Implementation Plan

for the

National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone

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Prepared by the
National Ocean Mapping, Exploration, and Characterization Council
of the
Ocean Science and Technology Subcommittee and Ocean Policy Committee

About the Ocean Policy Committee

The Ocean Policy Committee (OPC) was established in 2018 by Executive Order 13840, "Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States," to coordinate Federal actions on ocean-related matters and is co-chaired by the Director of the Office of Science and Technology Policy (OSTP) and the Chairman of the Council on Environmental Quality (CEQ). The Executive Order directed the OPC to engage and collaborate with the ocean community on ocean-related matters, identify priority ocean research and technology needs, and leverage resources and expertise to maximize the effectiveness of Federal investments in ocean research. For more information about the work of the OPC, please see the Ocean Policy page on the CEQ website: https:// www.whitehouse.gov/ceq/.

About the Ocean Science and Technology Subcommittee

The OPC established the Ocean Science and Technology (OST) Subcommittee pursuant to Section 4(b) of Executive Order 13840 to address ocean science and technology issues across agencies. This includes identifying priority ocean research and technology needs, participating as appropriate in the work of the National Oceanographic Partnership Program (NOPP), and supporting research and technology collaboration among the Federal agencies and departments represented on the OPC.

About the National Ocean Mapping, Exploration, and Characterization Council

The OPC established the National Ocean Mapping, Exploration, and Characterization (NOMEC) Council in June 2020 pursuant to the "National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone," which was developed under Section 2 of the November 2019 Presidential Memorandum on "Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska." The purpose of the NOMEC Council is to coordinate Federal agency policy and actions needed to advance ocean mapping, exploration, and characterization, and to support collaboration with both non-Federal and non-governmental partners and stakeholders. The NOMEC Council will develop and implement multi-disciplinary, collaborative, and coordinated approaches to mapping, exploring, and characterizing the Exclusive Economic Zone of the United States (United States EEZ). The NOMEC Council will report to the OPC's OST Subcommittee, which will provide support and guidance for the NOMEC Council's work as appropriate. The OPC will provide strategic direction and facilitate interagency resolution of policy issues as appropriate.

About the Interagency Working Group on Ocean and Coastal Mapping

The Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM) is a working group of the National Science and Technology Council (NSTC) Subcommittee on Ocean Science and Technology (SOST), and also reports to the OST Subcommittee of the OPC via the NOMEC Council. The SOST serves as the lead interagency entity for Federal coordination on ocean science and technology. The IWG-OCM was established in 2006 to "facilitate the coordination of ocean and coastal mapping activities and avoid duplicating mapping activities across the Federal sector as well as with State, private sector, academic, and non-governmental mapping interests" (National Ocean and Coastal Mapping Strategic Action Plan 2009). The IWG-OCM focus areas, which includes United States coasts, Great Lakes and oceans out to the limits of the United States EEZ, and our extended continental shelf, were established by the Ocean and Coastal Mapping Integration Act of 2009 (OCMIA). The IWG-OCM also represents the ocean and coastal mapping aspects of elevation on the Federal Geographic Data Committee's 3D Nation Elevation Subcommittee.

About the Interagency Working Group on Ocean Exploration and Characterization

The Interagency Working Group on Ocean Exploration and Characterization (IWG-OEC), created in September 2020, is charged with helping to implement the 2019 Presidential Memorandum on Ocean Mapping, particularly Section 2's "National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone" (NOMEC Strategy). The NOMEC Council provides direction and support to the IWG-OEC and will consult and rely on the technical expertise and operational capacities of IWG-OEC members/agencies in implementing its objectives. The IWG-OEC will recommend and facilitate exploration and characterization efforts that provide needed information and insights about deep water (>40 meters (m)) environments, including the seafloor, sub-bottom, and water column, from exploratory initial assessments to comprehensive characterization in direct support of specific research, resource management/stewardship, policymaking, or applied mission objectives. The actions recommended in this Implementation Plan are subject to the Administration's annual budget process and the availability of appropriations.

About this Document

Pursuant to Section 2 of the Presidential Memorandum of November 19, 2019 on "Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska," this document provides an Implementation Plan for the

"National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone" released by the OPC in June 2020.

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Abbreviations and Acronyms

ACMS	Alaska Coastal Mapping Strategy
BGA	Bathymetric Gap Analysis
BOEM	Bureau of Ocean Energy Management
CEQ	Council on Environmental Quality
CIO	Chief Information Officer
CMECS	Coastal and Marine Ecological Classification Standard
CRADA	Cooperative Research and Development Agreement
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
FGDC	Federal Geographic Data Committee
FWS	Fish and Wildlife Service
ISO	International Organization for Standardization
JCS	Joint Chiefs of Staff
IWG-FI	Interagency Working Group on Facilities and Infrastructure
IWG-OCM	Interagency Working Group on Ocean and Coastal Mapping
IWG-OEC	Interagency Working Group on Ocean Exploration and Characterization
LIDAR	Light Detection and Ranging
MEC	Mapping, Exploration, and Characterization
MMC	Marine Mammal Commission
NASA	National Aeronautics and Space Administration
NCEI	NOAA National Centers for Environmental Information
NCSG	NOMEC Council Security Group
NGA	National Geospatial-Intelligence Agency
NGDA	National Geographic Data Asset
NIH	National Institutes of Health
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Oceanographic Partnership Program
NPS	National Park Service
NSF	National Science Foundation

OCM	Ocean and Coastal Mapping
OCS	Outer Continental Shelf
ODNI	Office of the Director of National Intelligence
OMB	Office of Management and Budget
ONR	Office of Naval Research
OPC	Ocean Policy Committee
OSD	Office of the Secretary of Defense
OSTP	Office of Science and Technology Policy
RFI	Request for Information
ROV	Remotely Operated Vehicle
SI	Smithsonian Institution
S&T	Science and Technology
SME	Subject Matter Expert
SOMP	Standard Ocean Mapping Protocol
UNOLS	University-National Oceanographic Laboratory System
USACE	United States Army Corps of Engineers
USARC	United States Arctic Research Commission
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USGS	United States Geological Survey

Preface

On November 19, 2019, President Trump signed a Presidential Memorandum titled "Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska" (Presidential Memorandum), recognizing the value of mapping, exploration, and characterization data and products to enhance our future prosperity, health, and national security. The Presidential Memorandum includes three directives which provide an interagency framework for how this effort will be implemented and executed: Section 2 directs preparation of a national strategy for mapping, exploring, and characterizing the Exclusive Economic Zone of the United States (United States EEZ); Section 3 directs preparation of a strategy for mapping the Arctic and Sub-Arctic Shoreline and Nearshore of Alaska; and Section 4 directs preparation of recommendations for efficient permitting of ocean exploration, mapping, and research activities.

Pursuant to Section 2 of the Presidential Memorandum, the "National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone" (NOMEC Strategy) was released on June 9, 2020. The NOMEC Strategy proposes ambitious goals to completely map the seafloor within the outer boundary of the United States EEZ; explore and characterize priority areas; and leverage the expertise and resources of multi-sector partnerships. Deploying new and emerging science and technologies at scale - and doing so in partnership with the private sector, academia, and non-governmental organizations (NGOs) - is essential to the NOMEC Strategy's success. The NOMEC Strategy outlines a phased approach to address near-term priorities, emphasizing actions that should be undertaken within the next three years. The NOMEC Strategy will be updated periodically, initially in 2023 as required by the NOMEC Strategy, as science and technology (S&T) advances and new partnerships contribute to operational growth in the mapping, exploration, and characterization enterprise.

