibility of the program to respond to research needs. Also activities supported by the National Office are directed toward those issues that are not specific to a geographic region of a Center.

11) Do you believe that there is overlap or duplication in the undersea research activities funded by NURP, Sea Grant, the National Science Foundation and the Navy? How can we better coordinate undersea research?

Answer: Close coordination by the program managers at each agency eliminates overlap in the activities funded. Also, the peer review process is useful in identifying, and hence precluding, duplication.



UNITED STATES DEPARTMENT OF COMMERCE  
 National Oceanic and Atmospheric Administration  
 Silver Spring, MD 20910  
 OFFICE OF OCEANIC AND ATMOSPHERIC RESEARCH

MAY 11 1993

The Honorable Curt Weldon  
 Ranking Minority Member  
 Subcommittee on Oceanography,  
 Gulf of Mexico, and the  
 Outer Continental Shelf  
 Committee on Merchant Marine and Fisheries  
 House of Representatives  
 Washington, D.C. 20515-6230

Dear Congressman Weldon:

Thank you for your letter regarding my testimony  
 on the National Undersea Research Program before the  
 Subcommittee on Oceanography, Gulf of Mexico, and the  
 Outer Continental Shelf.

In your letter regarding the National Undersea  
 Research Program there were further questions submitted  
 by you and the Subcommittee. I am pleased to answer  
 these questions. The responses are enclosed.

Your interest in the National Undersea Research  
 Program is appreciated.

Sincerely,

A handwritten signature in black ink, appearing to read "Ned A. Ostenson".

Ned A. Ostenson  
 Assistant Administrator

Enclosure



FOR DR. NED OSTENSO OF NOAA

Question: Dr. Osteno, at last years October 15 hearing, you testified that NURP should be supported through user charges rather than block federal grants. Do you still support this as an effective means to fund the NURP Program?

Answer: Due to the severe austerity of the NOAA budget NURP will not be able to provide facilities support that subsidizes research supported by other agencies. Funding will continue only for high-priority programs directly supported by the National Office in support of key NOAA missions in deep submergence and diving safety and physiology.

Question: How effectively do you feel the NURP program works with other research agencies (for example, the Sea Grant Program, civilian efforts conducted through universities, private industry and so forth). Is there a need to expand this partnership and if so, how would you suggest developing a more effective working relationship?

Answer: NURP works very effectively with the Sea Grant Program, universities, and other Federal agencies. Most of the NURP funds go to providing submersibles, remotely operated vehicles, an underwater habitat, or diving support for scientists who then seek grants from other programs within NOAA or other agencies in order to complete analyses of samples obtained from the NURP supported field program. In this way NURP funds are leveraged with those from other programs and agencies that provide co-funding to complete the total project. Coordination of NURP program directors with their counterparts in other programs assures an effective working relationship.

Question: In addition, would the development and implementation of a long-term comprehensive undersea research plan fall under the jurisdiction of NOAA? Are there any similar efforts currently underway to devise such a plan? Lastly, what other agencies would be involved in the development of a plan?

Answer: A long range comprehensive plan for undersea research would necessarily involve other Federal agencies such as NSF, U.S. Navy, and others. An example of the coordination of planning efforts is the recent workshop on deep submergence that was co-sponsored by NOAA, NSF, and the U.S. Navy that involved scientists from universities and Federal agencies who wished to identify the means to continue submersible activities in the deep ocean. NOAA also co-sponsored a workshop on undersea technology convened by the National Research Council. The report from that workshop is expected to identify the technological needs of the undersea research community in the next few decades.

Question: Dr. Osteno, as you know, in the 102nd Congress, the House passed H.R. 3247, the National Undersea Research Program. I would appreciate if you would comment on some of the specifics of this legislation.

To begin with, as you know, the purpose of NURP is to fund and conduct research within a number of priority research areas. In an effort to ensure that this is the case, there was a provision included in H.R. 3247 that directs the Under Secretary to appoint a Program Director to oversee the Office of Undersea Research and to administer NURP. Do you feel that a Program Director will serve to both enhance the NURP program as well as provide better coordination between the research centers?

Answer: Yes. The leadership of a Program Director is required to identify and manage the research efforts of the program. The director provides the regional centers with overall guidance as to NOAA goals and provides the focus for coordination of the research priorities at the centers.

Question: How adequately do you feel that the Program Director of the NURP program would work with the National Science Foundation and the Office of Naval Research in the development of multi-agency research proposals? Do you feel that this is necessary?

Answer: The NURP program Director would be expected to continue the excellent cooperative working relationship with the National Science Foundation and other agencies that exists at present.

Question: Secondly, as you may recall, this legislation also directs the Under Secretary to appoint a non-federally employed Science Advisor for a two-year term to advise the Program Director on the scientific needs of the Program. Do you see a need for such an advisor? Do you feel an advisor should be a non-federally employed scientist? If not, then why should an advisor be a federal scientist?

Answer: No, a Science Advisor is not needed. The National Office has adequate professional staff and review process to ensure that the research done with NURP is of high quality and addresses national and NOAA goals. The cost of a Science Advisor would be better spent on supporting research or at sea operations.

Question: Thirdly, this legislation also directed the Under Secretary to establish an independent steering committee to advise the Under Secretary and the Program Director on the operation of NURP; the need to revise the priority research areas; and the designation and operation of the National Undersea

Research Centers. Do you feel that such an advisory board is necessary to ensure that NURP is able to operate more effectively?

Answer: No. The National Office uses both peer and onsite reviewers. A Steering Committee would lay another level of bureaucracy on the program and restrict the efficiency of present operations. Furthermore, the cost of administering the Committee and its functions would use funds which could be better spent on research or at-sea operations.

Question: Do you feel that this steering committee should review the configuration of undersea regions every five years to determine if these regions are consistent with scientific needs?

Answer: No. The program has already established a mechanism of re-certification of each Center every six years. Additionally, the program has already established and implemented a procedure for creating a new Center when the need for that Center has been derived from the research community in that region. The procedure resulted in the establishment of the West Coast Center at the University of Alaska in 1990.

Question: Dr. Osteno, in your testimony, you state that the National Office annually updates its guidance for identifying high priority research and technology themes. What is your process for determining what constitutes priority research? Has NOAA developed criteria for this research? Based on this information, how is it then determined which programs to fund?

Answer: A combination of factors are used to update the annual guidelines. Suggestions from the centers, peer review panels, National Office staff, interagency workshops, and NOAA goals are all used to identify the science and technology priorities. In FY 1993, funds permitting, NURP plans to have several workshops involving academic and NOAA scientists in order to continue to identify the most important and highest priority research themes for undersea research and technology.

