



National Association of Marine Laboratories -- FY 2017 Public Policy Priorities

In setting NAML's priorities, NAML recognizes the importance of federal investment in the geosciences as it contributes to the Nation's innovation, safety, and security. Drawing from two key reports from the National Academy of Sciences: [Sea Change: 2015-2025 Decadal Survey of Ocean Sciences \(DSOS\)](#); and [Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century](#),

NAML's federal priorities are:

- Enhancing research, education and public engagement at marine labs that foster the continued development of the nation's workforce, expansion of opportunities for active learning and collaborative research, and improved engagement with the public;
- Increasing support for competitive, merit-based ocean, coastal, and Great Lakes research and education from relevant federal agencies to address research priorities and agency mission priorities; and
- Promoting a network of advanced connectivity among Federal and non-Federal laboratories that strengthens the Nation's research and education enterprise – this includes advanced cyber infrastructure and the co-location of federal scientists and infrastructure at NAML facilities.

The Role of Marine Laboratories in the Nation's Research and Education Enterprise

"Field stations are national assets formed by the unique merger of natural capital, intellectual capital, social fabric, and infrastructure that leads to the important scientific endeavors required if we are to understand our rapidly changing natural world." Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century.

Ocean, coastal and Great Lakes marine laboratories are vital, place-based "windows on the sea." They connect communities with cutting edge science, while providing students and citizens with meaningful learning experiences. The members of NAML work together to improve the quality and relevance of ocean, coastal and Great Lakes research, education and outreach. NAML seeks support for the following activities:

- Research of the highest quality, making use of the unique capabilities of coastal laboratories in conducting education, outreach and public service;
- Physical and cyber-related infrastructure for research and networking within and among facilities;
- Effective management and conservation of marine and coastal habitats and resources using ecosystem-based management approaches;
- Observing systems that collect data needed to support the management of marine resources for the benefit of environmental and human health needs; and;
- Education and training based on experiential, problem-solving approach.

Oceans, Coasts and Great Lakes are Vital for Economic Growth and the Well-being of the Nation

Six economic sectors of the U.S. economy depend on the oceans, coasts, and Great Lakes, which provide an important and resilient part of the national economy. According to NOAA, in 2012, the ocean economy accounted for • 147,000 business establishments • 2.9 million employees • \$113 billion in wages • \$343 billion in gross domestic product. In 2012, the ocean economy's contribution to gross domestic product grew by 10.5 percent— more than four times as fast as the U.S. economy as a whole (which grew by 2.5 percent). During the same year, employment in the ocean economy increased 3.8 percent (adding 108,000 jobs). This was twice the national average employment growth of 1.8 percent. Programs such as NOAA's Sea Grant program, NSF's geoscience and biological sciences research programs including the Field Stations and Marine Laboratories program, NOAA's National Estuarine Research Reserve System, ocean observing and education programs at NSF and NOAA, and EPA's national estuaries and other water-related programs all contribute to either the continued economic development of our coastal economies and/or the improved management of coastal and marine natural resources.

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Research and Education: Commitment to Innovation

Innovation in the form of new goods, services, or processes builds new knowledge and technology, contributes to national competitiveness, improves living standards, and furthers social welfare. Research and development is a major driver of innovation. R&D expenditures indicate the priority given to advancing science and technology relative to other national goals.

According to the latest federal data, the U.S. science and engineering (S&E) enterprise still leads the world. The United States invests the most in research and development (R&D), produces the most advanced degrees in science and engineering and high-impact scientific publications, and remains the largest provider of information, financial, and business services. However, Southeast, South, and East Asia continue to rapidly ascend in many aspects of S&E. The region now accounts for 40 percent of global R&D, with China as the stand-out as it continues to strengthen its global S&E capacity. The National Science Board's (NSB) [Science and Engineering Indicators 2016](#) (*Indicators*) report highlights that China, South Korea and India are investing heavily in R&D and in developing a well-educated workforce skilled in science and engineering. *Indicators 2016* makes it clear that while the United States continues to lead in a variety of metrics, it exists in an increasingly multi-polar world for S&E that revolves around the creation and use of knowledge and technology.