The NOMEC Strategy advances five goals, each supported by strategic objectives that incorporate high-level actions, to accomplish the task of mapping, exploring, and characterizing the United States EEZ. These are:

- **Goal 1:** Coordinate Interagency Efforts and Resources to Map, Explore, and Characterize the United States EEZ
- **Goal 2:** Map the United States EEZ
- **Goal 3:** Explore and Characterize Priority Areas of the United States EEZ
- **Goal 4:** Develop and Mature New and Emerging Science and Technologies to Map, Explore, and Characterize the United States EEZ

- **Goal 5:** Build Partnerships to Map, Explore, and Characterize the United States EEZ

The NOMEC Strategy directed the establishment of the National Ocean Mapping, Exploration, and Characterization (NOMEC) Council to coordinate policy and actions needed to advance mapping, exploration, and characterization and to support collaboration with non-governmental partners and stakeholders. The NOMEC Strategy also directed the NOMEC Council to develop an Implementation Plan to complete the goals. This Implementation Plan describes the approach taken and the planned actions to accomplish these goals.

Approach

Ocean mapping, exploration, and characterization (MEC) is necessary to advance maritime commerce, domestic seafood production, healthy and sustainable fisheries, coastal resilience, energy production, tourism and recreation, environmental protection, conservation, national and homeland security, and other interests. MEC activities are currently undertaken by various Federal agencies, the private sector, NGOS, and academic institutions and lack comprehensive coordination across sectors. This Implementation Plan outlines the near-term steps Federal agencies anticipate taking to bring the interests and capacities of all sectors together to efficiently meet the ambitious goals outlined in the NOMEC Strategy. Specifically, the NOMEC Strategy aims to complete mapping of deep waters (>40 meters (m)) of the United States EEZ by 2030, coastal (<40 m) United States waters by 2040. The NOMEC Strategy also provides a framework to conduct high-resolution, in situ exploration and characterization in high-priority, mission relevant areas and respond to broad sectoral priorities identified through public engagement. The data and products resulting from this initiative will greatly increase understanding of our oceans and coasts. Collaboration across agencies and sectors with the necessary capabilities (e.g., vessels, autonomous systems, sensors, and technical and operational expertise) and relevant data needs (e.g., management, energy and aquaculture siting, marine minerals mining, and navigation) are critical to rapidly and efficiently meet these goals. A successful national program for MEC requires a combination of national leadership and robust coordination with and among scientists and managers implementing regional field efforts.

This Implementation Plan outlines steps that will be taken to carry out this vision, coordinating across all relevant sectors to determine and execute ocean MEC priorities ensuring common standards are met, archiving and making data accessible for all interested parties, supporting technology development, and engaging and educating the public throughout all stages of the process.

National security concerns can intersect with scientific exploration and characterization activities. The data that sensors collect can reveal information about vulnerabilities or patterns of military activity (e.g., exercises, resupply). The national security and intelligence community will be consulted and included in all stages of implementation and safeguards will be included in the implementation of the NOMEC Strategy. The NOMEC Council established a National Security Subgroup to discuss and collaborate across the intersections of ocean MEC interests and national security.

By including all relevant agencies and stakeholders, a reimagined and systematic (i.e., using a shared set of standards and protocols), yet flexible, approach to ocean MEC will

be achieved. Recognizing the challenge of bringing together many entities with different goals and organizational processes, much of this Implementation Plan outlines the steps that the NOMEC Council will take to establish norms for communication and coordination to plan, prioritize, and execute activities. The first step is to obtain comprehensive inventories of data needs, available assets, and planned activities of Federal and State agencies, the private sector, academics, and NGOs. Federal agencies will align existing programs and develop shared standards and databases for tracking progress with stakeholder input. This Implementation Plan outlines the steps to identify technology needs for future activities and to support innovation to meet these needs. The NOMEC Council will identify opportunities for coordinated MEC campaigns and conduct them collaboratively across Federal agencies, with non-governmental partners, and consider national security interests at every step. The products of the NOMEC Strategy will be incorporated into education and outreach to support an ocean-literate society, develop a blue workforce (those employed in ocean-related industries), and inspire the public.

In Fall 2020, the NOMEC Council solicited public input to inform the Implementation Plan through Federal Advisory Committees, workshops and conferences, and two virtual public listening sessions. Additionally, two separate Requests for Information (RFIs) were published in the Federal Register, one for input on the Implementation Plan and one to solicit input on priorities for exploration and characterization. Responses to the latter will be incorporated into implementing NOMEC Goal 3, "Identify Strategic Ocean Exploration and Characterization Priorities." There was a robust cross-sectoral response to these activities. Forty-three written comments were submitted to the NOMEC Council regarding the Implementation Plan and several hundred people participated in the listening sessions. Comments were received from the Federal agencies, private sector, academia, NGOs, and private individuals. Listening session attendees additionally included State and Tribal governments, Congressional staff, and international colleagues.

Stakeholders expressed support and enthusiasm for the NOMEC Strategy, a general appreciation for the opportunities provided to learn more about it, and significant interest in participating directly in implementing the NOMEC Strategy as both data users and providers. The public input included specific recommendations, clarifying questions, and expressions of enthusiasm for the NOMEC Strategy. Six major themes emerged from the public input:

1. Develop transparent and sustained paths for partnerships and stakeholder engagement;
2. Include marine cultural heritage, underwater archaeology, and paleolandscapes in NOMEC Strategy implementation;

3. Collaborate with private sector, including small businesses, to advance innovative S&T development;
4. Ensure shallow water mapping for multiple applications is carried out;
5. Align technical specifications and protocols to specific fields of study or management applications; and
6. Engage the next generation of ocean mappers and explorers.

The NOMEC Council, IWG-OCM, and IWG-OEC reviewed and considered all comments received and incorporated the input into the Implementation Plan where feasible and appropriate. They will continue to incorporate these comments and future input into subsequent actions. The NOMEC Council recognizes that the public input process must be iterative and sustained to foster meaningful partnerships. Further details on the public input process and input received are provided in **Appendix A**.

The Implementation Plan outlines numerous opportunities for stakeholders across all sectors to provide input in planning and implementing the NOMEC Strategy goals to map, characterize, and explore the United States EEZ. All goals and actions in the Implementation Plan are derived from the NOMEC Strategy goals. There will be ongoing opportunities for public input through Federal Advisory Committees, Requests for Information, workshops, listening sessions, and other forums. This Implementation Plan includes initial public scoping sessions as well as opportunities to continually engage throughout each of the five goals outlined below. In addition to the traditional outreach methods of Federal Register notices and advisory committees, this Implementation Plan aims to create and showcase an expanded model for partnerships that includes greater participation from non-Federal entities in the process from the outset. Opportunities for cross-sector partnerships will be pursued through a variety of mechanisms, including research partnerships, prizes and competitions, and innovative funding mechanisms. Through regular opportunities for public input, the Implementation Plan will remain adaptable and agile to respond to partner needs and feedback. The NOMEC Council and Interagency Working Groups will identify pilot projects and campaigns (i.e., a series of scientific activities intended to meet the NOMEC Strategy goals and objectives, often focused on a particular priority, confined to a particular area, or involving a specified type of operations) to make progress toward meeting the goals, as well as to serve as testbeds for new levels of coordination. Further, campaigns will incorporate lessons learned from these pilot projects, and ongoing and future campaigns will be scaled up to meet long-term objectives. Throughout the execution of this Implementation Plan, agencies will work together to identify and support opportunities for technological innovation and to educate the next generation of ocean mappers and explorers. Given the rapid pace of technological advancement and variability in appropriations, the Implementation Plan

will be periodically reviewed and updated as appropriate, beginning in 2023 as required by the NOMEC Strategy.

