Ocean Science and Technology Highlights: Selected Projects From Our Federal Agencies

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*"From **sea to shining sea,** Americans benefit from the ocean's bounty – from the **industries it supports** and **the jobs it creates.**"*

– President Donald J. Trump

Overview

The Trump Administration recognizes the importance of our Nation's oceans, waters, and Great Lakes to America's economy, global competitiveness, and well-being. On May 31, 2018 The White House issued a Presidential Proclamation formally recognizing June as National Ocean Month. On June 19 President Trump signed an Executive Order to streamline Federal Ocean policy and create an Ocean Policy Committee to focus on growing the ocean economy and to prioritize scientific research, coordinate resources and data sharing, and engage with stakeholders.

The oceans cover 71 percent of the world's surface and play an important role across commercial, economic, and security sectors. Oceans support our Nation's workforce and economy, providing over 3.2 million jobs and contributing $320 billion to the national GDP[1].

Several Federal agencies are critically important to America's robust oceans-related policy. In honor of National Ocean Month, below are just a few highlights of their significant work to preserve and support our Nation's strong oceanic ecosystem.

Department of the Interior

The Department of the Interior (DOI) protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities and special commitments to American Indians, Alaska Natives, and affiliated island communities. DOI has several bureaus and offices tasked with protecting our oceans, including the National Park Service and U.S. Geological Survey, among others.

National Park Service

The National Park Service (NPS) manages 89 ocean and Great Lakes parks with over 11,000 miles of coast and 2.5 million acres of marine waters, including coral reefs, kelp forests, tidewater glaciers, estuaries, beaches, wetlands, lighthouses, historic forts, and shipwrecks. Together these coastal lands and waters comprise a system of tremendous recreational, biological, and historical. During 2017, ocean and coastal parks attracted more than 94 million visitors and accounted for over $5 billion in visitor spending in local communities.

Protecting and Preserving Our Oceans

Naional Parks and NPS programs provide important services to support ocean park stewardship, public education, recreational access, scientific monitoring and research, and other activities. The NPS is committed to restoring and sustaining ocean health by reducing inputs of pollutants into the ocean, and making sure that living resources are not depleted or damaged. These threats include invasive species, ocean plastics, and water quality, among others. Everyone, from the National Park Service, to local communities, to individuals, can make a positive contribution towards improving our oceans.

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[1] Source: NOAA, "NOAA Report on the U.S. Ocean and Great Lakes Economy."
https://coast.noaa.gov/data/digitalcoast/pdf/econ-report.pdf

U.S. Geological Survey

The U.S. Geological Survey (USGS) employs the best and the brightest experts who represent a range of Earth and life science disciplines. By integrating diverse scientific expertise, USGS understands complex natural science phenomena and provides scientific products that lead to solutions.

Using Artificial Intelligence to Improve Water Quality

The U.S. Geological Survey (USGS) supports Federal partners to provide science and information to meet the objectives and goals of the Great Lakes Restoration Initiative. The USGS is developing and testing new technologies in the Great Lakes to detect and quantify invasive species. Three technologies—autonomous underwater vehicles, stereo cameras, and artificial intelligence—are being combined in 2018 to collect images within several meters of the lake bottom in lakes Ontario, Erie, Huron, and Michigan. The acquired images will be used to train computer models to discriminate and count invasive species and to estimate the amount of the harmful algae found in bodies of water. Products of the research will support policies to manage fisheries and water quality, protect our coastal communities from the impacts of Harmful Algal Blooms (HABs), and create a three-dimensional visualization of the bottom of the world's largest freshwater ecosystem.

Environmental Protection Agency

The Environmental Protection Agency (EPA) protects and restores ocean and coastal ecosystems by promoting watershed-based management, preventing aquatic pollution, managing ocean dumping sites, assessing coastal conditions, establishing effective partnerships, and facilitating collaborative science-based efforts.

Protecting Coral Reefs

EPA is researching how to better protect corals and ensure coral reef ecosystem sustainability. These goals have guided investigations across a broad range of science needs, including: stresses from extreme water temperatures and acidification; impacts of sediment, nutrient, and contaminants; methods to measure and assess coral reef ecosystem condition and estimate their value in terms of goods, services, and benefits; and approaches for framing management scenarios that support informed decisions by communities and resource managers.