According to *Indicators 2016*, China is now the second-largest performer of R&D, accounting for 20 percent of global R&D as compared to the United States, which accounts for 27 percent. Between 2003 and 2013, China ramped up its R&D investments at an average of 19.5 percent annually, greatly exceeding that of the U.S. China made its increases despite the Great Recession. China is also playing an increasingly prominent role in knowledge and technology-intensive industries, including high-tech manufacturing and knowledge-intensive services. These industries account for 29 percent of global Gross Domestic Product (GDP) and for nearly 40 percent of U.S. GDP. China ranks second in high-tech manufacturing, where the U.S. maintains a slim lead with a global share of 29 percent to China's 27 percent. While China plays a smaller role in commercial knowledge-intensive services (business, financial, and information), it has now surpassed Japan to move into third place behind the United States and the European Union. China has also made significant strides in S&E education, which is critical to supporting R&D as well as knowledge and technology-intensive industries.

At the same time that China and other Asian nations have continued to increase their R&D investments, the United States' longstanding commitment to federal government-funded R&D is wavering. Federal obligations for the total of R&D and R&D plant were \$129 billion in FY 2008, \$145 billion in FY 2009, and \$147 billion in FY 2010. But the years thereafter have been mostly marked by funding declines: FYs 2011 and 2012 were down \$6–\$7 billion from the FY 2010 peak and then declined further to \$127 billion in FY 2013. In FY 2014, the total increased to \$131 billion. Nonetheless, the drop from the FY 2010 level to that in FY 2014 is a current dollar decline of 11%—and when inflation is factored in, it is steeper still, at 17%. Since the Great Recession, substantial, real R&D growth annually -- ahead of the pace of U.S. GDP -- has not returned. Inflation-adjusted growth in total U.S. R&D averaged only 0.8 percent annually over the 2008-13 period, behind the 1.2 percent annual average for U.S. GDP.

NAML believes the nation is faced with a widening gap between the actual level of federal funding for research and education and what the investment needs to be if the U.S. is to remain the world's innovation leader. NAML believes the nation needs to increase its investments in research and education to develop the ideas, the people, and the innovations that power the nation's economy, create jobs, improve health, and strengthen our national security, ensuring the U.S. maintains its role as a global leader.

National Science Foundation

NSF's annual budget represents 25 percent of the total federal budget for basic research conducted at U.S. colleges and universities, and this share increases to 60 percent when medical research supported by the National Institutes of Health is excluded. In many fields NSF is the primary source of federal academic support. For example, NSF provides 61% of all federal support for basic research at academic institutions in the environmental sciences and 66% in biology (excluding the biomedical sciences). Although many federal agencies contribute to ocean, coastal, and Great Lakes research and education, NSF provides the broadest base of support, including funding for research in physical, biological, and chemical oceanography and marine geology and geophysics, and the development, implementation, and operational support for ocean, coastal, and Great Lakes research infrastructure. NSF funds vital basic research that enhances the public understanding of the Nation's oceans, coasts and Great Lakes. NSF also supports science, engineering and education to inform the societal actions needed for environmental and economic sustainability and sustainable human well-being. Research in ocean and coastal areas is supported via a highly competitive, merit-based process through a variety of modes of support at NAML laboratories involving individual investigators, small interdisciplinary teams of researchers and students, and large collaborative efforts integrating several laboratories.

NAML strongly supports robust funding of the geo and biological sciences at the NSF. NAML notes that with respect to the geosciences that since FY 2011 the NSF research and related account has increased by nearly 10%, the geosciences has remained nearly flat. This has exacerbated the budgetary pressures on the core research programs and the support for supporting infrastructure throughout the directorate and as specifically addressed in **DSOS**. The FY 2017 NSF budget request contains a proposed 6% increase for both the geosciences and the biological sciences, with a 6.5% increase for NSF's entire research budget. NAML strongly supports this requested investment in research and and education through NSF.

Research emphases at NSF should reflect the priority science questions contained in **DSOS**. NSF's support for ocean research infrastructure should be realigned with these research priorities. NAML is particularly supportive of the creation of new research networks that connect NAML laboratories and terrestrial field stations in ways that would enhance other ecosystem networks (e.g., LTERs) supported by NSF. NAML embraces this and other recommendations, which stem, in part, from **Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century**.

