

PROSPECTUS: OCEAN RESEARCH IN THE COMING DECADE

Preamble

The Subcommittee on Ocean Science and Technology (SOST), under the National Science and Technology Council (NSTC), is initiating, in coordination with the National Ocean Council, development of a 10-year ocean research plan (tentatively titled “Ocean Research in the Coming Decade” and hereafter, “the Plan”). The Plan will describe the most pressing research questions and most promising areas of opportunity within the ocean science and technology (S&T) enterprise¹ for the coming decade. It will set the stage for agency-specific and interagency-coordinated actions across Federal agencies and with non-Federal entities to address societal needs and issues of national importance.

This Prospectus outlines the purpose and intended uses of the Plan, the proposed structure and content of the Plan, how the Plan will be developed and reviewed, and opportunities for community and stakeholder engagement. This document is intended to stimulate feedback from the public on the overall framing and content of the Plan.

The SOST invites all interested parties to provide input relevant to the Nation’s ocean S&T enterprise. Suggestions directed toward how the Plan should be structured and specific topic areas that should be considered for inclusion in the Plan are particularly encouraged. A subsequent draft of the Plan-- developed by the SOST agencies and informed by public input, public outreach, and other means of community engagement--will be made available for public comment prior to the production of the final Plan.

Introduction

The ocean² plays a central role in the global cycles that sustain all life on Earth. It provides the primary source of food for nearly half of the world’s population, contributes hundreds of billions of dollars to the global economy, regulates climate, and serves as a sink for carbon dioxide. Yet, the ocean and its resources are vulnerable to human activities that reduce their overall health, leading to environmental, cultural, and economic losses. Pollution degrades marine ecosystems. Habitat loss destabilizes marine populations. Overfishing compromises food security and, in combination with other stressors, may result in altered food chains and ecosystem collapse. Ocean acidification leads to adverse chemical and physical changes in the ocean environment. Natural hazards impact lives and livelihoods in coastal communities and the safety, security, and health of coastal and marine ecosystems and industries.

Every day, society makes decisions about the ocean and its resources, often involving challenging circumstances, competing interests, and drivers that occur far away from the ocean. With each of these decisions comes an opportunity for all aspects of society to become better informed and more capable stewards of the ocean. Advances in scientific research, technology, education, workforce, and innovation will further understanding of the ocean and its relationship with society. Application of that knowledge will allow for more sustainable use of marine resources while maintaining ocean health.

¹ For the purposes of this document, “ocean science and technology enterprise” encompasses basic, inquiry-driven, fundamental research; applied science and research driven by societal and management needs; the translation and application of research results; technology, tools, and infrastructure; innovation; education and workforce development; social sciences as related to ocean issues; and operational oceanography.

² For the purposes of this document, “ocean” includes the open ocean, coasts, estuaries, coastal watersheds, and Great Lakes.

Purpose of the Plan

The purpose of the Plan is to provide up-to-date, cohesive, and strategic guidance for the Federal ocean S&T enterprise. That guidance must be informed by and in alignment with the broader ocean S&T community and the science-based information needs of resource managers, policy-makers, educators, communities, and stakeholders. The Plan will establish ocean science, technology, and innovation targets in the broader context of overall Earth sciences to advance scientific knowledge and inform environmental, economic, and social outcomes at local, regional, national, and global scales. The Plan will also guide Federal and other ocean sectors as they align resources to support the high priority research goals and activities described in the Plan.

The Plan will not cover all ocean issues. It will capture pressing current and emergent areas that Federal agencies and the ocean community identify as opportunities to make the most progress in advancing science, technology, and innovation for societal benefit in the coming decade. The Plan may also be useful to inform activities of non-Federal entities that support ocean research, including those activities coordinated with and complementary to Federal efforts. As a research-focused document, the Plan will not prescribe policies. It will, however, emphasize research and related activities that will generate the information necessary to make sound decisions and promote effective policies.

