On behalf of the Consortium for Ocean Leadership, I appreciate the opportunity to discuss the Fiscal Year 2017 (FY17) federal science budget for the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA). Ocean Leadership represents the leading ocean science, education, and technology institutions, 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 our understanding of complex ocean and coastal ecosystems. We respectfully request the subcommittee provide no less than $7.96 billion for NSF (including full funding for geosciences); $2.03 billion for Earth Sciences at NASA; and $6.0 billion for NOAA. These funding provisions are essential to our future security and economic prosperity.

As Congress addresses federal investments in the face of constrained budgets, it is important to recognize and maintain support for basic and applied research as a core federal responsibility. This federal investment must be a priority given that our nation’s science- and technology-based economy strongly relies on a foundation built upon scientific advances, both within specific disciplines as well as across disciplines. Historic federal investment in basic research and development has been critically important to advancing our science superiority on the world stage as well as growing our economy, both of which can and should be built upon in the FY17 appropriations process. Investing in earth, ocean, and atmospheric sciences – collectively known as the geosciences – are opportunities for the American taxpayer to address global issues while maintaining U.S. primacy in science and technology, as well as benefitting the U.S. economy, national security, and public safety. Geosciences are found across the federal family, in: NSF’s Geoscience Directorate, NOAA’s Office of Oceanic and Atmospheric Research, and NASA’s Earth Science Division; with each agency partnering, leveraging, and building upon each other’s data and information. The ocean science and technology community urges Congress to look to the future of our nation. With geosciences contributing $100 billion to U.S. GDP in 20121 with an expected increase to $127 billion by 20222, it is clear that these scientific disciplines are valuable to our economy.

**National Science Foundation**

NSF is the premier federal agency tasked with supporting basic scientific research, and has been a primary force in providing support for discoveries that have driven our nation’s economy through innovation. In fact, 70% of Nobel Laureates since 1950 have received federal funding from NSF at one time3. Historically, Congress has appropriated top line numbers for the agency, refraining from directing the course of the agency’s research agenda or setting science or infrastructure priorities for the agency. We hope that this policy will continue so the Foundation can continue to make decisions based on the highest quality peer-reviewed science, rather than

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politics. For example, through this method of federal science support, NSF’s physical science, computer science, and geoscience basic research have resulted in the development of radar systems, satellites, and computer models used by other federal agencies which have improved weather and ocean forecasting; and ultimately saved countless lives and livelihoods. Given the tremendous impact that natural hazards have on our nation’s economy and public welfare, we believe that investing in the geosciences is critical to advance our knowledge of the planet, while at the same time investing in social and behavioral sciences can improve our ability to understand and communicate key scientific findings and risks to the public and policymakers, who must deal with a rapidly changing planet. Additionally, with NSF providing 64% of all funding for basic geoscience research at U.S. universities and the projected 14% geoscience job growth, it is obvious that this federal agency plays a key role in both workforce development and industry growth in the U.S.

National Oceanic and Atmospheric Administration
To meet its many missions and mandates, NOAA requires timely, accurate, and sensitive observations of the planet. Given the pressures of the current fiscal climate, we are confident that NOAA can more efficiently and effectively meet its scientific requirements through partnerships with extramural academic and private sector partners that enhance and strengthen its scientific capability. Such collaborations have led to innovative and cost-effective sensor technologies, streamlined data assimilation and dissemination, improvements in our ability to understand and forecast harmful algal blooms and ocean chemistry, and to a greater understanding of how the ocean and coasts are changing over time. Accessing and partnering with the best minds of the nation to help manage resources, observe and analyze trends, make forecasts, and address critical concerns requires a greater commitment to external, competitive, and peer-reviewed grant opportunities.

As the ocean absorbs much of the heat and carbon dioxide in the atmosphere, it is crucial to better understand air-sea-ice interactions. These and other ocean and coastal observations provide data and information critical to: forecasting typhoons, hurricanes, flooding, heat waves, droughts, and wildfires; they help calibrate and validate satellite observations; they provide baselines for fisheries management, and long-term data sets on ecosystems, tides and currents, sea level change, and ocean chemistry. Without sustained observations feeding into our prediction capabilities on regional and seasonal scales, we are essentially flying blind in terms of managing resources and protecting overall public health. There are many major natural threats facing our nation, and significant challenges ahead in understanding, forecasting, and mitigating them, all of which require significant financial resources. Ocean and coastal observations require federal investment and the return on that investment includes accurate forecasts of weather and extreme events; communities that are prepared for, and can respond to, long-term changes as well as sudden events (e.g., flooding, drought); national, international, state, and local governments having science-based resource management; and weather-climate sensitive industries working with greater certainty in their business models.

National Aeronautics and Space Administration
The ocean science and technology community urges the subcommittee to fund NASA’s Earth Science Division at $2.03 billion in order to support ocean science and education. NASA

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4 https://www.nsf.gov/geo/about.jsp. National Science Foundation
5 2012-2022, Status of the Geoscience Workforce Report, the American Geosciences Institute, 2014. This handout was compiled by the American Geosciences Institute (AGI), 2014.
satellites provide a view of, and data pertaining to, the planet we live on – ocean and land, atmosphere and deserts, ice sheets and mountains – all important components of a complex and changing system. Beyond interesting information and glorious imagery, NASA earth science activities facilitate and improve the forecasting leading to a national science enterprise with stellar weather, climate and natural hazard predictive capabilities.

**Geoscience Education**

The interdisciplinary nature of oceanography (e.g., physics, biology, chemistry, geology, engineering, computer and information science) requires dedicated education and training opportunities for the next generation of ocean scientists. We believe that the mission agencies mentioned above should continue to have a robust role in education and training as they are best situated to anticipate changing trends and challenges. With 20% of American jobs requiring a high level of STEM understanding⁶ (26 million) and 63% of high school graduates not meeting the college readiness benchmark for science⁷, this is a timely investment. We can ill afford to have a 135,000 geoscience worker shortage over the next decade – as the Workforce Research team at the American Geosciences Institute have calculated – workers that are vital for national and international security, energy and weather forecasting industries, as well as natural resource managers, land-use planners and first-responders. Additionally, diversity continues to be a challenge for the scientific community overall; we need to develop a workforce whose composition better resembles the broader population. We greatly appreciate the support this committee has given to STEM education programs at NSF, NOAA, and NASA, and encourage this support to extend into the geoscience directorate at NSF, which aids the development of thousands of early career geoscientists.

**Summary**

Geosciences impact everyday Americans every day; and across the nation, across science disciplines, 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 FY17 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. We also hope that you will continue to permit science priorities and decisions to be made by the scientific community, a proven method that has enabled America’s thriving, innovation economy for decades.

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 FY17 appropriations process and into the future.

Below is a list of the institutions that are represented by the Consortium for Ocean Leadership:

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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