Answer:

Question: Of the NURP total budget for FY 1993 (\$15,998,000), how much is spent on research and how much is used purely for administrative costs. Why is this the breakdown?

Answer: The following table summarizes the breakdown between administration, operations, and science support for the six Centers and the National Office OUR) for FY 1993. Univ. N. Carolina-Wilmington (UNCW); Univ. Connecticut-Avery Point (UCAP);

Hawaii Undersea Research Lab (HURL); Caribbean Marine Res. Center (CMRC); Univ. of Alaska-Fairbanks (UAF); New York Bight at Rutgers Univ. (NYB).

	UNCW	UCAP	HURL	CMRC	UAF	NYB	OUR
Admin.	11%	21%	39%	26%	43%	19%	8%
Ops.	50%	73%	49%	35%	34%	36%	4%
Res.	39%	6%	12%	39%	22%	45%	88%

Note: Some administrative expenses are allocated to operations.

The greatest expense at the Centers is the cost of providing operational support for field programs. Quality operations support is absolutely necessary for assuring safety and effectiveness in the operations and facilities leasing. NURP's unblemished record of safety is the direct result of qualified and experienced staff and adherence to established procedures.

The percentage of administrative costs vary at the Centers. The administrative costs at the University of Alaska are high on a percentage basis because there is a minimum staff required to operate a Center and their budget is the lowest. For a similar reason, the percentage at the University of North Carolina-Wilmington is low because they have the largest budget.

Question: In the Economic Stimulus package that recently passed the House, were there monies included for NURP? If so, how much and what for?

Answer: The Economic Stimulus Package had \$1,500,000 for the purchase of Remotely Operated Vehicles.

Question: Finally, Dr. Ostenso, besides federal monies, does the NURP program receive any other private funds?

Answer: The only private funds received are those by the Perry Foundation which are in the form of facilities made available to the Caribbean Marine Research Center field station on Lee Stocking Island and the CMRC office in Lynchburg, Virginia. Some of the Universities where the regional centers are located contribute full or partial state-funded positions of center personnel as an "in kind" contribution.



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Sea Grant College Program

Texas A&M University • 1716 Briarcrest • Suite 702  
Bryan, Texas 77802

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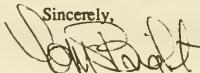
April 12, 1993

The Honorable Solomon P. Ortiz  
Chairman  
Subcommittee on Oceanography, Gulf of Mexico,  
and the Outer Continental Shelf  
U.S. House of Representatives  
Committee on Merchant Marine and Fisheries  
Room 1334, Longworth House Office Building  
Washington, D.C. 20515-6230

Dear Congressman Ortiz:

It was my pleasure to testify before your subcommittee on Oceanography, Gulf of Mexico and Outer Continental Shelf concerning the National Undersea Research Program (NURP) on March 24. Attached are my responses to the written questions addressed to my by the subcommittee at the conclusion of the hearing.

If I can be of further assistance please do not hesitate to contact me at (409)845-3854 or fax (409)845-7525.

Sincerely,  


Thomas J. Bright  
Director/Professor

TJB/cll

**Answers to Questions Directed to Dr. Thomas Bright  
by the Subcommittee on Oceanography, Gulf of Mexico and  
Outer Continental Shelf during the Hearing on the National Undersea Research Program (NURP)  
on March 24, 1993**

1. The research community tends to live within the bounds prescribed by the funds available and to make best use of resources. Research support needs far exceed those which are available and, in my opinion, federal appropriations for marine and environmental research are inadequate across the board. This country's leadership in undersea research is questionable, in part due to limited resources. If we are to realize our technical and intellectual potential, and compete with Japan, Russia, France and other ground-breakers we definitely need an infusion of federal support. Also, if we are to rectify the imbalance in NURP regional coverage within our own country we must have additional funding to support at least two new NURP centers.
2. The NURP Center at the University of North Carolina has an exceptionally long coastline to cover and a large number of marine research institutions as constituents. Their territory is the Southeast U.S. region, including the South Atlantic Bight, Florida Keys, and the entire Gulf of Mexico.

Within their resources the center has provided balanced services to the region's research community. They simply do not have enough funding to cover the needs, and their regional responsibilities are excessive compared to other NURP centers. Establishment of a NURP center for the Gulf of Mexico, with new appropriations, would allow sharper regional focus for both programs and provide the added funding necessary to enhance undersea research throughout the Southeast and the Gulf.
3. The North Carolina NURP center's research grant peer review process is fair and gives Gulf of Mexico proposals due consideration. However, resources are limited and the ability of NURP to fund only a few projects in the Gulf discourages researchers from seeking NURP support.
4. There is no question in my mind that geographical proximity of a funding agency encourages submission of proposals. A NURP center in the Gulf would lead to greater awareness in the region of NURP services, and a perception that chances for successful proposals are increased. This will result in more and better proposals, and a greater level of undersea research activity in both the Gulf and the Southeast.
5. Congressional authorization for NURP is overdue. The program has proven its usefulness and demonstrated its future potential for enhancing our nation's exploration and study of the sea and its resources.
6. NURP centers should receive funding in proportion to the regions research needs and the magnitude and quality of the undersea research community in each region.

7. The United States is rapidly losing its lead in deep submergence research capability to the French, Japanese and Russians. The very limited deep submergence services available to U.S. researchers results in exclusion of the majority of potential research users.
8. There is no overlap or duplication in undersea research activities funded by NURP, Sea Grant, NSF or the NAVY. NURP, by its nature, works with the other organizations in a partnership to enhance undersea research.

9. A great need exists to assess the environmental, fisheries, recreational and socioeconomic impact of the presence, and ultimate removal, of the thousands of offshore oil and gas platforms in the Gulf of Mexico. States, industry and the federal government are cooperating in programs to convert some of these platforms to artificial reefs. Generally favored by recreational fishermen and divers, the artificial reef program is opposed by the shrimp fishing industry, which uses bottom trawls. The dynamic process of rig removal itself is thought to have impacts on endangered species and local fishery populations.

Research relating to the assessment of environmental and fishery consequences of manipulation of offshore platforms as habitat requires attention. NURP could play a key role in such an effort in the Gulf of Mexico, which has the largest concentration of such platforms in the world.

The undersea research community in the Gulf of Mexico includes numerous scientists who would be able and willing to address such specific questions as: do platforms and artificial structures provide new habitat which actually increases benthic and fishery populations, or do the structures simply attract biota from natural reefs; do small artificial reefs made of only one platform significantly enhance local fishery populations or does it require that an artificial reef be constructed of many discarded platforms to provide significant habitat enhancement.

10. I suggest that the committee could generate a favorable report on NURP authorization, establish additional NURP centers in the Gulf of Mexico and on the Pacific coast, and increase authorized annual funding limits by at least \$10 million to support the new centers and enhance the existing effort.



