

Testimony of RADM Jonathan White, USN (Ret.)
President and CEO of the Consortium for Ocean Leadership
Before the Senate Appropriations Committee's Subcommittee on Commerce, Justice,
Science and Related Agencies Regarding NSF, NOAA and NASA
May 11, 2017

On behalf of the Consortium for Ocean Leadership (COL), I appreciate the opportunity to discuss Fiscal Year 2018 (FY18) federal science funding of the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA). COL represents the nation's leading ocean science, education, and technology institutions, with the mission to shape the future of ocean sciences. Geosciences, broadly, and ocean science and technology, specifically, strengthen our national and homeland security, support a safe and efficient marine transportation system, underpin our economy, contribute to improved human health, and further the understanding of benefits from the sea upon which our nation relies. Aligning with like-minded science organizations and coalitions, we respectfully request the Subcommittee provide no less than \$8 billion for NSF (including funding parity for all directorates or at least \$1.4 billion for the Geosciences Directorate); \$5.9 billion for NASA's Science Mission (including at least \$2.03 billion for the Earth Science Division); and \$6.1 billion for NOAA (including research, extramural grant programs, and education). Additionally, the ocean science and technology community is deeply concerned by the Administration's FY 2018 budget proposal outline to drastically reduce non-defense discretionary funding (-\$54 billion) with draconian cuts and outright program eliminations in the geosciences, education, and extramural grants. Specifically, we oppose any reductions to NSF's geosciences or education programs; the proposed zeroing out of over \$250 million in targeted NOAA grants and programs supporting coastal and marine management, research, and education, including Sea Grant (and its Knauss Fellowship program); and reducing NASA's Earth science portfolio by \$102 million (slashing funding for Earth science research grants and terminating four Earth science missions).

Ocean Science: Vital To The Nation
Improves National and Homeland Security

Ocean science and technology provide the nation with a knowledge advantage against myriad maritime threats we face, both now and in the future. Basic ocean research forms the critical foundation needed to ensure continuity of our superior knowledge of the ocean, which in turn generates warfare advantage and ensures homeland security. However, this ocean knowledge advantage over key military competitors has diminished and can only be reestablished through investments in basic research across all agencies. Asian and European ocean education and research enterprises have, in many cases, matched or exceeded that in the U.S. For example, Russia has 40 icebreakers with which to access the opening Arctic, compared to the two operational American icebreakers (one heavy, one medium) in existence.

Changing ocean systems are altering not only when and where our military and Coast Guard may be called to duty but also *how* they can respond, influencing amphibious landing opportunities, deployment of military assets, surveillance, interpretation of intelligence, search and rescue, reconnaissance capabilities, and other operations and tactics. This necessitates new planning in multiple geographic areas, including the Arctic. To do this safely and economically, the baseline conditions, changes, and geographic differences must be researched and understood to the greatest extent possible. To successfully navigate an ocean with changing physical, chemical, and biological properties while maintaining geopolitical establishments, the sea-dependent agencies must understand the ocean and coastal baseline conditions, changing and forecasted conditions, the vulnerabilities of marine and coastal infrastructure, and the threats facing human populations. It is only through robust federal support of basic and applied research, maintaining superiority in technology development and integration, and creating collaborative partnerships with ocean science and technology institutions that this will happen.

Expands Economic Prosperity

A strong ocean economy is requisite for a strong national economy. The U.S. coastal and ocean economy contributes \$359 billion to our gross domestic product, including marine construction (\$5.8 billion), ship building (\$17.3 billion), marine transportation (95% of all imports to the U.S.; \$59.1 billion), offshore oil and gas (\$167 billion), living marine resources (\$7.3 billion), and tourism and recreation (\$101.1 billion). These 150,000 business establishments and three million employees (more than telecommunications, crop production, or building construction sectors) provide \$117 billion in wages annually and is expected to increase by another 10 million employees by 2020. Additionally, the ocean economy withstood the recession of 2007 to 2009 better than the U.S. economy as a whole.

Weather forecasting plays an important and widely-understood role in our nation's economy, but we lack similar ability to forecast the ocean with robust accuracy and timeliness. Comprehensive ocean observations are required to understand the sea's role in weather forecasts (as well as ocean-specific forecasts) if we are to reap similar industry benefits. Ocean data and information supports analysis and understanding of our rich ocean resource. From this, businesses and communities can build new ocean-dependent enterprises and maintain and grow current endeavors, all while effectively managing risk.