Why Now

*Charting the Course for Ocean Science for the United States for the Next Decade*³ was released in 2007 as the first comprehensive national ocean research priorities plan. Since then the ocean community has advanced ocean technologies, discovered new marine species, observed and tracked unexpected environmental changes, and answered important questions about how the ocean works. More is now known about the ocean, its processes, and the life it contains than ever before. Society continues, however, to be confronted with issues that highlight what we have yet to learn about the ocean and its role in the economic, environmental, cultural, and social health of the Nation. Coastlines are visibly changing. Communities are succumbing to shifting environmental and economic conditions. New and emerging diseases are threatening human health. Centers of population for commercially important marine species are moving. Society needs to better understand and address these and other transformations, especially in the context of continuing changes in ocean conditions.

Now is an opportune time to examine, as an ocean Nation, what ocean research, technologies, innovations, and education and workforce development are needed to tackle local, regional, national, and global challenges. A cohesive Federal strategy to advance the ocean S&T enterprise, in partnership with other sectors and levels of government, will set the stage for effective decisions and inspired action in the coming decade for the good of the ocean and the Nation.

Anticipated Impacts of the Plan

The Plan will provide the framework for specific actions Federal agencies will take, both individually and in collaboration, and is intended to:

- Accelerate understanding of the ocean and its role in the Earth system through cutting edge scientific research;
- Promote effective translation and application of science to address ocean resource management and policy-making needs;
- Harness advances in technology and innovation in support of the ocean S&T enterprise;
- Promote more efficient information sharing among ocean sectors;

³ <https://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc-orppis.pdf>

- Inform the evolution of an innovative ocean S&T research agenda and provide context and guidance for national ocean S&T priorities;
- Better align Federal ocean S&T activities with broader national and global efforts to address environmental and societal issues;
- Foster interdisciplinary collaboration, leveraging, and partnerships (including with the private sector) to advance ocean S&T and anticipate and address societal challenges; and
- Inform allocation of Federal and other ocean S&T resources to support high priority research activities.

The result of the Plan will be more complete, accessible, and actionable knowledge regarding ocean S&T in the coming decade. The Plan will result in a more focused application of that knowledge and stronger collaborative efforts across the ocean community at scales most relevant to decision making to bring about positive change.

Scope of the Plan

The Plan will focus on science, technology, and innovation to advance ocean research and promote its societal relevance and impact. The ocean is a component of the larger Earth system with a significant and highly influential human dimension. As a result, the Plan may address multi-faceted topics potentially relevant to polar, terrestrial, freshwater, atmospheric, engineering, and social research. The focus, however, will be on the *ocean* aspect of each topic included in the Plan. The Plan will be complementary to and informed by related research efforts carried out by other Federal activities, non-Federal efforts, and international entities.

Guiding Principles

The Plan will embody a set of Guiding Principles that represent the qualities of the ocean S&T research enterprise, independent of specific research areas. Proposed Guiding Principles include:

- *Education and Workforce* – The dependence of research on an educated and dynamic workforce to obtain and apply the knowledge needed to address national challenges;
- *Inquiry and Advancement* – The continuum from inquiry-based science to applied research, including translational research across disciplines and sectors;
- *Flexibility* – The ability to anticipate and address new issues and respond to unexpected events;
- *Capabilities and Capacity* – The central role of people, tools, and partnerships in meeting research goals and application demands;
- *Innovation* – The need to develop, evolve, and apply new approaches, thinking, and technologies;
- *Connectivity and Coordination* – The importance of connecting with related research areas and regional interests, and leveraging with international efforts; and
- *Balance* – The development of new ideas and approaches while ensuring continuation of sustained efforts, and undertaking short-term actions while looking toward long-term value.

Overview of Ocean Research in the Coming Decade

The Plan will describe:

- Societal Themes that highlight the benefits-based rationale for conducting ocean research;
- Research Goals that reflect and address the Societal Themes; and
- Research Activities that support the Research Goals and represent current and growing opportunities to provide the Nation with the scientific and technical means to address the Societal Themes.

This Overview section represents the main content of the Plan. It will outline specific areas where the ocean S&T enterprise can be advanced, and will constitute the majority of the Plan's length.