## Sea Grant College Program

Texas A&M University • 1716 Briarcrest • Suite 702  
Bryan, Texas 77802

April 13, 1993

The Honorable Curt Weldon  
Ranking Minority Member  
U.S. House of Representatives  
Committee on Merchant Marine and Fisheries  
Subcommittee on Oceanography, Gulf of Mexico and  
the Outer Continental Shelf  
Room 1334, Longworth House Office Building  
Washington, D.C. 20515-6230

Dear Congressman Weldon:

I am pleased to respond to the questions posed to me by you following my testimony before the Subcommittee on Oceanography, Gulf of Mexico and the Outer Continental Shelf during the Hearing on the National Undersea Research Program on March 24.

It is increasingly essential that federal and state marine research programs in the Gulf coordinate their efforts to address the growing information needs identified by those charged with the responsibility of managing and assuring the health of the Gulf's marine ecosystem and resources. Programmatic coordination efforts in the Gulf are more common now than in the past. NURP is a good example insofar as its objective is to provide field logistic support for research projects funded primarily by other agencies. Other examples of collaboration at the program level include the EPA Gulf of Mexico Program, which coordinates its activities with virtually all state and federal entities engaged in regional marine management and research. The Minerals Management Service LATEX physical oceanography project has combined efforts with the NOAA Coastal Ocean Program NECOP study to increase research productivity in their study of physical-chemical-biological processes off the Louisiana and Texas coasts. The Sea Grant Programs continually seek input from state and federal agencies concerning perceived research needs.

The trend toward programmatic coordination of research in the Gulf is in the correct direction, but has a long way to go. One of the greatest deficiencies at present is the lack of a Gulf-wide research plan specifying and prioritizing environmental research needs, which would serve as a guidance document for the agencies. In fact, such a plan is in preparation through the joint efforts of Sea Grant, the EPA Gulf of Mexico Program, and the Regional Marine Research Board, which has appointees from all the Governors offices, EPA and NOAA.

Associated with this is the immediate need for a current, and continually updated, descriptive catalog of marine research projects in the Gulf. If this existed, it would be a "best-seller" within the research community, and it would be a key element in facilitating cooperative research, increasing research efficiency, and reducing redundancy.

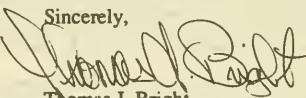
Considering the independent and fragmented nature of marine research programs in the Gulf, I feel that coordination of their efforts must be voluntary, and can be achieved in part by providing information such as that which would be assembled in the above documents. No single agency could coordinate by dictum, however, existing activities such as the EPA Gulf of Mexico Program, Regional Marine Research Program, Sea Grant, and the Southern Association of Marine Laboratories could, and should, engage in efforts to accomplish "Coordination by Communication".

To answer your question relating to oil and gas platforms, a great need exists to assess the environmental, fisheries, recreational and socioeconomic impact of the presence, and ultimate removal, of the thousands of offshore oil and gas platforms in the Gulf of Mexico. States, industry and the federal government are cooperating in programs to convert some of these platforms to artificial reefs. Generally favored by recreational fishermen and divers, the artificial reef program is opposed by the shrimp fishing industry, which uses bottom trawls. The dynamic process of rig removal itself is thought to have impacts on endangered species and local fishery populations.

Research relating to the assessment of environmental and fishery consequences, and effectiveness, of manipulation of offshore platforms as habitat requires attention. The undersea research community in the Gulf of Mexico includes numerous scientists who would be able and willing to address such specific questions as: do platforms and artificial structures provide new habitat which actually increases benthic and fishery populations, or do the structures simply attract biota from natural reefs; do small artificial reefs made of only one platform significantly enhance local fishery populations or does it require that an artificial reef be constructed of many discarded platforms to provide significant habitat enhancement.

NURP could play a key role in such an effort in the Gulf of Mexico, which has the largest concentration of offshore platforms in the world. One structure is even within the boundary of the newly-designated Flower Garden National Marine Sanctuary, 100 miles offshore from Texas and Louisiana. NURP logistics for undersea research relating to platform and artificial reef issues should be employed in support of projects funded by the Texas Parks and Wildlife Department, the NOAA National Marine Sanctuary Program, the U.S. Minerals Management Service, National Marine Fisheries Service, and the regional Sea Grant Programs. This type of cooperation among state and federal agencies and the academic research community attracts additional support from private foundations and industry. Such has been the case with the collaborative Flower Garden monitoring study, which is jointly sponsored by the National Marine Sanctuary Program, Minerals Management Service, Sea Grant, Mobil, Texaco and non-profit foundations. NURP services for these studies will become essential, and can greatly enhance the quality and extent of the field data collection process.

Sincerely,



Thomas J. Bright  
Director

TJB/cll

RESPONSES TO QUESTIONS BASED ON THE MARCH 24, 1993  
SUBCOMMITTEE ON OCEANOGRAPHY, GULF OF MEXICO AND OUTER  
CONTINENTAL SHELF HEARING ON THE NATIONAL UNDERSEA RESEARCH  
PROGRAM (NURP).

SUBMITTED BY DR. SYLVIA A. EARLE, FOUNDER AND DIRECTOR, DEEP  
OCEAN ENGINEERING, INC. AND FORMER CHIEF SCIENTIST, NOAA

QUESTION 1. Do you feel that the \$16 million appropriated last year for NURP is adequate to support the undersea research needs of the U. S. civilian research community? How much more in additional funding do you feel the program justifies?

RESPONSE

The \$16 million appropriated last year was enough to keep NURP's heart beating, but is far from adequate to support undersea research needs of the U. S. civilian research community.

As to how much additional funding can be justified, I believe the investment made in supporting technology, facilities and research in aerospace development provides a good model. If the investment made for the reach skyward in the past two decades has been justified (and I believe it has), there are reasons equally good, perhaps better, for a comparable investment in gaining effective access to the sea from the surface to the greatest depths, seven miles down.

In the near future, doubling the support -- as proposed in the legislation that failed to gain approval last year -- would be a good start.

QUESTION 2. Do you believe that the Program's current research grant peer review and distribution process is a fair one?

RESPONSE

Given the present size of the program, it is fine.

QUESTION 3. Should all of the regions be funded equitably through the centers with the National Office funding research in critical areas that exceed center funding levels?

RESPONSE

Equal funding for each center is not appropriate (their needs vary ), but equitable in the sense of "fair" or "just" for each center makes sense, complemented by National Office support for cross-cutting programs.

QUESTION 4. In your opinion, is there adequate deep submergence capability available to civilian researchers?

