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Good morning, Mr. Chairman and members of the Committee. I am Richard W. Spinrad, Assistant Administrator for Oceanic and Atmospheric Research at the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. Thank you for inviting me to discuss H.R. 3835 and the role of the National Oceanic and Atmospheric Administration (NOAA) in ocean exploration and undersea research.

NOAA's vision is an informed society that uses a comprehensive understanding of the role of the oceans, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions. NOAA's mission is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our nation's economic, social, and environmental needs. NOAA's Office of Ocean Exploration and National Undersea Research Program (NURP) are contained within the Office of Oceanic and Atmospheric Research (OAR). In support of NOAA's mission, OAR conducts the scientific research, environmental studies, and technology development needed to improve our operations and broaden our understanding of the Earth's atmosphere and oceans. The Office of Ocean Exploration is devoted exclusively to the critical mission of exploring the still largely unknown ocean. The ocean exploration program focuses on discovery of new ocean resources for societal and economic benefits, serves as an effective means to promote ocean education and ocean literacy, and enables NOAA to become aware of ocean issues that may become the basis for future NOAA missions. NURP harnesses the academic community to focus on NOAA's undersea research needs. NURP currently supports NOAA's mission by providing undersea scientists inside and outside NOAA with advanced technologies, such as an underwater laboratory, submersibles and remotely operated vehicles, and the expertise needed to work in the undersea environment.

I am pleased to be here today to discuss H.R. 3835, an act to establish a coordinated national ocean exploration program within NOAA. NOAA supports the intent of this legislation. Title I of the bill addresses ocean exploration; Title II addresses NOAA's complementary program in undersea research. Together, these two programs provide a solid foundation for the aggressive ocean exploration and undersea technology program for our nation. Today, I will outline our current ocean exploration and undersea research

programs, describe our planned merger of these programs, and explain why this legislation is important to NOAA.

In his preface to the President's Panel on Ocean Exploration report in 2000, former Secretary of Commerce Norman Mineta eloquently stated the importance of ocean exploration to our nation's interests and future:

“Our nation’s history, from colonization and westward expansion to the deployment of the Hubble telescope, is testament to the fact that America is a country of explorers. Our pride as a nation is founded upon our yearning to make new discoveries and to seek out new knowledge. Exploration of the oceans responds to a growing national interest in our seas and an acknowledgement of their importance to our environment and quality of life.

We are growing in the awareness that the ocean influences our daily lives in hundreds of ways. From providing fisheries resources or cures for disease, to unlocking the secrets of long-term climate variations, we are constantly reminded of the ocean’s importance in sustaining life. Truly, our economic, environmental, and national security depends on our ability to understand the ocean frontier, as well as balancing the competing interests of conservation and economics.”

Historical Perspective

In 2007, NOAA will celebrate 200 years of history of science and exploration, service, and stewardship of our nation's oceans, coasts, and Great Lakes. National interest in establishing a comprehensive ocean exploration program stretches back over 40 years, when, in the late 1960's, the Stratton Commission initiated the International Decade of Ocean Exploration. The resulting programs dramatically enhanced understanding of the global climate system, geochemical cycling, ocean circulation, plate geodynamics, and life in extreme environments. In 1971, NOAA established the Manned Undersea Science and Technology (MUST) program, which pioneered exploration from undersea habitats. MUST was transitioned in 1980 from a primarily headquarters program to the extramural NURP. Since then, NURP has continued to provide the scientific community with the undersea tools to conduct exploration and cutting edge research.

In 1983, an interagency effort to comprehensively map the U.S. exclusive economic zone (EEZ) was initiated. Our EEZ is the largest in the world spanning over 12,300 miles of coastline and contains 3.4 million square nautical miles of ocean — larger than the combined land mass of all 50 states. While the surface of the ocean has been studied via remote sensing for basic physical and biogeochemical properties, today less than 10% of the U.S. EEZ has been mapped with current multibeam technology. Less than 5% of the EEZ has been mapped at a resolution required for accurately defining habitat. In addition to our nation's EEZ, approximately 95 percent of the world's oceans have not been visited or studied in situ. This includes the major features such as the 31,000 miles of mid-ocean ridge crest, 6,200 miles of deep sea trenches, over 30,000 seamounts and the water-column of the ocean – which together are home to 99 percent of the Earth's living

organisms. Because the scope of what remains unknown below the surface is enormous, we will continue to carefully prioritize the work we undertake.