Societal Themes

The Plan will present Societal Themes that provide the high-level impetus for the ocean research topics included in the Plan and answer the question "Why conduct ocean research?" Examples of the areas that could be included as Societal Themes are:

- Ensuring Resource Availability and Sustainable Use;
- Conserving Ocean Ecosystems;
- Understanding the Relationship between the Ocean and Human Health;
- Clarifying the Ocean's Role in Earth and Atmospheric Processes;
- Contributing to the Economy and Social Well-being;
- Enhancing the Protection and Resilience of Coastal Communities; and
- Informing Marine Operations and National Security.

These examples provide an idea of the scale and scope envisioned for Societal Themes and are presented here as a starting point for discussion. They are by no means final and are not the only areas that should be considered. Community engagement and public input will help identify Societal Themes to be included in the Plan.

Research Goals

Research Goals answer the question "What ocean research is needed to address the Societal Themes?" They describe where interagency and inter-sector collaboration can yield significant advancement, utilization, and innovation in the ocean S&T enterprise to address critical areas of societal need.

Examples of potential Research Goals are noted below:

- To Quantify the Role of the Ocean in Climate Variability;
- To Predict Changing Ocean Conditions;
- To Inform Societal Responses under Various Management Options;
- To Characterize Ocean Habitats and Biodiversity;
- To Improve Understanding of the Human Component of Ocean Ecosystems; and
- To Explore Unknown Areas and Processes of the Ocean.

As with the Societal Themes, the areas noted here are examples. This list is not final or inclusive. The Research Goals that eventually will be included in the Plan will be informed by community engagement and public input.

Research Activities

Each Research Goal will be supported by focused Research Activities, some of which will be cross-cutting and needed to achieve multiple Research Goals (e.g., Advancing Observing and Modeling Capabilities; Harnessing the Data Revolution to Support Ocean Stewardship; Fostering Ocean Workforce Development). The Research Activities will parse the Research Goals into actionable topic areas. They will focus on understanding critical ocean processes and interactions, and how those processes and interactions relate to health, safety, security, and prosperity. Federal implementation of the Plan will be based on and responsive to the Research Activities. The Research Activities will be identified once the Societal Themes and Research Goals are determined, and will be presented in the Draft Plan for public

review. Public input is encouraged to include suggested Research Activities for consideration in support of potential Research Goals.

How the Plan will be Developed

Authors

Subject matter experts from the Federal agencies represented on the SOST will develop the Draft and Final Plan, under the auspices of the NSTC and drawing on their own expertise and input from the public. The Federal authors will be selected once key sections of the Plan have been identified. Development of the Plan will include efforts to identify and incorporate relevant expertise and materials from non-Federal sources.

Plan Development Process and Timeline

The SOST will develop a Draft Plan informed by public input. The Draft Plan will be released for public comment, resulting in the Final Plan. The SOST is crafting criteria to guide which Societal Themes, Research Goals, and Research Activities ultimately will be included in the Plan. The process and timeline for developing the Plan is anticipated to be as follows (subject to change):

Activity	2016			2017												
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
Release Prospectus	█															
Request for Information Period & Community Engagement on Plan Structure and Content	█	█	█													
Develop Draft Plan			█	█	█	█	█									
Release Draft Plan								█								
Public Comment Period & Community Engagement on Draft Plan								█	█	█						
Develop Final Plan											█	█				
Release Final Plan													█			
Share Information on Final Plan among Ocean Community													█	█	█	

Review of the Plan will include opportunities for public input and Federal review through the National Science and Technology Council. Each document in the Plan development process (i.e., Prospectus, Draft Plan, and Final Plan) will be reviewed and cleared through the NSTC prior to public release.

Community Engagement

Community engagement in the Plan development and review process is critical. The SOST will engage academia; industry/for-profit entities; non-governmental organizations; local, state, and tribal governments; stakeholders; the public; international ocean-related entities; and other Federal and non-

Federal sources. Interested parties will have multiple opportunities to provide input during the Plan development process, including:⁴

- Request for Information period to inform the Plan structure and content at an early stage and ensure that the process takes into account a range of knowledge and viewpoints;
- Public Comment period on the Draft Plan to inform development of the Final Plan; and
- Participation in community engagement activities, such as meetings, webinars, and conferences.