RESPONSE

Deep submergence capability available to civilian researchers is far from adequate if this nation intends to have a leadership role with respect to ocean technology, ocean research, and even ocean policy matters — and if the nation intends to gain effective understanding of basic matters such as the nature of most of the ocean's physical, chemical and biological environment, of global ocean processes, of the underlying forces that help drive global change, of the special nature of life in the deep sea, and so on. If we wish to remain incapable of gaining access to most of the planet's usable space, if it is acceptable that we remain largely ignorant of the environment that hosts most of the diversity and biomass of life on earth, and if we are content to nibble around the edges of earth's dominant feature without having the capability of actually taking ourselves and our instrumentation there, and if it is considered appropriate for irrepressible U. S. researchers and entrepreneurs who decide they MUST have access to turn to other nations for necessary technology and research support — then, yes, present capability is adequate.

QUESTION 5. Generally, do you feel that more proposals for undersea research are being submitted from institutions and individuals near existing NURP Centers because of the visibility that a physical Center gives to the Program?

Would creating a network of Centers in a more geographically balanced manner than currently exists, create an increase in the number of research proposals from other regions of the country?

**RESPONSE.**

It appears that applications come from all over the country to each of the existing Centers and are not skewed strongly in the direction of local researchers. I understand that all receive many more good applications than can be supported with existing funding.

Creating Centers to achieve better balanced geographical representation of proposals may not be justified — and should not overshadow the more fundamental need for having adequate funding for good programs that already exist.

The justification for establishing new Centers should include consideration of various factors, including geographical proximity to areas of special research interest.

QUESTION 6. Dr. Earle, you mentioned that private industry has recognized the need for undersea technology especially with the development of the offshore oil and gas industry. Do you believe that the current NURP funding is adequate for undersea research aimed at areas most greatly impacted by oil and gas development?

**RESPONSE.**

No. Much more could and should be done through NURP Centers to implement baseline documentation of areas where oil and gas development is proposed, and to help assess impacts.

QUESTION 7. Dr. Bright mentioned in his testimony that NURP funding should not come at the expense of underwater or undersea research conducted by other entities such as the National Science Foundation or Sea Grant. From your experience in the private sector and formerly with the federal government, do you believe there is overlap or duplication in the research activities funded by NURP, Sea Grant, the National Science Foundation, the Navy or any other programs that may be out there?

**RESPONSE.**

Not much. Some research, such as that conducted from the submersible ALVIN, is supported by funds that are derived from NURP, NSF, and the Navy operating cooperatively. Some projects presently funded by NURP may have complementary support from other sources. However, NURP maintains special research facilities that do not overlap or duplicate activities funded by other agencies such as the submersible program in Hawaii and – in theory – the Aquarius underwater laboratory that is under the aegis of the NURP center at the University of North Carolina.

**QUESTION 8.** How would you compare the value of undersea ocean research to satellite and surface ocean research?

**RESPONSE.**

All are valuable, but there is presently far greater appreciation for research conducted from the surface, either from high above or at sea level, than there is for research conducted IN the ocean. In a small way, it is comparable to gaining insight concerning a forest or city from aerial overviews complemented by knowledge gained by lowering instruments from the treetops or the roofs of the skyscrapers, without venturing directly into the forest or city. It is well to keep in mind that the average depth of the sea is about 4,000 meters, and the maximum 11,000 meters.

The value of satellite and surface ocean research can be greatly enhanced when complemented by knowledge gained from conducting research within the ocean itself, especially concerning detailed insight about the physical, chemical and biological nature of the sea. Satellites provide valuable data concerning areas where photosynthesis appears to be taking place, but is not helpful in determining what kinds of organisms are involved, nor how deep such activity may be occurring. Some complementary information can be gained from instruments operated from surface ships, but there are limits to what can be done.

It is extremely difficult to study animal behavior from a satellite or surface ship or even to discover from such distant platforms what kinds of creatures live in the ocean. Nets dragged from ships yield some insight concerning the presence of certain kinds of organisms, but information thus gained can be enormously distorted and misleading.

**QUESTION 9.** Is there a need for additional submersible platforms for research? If so, how great is the need, where are the critical areas of need, and how should they be addressed? Is NURP the correct venue for funding these platforms? Would the NOAA fleet or other funding sources be more appropriate?

**RESPONSE.**

There is an urgent need for better support for existing platforms, such as the ALVIN, and for the construction and support for additional facilities, both for access to nearshore

environments within the EEZ, and for the deep sea, to full ocean depth. There is a need IF this nation is serious about understanding, using, and conserving ocean resources, IF this nation is serious about understanding global change issues, IF there is a desire to maintain a leadership position with respect to ocean issues generally.

NURP is the logical organization to coordinate an expanded program of submersible activity, in cooperation with institutions that already have a proven track record of performance — such as Woods Hole Oceanographic Institution. If a serious effort is made to implement new platforms, a serious commitment must be made to provide ongoing support to NURP.. If NURP continues to be funded in the hap-hazard way, that has characterized the past decade, it would be most inappropriate for NURP to be given responsibility for major new facilities.

**QUESTION 10.** Do you believe that there is overlap or duplication in the undersea research activities funded by NURP, Sea Grant and the Navy? How can we better coordinate undersea research?

**RESPONSE.**

As indicated above, there is already some cooperation, but not much overlap or duplication. If the time comes when there is serious development of federally supported civilian undersea research activity, it would be highly beneficial to encourage coordination and expanded cooperation among federal agencies — and relevant private institutions.

**QUESTION 11.** What is the danger of allowing Japan to take the world leadership role in undersea technology and research? What can the U.S. do to recapture the momentum in this area (and) re-emerge as the world leader in this critical area of research?

**RESPONSE.**

Japan's present leadership in undersea technology stems from an awareness of the economic, environmental and strategic importance of the oceans. Why should this nation's interest be less?

Presently, Japan supports substantial ocean research and development because it is believed to be in that nation's best interest to do so. Is it not also in the best interests of the U.S. to gain real working access to full ocean depth, thereby putting all of the living ecosystems of the world within reach — instead of ignoring vast areas, or leaving them to the discretion of other nations?

It is particularly important that the U.S. maintain at least equal access to the world's oceans, particularly since jurisdictional questions are still largely open with respect to areas beyond the EEZ's of the world. Precedents will be set by those who have the capability of getting to remote areas and establishing an effective working presence.

If this nation is content for Japan to set the tone for what will happen to the remaining ocean wilderness, to establish guidelines — through actions they uniquely can take — for utilization of ocean space and ocean resources, then so be it. By the end of 1993, Japan will be the only nation in the world with effective working access to an area of the ocean as large as the United States — the deep sea below 6000 meters depth. Maybe this poses no dangers to the ocean or to our national interest, but it might be helpful if various points of view other than those expressed by one nation could be taken into account with

respect to the fate of large parts of the planet.