Increasing national interest in ocean exploration, in large part stimulated by NURP-sponsored activity, culminated in 2000, when a Presidential Panel on Ocean Exploration convened by the Department of Commerce called for a robust national ocean exploration program propelled by the spirit of discovery. The panel proposed a strategy of interdisciplinary expeditions, new partnerships, and integrated federal programs to characterize the vast array of biological, physical, and chemical environments of the oceans and foster the development of technology. The panel's recommendations led to the establishment of the Office of Ocean Exploration within NOAA in 2001.

In 2003, a National Research Council report expressed support for a comprehensive national ocean exploration program strongly linked to traditional research, with broad international partnerships, and a commitment to educational opportunities. This report was followed in 2004, by the U.S. Commission on Ocean Policy recommendation to establish an expanded ocean exploration program. In response to the report of the U.S. Commission on Ocean Policy, the Administration developed the U.S. Ocean Action Plan. Ocean exploration will be addressed in the context of the Ocean Research Priorities Plan and Implementation Strategy, which was called for as part of the U.S. Ocean Action Plan. The National Science and Technology Council Joint Subcommittee on Ocean Science and Technology (JSOST) is currently developing this interagency planning document and implementation strategy on priorities for ocean science technology for the next 5 to 10 years. As one of the co-chairs of the JSOST (along with the National Science Foundation and the Office of Science and Technology Policy) I am closely involved in this work, and can report that we continue to make progress. On April 4, 2006, we released our Ocean Priorities Framework for developing the Ocean Research Priorities Plan and Implementation Strategy; the detailed plan is due at the end of this calendar year.

The Office of Ocean Exploration

The recent sustained national interest in ocean exploration has resulted in an exciting, successful ocean exploration program within NOAA. The mission of this program is to conduct interdisciplinary ocean exploration expeditions and projects that provide scientific information as well as technical and educational leadership that contributes to NOAA's evolving environmental and economic missions. The program pursues this mission by focusing on four key goals:

Explore unknown and poorly known areas of the ocean: Exploration science expands our understanding of what resources and processes are in the oceans. The wealth of living and non-living resources yet to be discovered holds vast untapped economic potential and offers new opportunities for medical science. For example, microbial organisms that thrive in deep-sea environments produce novel enzymes and other compounds as a consequence of living in extremes of temperature and chemistry which have significant potential for creating bioproducts for use in pharmaceutical and

industrial applications. Recent screenings show that these marine samples are 20 times more active than their terrestrial counterparts.

Ocean Mapping: Less than 10 percent of the U.S. EEZ has been mapped with current technology, and many resources, habitats, and features remain undiscovered. Our ability to manage ecosystems is dependent upon our ability to define the area these ecosystems cover. In conjunction with other NOAA mapping efforts, ocean exploration routinely maps ocean areas during expeditions to discover and record the physical, biological, geological, archaeological, and chemical nature of the oceans. This information is critical for both expanding our understanding of the U.S. EEZ, and supporting future establishment of the U.S. continental shelf, where potential resources such as mineral deposits, valued at \$1.3 trillion, are estimated to exist.

New Technology: The Office of Ocean Exploration invests in new technologies to increase the pace, efficiency and scope of ocean discovery and to enhance the technical capability of the United States by promoting the development of improved oceanographic research, communication, navigation, and data collection systems, as well as underwater platforms and sensors. The program coordinates new technology needs and investments with other NOAA programs, other federal agencies, and through the National Oceanographic Partnership Program. The program also invests in projects that test and evaluate new and emerging technologies under live conditions. A merger of NOAA's ocean exploration program and undersea research program, which I will discuss later, will enhance NOAA's ability to support emerging technology in these areas.