NAML notes the increasing share of NSF's research funding to support facilities and infrastructure, which now approaches 50% of the total. This is up substantially from the historical 40% share. Advanced infrastructure, while expensive, is essential for the field to move forward. However, the support for infrastructure must be balanced with the need to support individual investigators – particularly young investigators – with the resources needed for high quality research activities. The **DSOS** considers marine laboratories and field stations **critical** for the research priorities related to coastal and estuarine oceans, biodiversity and marine ecosystems, and marine food webs. NAML endorses the recommendations of **DSOS**. NAML particularly calls out the following **DSOS** recommendations:

- In order to sustain a robust ocean science community, holistic fiscal planning is necessary to maintain a balance of investments between core research programs and infrastructure. To maintain a resolute focus on sustaining core research programs during flat or declining budgets, NSF should strive to control operating costs of its major infrastructure programs over the next five years.
- NSF should reconsider whether the current regional class research vessels (RCRV) design is aligned with scientific needs and is cost effective in terms of long-term O&M pressures, and after doing so, should act accordingly.
- NSF should expand its partnership capabilities with other federal agencies and international partners, particularly with regard to shared community research priorities (e.g., climate change, ocean acidification, hypoxia, HABs, etc.).

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National Oceanic and Atmospheric Administration

One of NOAA's key priorities is providing information and services to make communities more resilient. America's coastal communities and shorelines are facing escalating risks from changes in storm intensity, precipitation, flooding, rising sea levels, and ocean ecology, as well as from earthquakes and tsunamis that can result in dramatic human and economic losses. Increasing population density along the coast will further intensify pressures on ecologically and economically important areas, and put more people at risk. Increasing sea level can further escalate the costs and risks of inundation events. A study by the National Institute of Building Sciences on Federal hazard mitigation grants estimated that \$1 spent on hazard mitigation potentially leads to avoidance of \$4 in disaster relief costs and lost Federal tax revenue. Smartly investing in resilience will reduce the economic impacts of these hazards and improve national economic security. Similarly, the Great Lakes region boasts a massive geographic footprint, and is a major driver of the North American economy. With economic output of \$4.7 trillion in 2011, the region accounts for 28% of combined Canadian and U.S. economic activity. By comparison, the region's output ranks ahead of Germany, France, Brazil and the U.K., and it would rank as the fourth largest economy in the world if it were a country, behind only the U.S., China and Japan.

NAML envisions invigorated coastal communities and economies, with increased resiliency and productivity. Comprehensive planning will help protect coastal communities and resources from the effects of hazards and land-based pollution to vulnerable ecosystems by addressing competing uses, improving water quality and fostering integrated management for sustainable uses. Geospatial services will support communities, navigation and economic efficiency with accurate, useful characterizations, charts and maps, and assessment tools and methods. Coastal decision makers will have the capacity to adaptively manage coastal communities and ecosystems with the best natural and social science available. Resilient coastal communities and economies cannot be achieved without strong partnerships. NOAA should increase its outreach to and usage of NAML laboratories by increasing support of *existing programs* before embarking on the establishment of new, potentially duplicative, programs.

NAML strongly supports recommendations made by the NOAA Science Advisory Board (SAB) that calls for priority support for NOAA extramural programs. These include: the National Sea Grant College (NSGC) Program and Coastal Services Center; Aquaculture Initiatives; Prescott Marine Mammal Program; Highly Migratory Shark Fishery Research Program; NOAA Cooperative and Joint Institutes; the Integrated Ocean Observing Systems; NOAA's Center for Sponsored Coastal Ocean Research harmful algal bloom, hypoxia, and ecological forecasting initiatives; the National Estuarine Research Reserve System (NEERS); the National Marine Sanctuary Program; and NOAA's Office of Education. NOAA should also join with NIH and NSF to revitalize its support for the Oceans and Human Health research program. Extramural funding enables NOAA to leverage its R&D and operational investments with the resources of the nation's leading university scientists resulting in greater and faster scientific advances at lower costs. A predictable and reliable partnership with the extramural research community is critical to NOAA's long-term success. As available resources become scarcer and major program reorganizations may be considered, NOAA should expand its efforts to co-locate agency research staff and infrastructure at non-Federal marine laboratories. Such actions will not only result in significant cost savings, but also will achieve a greater return for its investment and increase scientific collaborations and productivity. NAML also continues to express concern with NOAA proposals contained in appropriation language requests that would enable NOAA to compete with non-federal and private entities for private sector support (See proposed Sec 109 on p.219 of the *Appendix to the Budget of the U.S. Government* for FY 2017). NOAA should adhere to its public-private partnership policy, which recognizes the distinct, yet cooperative, roles of the public and private sectors as it relates to environmental information.