As each data gap is narrowed, EPA is closer to identifying the most threatened reefs, isolating causes for reef decline, and informing management decisions to better protect reefs now and into the future.

National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) is an agency that enriches life through science. NOAA uses its knowledge to protect American citizens and America's diverse ocean resources. The Agency regulates and sustains marine fisheries and their ecosystems, protects endangered marine species, protects and restores habitats and ecosystems, conserves marine sanctuaries and other protected places, responds to environmental emergencies, and aids in disaster recovery. The

foundation of NOAA's long-standing record of scientific, technical, and organizational excellence is its people, applying a skilled workforce to support its wide-reaching functions.

Reducing Our Seafood Trade Deficit

Despite having one of the largest exclusive economic zones (EEZs) in the world, the U.S. imports more than 90 percent of the seafood consumed by Americans. NOAA is working to reduce the $14 billion seafood deficit by cutting back on unnecessary regulations on U.S. fisheries; leveling the playing field for U.S. fishermen in the global marketplace; maximizing sustainable yields for wild-caught species through better science; and fostering the development of a domestic aquaculture industry. NOAA is proactively adapting to changing ocean conditions through tools such as EcoCast, which provides real-time ocean condition forecast maps to help West Coast fishermen find the most productive fishing spots while avoiding non-target protected species. NOAA aims to increase the production of domestic aquaculture over the next decade in a sustainable manner that also protects the domestic wild-caught stocks.

Improving Maritime Commerce

Between 2002 and 2015, total vessel calls at U.S. ports grew by 45 percent and the new class of cargo ships are much larger given the expansion of the Panama Canal. To promote safe and efficient navigation to support and maximize the economic return of marine commerce flowing through the U.S., NOAA surveys and charts the navigationally significant waters of the U.S. EEZ. NOAA continually improves hydrography and charting technology through ongoing applied research and development. NOAA is developing and deploying precision navigation tools to provide mariners with a new one-stop data delivery service for navigation decision support. In the Port of Long Beach, precision navigation efforts allowed the port to increase the maximum draft of tankers from 65 to 69 feet. For every foot of extra draft, tanker ships can load 40,000 more barrels of crude oil, which equates to roughly $2 million of extra product per tanker.

Exploring Our Deep-Sea Habitats and Resources

The international mining community continues to develop deep-sea mining as an industry, to serve as an alternative to mining on land. Polymetallic nodules are a potential mineral resource for copper, nickel, cobalt, iron, manganese and rare Earth elements—metals used in making electronics like rechargeable batteries and touch screens, among other things. One target area is the abyssal seafloor in the vast Clarion-Clipperton Zone (CCZ) of the central Pacific Ocean, roughly between Hawaii and Central America, which is home to polymetallic nodules. Within this massive area, there are many unknowns, from understanding the abundance of these nodules to knowing bathymetric (seafloor) features, such as the number of seamounts, factors that influence the animal communities in the deep sea. However, the seafloor environment in the CCZ is poorly explored and we know little about the biodiversity and species ranges across the region. NOAA aims to collect baseline environmental data about this area to provide the necessary science and data needed to make informed decisions about its potential use.

National Science Foundation

The National Science Foundation (NSF) supports research, infrastructure, and education to advance understanding of the oceans and ocean basins, including their interactions with people and the Earth. Fundamental research provides the knowledge critical to address our Nation's most pressing challenges to support the economy, national security, and American competitiveness. In support of National Ocean Month, NSF will continue to invest in emerging scientific, engineering, societal, and education challenges related to ocean resources.

Unmanned Vehicles, On and Under Water

Unmanned vehicles, whether autonomous or human-guided, offer new opportunities for ocean sensing, exploration, search and rescue, and offshore supply and support operations. Deploying a human-robot team can significantly reduce costs, improve safety, and increase efficiency. Fundamental research will enable unmanned vehicles — in cooperation with people — to safely perform complex tasks under marine navigation rules, in variable and unforgiving environments, and with intermittent communication.