Education and Outreach: The President's *Ocean Action Plan* calls for promoting lifelong ocean education as essential for fostering a strong economy, promoting healthy ecosystems and preparing a competitive workforce with the scientific understanding needed to balance the sustainable use and conservation of our natural resources. The ocean exploration program is a leader in this effort dedicating 10 percent of its budget to education and outreach to improve ocean literacy in the United States and to stimulate interest in ocean science. The program is uniquely positioned to use interdisciplinary expeditions as a catalyst to bring the excitement of ocean exploration to teachers and school children. The program's website (www.oceanexplorer.noaa.gov) is rated in the top five worldwide in its category, by a major international science education authority. This website, which includes teaching materials for educators, daily logs of expeditions, immediate reports of the discoveries, and live images of the sea floor, was visited by more than four million people last year. These efforts are inspiring a whole new generation to explore and work in the oceans which will help ensure that in the future the United States will have a competitive edge in the oceans and remain a global leader in ocean science and technology.

In less than five years, the Office of Ocean Exploration has been able to successfully leverage federal funding, equipment, and expertise to assemble interdisciplinary teams of scientist-explorers in support of more than 100 ocean expeditions and projects to unknown and poorly known areas of the ocean. These ocean expeditions have discovered many new marine ecosystems (including fish and coral habitats); new species of micro

and macro-organisms; and chemical and geological processes that impact the oceans such as large quantities of carbon dioxide produced by underwater volcanoes. These expeditions have also mapped thousands of square miles of ocean floor that had never been mapped before, where they discovered new landforms, including large submarine volcanoes, seamounts, and extensive areas of deep water coral reef and sponge habitats.

NOAA's partnerships with other federal agencies, academia, industry, ocean institutions and scientists from U.S. and international organizations are a vital component of NOAA's ocean exploration program. Together with our partners, NOAA increases our national understanding of ocean systems and processes by undertaking 6 to 10 major voyages of discovery per year and funding up to 25 additional missions and exploration-related projects per year. All expeditions are selected through a rigorous peer-reviewed process. The program spends approximately 70 percent of its funds outside of NOAA on science that benefits the nation's understanding of the oceans and ecosystems.

Programs across NOAA benefit from new sources and scales of information generated by the Office of Ocean Exploration. These benefits include greater knowledge of living marine resources, their habitats, and ecosystems which enhance fisheries and ocean stewardship and comprehensive site surveys and inventories that inform management of NOAA's National Marine Sanctuaries. The program's characterization of the EEZ improves the management of habitat and marine resources, and by providing inventories of our nation's submerged cultural and historical resources, the Office of Ocean Exploration aids in the preservation of this heritage. The Office of Ocean Exploration also provides important governance and scientific investigation in support of the international Census of Marine Life, which is helping to identify important breeding areas and inform strategies for sustainable management.

The Office of Ocean Exploration's efforts are, in turn, supported by other programs within NOAA including the National Oceanographic Data Center, which provides vital data access, archive, and assessment support. NOAA has also assembled a team of data and information experts from its National Geophysical Data Center, the National Coastal Data Development Center, NURP, and the NOAA Library to ensure the broadest public access and use of the results from its ocean expeditions. This team has developed procedures for ensuring archival and public access to the variety of the data products generated on these expeditions including underwater video, which has become an important new source for quantitative data about the ocean environment, as well as for stimulating public interest and life-long learning.

We will see more opportunity for learning and discovery through ocean exploration when a new vessel dedicated to ocean exploration joins the NOAA fleet. After conversion, a former Navy vessel will be commissioned and named NOAA vessel *Okeanos Explorer*. The vessel will be available in 2008 to serve the nation as a premier ocean research platform to conduct critical deep-sea missions including ocean floor mapping and biological and chemical oceanographic research. The vessel will also be equipped for "telepresence", a satellite-based communications technology that allows shore-side scientists, teachers, and students to connect in near real-time with scientists at sea and to

view images from the ocean and seafloor using high-speed Internet. The near real-time data and images are transmitted to science command centers ashore where teams of scientists augment the work of scientists and explorers at sea. By bringing multiple high-quality video streams and sensor data from the remote seafloor to scientists, teachers, and students on shore, the potential exists to revolutionize oceanographic research and ocean education. "Telepresence" technology was successfully pioneered on a NOAA-sponsored expedition to the deep-sea hydrothermal vent field known as the "Lost City" on the Mid-Atlantic Ridge in July 2005.