Definitions

As defined within the NOMEC Strategy and for the purposes of this Implementation Plan:

- **Ocean mapping** provides comprehensive data and information needed to understand seafloor characteristics such as depth, topography, bottom type, sediment composition and distribution, and underlying geologic structure.
- **Ocean exploration** provides a multidisciplinary first look at an unknown or poorly understood area of the seafloor, sub-bottom, and/or water column and an initial assessment of an area's physical, chemical, and biological characteristics.
- **Ocean characterization** provides comprehensive data and interpretations for a specific area of interest of the seafloor, sub-bottom, and/or water column, in direct support of specific research, resource management, policymaking, or applied mission objectives.

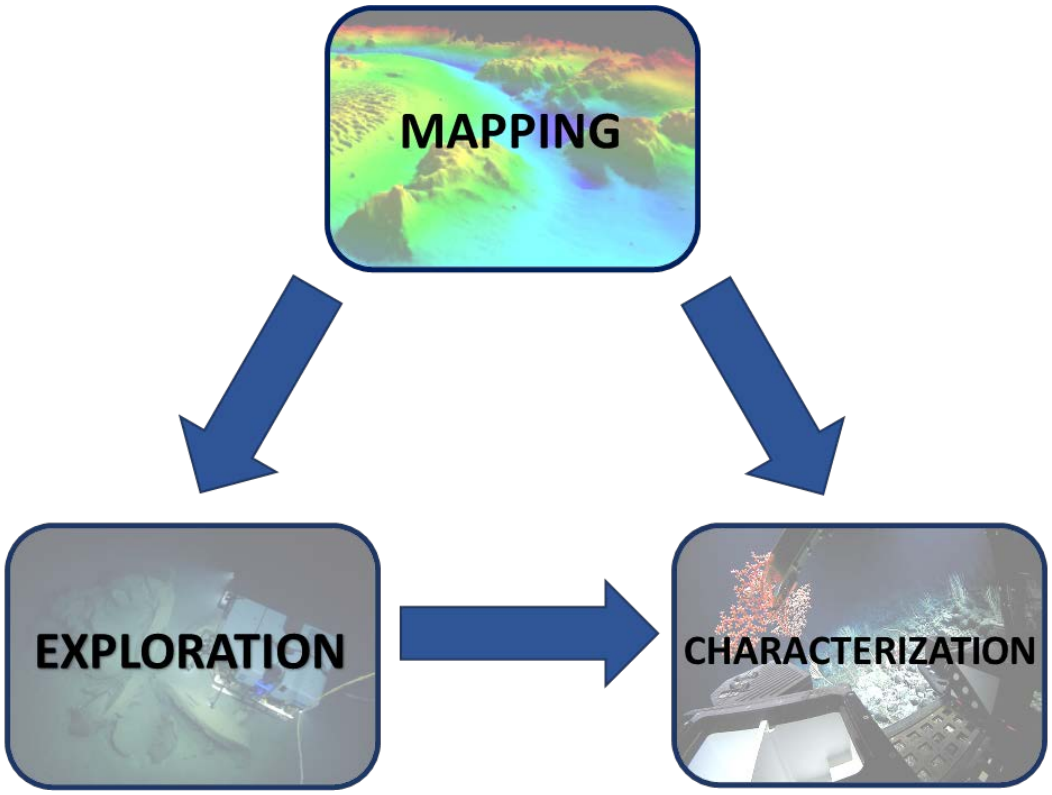

Figure 1. Interdependencies of mapping, exploration, and characterization.

High quality, accessible, and discoverable mapping data and derived products are necessary to plan and safely execute both exploration and characterization. Exploration in turn, informs more in-depth characterization. Reverse dependencies exist as well: for example, characterization at a representative site may inform selection of new exploration target locations.

This Implementation Plan uses the following nomenclature to describe proposed activities: Milestone, Lead, Support, Performance Indicator, and Year/Goal. The Milestone describes the activity undertaken. The Lead and Support roles assign the interagency working groups, agencies, or governance bodies that will be involved in completing the Milestone. Performance Indicators are metrics used to track progress and completion of each Milestone. The Year/Goal column is the target date for completion of the Milestone. These activities build off of each other throughout the Implementation Plan and, as such, are linked across the Implementation Plan when possible.

Goals and Actions

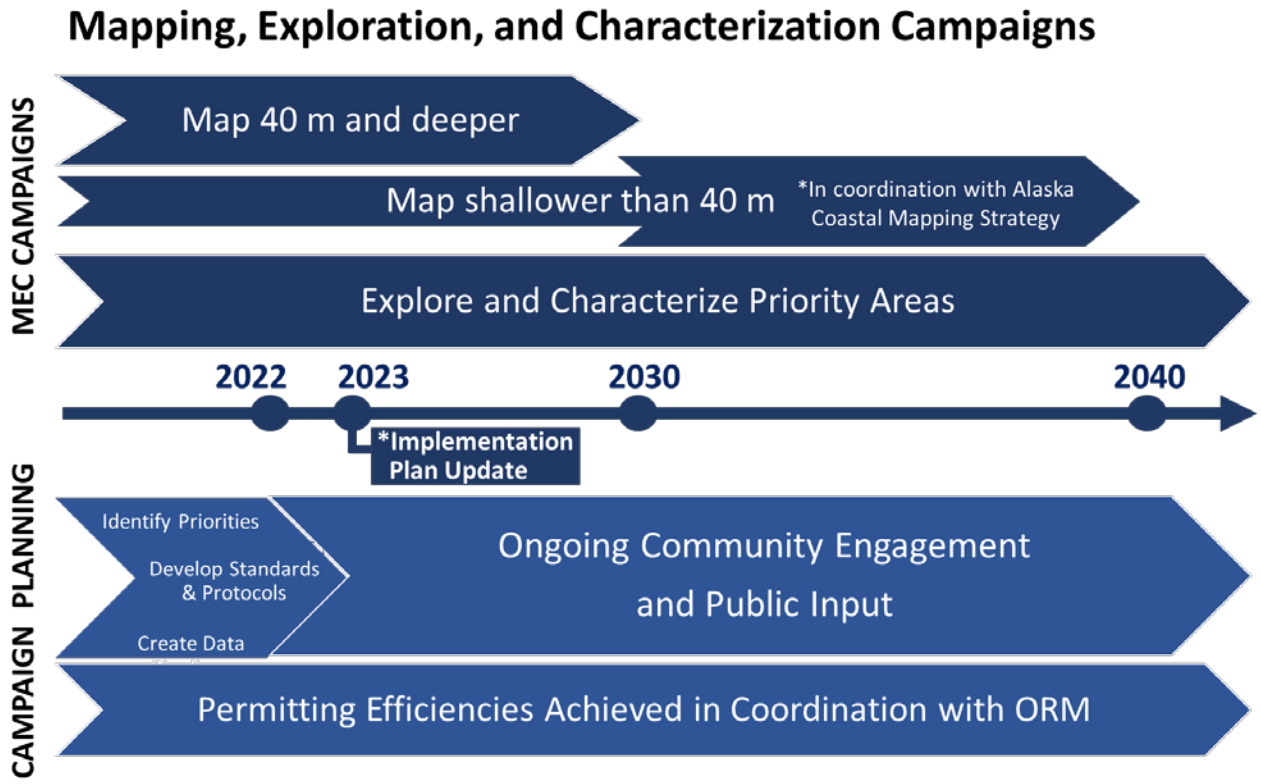

Figure 2. Timeline for accomplishing NOMEC Goals.