Input from regional perspectives is important to ensure alignment and complementarity between a national view and issues most pressing to localities, states, and tribes. Regional governance and coordinating entities will be engaged to help ensure this connectivity.

A website containing information about the Plan is available at www.nsf.gov/geo/oce/orp. Throughout the development process, the website will include updates on progress, draft materials for review, instructions for providing input, details on community engagement events, and a contact email address. Federal Register Notices will provide official notification of progress and opportunities to provide input. The SOST will also use social media, stakeholder networks, newsletters, and other mechanisms to distribute information on the Plan. Peer reviews may be sought through established Federal advisory committees and other relevant committees.

Building Blocks and Related Activities

In developing the Plan, the SOST will build from relevant past and current planning, coordination, and review efforts. It will apply lessons learned from development and implementation of *Charting the Course for Ocean Science for the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy*⁵ (2007) and *Science for an Ocean Nation: An Update of the Ocean Research Priorities Plan* (2013). The Plan will respond to expert community input as presented in documents such as the National Research Council/National Academy of Sciences *Sea Change: A Decadal Survey of Ocean Sciences, 2015-2025*⁶ (2015). It will reflect complementary documents, including the Interagency Arctic Research Policy Committee's *Arctic Research Plan 2017-2021*,⁷ and the U.S. Global Change Research Program's *National Global Change Research Plan 2012–2021: A Strategic Plan for the U.S. Global Change Research Program*.⁸ The Plan will recognize the scientific foundation of ocean policy documents and the information and data needs for effective policy implementation.

Target Audience for the Plan

The target audience for the Plan includes the public sector (Federal, State, tribal, and local governments), scientists in ocean S&T and related fields, the private/for-profit sector, environmental interest groups, other ocean stakeholders, international entities addressing ocean issues, and the general public. As a high-level strategy, the Plan will not address all relevant questions that might arise from this diverse array of stakeholders. It is expected, however, to inform and foster coordinated action to address the most compelling and promising ocean S&T research areas for the next decade. The Plan will be designed to communicate with a range of interested parties.

⁴ All input will be considered by Federal subject matter experts from the agencies represented on the SOST. When the final Plan is issued, relevant comments received, along with the commenters' names and the authors' responses, will become part of the public record and be made available online.

⁵ <https://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc-orppis.pdf>

⁶ <http://nas-sites.org/dsos2015/>

⁷ <http://www.iarpccollaborations.org/index.html>

⁸ <http://www.globalchange.gov/browse/reports/national-global-change-research-plan-2012%E2%80%932021-strategic-plan-us-global-change>

Distribution of the Final Plan

The Final Plan will be distributed through readily available public mechanisms in accordance with established practices for Federal government documents. It will be posted on the SOST page of the NSTC website. The SOST will seek opportunities to share information on the Final Plan through various scientific and other public venues, and a summary may be published in appropriate professional journals.

Implementation of the Plan and Resulting Actions

The Plan will be a strategic document establishing a vision for the Federal ocean S&T enterprise, in partnership with the broader ocean community, for the next decade. It is the first stage of a two-stage process for coalescing the ocean community around key areas where concerted effort will advance understanding of the ocean and improve application of that understanding for the benefit of the Nation.

The second stage is acting on that strategy. The Plan itself will not be an implementation document, but it will include general guidance on implementation in the form of Research Activities under each of the Research Goals. Federal implementation actions will stem from those Research Activities and result in specific, tangible deliverables. Implementation actions and timeframes will be defined in separate documents once the Plan content has been determined.

The key to successfully using the Plan is awareness and engagement across the ocean community and the Federal agencies that contribute to the ocean S&T enterprise. The anticipated overarching outcome of the Plan is harnessing the power of the ocean community and catalyzing action toward advancing ocean science, technology, and innovation priorities, as described in the Plan.