To "catch up" will not be difficult, technologically. I am aware of materials and systems already developed for military and industrial applications that could immediately advance this country as a serious participant in ultra-deep sea access -- and the research and knowledge that would follow.

#### QUESTION 12.

What can this committee do to facilitate the development of a national strategy and commitment to deep submergence research?

#### RESPONSE.

One immediate positive action that the Committee could take would be to enlist support for legislation to ensure a long, active, healthy life for NURP. Stability beyond the present year-to-year cliff-hanging exercise is necessary if NURP is to take responsibility for long range programs.

The committee can call for actions to be taken for the development and implementation of a national plan for the oceans generally, with deep submergence research high on the agenda. During the hearings on March 24, I identified the need for champions for the oceans, and it appears that this Committee has several. Leadership is needed to bring the ocean to center stage for this country. The deep submergence issues will naturally follow. Perhaps a commission comparable to the Stratton Commission could be organized to review the nation's policies with respect to the ocean, emphasizing the growing problems relating to the global ocean commons -- and to the deep sea in particular.

It would be helpful if members of the Committee or the Committee as a whole could encourage for civilian use greater availability of ocean technology developed for military applications -- to the extent possible without compromising security interests.

Perhaps a special group could be convened to consider technology useful for civilian deep submergence applications.



CENTENNIAL  
University of Rhode Island  
Graduate School of Oceanography

May 6, 1993

Congressman Solomon P. Ortiz  
Ranking Majority Member  
Subcommittee on Oceanography, Gulf of Mexico,  
and the Outer Continental Shelf  
Room 1334  
Longworth House Office Building  
Washington, DC 20515-6230

Dear Congressman Ortiz:

Please find enclosed answers to the written questions that you sent me several weeks ago. I apologize for taking so long but the end of the academic year creates endless obligations.

Let me take this opportunity to say how much I enjoyed the opportunity to work with you and the Subcommittee on Oceanography, Gulf of Mexico and the Outer Continental Shelf. I was very impressed with the perceptive questions asked during testimony and later by letter.

If I can be of further assistance, please do not hesitate to call on me.

Yours sincerely,

Paul J. Fox  
Professor of Oceanography

PJF:sk

Narragansett Bay Campus, Narragansett, RI 02882-1197

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To: The Honorable Solomon P. Ortiz  
Chairman, Subcommittee on Oceanography,  
Gulf of Mexico, and the Outer Continental Shelf

From: P. J. Fox  
Chair, Deep Submergence Science Committee  
UNOLS

Subject: Answers to questions about the National Undersea  
Research Program (NURP)

Date: May 6, 1993

**Question #1:** Is the \$16 million appropriated last year for NURP adequate to support the undersea research needs of the U.S. civilian undersea research community?

In order to frame my response, let me first offer a few salient observations.

- \$16 million is approximately equal to the amount that the Oceanography Directorate at NSF spends, excluding shiptime, on each of the major oceanographic disciplinary themes (e.g. marine biology, chemistry, physics and geology). This is to say that \$16 million is a relatively large number in terms of support levels for oceanographic research.
- The NURP centers have been set up over the years in response to political concerns/interests to satisfy the research needs of specific regions. This means that their location, research emphasis and overall direction has been developed in the absence of an overarching national plan.
- The NURP National office has endeavored to place the work done by the Regional Centers into major research categories (e.g. global change, material flux, marine productivity) that are fundamental in nature and have instituted a peer review process (modeled after NSF) that has raised the standards of research conducted by the NURP centers.

With the above observations in mind, I offer the opinion that the NURP centers are well funded and are carrying out important research. I believe, however, that the NURP centers would be even more effective if the NURP centers would become part of the Administration's budget. This change would diminish the opportunity for earmarking, a process that flies in the face of a national research plan and peer-review driven science. In addition, the NURP centers focus largely on research carried out in shallow water (<1000 ft). Only a small portion of the NURP budget (approximately 1 million) is directed toward research in the deep sea; this is the support that goes to the operation of ALVIN, to support

U.S. scientists to dive on Japanese submersibles, and to use the U.S. Navy submersibles. In other words, the total budget for NURP is biased towards shallow water. As I alleged in my testimony, deep submergence facilities in this country are underfunded and NURP could address this situation by increasing its contribution to the National Deep Submergence Facility at Woods Hole Oceanographic Institution (WHOI).

**Question #2:** Is the current research grant peer review and distribution process a fair one?

I believe that the National Office has made great progress in establishing an NSF-style peer review process that holds the potential for raising the standards. Needless to say, this process is hollow if congressional earmarking protects a NURP center's budget and, thereby, ignores the peer review process. The NURP operation can only become a flagship Federal research program if the National Office has the power/freedom to oversee the research programs of the NURP centers through peer review.

**Question #3:** Should there be a funding base level for all the centers with the National Office funding research in critical areas that exceed base level support?

This plan sounds like an entitlement to me that allows the opportunity for scientific stagnation and isolation. The peer review process, by definition, keeps the competitors on the intellectual Serengety lean, agile and involved.

**Question #4:** Is their adequate deep submergence capability available to civilian researchers?

As I stated in my testimony, the health of deep submergence science is the U.S. is not robust, largely because the National Deep Submergence Facility at WHOI is underfunded. The result is that the technological capability of ALVIN is below the standards set by Japanese, French and Russian counterparts, resources are not available to support engineers to work on development, and, with the arrival of the new Jason-Medea ROV system at the National facility, it is not clear how this system will be supported. Although the U.S. has pre-eminent strength in the quality of the U.S. deep submergence science community and in the knowledge of what needs to be done, the U.S. is in danger of becoming second rate because our deep submergence systems are underfunded.

**Question #5:** Is there a need for additional submersible platforms? If so, how great is this need? Is NURP the correct venue for funding these platforms?

It is my sense that what the U.S. deep submergence science community needs in the future is a new deep diving submersible (6000 m depth capable of reaching 98% of seafloor) to replace ALVIN (4000 m capability). The submersible would be designed to be

a state of the art observational, imaging, and manipulative platform. In addition, the community will need a family of ROVs and AUVs that are designed to carry out a range of tasks at the complete range of oceanic depths.

Presently, our deep submergence assets are: a depth limited (4000 m) submersible (ALVIN) that is no longer optimally configured for deep submergence; restricted access to a 6000 m submersible (USN Sea Cliff; 40 dives/yr) that has proved to be unreliable; and a single deep submergence ROV (Jason-Medea), that is just coming on line. Given these capabilities, I think we are very poorly equipped to meet the scientific challenges of the global abyss as we cross the threshold of the 21st century.