NOMEC GOAL 1. Coordinate Interagency Efforts and Resources to Map, Explore, and Characterize the United States EEZ

Agencies across the Federal government play a role, directly or indirectly, in mapping, exploring, and characterizing the ocean. These agencies also require the information derived from these activities to fulfill their missions and support non-government sectors that advance the economic, security, and environmental interests of the United States. There is currently no process to strategically coordinate these activities as an integrated "all of Federal government" pursuit. Therefore, the first goal of the NOMEC Strategy is to develop the NOMEC Council and its governance structures and processes, promoting efficient and effective coordination across the Federal government. The intent is to better leverage and strategically align Federal agency efforts to map, explore, and characterize the United States EEZ, while promoting effective cross-sectoral efforts to advance the NOMEC Strategy. Objectives under Goal 1 are focused on Federal coordination.

Objective 1.1. Establish a National Ocean Mapping, Exploration, and Characterization Council

This objective establishes the NOMEC Council as the interagency body to oversee implementation of the NOMEC Strategy. The NOMEC Council is responsible for facilitating coordination across Federal agencies, relevant interagency working groups, and non-Federal partners (described more fully in Goal 5). The NOMEC Council will oversee two working groups. The existing National Science and Technology Council (NSTC) Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM), first formed in 2006, will focus primarily on ocean and coastal mapping (OCM). A new Interagency Working Group on Ocean Exploration and Characterization (IWG-OEC) will focus on ocean exploration and characterization. The NOMEC Council, IWG-OCM, and IWG-OEC will work together to coordinate Federal input and implement NOMEC activities.

Measure of Success: The NOMEC Council and its working groups lead observable improvements in ocean and coastal MEC coordination and collaboration across Federal agencies and non-Federal partners.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
1.1.1	Establish the NOMEC Council, NOMEC Council Security Group, and IWG-OCM/OEC governance structure	NOMEC Council	IWG-OCM, IWG-OEC, NOMEC Council Security	NOMEC Council members identified, IWG-OEC created, NCSG created, Executive Secretaries assigned, and regular meetings held; IWG-OCM/IWG-OEC reporting structure established	Sept. 2020 (Completed)

			Group (NCSG)		
1.1.2	Coordinate MEC-related activities and S&T development across Federal entities	NOMEC Council, IWG-OCM, IWG-OEC	NOMEC Council agencies, Relevant IWGs	NOMEC Council, IWG-OCM, and IWG-OEC members share information on NOMEC plans across Federal agencies to advance the NOMEC Strategy	May 2021, Ongoing
1.1.3	Identify and inventory the mechanisms available for leveraging MEC expertise, personnel, platforms, sensors, and funding of Federal and non-Federal MEC partners	NOMEC Council	IWG-OCM, IWG-OEC	Capabilities inventory will be used to identify the most efficient approaches to conducting MEC campaigns	June 2021
1.1.4	Convene an ocean MEC forum for relevant Federal and non-Federal entities	NOMEC Council	IWG-OCM, IWG-OEC	Complete forum and incorporate input to future implementation activities	Fall 2021, Annual

Objective 1.2. Develop an Implementation Plan for the NOMEC Strategy

Implementation of the NOMEC Strategy requires the NOMEC Council to develop a detailed approach to accomplishing the goals and objectives described in the NOMEC Strategy. The Implementation Plan identifies specific actions that describe how the goals, objectives, and associated timelines presented in the NOMEC Strategy will be accomplished.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
1.2.1	Create opportunities for public engagement to provide input into Implementation Plan development and execution of NOMEC activities	NOMEC Council	IWG-OCM, IWG-OEC	Plans shared with relevant FACAs; RFIs published in Federal Register; Public listening sessions held; NOMEC entities participate in workshops, conferences, and forums; Public comments collected and recorded for transparency; Implementation Plan and updates are informed by public input (See also Goals 5.1 and 5.2)	Fall 2020, Ongoing
1.2.2	Submit Draft Implementation Plan to OPC for review and feedback	NOMEC Council	IWG-OCM, IWG-OEC, NCSG	Draft Implementation Plan reviewed by OPC to ensure the milestones and actions outlined in the draft Implementation Plan align with the NOMEC Strategy	Dec. 2020
1.2.3	Release Implementation Plan Review and update Implementation Plan in 2023 and periodically thereafter	NOMEC Council	IWG-OCM, IWG-OEC, NCSG	Final version of Implementation Plan released, providing opportunity for Federal agencies to be responsive to the goals and actions outlined Regularly updated Implementation Plan will respond to ongoing public input, technological developments, and emerging policy direction	Jan. 2021 June 2023, Ongoing

NOMEC GOAL 2. Map the United States EEZ

Goal 2 builds on existing efforts to survey and comprehensively map oceans and coasts of the United States by increasing collaboration and efficiency of mapping operations. Mapping the United States EEZ will increase our Nation's understanding of natural and cultural resources, physical hazards, and processes related to climate, earthquakes, tsunamis, weather forecasting, ocean habitats, and fisheries. For the purposes of this goal, **ocean mapping** is defined as the acquisition and provision of comprehensive data and information needed to understand seafloor characteristics such as depth, topography, bottom type, sediment composition and distribution, and underlying geologic structure. Water depths and conditions dictate the necessary sensor technology and instrumentation to accomplish mapping objectives (e.g., swath sonar in deeper waters and topobathymetric lidar in shallower, clear waters). To maximize value of operations, mapping efforts pursuant to the NOMEC Strategy seek to simultaneously acquire ancillary data types where feasible during continuous underway operations.

All mapping and ancillary data collected should be preserved to maximize potential future use and return on investment (e.g., both seafloor and water column backscatter data should be preserved). While this Implementation Plan will establish "minimum" standards for classifying an area as mapped (and counting towards 100 percent completion), desired additional attributes (e.g., seafloor and water column backscatter) will be collected to the greatest extent possible. The focus of Goal 2 is to completely map United States waters 40 m and deeper by 2030 and waters shallower than 40 m by 2040. Achieving this goal will require anticipated technological advances in uncrewed, airborne, and satellite remote sensing (accelerated by NOMEC Goal 4 activities).

Finally, the value of OCM is realized through use and application of the resulting data. The data resulting from this Implementation Plan will be processed, preserved, and provided through data centers that enable users to search, find, access, and apply it to their own purposes. Mapping data collected through the Goal 2 milestones complement Exploration and Characterization data, described in Goal 3. Mapping data are required to inform siting of in situ exploration and characterization activities such as submersible dives; and when combined together, mapping and exploration/ characterization data together can inform habitat classification.

Objective 2.1. Establish a Standard Ocean Mapping Protocol (SOMP)

The purpose of this objective is to craft a standardized protocol for OCM that will encourage consistency in data acquisition and stewardship across a subset of ocean sensing capabilities for seafloor mapping (as described in the NOMEC Strategy) as well as ancillary data, including bathymetry (acoustic and airborne), seabed backscatter, water column backscatter, side scan sonar imagery, sub-bottom profiling, and magnetometer data readings. The SOMP will use national standards and best practices to guide all ocean mappers in data acquisition and processing, with the goal of ensuring the widest access to, use of, and integration of data, minimizing duplication of effort, and efficiently collecting, processing, publishing, preserving, and archiving as much OCM data as possible into publicly-accessible archives, repositories, and databases.