The goals and missions of the current Ocean Exploration and Undersea Research Programs not only complement existing programs at NOAA, they also form the basis for growing partnerships with the National Science Foundation, and other federal agencies. For example, NOAA's Office of Ocean Exploration has initiated a pilot partnership with the National Science Foundation that has recently resulted in a highly successful, jointly funded exploration expedition to the Galapagos Ridge. This is a model for future, jointly funded cruises that support both OE's and NSF's interests in exploring unknown areas of the ocean.

NOAA's ocean exploration program is a national program that provides the opportunity of discovery to our partners in academia, federal and state agencies, and industry. No other federal dedicated source of funding or logistics exists for discovery-based ocean science. The economic and social benefits of discovery are significant and the promise of future discovery is clear; wherever the program has looked, new discoveries and information have been found.

The National Undersea Research Program

NURP has served NOAA and the nation for over 25 years as an underwater research and technology program. NURP places scientists underwater using advanced technologies, either directly or remotely, and focuses its considerable expertise and connections to the academic community on NOAA's undersea research agenda. In recent years, the program has functioned through a network of 6 regional centers and an institute, hosted primarily by universities. Two centers are located on the West Coast in Hawaii and Alaska, and four are located on the East Coast in North Carolina, New Jersey, Connecticut, and Florida.

NURP has a proven record of providing the advanced technologies and infrastructure necessary to support undersea research and exploration operations for both the academic community and NOAA. Through regional competitive processes, the program sponsors cutting edge undersea research, which is applicable to NOAA's stewardship and management missions. The program also fosters innovative uses of existing technologies to meet undersea exploration and research challenges. Through ownership or leasing, NURP has provided undersea systems that work from the coast to the deep sea. For example:

- NURP owns and operates the Aquarius, the world's only underwater science laboratory, located in the Florida Keys National Marine Sanctuary. Aquanauts live on and study sensitive coral reef ecosystems threatened by natural and human-caused impacts and are able to perform studies not possible through traditional diving techniques.
- NURP operates undersea remotely operated vehicles (ROVs) and autonomous undersea vehicles (AUVs) that increase the access of researchers to the depth and breadth of the oceans.
- NURP owns and operates the Pisces IV and V, human occupied submersibles that enable scientists to explore the deep ocean-depths down to 6,000 feet. In partnership with the Office of Ocean Exploration in the summer of 2005, the Pisces submersibles completed a historic expedition to the South Pacific where scientists examined more than 20 previously unexplored sub-sea volcanic ecosystems. The program also provides scientists with access to research submarines including the *Alvin*, *Johnson Sea-Link*, and *Delta* submersibles.
- NURP, as the lead office for fulfilling NOAA's statutory responsibility to improve the safety and performance of civilian divers, has supported advanced diving techniques, which enable researchers to explore and characterize little known habitats such as deep corals.
- NURP supports pioneering uses of technologies such as multibeam sonar, advanced cameras, and seabed observing instrumentation to address emerging ocean exploration and undersea ocean observing, sampling, monitoring and modeling issues for the National Ocean Service and the National Marine Fisheries Service within NOAA.

NOAA and the National Aeronautics and Space Administration (NASA) share the mission of exploration in remote and hostile ocean and space environments, respectively. Humans working both in space and under the ocean face similar challenges of lack of oxygen, weightlessness, extreme pressure differentials, and remote, cramped living quarters. Currently, the National Undersea Research Program and NASA conduct a uniquely successful partnership in which astronauts train and simulate moon exploration at the Aquarius undersea laboratory. In addition to the operational benefits, this partnership provides a springboard for increased leveraging of exploration technology development between NOAA and NASA.

In FY 2006, Congress appropriated funds for NURP at a level significantly below the President's budget request. This reduction eliminated support for the four East Coast centers, and reduced funding at the West Coast and Polar Regions Center at the University of Alaska, Fairbanks, by one half. NOAA redirected a small amount of funds internally to enable NURP to maintain essential personnel and equipment at the four centers during restructuring efforts. NURP, as supported by the Administration's FY2007 request, will include both an East and West Coast capability. Further details of the restructuring are currently under discussion in consonance with the merger of the program with NOAA's Office of Ocean Exploration.