The NOAA budget request for FY 2017 includes requested increases for Coastal Science and Assessment Competitive Research to support research into harmful algal blooms, hypoxia, and coastal ecosystem research and assessment which NAML is pleased to support. NAML is concerned, however, with proposed reductions in oceans, coastal, and Great Lakes research - including the National Sea Grant College Program, the Ocean, Coastal, and Great Lakes cooperative institutes and Ocean Exploration and Research.

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National Aeronautics and Space Administration

Part of NASA's mission is to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment. Oceans play a major role in influencing changes in the world's climate and weather. Long-term ocean data from satellites make it possible to employ modeling techniques for global mapping of seasonal changes in ocean surface topography, currents, waves, winds, phytoplankton content, sea-ice extent, rainfall, sunlight reaching the sea, and sea surface temperature. Studying these patterns at a global scale can help forecast and mitigate the effects of floods and drought. Ocean observing satellite images tell us about the most fundamental climate changes. Satellite data have improved forecasting model capabilities to predict events such as El Niño and other global and regional climate cycles. Expanding NASA extramural support will further develop the ability to better predict ocean phenomena, particularly those impacting coastal environments (e.g. harmful algal blooms, hypoxia, ocean acidification).

Environmental Protection Agency

EPA is an important source of support for marine laboratories, and EPA's own laboratories are a critical part of the marine science community. EPA's Office of Research and Development and Office of Water provide essential resources to marine laboratories nationwide, fund research grants in various environmental science and engineering disciplines, and engage the Nation's best scientists and engineers in targeted research complementary to EPA and other federal research activities. Unfortunately, support for research has declined dramatically over the past several years within EPA, and the EPA's Science Advisory Board has called for renewed investments. Enhanced support for extramural research programs at EPA, such as BEACHES, Science to Achieve Results and the National Estuary Program, are essential in helping to mitigate and adapt to environmental change.

Department of Interior

DOI is an important federal player with respect to the ocean and coastal community through the research and other activities supported and conducted by the Bureau of Ocean Energy Management (BOEM), the U.S. Geological Survey (USGS) via the Coastal and Marine Geology program and the National Biological Service, and the U.S. Fish and Wildlife Service (FWS). Greater partnership with NAML laboratories would provide BOEM, USGS, and FWS with improved access to marine science information to support their roles in the management of ocean and coastal resources.

National Institutes of Health – National Institute of Environmental Health Sciences (NIEHS)

NIEHS Centers for Oceans and Human Health fund research on marine-related health issues, such as developing techniques for more accurate and earlier detection of harmful algal blooms with the goal of preventing or reducing exposure, and studying the health effects of eating seafood that harbors toxins produced by harmful algae. NIEHS grantees examine the health effects of consuming seafood containing pollutants such as PCBs and mercury; identify indicators of recreational water contamination and illness, and explore compounds from marine organisms that hold promise as therapies for neurodegenerative disorders, cardiovascular and infectious diseases, certain cancers and other conditions. NIEHS is conducting research on the effects of the *Deepwater Horizon* oil spill on coastal communities with regard to social and human health effects. NAML encourages NIH to reinvigorate its support for the Oceans and Human Health research program, in cooperation with NSF and NOAA.

Department of Energy

DOE's Energy Efficiency and Renewable Energy division has initiated significant efforts to understand and develop sources of renewable marine energy from tidal, wave and current sources. Environmental effects and conflicts with existing ocean uses must be evaluated as U.S. coastal energy sources are developed. The Nation's marine laboratories are uniquely distributed and serve as ideal locations for much of the research needed to rationally develop these energy sources. Opportunities to partner with DOE in these areas are strongly encouraged.

