On behalf of the Consortium for Ocean Leadership (Ocean Leadership), I appreciate the opportunity to discuss our funding priorities for the Fiscal Year 2017 (FY17) Defense Appropriations Act. Ocean Leadership represents the ocean science, education, and technology community, with the mission to shape the future of ocean sciences. Ocean science strengthens our national security, supports a safe and efficient marine transportation system, underpins our economy, and furthers understanding of complex ocean and coastal processes important to our everyday lives – today and tomorrow.

Admiral James Watkins, former Chief of Naval Operations, remarked on numerous occasions that oceanography was a key determinant in the U.S. Cold War “victory,” due to the knowledge advantage provided to our forward deployed maritime forces, especially our submarines. We are firmly convinced that ocean science and technology today can and must provide us with the same knowledge advantage against the myriad maritime threats we face today.

The academic research community has enjoyed a long and productive partnership with the U.S. Navy in helping to ensure maritime military readiness, domain awareness, and warfighting advantage. This success has its foundation in sustained investment in supporting science and technology programs implemented through the 6.1, 6.2, and 6.3 programs. The 3rd Offset Strategy highlighted by Secretary of Defense Carter and other service leaders in recent congressional testimony\(^1\) acknowledges the increasing competition in science and technology by other nations that are challenging U.S. military superiority. Investments in science and technology now are crucial to ensuring future capabilities, which take time and sustained funding to nurture through the research and development process and integrate into the operational battlespace. A good example of this is the continued acceleration of Autonomous Undersea Vehicles (AUV) and other ground-breaking submarine technology usage in the undersea environment by the Navy and Department of Defense (DOD). The impact of the ocean environment on these systems is even more pronounced than it was for the manned and tethered systems of the past. Acoustic advantage; endurance and energy consumption; autonomy; and effective command, control, and communications for AUV are heavily influenced by the ocean conditions. These conditions must be measured, modeled, and accurately predicted to ensure undersea warfare advantage is maintained against a global, undersea threat that is ever-growing in complexity and proliferation. Basic ocean research provides the critical foundation to ensure continuity of our undersea knowledge superiority that generates warfare advantage. Simply put, our undersea forces must be able to win every “away game,” and we therefore must be able to exploit the ocean environment to ensure “home field advantage” at those “away games.”

In order to ensure our nation can maintain maritime battlespace superiority in an increasingly unstable world, Ocean Leadership respectfully requests the Subcommittee oppose the significant cuts in funding proposed in the President’s FY17 Budget Request, and provide the Navy with no less than the science and technology funding levels appropriated in the FY16 omnibus spending

bill, which were $671 million for 6.1 basic research, $967 million for 6.2 applied research, and $697 million for advanced technology development. Ensuring sustained funding support for Navy science and technology programs (which represents a small fraction of the overall Navy budget) is key to ensuring that the culture of innovation and initiative that the DOD has prioritized (internally as well as with its non-federal research partners) will permit the U.S. to stay ahead of the rapid changes in the technology and the human-machine interface that are being pursued by our rivals.

**Intelligence Advantage Through Ocean Knowledge**

As defined by the Navy, Maritime Domain Awareness (MDA) is the “effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment of the United States.” MDA is comprised of situational awareness (observable and known) and threat awareness (anticipated or suspected) – a mix of operational intelligence, and environmental data and information. Whether it is ocean observations, remote sensing, or ocean modeling, a better understanding of the ocean significantly enhances MDA. The security advantage gained through increased ocean knowledge is not limited to the warfighting arena. Beyond situational awareness contributions of forward-deployed naval forces, information and intelligence capacities of Navy and the intelligence community (e.g., CIA, NSA, DIA, NGA) benefit from basic and applied research programs, as well as partnerships with academic institutions supporting robust ocean observations and monitoring to enhance threat awareness.

**Long-term Commitment to People, Platforms, and Partnerships**

The Navy and DOD have a distinguished history of fostering the science and technology that has been responsible for U.S. military success and superiority. There is growing concern that this superiority is being challenged by a significant increase in investment by our rivals, while funding support for science and technology within DOD and the Navy has languished. This is particularly apparent in the proposed reduction in the Navy 6.1 funding request included in the President’s budget, which would result in an approximately 20 percent decrease in resources.