Fosters Human Health

Human health depends on complex information, integrated networks, and a fragile framework. Food safety, food security, harmful algal blooms, aquaculture, adaptive healthcare infrastructure, and seafood fraud are all ocean-related health components for our nation. When one thinks about food security, terrestrial agriculture is probably the first thing that comes to mind, but it should be the ocean. The ocean's role in human's protein consumption and the water cycle link food security and the sea. Examples include consideration of ocean conditions to improve drought forecasts, model changes in fish distributions, understanding the spread of seafood disease, and development of aquaculture. Data and information from the sea strengthen the nation's ability to understand and predict crop loss, food availability and pricing, contamination, disease, and conflict catalysts. Extreme weather events have direct health impacts (e.g., droughts, wildfires, floods) and indirect impacts (e.g., freshwater access, sanitation, pathogen distribution). Linking health professionals and ocean scientists enables better understanding of complex ways that humans interact with the ocean ecosystem, including numerous positive and negative effects on our nation's citizens. Multilevel, interdisciplinary, integrated approaches from both the top down and the bottom up can help to ensure a healthy population.

Builds a Dynamic Workforce

A secure, healthy, and prosperous nation requires a society that is able to adapt its workforce to meet the needs of a changing world. A diverse, well-educated, ocean literate workforce provides the necessary base from which innovation grows. Looking ahead to a 12.5 percent projected growth of science, technology, engineering, and math (STEM) jobs in the U.S. from 2012 to 2022 and a 14 percent projected increase in U.S. geoscience jobs in that same period, coupled with the greying of America's geoscience workforce (47 percent of American geoscientists in the private sector and 43 percent in the federal government were over the age of 55 in 2016), it is clear that we will experience major changes with our innovation workforce. Not only does the nation depend on the available pool of scientists, but it also needs those who will train the following generation and those whose work supports novel and emerging science solutions. A dynamic workforce moves our nation forward. From business professionals who can commercialize scientific advances to technicians who maintain observing infrastructure and employees trained in scientific principles, our future depends upon how we will meet these demographic and educational challenges.

An Ocean Planet; A Maritime Nation

Earth is an ocean planet, with saltwater covering more than 71 percent of its surface. The ocean sustains life itself – providing the oxygen we breathe, the food we eat, water for drinking and farming, energy to run our societies, and even the warmth that has allowed humans to thrive. One half of the oxygen on Earth comes from marine phytoplankton. Seafood contributes 15 percent of animal protein for three billion people (another billion rely on fisheries for their main source of protein). The ocean holds 97 percent of Earth's water, which then becomes freshwater for drinking, farming, and manufacturing. Roughly 80 percent of

global energy comes from petroleum formed in ancient seas. Around the world, 350 million jobs are linked to the ocean, and coastal zones contribute \$26.8 trillion to the global economy each year.

The U.S. is a maritime nation, with more ocean area in our Exclusive Economic Zone than in our terrestrial 50 states combined. From the very beginning, the U.S. has turned to the sea for protection, exploration, lifestyle, economic security, food, recreation, and energy. Our country is protected by a Navy battle force of 275 ships, 118 Army watercrafts, 245 Coast Guard cutters, and over 80 coastal military bases. Coral reefs, sand dunes, mangroves, and other living shorelines provide storm protection to our coastal communities. The ocean is an economic driver to more than three million Americans who work in ocean and coastal industries (which are worth \$359 billion annually). Our nation's energy needs are met by the ocean's production of 63 million gallons of oil every day from offshore drilling and could sustainably produce more than five billion gallons of algae-based diesel annually by 2020. The ocean's role in food security is critical – it provides 20 percent of the animal protein we depend on for food, provides fishmeal that fertilizes the nation's crops, and is the major driver of the weather and water cycle that bring warmth and water to inland farms. Increasing numbers of people are calling the coast home, with populations in coastal watershed counties increasing by 45 percent from 1970-2010. Even the nation's heartland is intimately coupled to the ocean through its influence on weather and its importance in providing transportation of goods and services through all 50 states.