Measure of success: A SOMP validated with stakeholder input and published for use by all interested OCM data contributors, to increase consistency in data acquisition, processing, accessibility. Looking ahead, to ensure that data that is efficiently acquired, consistent, accessible, and usable, all data contributors will follow the validated SOMP.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
2.1.1	Draft the SOMP around 7 mapping (and associated) components: data stewardship, bathymetry, backscatter, water column, side scan sonar, magnetometer, and sub-bottom profiling	IWG-OCM	Subject Matter Experts (SMEs) from IWG-OCM agencies	SOMP Leads and writing team identified Draft SOMP circulated for NOMEC Council review	Sept. 2020 (Completed) Apr. 2021
2.1.2	Engage non-Federal stakeholders in SOMP development to ensure non-governmental data capabilities and needs are included	IWG-OCM	States, Territories, Private Sector, Academia, NGOs	SOMP Symposium held for academic/private sector input on SOMP components Symposium proceedings shared via iocm.noaa.gov Draft SOMP published to Federal Register for public comment	Oct. 2020 (Completed) Nov. 2020 June 2021
2.1.3	Pilot SOMP on various vessels/platforms and projects	IWG-OCM, IWG-FI	Federal Research/ Mapping Vessels	Field test SOMP use on at least two mapping projects on different vessels/platforms; Lessons learned will inform the final SOMP	Apr. – Oct. 2021 (dependent on Covid-19 restrictions)
2.1.4	Finalize SOMP and publish for general use across sectors, revisiting on a 5-year refresh cycle with public comment incorporated	IWG-OCM	All Federal/ non-Federal mapping partners	Public outreach (e.g., events, conference sessions, and webinars) held to increase SOMP awareness and use	Oct. 2020 – June 2022 June 2022

				Completed SOMP is available for use by Federal and external mapping operators Periodically updated SOMP reflects latest in OCM tools, technology, and techniques	June 2026 (and every 5 years thereafter)
2.1.5	Work with professional organizations to develop SOMP sections into Federal Geographic Data Committee (FGDC)-recognized standards where needed to ensure consistent standards are adopted and utilized across sectors	IWG-OCM	Private Sector, Academia, NGOs	Standards vetted and published for use, in accordance with Geospatial Data Act (GDA) implementation	July 2022

Objective 2.2. Coordinate and Execute Campaigns to Map the United States EEZ

The purpose of this objective is to promote the efficient, effective, and comprehensive mapping of the United States EEZ. First steps in this process are to catalog and analyze existing OCM data to identify and fill current gaps in mapping coverage. Priorities will be identified using tools including the United States Bathymetric Gap Analysis (BGA), 3D Nation Requirements and Benefits Study, and the United States Federal Mapping Coordination website. To inform OCM campaign planning, stakeholder prioritization exercises (e.g., use of interactive geospatial platforms to solicit cross-sector spatial and topical priorities) may highlight both areas of common interests and important but potentially isolated needs for mapping. Clear delineation of priorities, plans, and performance expectations will enable Federal and external partners to effectively collaborate. The ultimate outcome of this objective is to design and execute OCM campaigns in manageable segments over time, and track and report on the progress of these campaigns. Flexibility will be necessary, for example to adjust annual planned operating areas based on weather, equipment, and scientific cruise schedules. OCM campaign mapping will use a diverse suite of funding mechanisms including Federal agency contract vehicles, grants, agreements, tools such as Federal, private sector, and academic vessels, uncrewed systems (e.g., remotely operated vehicles, autonomous underwater vehicles), and other technologies. Technology advancements (See Goal 4) will accelerate the pace of mapping the United States seafloor. To the greatest extent possible, the IWG-OCM will work with the IWG-OEC and through the NOMEC Council to ensure mapping efforts are coordinated with exploration and characterization activities (See Objective 3.4) to optimize collection of complementary data.

Measure of Success: Measurable annual progress on United States OCM data acquisition using all available platforms to maximum extent through coordinated mapping campaigns responding to identified priorities.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
2.2.1	Use and improve geospatial analysis tools and geographic information system (GIS) services and layers for campaign project planning, gap identification, and metrics (e.g., United States BGA, MarineCadastre,gov, fedmap.seasketch.org, and Global Multi-Resolution Topography Data Synthesis)	IWG-OCM	Federal Agencies	User-friendly tools allow stakeholders to visualize spatial coverage of 7 SOMP components (See Milestone 2.1.1), calculate percentage data coverage, identify mapping data gaps, and track progress toward NOMEC mapping goals	Updated annually at minimum
2.2.2	Identify and inventory existing OCM data not currently in a national repository (such as the National Oceanic and Atmospheric Administration's (NOAA's) National Centers for Environmental Information (NCEI)) to include in coverage maps	IWG-OCM	NOAA, Federal agencies, mapping partners	Increase in data provided to NCEI and other repositories with the ultimate goal to discover and publicly archive all existing OCM data; Updated coverage maps will be updated regularly to include newly discovered OCM data	Ongoing
2.2.3	Solicit Federal and non-Federal vessel operators to acquire and share transit route data to inform mapping plans	IWG-OCM, IWG-OEC, IWG-FI	Federal Fleet, United States Academic Research Fleet, States, Territories Private Sector, NGOs	Increase number of vessels submitting transit route data to NCEI; Shared result from increased communication across sectors and use of tools as described in 2.2.2 to easily identify mapping gaps	2021, Ongoing
2.2.4	Design, execute, and track multiyear regional mapping OCM campaign plans using gap analysis tools, OCM priorities, and other inputs to report on progress and outputs	IWG-OCM	Federal agencies, States, Territories, Private Sector, Academia, NGOs	Acquire a minimum of 150,000 square nautical miles of new bathymetric data coverage annually OCM campaign plans outline mapping goals, resources, assets available, and strategy for completing; OCM campaign plans updated and revised based on performance metrics (data quality and percentage coverage)	Annual Ongoing
2.2.5	Build stakeholder engagement with regional summits and other opportunities to identify OCM data needs and drivers, build acquisition partnerships, and leverage external resources	IWG-OCM	Federal agencies, States, Territories, Private Sector, Academia, NGOs	Participate in at least one engagement opportunity for each of the eight United States regions annually, including convening two annual regional summits. Federal agency and regional Prioritization Exercises completed	Annual 2021-2022 (and every 5 years thereafter)

2.2.6	Review campaign plans to ensure protection of critical and sensitive infrastructure	NCSG	NOAA and other Federal agencies	Critical infrastructure and sensitive locales mapped by NOAA or other trusted Federal entity	Ongoing

Objective 2.3. Make Mapping Data Usable and Available

Mapping data acquired by Federal agencies and external partners provides the most value when it is available for easy public access, download, and use. Consistent with, and subject to, national security considerations and applicable laws, Federal agencies and their partners will collect and archive OCM data in standardized formats wherever possible. Making these data available at appropriate national repositories, such as NOAA's NCEI for geophysical data and supporting portals such as Digital Coast and the National Bathymetric Source (NBS), is critical to facilitate public use, integration, and accessibility. Good metadata is also essential for all types of SOMP data. Best efforts will be made to coordinate data discovery for mapping and exploration and characterization data, which together can inform habitat classification using national standards such as the FGDC-approved and IWG-OCM-supported Coastal and Marine Ecological Classification Standard (CMECS). Federally-funded projects working with environmental data in marine settings should include CMECS attributes for their data where possible and appropriate.