Office of Ocean Exploration and NURP Merger

In FY 2007, NOAA will further address the need for ocean technology development by refocusing the priorities, direction, and partnerships of its National Undersea Research Program and merging it with the Office of Ocean Exploration (OE) (the Appropriations Committees concurred with this reorganization in 2005). Both NURP and OE strive to meet NOAA, national, and international needs for innovative undersea exploration and research. The merger of the two programs will help meet these needs and also effectively address NOAA's undersea technology requirements. Merging the two programs will more efficiently utilize our resources to focus on exploration and undersea technology challenges; expand the excitement of ocean exploration with a regional network of partnerships; and take advantage of efficiencies of time, personnel, and funding between both programs. The merged program will also allow NOAA to capitalize on the synergy between these programs to achieve the goal of expanding exploration into focused research, and then to finding operational or commercial applications for our discoveries. Together, these programs will provide a more robust program of ocean discovery.

This merger is also an opportunity for NOAA to increase its emphasis and effectiveness in utilizing and developing advanced undersea technology. Despite recent technological advances, the current pace of discovery and acquisition of new knowledge is slow and is limited by the present requirement of having to conduct nearly all ocean exploration from surface ships. Ships support a variety of advanced technologies for accessing the underwater environment, but information collection is limited to observations from humans in submersibles or remote observations from cameras carried by robots tethered to the ship. An increased focus on ocean technologies would complement ship-based explorations by advancing the development and use of new underwater exploration assets and sensors, especially including autonomous underwater vehicles and remote sensing. Autonomous robots with their expanded sensing capabilities could significantly increase the pace of exploration, discovery, and generation of new knowledge. Such technological advancements would benefit the entire marine science community by developing improved systems for oceanographic research, communication, navigation, and data collection.

The OE and NURP programs currently collaborate in a number of areas including expedition planning and execution, and data management. The full details of the merger are currently under discussion and will depend upon several factors including input from the regional undersea research centers and the extramural community, and program funding levels.

Support of the U.S. Ocean Action Plan

NOAA is lead or co-lead for roughly half of the assigned items from the President's *U.S. Ocean Action Plan*, and has made significant strides on several actions. The Office of Ocean Exploration and NURP provide unique capabilities to gather, synthesize, and apply information collected during expeditions of discovery to directly address many of

the challenges described in the U.S. Commission on Ocean Policy report and the President's *Ocean Action Plan*. The Office of Ocean Exploration and NURP are supporting several of NOAA's *Ocean Action Plan* actions through activities including: conversion of the ship *Okeanos Explorer* for dedicated ocean exploration, providing advanced undersea technologies to support and integrate with the U.S. Integrated Ocean Observing System (IOOS), participating in the Joint Subcommittee on Ocean Science and Technology development of an Ocean Research Priorities Plan and Implementation Strategy, participating in Integrated Coastal and Ocean Mapping activities, and conducting and participating in a range of educational activities. In addition, NURP and OE support exploration and research projects which further conservation of deep corals, including deep corals within the Northwestern Hawaiian Islands Marine National Monument. An OE-sponsored expedition recently discovered extensive deep-water corals in the Olympic Coast National Marine Sanctuary. In direct response to the *Ocean Action Plan* recommendation to "Research, Survey, and Protect Deep-Sea Coral Communities," the Office of Ocean Exploration supported four expeditions with international partners in FY 2005 and is conducting additional activities in FY 2006 and FY 2007.

NOAA's Views on H.R. 3835

NOAA supports the intent of H.R. 3835 to establish a coordinated national ocean exploration program by building on the current capability within NOAA. This legislation would elevate the importance of science-based ocean exploration, and undersea technology development as a vital national activity and strengthen federal efforts to pursue and support it. H.R. 3835 recognizes the critical components of NOAA's current ocean exploration activities, including the development of new undersea technologies, outreach, and education. As part of its responsibilities NOAA supports the authorization of interdisciplinary exploration to expand our knowledge of the ocean's living and nonliving resources.