During test dives in the Rainbow Reef in Fiji, SoFi – a soft robotic fish funded by NSF that can independently swim alongside real fish in the ocean – swam at depths of more than 50 feet for up to 40 minutes at a time, nimbly handling currents and taking high-resolution photos and videos using a fisheye lens. Such innovative advancements have the potential to revolutionize ocean science and scientific applications.

Coastal Resilience from Floods, Storm Surges, and Tsunamis

Inundations from storms and tsunamis have caused catastrophic damage to coastal communities, and they will continue to threaten growing coastal populations and trillions of dollars of infrastructure. With data collected from experiments and post-storm reconnaissance, researchers can understand and model potential damage from ocean forces and use this knowledge to design more resilient structures along our coasts. Recognizing that natural hazards are a national challenge, NSF has been funding the Natural Hazards Engineering Research Infrastructure (NHERI) program, which provides a network of shared, state-of-the-art research facilities and tools located at universities around the country for researchers to study the performance of civil infrastructure under hazardous conditions.

Students Run Million-Dollar Drone Business

Students at California's Monterey Peninsula College run a million-dollar business manufacturing and selling remotely operated underwater vehicles (ROVs) to K-12 schools. The business is an outgrowth of the community college's Marine Advanced Technology Education (MATE) center, which has received funding through NSF's Advanced Technology Education program since 1997. Through coursework and hands-on experience, MATE prepares students for marine occupations, including marine forecasters, ocean instrument technicians, and ROV technicians. MATE also helped 19 of its partner colleges develop courses and programs in marine technology, with more than 9,000 students enrolled in marine technology programs at affiliated colleges in the last 14 years. The center hosts an international ROV competition that challenges students to design and build ROVs that take on missions related to the ocean workplace.

U.S. Coast Guard

The U.S. Coast Guard protects the Nation's maritime domain against threats from the sea, to any bad actors out on the sea, and to the ocean environment. The Coast Guard promotes a more resilient, focused, and technologically advanced Service that maximizes America's economic prosperity in and through our maritime domain.

Innovative Search and Rescue Technology

The Coast Guard is working with the Department of Homeland Security (DHS) to support "Polar Scout," an innovative DHS Science and Technology (S&T) Directorate demonstration project to evaluate technologies to support the detection and reporting of search and rescue (SAR) beacons in the Arctic. Given the harsh weather, tremendous distances, and limited infrastructure in the remote Arctic region, the timeline for detecting and reporting emergency SAR needs to rescue forces is more critical than in other regions. By partnering with the Coast Guard, DHS S&T is leveraging the effectiveness of space-based sensors to improve maritime domain awareness and SAR operations in the Arctic.

U.S. Navy

Every month is National Ocean Month in the eyes of the U.S. Navy. The Navy continues to make investments in its global operational modeling capability to improve the ability to protect operational forces, installations, and equipment from hazardous conditions of the physical environment.

Unmanned Maritime Systems

The Navy, in collaboration with the University of Southern Mississippi, launched a one-of-a-kind program to provide a certification in Unmanned Maritime Systems late last year. The certification program enables students to participate in three-month training cycles where they study nautical science, 3-D positioning, ocean policy, and autonomous systems.

The Department of Defense (DOD) is investing extensively in autonomous vehicles to expand the efficiency and utility of this technology for natural resource research and monitoring in collaboration with the U.S. Department of Commerce National Oceanic and Atmospheric Administration National Ocean Service and the U.S Department of the Navy Naval Air Systems Command Naval Air Warfare Center Weapons Division.

Fleet Weeks

U.S. Navy Fleet Weeks bring the Navy and sea services – and our service men and women – to the communities that support them. During Fleet Weeks, the public learns about the capabilities, importance, and value of today's United States Navy. As part of Fleet Weeks, the general public gets the rare opportunity to visit and tour U.S. Navy ships, meet our Sailors, and learn more about the Navy first-hand. The Navy will facilitate 'ship riders' as a program focused on educating key community leaders in local business, government, and education who have not had prior exposure to Naval surface operations.