In the long term, as a nation we must outline a national deep submergence science plan and define a strategy for implementation. I am sure that a component of such an exercise would be to create a more rational funding/support scheme than the fragmented and unsatisfactory situation we have now. I think the long term key to a solution is to reduce the fragmented funding profile for deep submergence science and create a specific National Deep Submergence Program that can rise and fall on its merits and needs. Given NURP's mandate, it is an existing federal program that is well positioned to play a lead role in a new funding paradigm. The NSF would be the other natural home for a national program, but at present lacks a specific mandate. I can't emphasize too much that a deep submergence program must stand alone because it has such unique and critical asset needs (submersibles, ROVs and AUVs). To lump the program into a general ship operating budgets (the way it is at NSF), a broadly focused program (the way it is at NOAA), and an environmental science directorate (the way it is at ONR), is a recipe for frustration and mediocrity.

**Question #6:** Is there overlap between the research activities of NURP, Sea Grant, NSF, and the Navy?

In general, I would say the overlap is minimal and not a problem. Each agency has their own distinctive agenda and there is an effort to coordinate endeavors where there is overlap. The problem is not so much overlap as it is underlap. Certain programs, like deep submergence science, fall through the cracks between the agencies because each agency has only a small part of the deep submergence science portfolio.

As I suggested in my answer to question 5, I believe the long term solution is to focus the support and development of deep submergence assets in one agency where it has an identity and a mandate.

**Question #7:** How did the 1993 earmarking of the NURP appropriation effect the ALVIN three-agency MOU?

The MOU expired at the end of 1992 and a new version was up for renewal in December of last year. Although NSF and ONR had signed off on the new agreement by December 1992 and although NOAA had verbally agreed to the terms, NOAA did not sign the agreement because they had no assurance that they could meet their 1993 commitment. In the end NOAA was able to meet a substantial portion of the commitment level specified in the 1993 MOU, but not until the ALVIN program had been held hostage during the first several months of 1993. As far as I know, the MOU is still unsigned by NOAA.

**Question #8:** How can the conflict between ALVIN and the Jason-Medea ROV system be reconciled? How much funding is needed to support both systems and how should it be allocated?

I believe that the conflict is more apparent than real. The science of the abyss needs both systems in the near term. I enclose a copy of a letter that Craig Dorman and I sent to *Science* in the hope of clarifying this question.

To fully fund both systems to the extent that they are utilized during the year with full investigative schedules, the support level of the National Deep Submergence Facility at WHOI would have to be about 4 million (approximately double the present budget).

The allocation of resources should be governed by the peer review process of science proposals submitted to conduct ALVIN and Jason-Medea research. Since there is an abundance of compelling science to be done in the abyss and since each system is well suited to do certain things, I suspect there would be strong proposal pressure to use both systems and that they would both be well utilized.

**Question #9:** What can the committee do to facilitate the development of a national strategy and commitment to deep submergence research?

In the short term, make sure that there is unwavering support by NURP for the National Facility at WHOI. There is no need to talk about the future if there is no tomorrow.

In the longer term, find a mechanism that will bring federal agency representatives, scientists and engineers together to develop a national strategy for deep submergence research. Perhaps the most effective catalyst would be for Congress to mandate that there will be a national commitment to explore, characterize and understand the global abyss and its underlying seabed. Create a mandate and they will come.



Craig E. Dorman  
Director

Woods Hole  
Massachusetts  
02543  
508 - 548 - 1400

April 16, 1993

*Science*  
American Association for the Advancement of Science (AAAS)  
Attention Editor  
1333 H Street N. W.  
Washington, DC 20005

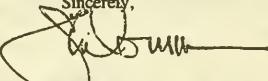
Dear Editor:

Attached please find a Letter to the Editor prompted by J. Travis's article published in *Science* (v. 259, 12 March 1993, p. 1534-1535). We feel that some important issues related to deep submergence science were not put in what we consider to be a balanced perspective that is representative of important issues facing the community. Given the critical juncture of the technology and science related to deep submergence research, it is important for the scientific community to have another opinion for consideration.

We would appreciate your publishing this letter as soon as possible and contacting us if you have any questions.

Thank you for your consideration of this commentary.

Sincerely,

  
Craig E. Dorman  
Director

  
Paul J. Fox (pc)

Paul J. Fox  
Professor  
Chairman, Deep Submergence  
Science Committee

CED:PJF:reg

Enclosure

*Alvin* and Remotely Operated Vehicles:  
A Synergistic Approach for Studying the Deep Ocean and Seafloor

P. J. Fox  
C. E. Dorman

The recent article by J. Travis, titled: "Deep-Sea Debate Pits *Alvin* Against *Jason*", (*Science*, v. 259, 12 March 1993, 1534-1535) unfortunately obfuscates the character of an ongoing and necessary dialogue about the future of deep submergence science, that is presently engaging the diverse community of biologists, chemists, geologists and physicists who work in the deep sea, by suggesting that the use of manned or unmanned vehicles in the abyss is an "either/or" situation. While it is commendable that Mr. Travis brought to the public forum a presentation of the exciting potential offered by unmanned vehicles to the solution of fundamental questions that can only be addressed through the effective use of deep submergence assets, it is unfortunate that his text magnifies an ancillary issue while overlooking the critical element that is conditioning discussions about the future of deep submergence science. We would like to identify a few perspectives that may help to sharpen the community's understanding of the salient issues.

• It is all but self evident that in more than 25 years of service to the oceanographic sciences, *Alvin* stands as a necessary and fundamental facility that has been, and still is, critical to benchmark advances in biological, chemical and geological oceanography. This probe into earth's inner space, with more than 2500 dives made, has proved to be a reliable workhorse providing investigators with a cognitive presence and a capability to carry out controlled, manipulative and interactive tasks. *Alvin*'s operational systems are completely disassembled and reassembled every three years in order to meet stringent U. S. Navy specifications required for manned submersibles. *Alvin* dives about 150-200 days per year for multidisciplinary science, considerably more than any other individual deep sea manned research submersible, and the key observations, samplings, measurements and experiments that have been made during these

dives provide data that has changed, in fundamental ways, our understanding of the earth and its biology. There is compelling evidence that community support in the continued use of *Alvin* as a viable vehicle into the abyss is strong because a recent call for letters of interest resulted in over 1300 dives requested for the 1994 and 1995 field seasons at sites distributed around the globe.