It is hard to overemphasize the significant advantages that have resulted from Navy support for basic research, including highly trained people, cutting-edge technology, and innovative ideas. The advantage and benefits that have accrued to DOD and the Navy cannot be attributed solely to the amount of investment; equally important is the Office of Naval Research’s culture that understood the importance of providing *sustained* support for technology development and the cultivation of researchers, including early career and established scientists (internally and among its academic partners). The cultivation of people and technology in support of national security priorities is well beyond the mission and role of other federal agencies supporting ocean science, such as the National Science Foundation and the National Oceanic and Atmospheric Administration. For example, the U.S. Navy's competitive advantage in undersea warfare research relies on the ability to execute unique data collection systems and sea-going expertise. The backbone for these programs is comprised of partnering scientists, expert engineers, and technicians with decades of experience in executing research at sea.

It is also important to recognize the important role science and technology funding plays in the development of new technology (e.g., sensors, platforms, models, data analytics) that are essential to helping the Navy meet its mission requirements. Much of the oceanographic equipment in use today, for defense and nondefense research, observations, and modeling, has

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2 [https://www.dhs.gov/sites/default/files/publications/HSPD_MDAPlan_0.pdf](https://www.dhs.gov/sites/default/files/publications/HSPD_MDAPlan_0.pdf)
resulted from Navy investment in its development, as well as its integration to defense and non-defense at-sea platforms and in research labs through the Defense University Research Instrumentation Program. Unfortunately, the level of investment in technology development has seriously declined in recent years, with greater focus being placed on the transition of applied technology into operations. The negative impacts of this shift in emphasis and support will be realized in future years as the flow of new technologies and their application to Navy mission requirements slows just as the increased investments by rivals begins to bear fruit. The Workforce Research team at the American Geosciences Institute calculated that there will be a shortfall of 135,000 geoscientists in the U.S. workforce over the next decade. We can ill afford to have a shortage of these workers who are vital for the national security community.

Given the critical importance of ocean knowledge in both the warfighting arena and in threat awareness, the ocean science community greatly appreciates the Subcommittee’s continuing recognition of the importance of the Auxiliary General Oceanographic Research (AGOR) research vessels fleet. Ocean Leadership strongly supports inclusion of adequate funds in the 6.2 account to complete the Service Life Extension Program of the AGOR-23 class, which adds 10-15 years of life to the vessels and ensures the availability of unique platforms capable of performing multidisciplinary, high endurance missions that support Navy information needs around the globe. There is also concern that the Navy does not have a long-term plan to recapitalize its operational oceanographic survey ship fleet. The T-AGS 60 Pathfinder class will begin to exceed their planned life expectancy within the next decade, and it is imperative that replacement ships be included in the Navy’s long-term ship building plan.

Navigating Changing Ocean Conditions
The Department of Defense Climate Change Adaptation Roadmap\(^3\) and both of the most recent Quadrennial Defense Reviews\(^4,5\) have recognized that changing climate is a threat to national security, and its effects must be assessed and addressed through adaptation. The melting of sea ice, acidification of the seas, decay of large ice sheets, and the melting of permafrost are just some of the ways the polar regions have responded to changing ocean and atmospheric conditions. Half of the world’s population lives within 60 km of the ocean, 75 percent of all large cities are on the coast\(^6\), and the U.S. coastal population is expected to increase by an additional 10 million people by 2020\(^7\). As many as 650 million people across the world are at risk from rising seas by the end of the century.\(^8\) Just this year we’ve begun to see a slowdown of ocean circulation in the Atlantic\(^9\), which is symptomatic of broader changes in global ocean circulation patterns that directly impact military operations (e.g., anti-submarine warfare), while also affecting storm and drought intensity (and the concomitant humanitarian response implications) and the chronic -but significant- concerns surrounding the rate of sea level rise on naval installations and facilities.

With the ocean providing 20 percent of the animal protein in the human diet\(^10\) and 24 percent of global land degrading (25 percent rangeland, 20 percent cropland)\(^11\), it is understandable that

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\(^7\) [http://oceanservice.noaa.gov/facts/population.html](http://oceanservice.noaa.gov/facts/population.html)
\(^10\) [http://www.education.noaa.gov/Ocean_and_Coasts/](http://www.education.noaa.gov/Ocean_and_Coasts/)
Illegal, Unregulated and Unreported Fishing (IUU) and desertification are not only food security issues, but ultimately ones of national security. Whether considering ocean conditions to better understand drought forecasts or to model changes in fish distributions, data and information from the sea strengthen the Navy’s awareness of conflict catalysts. The basic and applied research lines, robust partnerships and collaborations with ocean science and technology institutions, and in-house surveying capabilities all support the increase of ocean knowledge for our nation’s security advantage.