U.S. Department of Agriculture

The vision for USDA's Agriculture Research Service (ARS) aquaculture research and technology transfer is to support a thriving domestic industry based on improved genetic stocks and scientific information on biotechnologies and management practices to ensure a high quality, safe supply of healthful seafood and aquatic products. The mission of the Aquaculture National Program is to conduct high quality, relevant, fundamental, and applied aquaculture research, to improve the systems for raising domesticated aquaculture species, and to transfer technology to enhance the productivity and efficiency of U.S. producers and the quality of seafood and other aquatic animal products. The USDA's National Institute of Food and Agriculture (NIFA) manages the USDA's aquaculture research and extension program and facilitates the coordination of all federal programs in aquaculture through the Joint Subcommittee on Aquaculture, which reports to the National Science and Technology Council in the Office of Science and Technology Policy. NIFA's funding of scientific and technology transfer goals to support development of a globally competitive U.S. aquaculture industry includes: improving the efficiency of U.S. aquaculture production; improving aquaculture production systems; improving the sustainability and environmental compatibility of aquaculture production; ensuring and improving the quality, safety, and variety of aquaculture products for consumers; improving the marketing of U.S. aquaculture products; and improving information dissemination, technology transfer, and access to global information and technology in aquaculture. NAML embraces these goals and encourages more direct USDA extramural funding and co-location of agency research staff and infrastructure at non-Federal marine laboratories.

Education, Diversity and an Ocean Literate America

The U.S. continues to be at risk with respect to student achievement in science, technology, engineering and math among industrialized nations, as well as, emerging industrializing nations. As reported in the National Science Board's *Science and Engineering Indicators 2014* report:

- In mathematics, the percentage of U.S. students reaching the proficient level remained well below half in 2011: 40% of fourth graders and 35% of eighth graders performed at or above this level.
- In science, only 32% of eighth graders performed at or above the proficient level for their grade in 2011.

In comparison with other nations, the U.S. average score on the 2011 Trends in International Mathematics and Science Study (TIMSS) mathematics assessment was substantially lower at grade 4 than those of seven other countries/jurisdictions and those of six countries/jurisdictions at grade 8. The top performing nations each scored at least 50 points higher than the U.S. at grade 4 and at least 77 points higher than the U.S. at grade 8.

NAML continues to believe it is critically important that we improve ocean literacy and workforce development among all sectors of our nation. Marine laboratories play an important role in formal and informal education and workforce development by providing citizens of all ages a place for experiential ocean education. Marine laboratories serve as primary training grounds for students and are committed to enhancing diversity within the field of ocean, coastal and Great Lakes research and education. By fostering relationships with community colleges and minority-serving institutions, marine laboratories provide distinctive learning opportunities for underrepresented groups. Marine laboratories are key to achieving a greater understanding of ocean and coastal ecosystems and promoting stewardship of these ecosystem resources.

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NAML supports the Administration's proposed \$7 billion investment in STEM education across the Federal Government – with its expansion of access to rigorous STEM courses, improving STEM teaching and support for active learning, and expansion of opportunities for all students in STEM education. NAML laboratories believe the mission agencies have a role in helping to educate and train the workforce they will need in the future to carry out their missions. Therefore, NAML strongly supports the continuation of STEM education programs in NOAA, NASA, NIH and other mission agencies. NAML also continues to strongly support partnerships with Federal agencies to address the ocean education needs of the Nation. These include the NSF's Louis Stokes Alliance for Minority Participation, Research Experiences for Undergraduates and Research on Learning in Formal and Informal Settings programs; NOAA's Expanding Partnerships Program in the NOAA Education Office and Sea Grant's fellowships and K-12 STEM education programs; and EPA's Science to Achieve Results (STAR) Fellowship Program. Place-based networks such as NAML offer unique opportunities to provide hands-on training in diverse field settings with advanced sampling and sensing technologies. The importance of marine laboratories in support of coastal states' environmental literacy plans is essential in developing a literate public. Investment is needed today in coastal, ocean and Great Lakes education programs at NAML laboratories that support formal and informal learning at all age levels, in all disciplines and for all Americans.

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