Measure of success: OCM data support increased data integration and use by being in discoverable and accessible formats with GDA-compliant metadata. OCM data are retained in national data archives.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
2.3.1	Inventory, promote, and utilize centralized national repositories, data portals, and clearinghouses for OCM data management, access, synthesis, and archival	IWG-OCM, IWG-OEC	Federal agencies	IWG-OCM website updated with inventory of data portals and repositories for data access OCM data acquired with public funds archived at national repositories (e.g., NCEI, U.S. Geological Survey (USGS) National Archive of Marine Seismic Surveys, and other Federally-funded repositories) and made publicly accessible	Aug. 2021
2.3.2	Evaluate Federal agency mapping data holdings to ensure adherence to open data delivery commitments (formats, metadata, archive, and accessibility) to enhance interoperability	IWG-OCM	Federal agencies	Federal agency data holdings assessed using FGDC-like Lifecycle Maturity Assessment tool; Percent increase in interoperable data availability on national delivery systems	Sept. 2021

2.3.3	For existing and new mapping data, ensure data formats and products are archived and meet FGDC/ International Organization for Standardization (ISO) metadata and GDA requirements, using tools such as NCEI's CruisePack software	Federal agencies	IWG-OCM, NOAA	Compiled the following data into accessible and readily usable databases and products: FGDC/ISO compliant data; data archived in three forms: raw, unprocessed data; processed, with calibrations, corrections, and filters applied	Ongoing
2.3.4	Develop, produce, disseminate, and routinely evaluate use/usability of authoritative information products derived from OCM data (e.g., digital elevation models, CMECS-classified benthic habitat change maps, and NBS products)	IWG-OCM		Inventory of authoritative products produced	Mar. 2021
2.3.5	Build Federal agency areas of expertise into shared centers of expertise for data processing	IWG-OCM agencies		Centers of Expertise identified and promoted (e.g., USGS Earth Resources Observation and Science (EROS) Science Center for satellite data and topobathy integration, Joint Airborne Lidar Bathymetry Technical Center of Expertise for topobathymetric lidar data, and NOAA Joint Hydrographic Center for acoustic data)	June 2021
2.3.6	Ensure the integrity and security of aggregate data stores and centers	NCSG	NOAA and Federal agencies	Convene data security workshop to identify sensitive data risk, controls, and protections	June 2021

NOMEC GOAL 3. Explore and Characterize Priority Areas of the United States EEZ

Federal agencies will identify priority areas of interest (geographic and/or thematic) for exploration and characterization and coordinate interagency and cross-sector efforts to explore the ocean; make new discoveries; and characterize the ocean resources, hazards, settings, and processes of the United States. Exploration and characterization are related activities that are distinguished by their granularity and application. **Ocean exploration** entails an initial assessment of an area's physical, chemical, and biological characteristics to provide a baseline understanding of the area applicable to many uses, including geology and marine cultural heritage. **Ocean characterization** provides data and interpretations for a specific area or volume of the ocean to support specific assessments and applications, including research, resource management, policymaking, or other mission objectives. NOMEC exploration and characterization activities are focused on waters 40 m and deeper, because coordinated interagency and cross-sector efforts are lacking beyond the coastal zone. Mapping data (See Goal 2) complement exploration and characterization data outlined in this goal. Seafloor maps inform site selection for exploration and characterization activities, provide critical information for habitat classification, and are used to confirm validation requirements that are common to both exploration/characterization and

mapping-focused needs. Where possible, NOMEC-supported exploration and characterization activities will be coordinated with mapping (See Goal 2) to obtain comprehensive understanding of priority areas and increase efficiencies in data collection. The IWG-OEC first met in Fall 2020 and activities presented below represent new interagency coordination on ocean exploration and characterization efforts in the United States. The approaches and needs for "exploration" and "characterization" efforts still require differentiation in order to fully address the complementary but separate goals of exploring unknown areas and characterizing identified areas of interest to meet applied mission needs.

Objective 3.1. Identify strategic ocean exploration and characterization priorities

This objective will identify key strategic priorities for ocean exploration and characterization to address the President's direction to identify, explore, and characterize "priority areas" within the United States EEZ. Executing this goal will require the consideration of multiple factors, including statutory requirements, Federal agency missions, strategic national issues, Administration policy priorities, and stakeholder perspectives. Specific geographic and thematic priorities will be identified through workshops, requests for information, and other avenues to solicit input from a multitude of partners and stakeholders. Specific examples of strategic priorities include, but are not limited to: areas with potential for offshore energy development or aquaculture, notable archaeological resources and recognized Underwater Culture Heritage sites, critical minerals, biopharmaceutical resources, areas in which natural hazards pose a risk to public safety, features and resources subject to Federal agency resource management and stewardship responsibilities such as Essential Fish Habitats and National Marine Sanctuaries, and areas or ecosystems that may provide key insights into understanding ocean and Earth systems.

Measure of success: Report with actionable goals and/or geospatial platform that guides ongoing and future exploration and characterization efforts and identifies national-level multidisciplinary strategic priorities.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
3.1.1	Identify relevant subject areas and organize subgroups of Federal SMEs	IWG-OEC	Relevant IWGs, Federal agency SMEs	SME-led subgroups (e.g., economically valuable marine resources, water column, marine cultural heritage, biodiversity, and seafloor hazards) represent ocean exploration and characterization disciplines; Subgroups advise the IWG-OEC and NOMEC Council on OEC deliverables	Nov. 2020, Ongoing

3.1.2	Collect and synthesize perspectives of Federal agencies, private sector, academic, NGOs, and other stakeholders on priority geographic areas, features, data types, and/or technologies that are essential for deep water exploration and characterization	IWG-OEC	NOMEC Council, IWG-OCM, Relevant IWGs	Public input solicited through RFI, listening sessions, relevant meetings, workshops, and reports; Combined input will identify synergies (thematic, geographic, and spatial resolution needs), cross-cutting areas, and key partnerships to inform standards and OEC protocols (See Objective 3.2) and campaign planning (See Objective 3.3)	Nov. 2020 – Apr. 2021
3.1.3	Develop report and/or geospatial-enabled platform of initial recommended strategic ocean exploration and characterization priorities in deep United States waters	IWG-OEC	IWG-OCM	Report identifies strategic priorities and relevant timeframes (e.g., near-, medium-, long-term), clarifies key stakeholders, and outlines OCM campaign plans (See Objective 3.3)	June 2021 (and approximately every 2 years thereafter)

Objective 3.2. Establish Exploration and Characterization Standards and Protocols

Recognizing that there is no reasonable single suite of measurements, standards, and/or protocols that can address the full breadth of ocean exploration and characterization applications, this goal seeks to establish common standards for the collection and storage of data and information collected in exploration and characterization activities in order to maximize the benefit of such data and meet information needs across sectors. Actions within this objective will align with existing efforts to identify standards and protocols within the ocean science community, leverage existing repositories for housing data and samples, and promote consistency with standards and protocols of the FGDC, other similar bodies, and international efforts to standardize oceanographic data. Similar to the prioritization process outlined in Objective 3.1, established exploration and characterization standards and protocols may be periodically revisited to allow for improvements in understanding, advancements in S&T, and stakeholder input.

Measure of success: Data collection standards, protocols, and file format sharing guidelines are published for use by all Federal agencies that conduct or fund ocean exploration and characterization missions.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
3.2.1	Conduct outreach with Federal agencies, private sector, academia, NGOs, and other stakeholders on the standards and protocols that are essential for deep ocean exploration and characterization	IWG-OEC	IWG-OCM, Relevant IWGs, Federal agencies	Public input solicited through RFI, listening sessions, relevant meetings, workshops, and reports; Federal input is collected through review of existing Federal documents and reports; An assessment of Federal agencies' current deep ocean exploration and characterization activities, existing or emerging requirements, and shared interests is conducted	Apr. 2021

3.2.2	Develop standard metrics to track the area and volume of the United States EEZ explored or characterized to inform MEC campaign needs (See Objective 3.3)	IWG-OEC	NOAA/NCEI, NOMEC Council, Federal agencies	Metrics defined for categorizing area/volume as explored or characterized that consider the low spatial coverage of most in situ observations	June 2021
3.2.3	Develop outline of "Standards and Protocols for Ocean Exploration and Characterization" (Standards and Protocols) document, with feedback from: (1) the NOMEC Council and IWG-OCM; (2) Federal agencies via IWG-OEC subgroups; and (3) public input	IWG-OEC	NOMEC Council, IWG-OCM, Relevant IWGs, Federal agencies	Standards and Protocols document leverage prior efforts, current capabilities, emerging technologies, and existing Federal agency standards/protocols; Feedback will be incorporated into the final document	Apr. 2022
3.2.4	Provide draft Standards and Protocols document to OST for final review	IWG-OEC	NOMEC Council	Data collection standards, protocols, and file format sharing guidelines are published for use by all Federal agencies and non-governmental partners that conduct deep ocean exploration to use when executing and supporting exploration and characterization missions within the United States EEZ	June 2022