H.R. 3835 advances undersea technology development and furthers support for undersea research and exploration by mandating that the program "make available the infrastructure and expertise to service the undersea science needs of the academic community." The legislation supports two of the most successful and unique aspects of NURP: (1) harnessing the nation's extramural, academic expertise to provide solutions to NOAA's undersea challenges, and (2) conducting an open, competitive process for allocation of resources. It also supports the important program areas of undersea science-based education and outreach programs to enrich ocean science education and public awareness, and the discovery, study, and development of natural products from ocean and aquatic systems. The bill also provides a sufficient framework and guidance for ensuring that data generated by the programs will be made available to a broad spectrum of users, in essence supporting the approach that has already been developed within NOAA.

We do recommend that the following changes to the bill be considered. While NOAA agrees with the goal of Section 104, to promote coordination, such a statutory

requirement is unnecessary and would duplicate existing efforts. NOAA currently coordinates with other federal agencies on ocean exploration activities and plans for the future. In addition, the coordination among federal agencies mentioned in the bill will increase under the auspices of the new National Science and Technology Council's Joint Subcommittee on Ocean Science and Technology. The functions of the Joint Subcommittee on Ocean Science and Technology include identifying national ocean science and technology priorities and facilitating the coordination of interdisciplinary ocean research, ocean technology, and infrastructure development.

Section 107 authorizes appropriations to carry out the National Ocean Exploration Program described above in increasing amounts from \$30,500,000 in fiscal year 2006 to \$71,917,000 in fiscal year 2015, including \$33,550,000 for fiscal year 2007. The Administration requests that the authorization levels in the bill be consistent with the President's FY 2007 Budget Request, which provides \$15,128,000 for the Ocean Exploration Program.

In light of the NURP restructuring effort, the language of H.R. 3835 remains pertinent with few changes. The purpose of NURP remains consistent with Title II of the Act, to "increase scientific knowledge essential for the informed management, use and preservation of oceanic, coastal and large lake resources through undersea research, exploration, education and technology development." However, NOAA requests that particular named equipment not be enacted into law so that the program can best maintain the flexibility required to meet rapidly changing technological developments and needs.

Section 207 authorizes appropriations to carry out the Undersea Research Program described above in increasing amounts from \$12,500,000 in fiscal year 2006 to \$29,474,000 in fiscal year 2015, including \$13,750,000 in fiscal year 2007. The Administration requests that the authorization levels in the bill be consistent with the President's FY 2007 Budget Request, which provides \$9,152,000 for NURP in FY 2007. In addition, the bill includes authorization language and authorization for appropriations for the National Technology Institute. The Administration requests this language be removed to remain consistent with the President's Budget, which does not provide funding for the National Technology Institute.

NOAA also notes that in Section 207, all funding is directed to regional centers leaving no funding for administration of the program. Program administration should be provided, with a cap of 10 percent of appropriated amounts. NOAA supports an undersea research program that is national in scope. The Administration requests in the authorization of funding that no specific percentage of funding be authorized to either the West Coast or East Coast Regional Centers. This change would allow NOAA the flexibility to address research and technology needs from a national perspective covering our interests in the Atlantic, Pacific, Gulf of Mexico, and Great Lakes.

Conclusion

NOAA supports elevating the importance of ocean exploration based on sound scientific research as a vital national activity and endorses the strengthening of federal efforts to pursue and support it. H.R. 3835 recognizes the critical components of NOAA's current ocean exploration activities, including the development of new undersea technologies, and outreach and education programs. We are encouraged that the House of Representatives is considering this legislation to promote the importance of ocean exploration, and maintain and strengthen our ability to generate new ocean knowledge. The U.S.'s strength and leadership in the oceans depends on our nation's ability to generate and harness the latest in scientific and technological developments and to apply these developments to real world applications such as the management of our coastal and marine resources. A national ocean exploration and undersea technology development program is vital to sustaining the scientific advancement and innovation needed to maintain our nation's competitive edge in ocean science and technology, as well as to continue to meet the new emerging needs of NOAA's mission.