Through threatened freshwater sources (due to saltwater intrusion), loss of protein sources, loss of land, and increases in disease and other human health concerns\(^\text{12}\), human populations living within coastal zones across the globe are the groups to be impacted most directly by a changing ocean. Displacement or abandonment, mass migrations, and conflict over resources are real security threats both on the coasts and inland. Changes in ocean conditions directly associated with access in the Arctic lead to expanded navigation and commerce in the Arctic (e.g., shipping, fishing, oil and gas exploration, bioprospecting, mining) and could result in disputes amongst nations or accidents requiring search and rescue or other response.

To maintain global stability, it is critically important that the nation understands the factors of conflict catalysts. To successfully navigate a changing physical, chemical, and biological ocean while maintaining geopolitical establishments, the Navy must understand the ocean and coastal baseline conditions, changing conditions, forecasted conditions, the vulnerabilities of undersea and coastal infrastructure, and the threatened human population. The changing climate and ocean systems are altering when and where our military may be called to duty, but also how the military can respond. Rising sea-levels affect amphibious landing opportunities, and extreme weather could impact deployment, intelligence, surveillance, and reconnaissance capabilities. It is through the robust federal support of the Navy’s basic and applied research, maintaining superiority in technology development and integration, and through collaborative partnerships with ocean science and technology institutions that this will happen.

The ocean science and technology community is very grateful for the support that the Defense Subcommittee has provided for oceanographic research, and we hope that you will continue to prioritize science investments to ensure the U.S. can maintain its superiority at sea. We greatly appreciate your consideration of our recommendations and are available to discuss these recommendations with you further at your earliest convenience.

Below is a list of the institutions that participate in the Consortium for Ocean Leadership.

Alabama
Dauphin Island Sea Lab

Alaska
Alaska Ocean Observing System
Arctic Research Consortium of the United States (ARCUS)
North Pacific Research Board
University of Alaska Fairbanks

California
Aquarium of the Pacific
Bodega Marine Lab
Esri
Hubbs-SeaWorld Research Institute
L-3 MariPro, Inc.
Liquid Robotics, Inc.
Monterey Bay Aquarium Research Institute
Moss Landing Marine Laboratory
Naval Postgraduate School
Romberg Tiburon Center for Environmental Studies
Stanford University
Teledyne
University of California, San Diego (Scripps)
University of California, Santa Barbara
University of California, Santa Cruz
University of Southern California

Colorado
Cooperative Institute for Research in Environmental Sciences (CIRES)

Connecticut
University of Connecticut

Delaware
Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)
University of Delaware

Florida
Earth2Ocean, Inc.
FAU Harbor Branch Oceanographic Institute
Florida Institute of Oceanography
Mote Marine Laboratory
Nova Southeastern University
University of Florida
University of Miami
University of South Florida

Georgia
Savannah State University
Skidaway Institute of Oceanography of the University of Georgia

Hawaii
University of Hawaii

Illinois
John G. Shedd Aquarium

Louisiana
Louisiana State University
Louisiana Universities Marine Consortium (LUMCON)

Maine
Bigelow Laboratory for Ocean Sciences
The IOOS Association
University of Maine

Maryland
John Hopkins University
National Aquarium
University of Maryland Center for Environmental Science

Massachusetts
Massachusetts Institute of Technology
University of Massachusetts, Dartmouth
University of Massachusetts, Lowell
Woods Hole Oceanographic Institution

Michigan
University of Michigan

Mississippi
University of Mississippi
University of Southern Mississippi

New Hampshire
University of New Hampshire

New Jersey
Monmouth University Urban Coast Institute (UCI)
Rutgers University

New York
Columbia University (LDEO)
Stony Brook University

North Carolina
Duke University Marine Laboratory
East Carolina University
North Carolina State University
University of North Carolina at Chapel Hill
University of North Carolina at Wilmington

Oregon
Oregon State University

Pennsylvania
Pennsylvania State University

Rhode Island
University of Rhode Island

South Carolina
South Carolina Sea Grant Consortium
University of South Carolina

Texas
Fugro
Harte Research Institute
Sonardyne, Inc.
Texas A&M University
University of Texas at Austin

Virginia
CARIS, USA
CNA
College of William and Mary (VIMS)
Institute for Global Environmental Strategies (IGES)
Old Dominion University
U.S. Arctic Research Commission

Washington
Sea-Bird Scientific
University of Washington

Washington, DC
Marine Technology Society
National Ocean Industries Association (NOIA)
Southeastern Universities Research Association (SURA)

Wisconsin
University of Wisconsin-Milwaukee School of Freshwater Sciences