Objective 3.3. Explore and Characterize Priority Areas

Priority areas identified in Objective 3.1 will be explored and characterized leveraging a variety of mechanisms and partnerships and using the standards and protocols developed in Objective 3.2. In some instances, priorities may be addressed through a single at-sea mission supported by an individual Federal agency or partner. However, to optimize priority exploration and characterization missions, multi-mission campaigns will need to be developed and supported by a variety of partners and mechanisms. Such campaigns often encompass years of effort, a variety of platforms, technologies, and multi-sector partners. These multi-mission campaigns should be designed to evolve with expected new technologies and mission requirements. To facilitate coordination and execution, the NOMEC Council and IWG-OEC will collect information from Federal agencies (and from non-Federal partners when appropriate) about their planned exploration and characterization missions to identify opportunities for collaboration, resource coordination, and efficiency. To the greatest extent possible, the IWG-OEC will work with the IWG-OCM and through the NOMEC Council to ensure exploration and characterization activities (See Goal 3) are coordinated with mapping efforts (See Goal 2) to optimize collection of complementary data.

Measure of success: In executing exploration and characterization activities that advance identified strategic priority needs, collaborations and partnerships have been created or strengthened under the NOMEC Strategy, resulting in new or expanded exploration and characterization results, including new inventories, observations, and

assessments of living and non-living marine resources, ecosystems, ocean processes, and marine litter.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
3.3.1	Identify and utilize existing national priorities and standards documents relating to ocean MEC (using the results of Objectives 3.1-2, where applicable) and innovative approaches/models to facilitate and execute new ocean exploration and characterization projects and campaigns, in coordination with mapping-focused campaigns (See Goal 2)	NOMEC Council, IWG-OEC	Federal agencies, States, Territories, Private Sector, Academia, NGOs	New activities/projects are demonstrably responsive to Objectives 3.1 and 3.2; Federal agencies report projects identified to meet NOMEC priorities and demonstrate the value of effective leveraging/coordination	Ongoing
3.3.2	Conduct or attend workshops and meetings (See Milestone 5.2.3) to establish campaign-specific goals and partner responsibilities	NOMEC Council, IWG-OEC, IWG-OCM	Relevant IWGs, OST	Workshops conducted before, during, or after campaigns are used to inform and guide ongoing and future efforts; Information is efficiently synthesized and released	Ongoing
3.3.3	Execute, expand, and enhance exploration and characterization activities by Federal entities and also collaboration with non-Federal partners (per Objectives 5.1 and 5.2), utilizing mechanisms for innovation (e.g., prize challenges), where appropriate	NOMEC Council, Federal agencies	IWG-OEC, IWG-NOPP	Government and external (e.g., private sector and philanthropy) funding aligns with identified National priorities; Activities are tracked, quantified, and publicly shared	Ongoing
3.3.4	Scope, develop, and launch an Exploration Gap Analysis tool (similar to BGA) to assist with planning and tracking exploration and characterization activities	NOAA	IWG-OEC	Exploration Gap Analysis developed to geospatially track areas explored from previous and ongoing exploration and characterization activities; Exploration Gap Analysis will also be used to track progress on exploring and characterizing existing priority areas (from ongoing and previous missions) and to identify new priority areas	2023

Objective 3.4. Make Exploration and Characterization Data Usable and Available

Ocean exploration and characterization missions collect large amounts of data. While these data are used in near real-time to guide at-sea operations, the greater value comes from transforming data into actionable information that can be accessed and used by a wide variety of stakeholders, including scientists, government policymakers, educators, and business owners. This process of successfully transforming, standardizing, ensuring quality control, and disseminating data and information requires significant effort and planning. The milestones below identify some specific actions that the NOMEC Council, IWGs, and Federal agencies will take to make collected ocean exploration and characterization data

(including imagery, biological and geological samples, datasets and accompanying FGDC-compliant metadata) useful and publicly available. There are some known constraints relating to this objective, including national security considerations and proprietary data or data specifically exempted from public release by regulation or law (e.g., shipwreck locations under the National Historic Preservation Act). However, generally the NOMEC Strategy and this Implementation Plan seeks to promote and facilitate timely submission of data to established repositories, adhere to recognized standards, and ease public access. These steps will better enable subsequent analysis and synthesis, such as helping to identify geographic and topical gaps where further exploration and characterization data collection efforts should be prioritized (See Milestone 3.3.4).

Measure of success: Improved accessibility and usability of exploration and characterization data for the public, scientific communities, resource managers, and other data users and compliance with legally mandated data access and standards.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
3.4.1	Identify, promote, and utilize relevant data portals and clearinghouses for ocean exploration and characterization data management, access, synthesis, and visualization, including a new Exploration Gap Analysis tool (See Milestone 3.3.4)	NOMEC Council, IWG-OCM, IWG-OEC	Federal agencies, IWG-Ocean Education	Create a list of existing relevant ocean exploration and characterization related data portals/clearinghouses; Facilitate and promote appropriate archiving of ocean exploration and characterization data collected through NOMEC-guided projects	Mid-2021
3.4.2	Support primary, centralized repositories (e.g., NCEI) for ocean exploration and characterization data and publicly accessible repositories for physical samples including biological specimens (e.g., Smithsonian Institution) and geological samples (NCEI, multiple contractors, academia including NSF-funded repositories, USGS)	NOMEC Council, IWG-OCM, IWG-OEC	NOAA, Smithsonian Institution, USGS, NSF	Federal agencies coordinate on standard data requirements (See Objective 3.2) and language to include in Federal funding mechanisms (contracts, cooperative agreements, grants, interagency agreements, and prizes) for digital (e.g., imagery and geospatial files, and databases) and physical samples collected using Federal funding	Spring 2021, Ongoing
3.4.3	Promote and disseminate FGDC/ISO data and metadata standards and GDA compliance requirements for all Federal agencies	Federal agencies	FGDC, NOMEC Council, IWG-OEC	FGDC establishes and disseminates FGDC/ISO metadata standards for Federal agencies; Federal agencies' Inspectors General ensure FGDC/GDA compliance; GDA defines and assigns specific National Geographic Data Asset (NGDA) themes that are owned by specific agencies and a portfolio management plan; Crosswalk NGDA to relevant MEC datasets using agency points of contact	Ongoing
3.4.4	Facilitate development, coordination, and dissemination of new and existing ocean exploration and	IWG-OEC, IWG-OCM,	Federal agencies, FGDC	Information about relevant data management best practices shared via relevant websites, webinars, and workshops; Data management best practices	Ongoing

	characterization-related data management best practices	NOMEC Council		may include procedures for effective data/metadata storage, archiving techniques, quality assurance/acceptance/validation criteria, metadata standards, and accessibility	

NOMEC GOAL 4. Develop and Mature New and Emerging Science and Technologies to Map, Explore, and Characterize the United States EEZ

New and emerging S&T are key to making ocean MEC more efficient and effective. More frequent and ambitious ocean MEC campaigns should include new and improved technologies, remote sensing, analytics, vessels, and other platforms capable of measuring, sampling, and imaging deep waters. The rapid advancement of autonomous sampling tools, platforms, and technologies may provide for more cost-effective and efficient acquisition of MEC data. Leveraging partner expertise in marine technology development, including the private sector, academia, and NGOs, are key. Federal agencies will coordinate efforts to identify S&T requirements and will promote and advance new technologies to support MEC of the United States EEZ.