- The recent utilization of remotely operated (ROV) and autonomous vehicle (AUV) technology in the harsh environments of the deep sea is viewed as a marvelous new and necessary enhancement of our capability to carry out investigations at depth. Since these deep ocean systems have only recently become available, the number of scientific experiments with ROVs carried out to date in the abyss are few, and results from these experiments are as yet preliminary. Nevertheless, ROVs have developed to the point where they can be used as superb fine-scale imaging and mapping tools, creating a high resolution (centimeters to meters) acoustic (backscatter and bathymetry) and visual data set. These results make it possible for the first time to completely image patterns and relationships created by a mix of biological and physical processes at a local scale (meters to kilometers), providing an essential linkage between our regional data sets and the seabed outcrop. Rather than diminish the relevance of *Alvin*, ROVs and AUVs enhance *Alvin's* productivity by creating a well-constrained framework into which *Alvin* can be placed to most effectively maximize its unique potential. In addition, the rapidly developing robotic capability of ROVs indicates that these systems have an excellent potential for *in situ* sampling. Nearly all deep sea research scientists view the advent of ROVs and AUVs as welcomed and essential complements to *Alvin* considering the multidisciplinary research objectives that are planned to be carried out during the next decade. Each research tool has its operational niche and particular characteristics that make it best suited to a specific research task. Planned or proposed field programs indicate that there is growing community interest in using ROVs and AUVs to address a range of interdisciplinary questions, both in the water column and on the seafloor.

Given the scale of the global ocean, the broad range of fundamental scientific questions to be addressed, and the large community of scientists who wish to carry out experiments using deep submergence facilities, the challenge is to devise a comprehensive investigative strategy and an implementation plan that best integrates and utilizes the complete range of deep submergence assets available to the community. Even as new technological capabilities are made available in the form of ROVs and AUVs, such a challenge is daunting in the face of funding levels that remain restrained, as they have for oceanographic facilities during the last decade. Indeed, it is the diminished level of support, when measured against the requirements for utilization of deep submergence science assets, that frames the ongoing dialogue. A King Solomon-like solution that chooses a technological capability at the expense of another is a solution that does not serve the needs of the scientific community.

The inner space of the global ocean and its underlying seabed are arguably this planet's last frontier and a family of technological capabilities are needed to carry investigations of the abyss forward into the 21st century. To meet this challenge, a long-term programmatic commitment is necessary to assure the continued development of required deep submergence facilities, and the implementation of a wide range of scientific experiments that will greatly increase our understanding of the physical and biological processes in the deep ocean.



CENTENNIAL  
University of Rhode Island  
Graduate School of Oceanography

April 26, 1993

Congressman Curt Weldon  
Ranking Minority Member  
Subcommittee on Oceanography,  
Gulf of Mexico, and the Outer Continental Shelf  
Room 1334  
Longworth House Office Building  
Washington, DC 20515-6230

Dear Congressman Weldon:

Please find enclosed my answers to your questions that followed my testimony before the Subcommittee on Oceanography, the Gulf of Mexico, and the Outer Continental Shelf.

Let me take this occasion to say how much I appreciated and enjoyed the opportunity to testify before the Subcommittee. If there is anything else that I can do to assist you and your colleagues in your deliberations to improve the scientific vitality of U.S. oceanography in general, and deep submergence science in particular, please do not hesitate to call on me.

Sincerely,

Paul J. Fox  
Professor of Oceanography  
Chair, Deep Submergence  
Science Committee, UNOLS

PJF:cs  
Encl.

Narragansett Bay Campus, Narragansett, RI 02882-1197

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To: The Honorable Curt Weldon  
Subcommittee on Oceanography, Gulf of Mexico  
and Outer Continental Shelf

From: Dr. Paul J. Fox  
Chair, Deep Submergence Science Committee, UNOLS  
Graduate School of Oceanography, URI

Subject: Answers to questions about the National Undersea Research Program (NURP)

**Question 1:** Does NURP provide at least a step in the right direction for developing a comprehensive undersea research plan?

This is a question that touches upon a number of salient issues pertinent to the state of deep submergence science in the U.S. First, the NURP centers do indeed offer an opportunity to carry out important investigations relevant to deep submergence science. These centers, however, have been set up for political reasons and, therefore, the scientific agendas are not always as rigorously defined as they could, or should be, to best serve the interests of the U.S. taxpayer. The way to solve this problem is to give the National NURP office greater control in the scientific oversight and management of the centers. A component of this oversight should be an external peer review by appropriate scientists who would assess the merits of each NURP program and offer recommendations for improvement; such a process would ensure that the NURP centers were productive, effective, competitive and efficient. This would make the program more national in character, scope and organization. Second, as presently constituted, the majority of the NURP effort is focused on relatively shallow water programs (< 1000 ft.). The NOAA/NURP contribution to deep submergence science comes largely through their contribution to the operation of the National Deep Submergence Facility at Woods Hole Oceanographic that includes the submersible ALVIN and the Jason/Medea ROV system. As I mentioned in my testimony before the subcommittee, the funding profile outlined by the present three agency agreement (NOAA, NSF, ONR) does not support the facility at a level that allows for full utilization of the systems, and that insures engineering development and technology enhancement. NOAA/NURP could substantially improve our deep submergence science effort by increasing its contribution to the National Deep Submergence Facility.

**Question 2:** What constitutes peer-review of undersea programs?

I think that in the initial definition of a national program, whether it be undersea research or whatever, it is important to include in that dialogue contributions from industry, the research community, federal agencies and policy makers. Once the program is defined and the mission statements established, then the review process should only involve those parties best suited to judge the program elements. In the case of undersea research, this review should be carried out by scientists and engineers who would be drawn, based on excellence, from academia, industry and federal agencies.

**Question 3:** Would it be effective to establish an independent steering committee to advise the Under Secretary and Program Director concerning the operation of NURP?

Such an advisory body could be very effective in helping to provide a sense of overall focus and balance to the operation of NURP. I see such a group, and the advice that they would offer, to be consistent with my comments made in answers to questions 1 and 2. The key to success of such a group would be that they were independent and that they had the requisite expertise.

**Question 4:** What potential does the Jason Project have for education and undersea research?

The Jason Project has demonstrated that the use of high technology equipment in the deep sea to unravel its mysteries is a very effective methodology to engage the interest of young students in science. Here at the Graduate School of Oceanography, we serve as a downlink site for the Jason Project and I have had an opportunity to watch Jason Programs and to talk to many young students who have participated in the program. The Jason Project has demonstrated that it is an effective educational tool that can touch students throughout the country and around the world. The Project now must put more time and resources into program content and development. To date, there has been too much emphasis on pretty pictures and video razzle-dazzle. The common complaint I have heard from kids this year is that after 5-10 minutes they got bored because the program never moved beyond imaging of the tube worms that populate the sides of hydrothermal mounds. In short, the Project has demonstrated its great , great potential, but it is now time to create an educational package that can take advantage of a captivated and interested audience.

As an example of an ROV that is a superb imaging platform and that can carry out manipulative and interactive tasks at great depths, Jason has great potential for deep-sea research.