Conclusion

Ocean science and geosciences *writ large* impact every American every day. Across the nation, across science disciplines, and across the federal family, it is clear that robust and sustained federal investments in geosciences are key to addressing global and national challenges, underpinning new and growing economies while maintaining and supporting existing ones, and improving technologies that preserve lives and livelihoods, persons, and property. As the Subcommittee drafts the FY 2018 spending bill, we hope that you reflect on the fact that the bulk of the intellectual capacity regarding the ocean resides within the academic research community. Peer-reviewed extramural research is the most efficient and effective vehicle for providing our policy makers and our commercial partners with the expertise, information, and data necessary to address the emerging challenges facing our nation. I respectfully reiterate the geoscience community's recommendation that the Subcommittee provide no less than \$8 billion for NSF (including funding parity for all directorates or at least \$1.4 billion for the Geoscience Directorate); \$5.9 billion for NASA's Science Mission (including at least \$2.03 billion for the Earth Science Division); and \$6.1 billion for NOAA (including research, extramural grant programs, and education). Additionally, the ocean science and technology community opposes any reductions to NSF's geosciences or education programs; the proposed zeroing out of over \$250 million in targeted NOAA grants and programs supporting coastal and marine management, research, and education; and reducing NASA's Earth science portfolio through cuts to funding for Earth science research grants and terminating four Earth science missions.

Adequate and sustained investment in science is the bedrock upon which this nation's global science primacy and innovation economy are built. The U.S. is poised to maximize its maritime experience and potential to address security through science and increase competitiveness in the international marketplace, all while looking toward the long-term viability of our base resource – the ocean. Only through the Subcommittee's continued dedication to our nation's science and education enterprise will this be possible.

Mr. Chairman and members of the Subcommittee, we greatly appreciate the opportunity to share our recommendations, and I encourage bipartisan support for geoscience funding, including ocean science and technology, in the FY 2018 appropriations process and into the future.

Below is a list of the institutions that are represented by 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 Laboratory

Esri

L-3 MariPro, Inc.

Liquid Robotics, Inc.

Monterey Bay Aquarium Research Institute

Moss Landing Marine Laboratories

Romberg Tiburon Research Laboratory

Stanford University

Teledyne RD Instruments

U.S. Naval Postgraduate School

University of California, San Diego Scripps Institution of Oceanography

University of California, Santa Barbara

University of California, Santa Cruz

University of Southern California

Colorado

Cooperative Institute for Research in Environmental Sciences

Connecticut

University of Connecticut

Delaware

University of Delaware

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

Florida

Earth2Ocean

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, University of Georgia

Hawaii

University of Hawaii

Illinois

John G. Shedd Aquarium

Louisiana

ASV Global, LLC

Louisiana State University

Louisiana Universities Marine Consortium

Maine

Bigelow Laboratory for Ocean Sciences

The IOOS Association

University of Maine

Maryland

Johns Hopkins University Applied Physics Lab

National Aquarium

Severn Marine Technologies, LLC

University of Maryland Center for Environmental Science

Massachusetts

Massachusetts Institute of Technology

University of Massachusetts, Dartmouth

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

Rutgers University

New York

Columbia University Lamont-Doherty Earth Observatory

Stony Brook University

North Carolina

Duke University

East Carolina University

North Carolina State University

University of North Carolina, Chapel Hill

University of North Carolina, 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

Tennessee

Eastman Chemical Company

Texas

Harte Research Institute For Gulf of Mexico Studies

Shell Oil Company

Sonardyne, Inc.

Texas A&M University

University of Texas at Austin

Virginia

College of William & Mary (VIMS)

Institute for Global Environmental Strategies (IGES)

Old Dominion University

Teledyne CARIS

U.S. Arctic Research Commission

Washington

Sea-Bird Scientific

University of Washington

Washington, D.C.

Marine Technology Society (MTS)

National Ocean Industries Association (NOIA)

Southeastern Universities Research Association (SURA)

Wisconsin

University of Wisconsin, Milwaukee School of Freshwater Sciences

Australia

Institute for Marine and Antarctic Studies (IMAS)

Bermuda

Bermuda Institute of Ocean Sciences

Canada

Dalhousie University

University of Victoria Ocean Networks Canada