The Jason system has just joined the National Facility at Woods Hole Oceanographic and already the academic community is proposing scientific programs of great merit that require the Jason system. A deep water ROV asset like Jason greatly expands our national capability to carry out benchmark investigations in the abyss and nicely complements the ALVIN. Given the significance of the scientific questions to be addressed in the deep sea and the global scale of the investigative arena, we need a healthy and robust deep submergence capability that includes submersibles (shallow and deep), ROVs and autonomous vehicles. Presently, our deep submergence effort is fragmented between three agencies (NOAA, NSF, and ONR). This balkanization of the effort results in precarious levels of funding, both for the National facility, as well as, for the scientific programs that wish to use the deep submergence assets; a situation that all but insures that the U.S. will relinquish its leadership role in deep submergence science to Japan and France.

Responses to Questions by the Honorable Solomon P. Ortiz  
to Robert L. Wicklund  
on the National Undersea Research Program

1. No, considering that NURP is touted as our National program of undersea research, \$16 million is a small amount indeed. NURP covers a wide array of research disciplines and is responsible for studying thousands of miles of coastline in the U.S., Caribbean and other parts of the world. In fact, all oceans, particularly those areas that have never been explored much less studied, are within the purview of NURP. My personal feeling is that our National program should be at \$75 million or more at this point in its history. More practically, and considering fiscal constraints, I would recommend the level of \$23 million in FY1994, as written in last year's NURP Act language.

2. Our Center has identified several additional research priorities, if money were available. Two of these are: (a) expansion of coral reef research to other regions of the Caribbean, Florida and the Gulf of Mexico because coral reefs are declining worldwide at an alarming rate and we are not sure of the cause or causes; (b) continuation of research initiated at CMRC in the development and use of techniques to study the effects of increased ultraviolet light, particularly UV(B), on primary and secondary marine organisms.

3. The CMRC/NURP budget is as follows:

Category	Amount	%
Administration	\$517,500	25.7
Science	699,000	34.8
Operations	694,000	34.6
Monitoring	63,000	3.1
Program Development	36,000	1.8
Total	\$2,009,500	100.0

We are a public foundation and have been able to avoid a large overhead; all charges against our grant are direct costs. The science program at CMRC, including the monitoring and program development listed above, amounts to \$798,000. Operations funds, which are in direct support of the science program, are for facilities such as submersibles, boats, laboratory space, etc. Additionally, we received over \$200,000 in private gifts and receipts that were used to cost-share the NURP budget.

4. No. Presently the *Alvin* is the only longterm deepwater submersible available to civilian researchers. The Navy's *SeaCliff* and *Turtle* are available from time to time, but have not been effective tools for civilian research. Except for some foreign vehicles, there is nothing available to U.S. scientists that will dive deeper than about 4000 meters.

(continued)

5. Generally speaking, yes.

6. Although I would like to say yes because it would increase CMRC's budget, I don't believe equitable funding will work. Some regions are larger and more difficult in which to conduct undersea research than others, or a specific expensive piece of equipment might be needed by one center and not another. Realistically, much of the individual centers' budgets have been dictated by the interests of their Congressional delegations. As NURP has been zero funded by the Administration over the past 11 years, Congress has played a major role in NURP's survival. I don't believe that attempting to equate centers' funding would be acceptable or practical.

7. No. I believe that it is fairly common knowledge among researchers that they can submit a proposal to the center responsible for their region of interest, regardless of the center's homebase. I also believe, however, that a larger geographic network of centers with new funding would generate more proposals because of a wider area of research interests, and it would also increase funding for undersea research in general.

8. Yes. Legitimizing NURP would increase our chances of getting in the Administration's budget as a line item. It would also set guidelines for future directions and, I believe, basically give NURP a new and much needed positive image internally.

9. No. There is some undersea research supported by Sea Grant. NSF's support is tied directly to their science proposals and I am not aware of any duplication of their scientific efforts with NURP's programs. The Navy also does some civilian science. Last year it coordinated its *SeaCliff* program with NURP but was not productive.

Coordination with other programs, institutions or governments first requires a strong, well recognized undersea program that will provide the focus and leadership for longterm undersea research. NURP does not presently serve that role at the level necessary. If legislation and adequate funding are provided along with strong support from NOAA and the Secretary of Commerce, leadership in the field of undersea research and interprogram coordination should follow.

10. It might help to hold a hearing on deep submergence research this year. If the results of the hearing are positive toward further pursuit of deep submergence research, then Committee support for an appropriation to conduct a preliminary study of a 6-7000-meter system next year (as recommended in the report "New Directions for NOAA's Undersea Research Program," April 1986) would be very helpful. This kind of positive action can go a long way to help facilitate a full deep submergence research program in the future.

Responses to Questions by the Honorable Curt Weldon  
to Robert I. Wicklund  
on the National Undersea Research Program

No. 1

The genesis of the space program had all the ingredients to capture the imagination of the public and when the former Soviets got into the business, our pride and the perceived threat to our National security instantly became factors. The public fervor over space ultimately led to President Kennedy's announcement that we would put a man on the moon and to the creation of an independent NASA with a large budget.

Ocean programs did not have the same public image at that time, and, in fact, still do not. We already had a sizable and effective undersea warfare capability. Another key factor was that space study was brand new, whereas research on and in the oceans had been underway for years and its proponents were somewhat provincial in their receptiveness to new and aggressive programs.

I believe that the only way we are going to stimulate oceans research programs is to take an aggressive approach to increasing public awareness, starting with a reorganization of NOAA as an independent agency. It should not become part of EPA or a new Department of the Environment, but should function as an autonomous agency. Right now it is virtually unknown to the general public. NOAA should be charged with an aggressive program of ocean research and exploration on a global scale. We are putting a greater emphasis on the global environment these days without having explored but a small part of the world's oceans.

Nos. 2 & 3

I do not object to the scientific advisory committee and believe that it can provide healthy scientific oversight. My testimony was not meant to address this part of the bill, merely the committee's potential involvement with the merger of Centers.

As we well know, when a piece of legislation, with all good intentions, is signed into law, it is then subject to interpretation by the legal sector of the Administration which can lead to the public law having a different twist than what Congress intended. I believe, therefore, that very specific language should be added to the NURP Act to at least guide the committee in their decisionmaking on the issue of mergers. Even though we would hope and expect that any committee appointed by the Secretary would be fair and strictly professional, it is still possible that one or more members with specific interests could swing a vote in the wrong direction. I cannot think of very many scientific reasons for merging Centers, but I can definitely think of some political reasons to do so. My point is to urge Congress to consider the addition of language that provides clear and precise guidelines to the merger section of the bill that afford little possibility of being misinterpreted by legal counsel to the Secretary.



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