Objective 4.1. Identify Science and Technology Priorities in Mapping, Exploration, and Characterization

The NOMEC Council will develop and maintain a portfolio of S&T priorities that support the goals of the NOMEC Strategy and the objectives of the Implementation Plan. The S&T priorities will inform prioritization of S&T investments by the Federal government and non-government partners to incentivize innovation that will support more effective ocean MEC. The NOMEC Council will communicate S&T requirements across the Federal government and to the broader research community and the private sector. The NOMEC Council will produce and initial portfolio outlining S&T requirements within one year and will provide periodic reevaluations.

Measure of success: The ocean science community clearly articulates priorities for ocean MEC S&T development over the near and long term.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
4.1.1	Compile list of existing and emerging S&T requirements from the MEC community, including operations, research, and the private sector, through published materials and relevant meetings/workshops (e.g., SOMP Symposium, Consortium for	NOMEC Council	IWG-OCM, IWG-OEC, Relevant IWGs (e.g., IWG on Ocean	Synthesis will provide key information required to identify emerging technologies and gaps in Federal MEC asset availability that could be identified to accelerate advancement and development	June 2021

	Ocean Leadership Workshop to Identify National Ocean Exploration Priorities in the Pacific)		Sound and Marine Life)		
4.1.2	Convene 'Ocean Visions 2030' (or similarly named) workshop to identify MEC technology priorities for the next 5-10 years	IWG-OCM, IWG-OEC	NOMEC Council, Private Sector, Academia, NGOs	Prepare a conference report containing recommendations for 'achievable' technological innovations with the potential to dramatically improve NOMEC-guided activities	Mar. 2022
4.1.3	Identify and address gaps in data stewardship pipelines where technology can improve the delivery, archival, discovery, access, and use of data	IWG-OCM, IWG-OEC	Federal agencies	Document requirements for new technologies to aid comprehensive delivery, archival, discovery, access and use of data	June 2021

Objective 4.2. Support Development, Testing, Deployment, and Use of New Technologies

Through traditional contract and grant mechanisms, including those focused on small business and innovation, Federal agencies will support the development and transition of emerging marine observing technologies and applications. Federal agencies may also consider offering prizes or proposing challenges that will engage the private sector and the general public in the development of new technologies to solve MEC challenges. Past prize competitions have led to significant improvements in technologies to map the seafloor without the use of vessels. Currently, a competition seeks to integrate marine renewable energy with ocean observation platforms to allow for a longer duration or sustained data collection.

Federal agencies may use frameworks, proving grounds, and testbeds to conduct testing of advanced operations, services, and S&T capabilities that address the needs of users across the MEC community. Where appropriate, Federal agencies can enter into cooperative research and development agreements (CRADAs) with non-Federal entities to support at-sea testing of existing technologies or technologies under development to assess operational readiness and provide mission-focused feedback to non-Federal entities. Incorporation and use of these new or emerging technologies during MEC activities may enhance the overall objectives of the campaign, accelerate private sector innovation, spur further innovation and discovery, and create a market for commercially-developed technology applications.

Measure of success: Federal agencies efficiently and effectively execute development, testing, and adoption of new and innovative technologies, scaling up existing capacity to map, explore, and characterize the ocean.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
4.2.1	Identify Federal funding and incentivizing mechanisms, including prizes; Evaluate opportunities to use these Federal funding and incentivizing mechanisms to sponsor and contribute to a new MEC S&T-enhancing prize challenge, supporting technology development and demonstration projects	NOMEC Council, IWG-OCM, IWG-OEC	Federal agencies with prize challenge authority (e.g., DOE)	Catalog government funding mechanisms, the agencies/programs that can legally use them, and their strengths/weaknesses; By sharing best practices, Federal agencies identify opportunities for greater collaboration and leveraging and incorporate best practices across the Federal government New prize challenges are developed, prizes awarded, and winning technologies tested and eventually employed for MEC effort(s)	Late 2021 Biannual
4.2.2	Provide opportunities for non-Federal entities to participate in ocean "moonshot" exploration and characterization technologies, including demonstrations and testing, while also improving connections/outreach to non-traditional sectors (e.g., medicine and computer science)	Federal agencies	IWG-OCM, IWG-OEC	Federal agencies involved with MEC activities track and showcase engagement events, existing technology used by other sectors, and connections to fellowships Workshop/conference hosted on ocean 'moonshot' exploration and characterization technologies, potential cross-sector partnerships, CRADA ideas, and prize challenges; Prepare a workshop/conference report	Annual Biannual
4.2.3	Foster public engagement in MEC-focused activities, as appropriate, to support development and testing of new technologies	NOMC Council, IWG-OCM, IWG-OEC	IWG-Ocean Education	Increased public engagement and collaboration to advance the development, testing, deployment, and/or use of new technologies	Annual
4.2.4	Protect critical and controlled undersea technologies	NCSG	Federal agencies	Presence or absence of evidence suggesting that critical and controlled undersea technologies have been obtained by actors restricted from acquiring via legitimate means (e.g., illicitly obtained by near peer competitors)	Ongoing

Objective 4.3. Support Partnerships with Organizations that are Promoting, Investing in, or Developing Ocean Methodologies, Technology, and Applications

The United States has a robust ocean S&T industry, supported by numerous professional societies and coordinated through local, regional, and national organizations. These private sector groups promote awareness of the United States and international development in marine S&T, support information sharing, and facilitate cross-sectoral dialogue among leaders of government and non-governmental institutions and their members. Federal agencies will regularly engage with and support these groups to seek the subject matter expertise and novel partnerships needed to address the methodology, technology, and application development MEC S&T needs as identified in Objective 4.1. This will provide opportunities to better understand the landscape of domestic and international methodology and technology developments, improve cross-sectoral communication and coordination, encourage partnerships aimed at advancing the methodologies and technologies required to map, explore, and characterize the United States EEZ, and maximize the use of the resulting data.

Measure of success: Improved partnerships within and outside the Federal government to advance ocean MEC priorities.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
4.3.1	Provide opportunities for accelerated field testing and adoption of cutting-edge technologies to enable Federal agencies to achieve MEC goals	Federal agencies	NOMEC Council, IWG-OCM, IWG-OEC, Relevant IWGs (e.g., IWG-OSML)	Future missions on Federal vessels support testing and evaluation of new technologies through incentives and other tools (e.g., contracts, grants, and/or agreements that encourage or require use)	Ongoing
4.3.2	Participate and engage stakeholders through existing organizations and meetings/conferences (e.g., Fleet Improvement Committee (UNOLS), Deep Submergence Science Committee (UNOLS), American Geophysical Union, Ocean Sciences Meeting, Underwater Intervention, Offshore Technology Conference, and many others)	NOMEC Council, IWG-OCM, IWG-OEC		NOMEC Council, IWG members, and Federal agency staff promote MEC efforts through website, presentations, town halls, and workshops at relevant meetings/conferences	Ongoing
4.3.3	Create new MEC-focused engagement opportunities (e.g., meetings, workshops, forums, and conferences focused on sharing current and developing technologies)	NOMEC Council, IWG-OCM, IWG-OEC		New MEC-focused meetings, workshops, forums, and conferences are scoped, planned, and held; Input/feedback documented in reports and inform NOMEC-supported technology improvements and adaptations	Ongoing

4.3.4	Capitalize on international MEC efforts (e.g., UN Decade for Ocean Science, Seabed 2030/General Bathymetric Chart of the Ocean (GEBCO), NEKTON, Deep Ocean Observing Strategy (DOOS), Marine Biodiversity Observation Network) to share and improve consistency across efforts	NOMEC Council, IWG-OCM, IWG-OEC	NCSG	Living report/website documents United States contributions to international MEC, identifies key partners, synergistic priorities, and ensures consistent approaches; United States national security related interests are maintained via NCSG	Ongoing

NOMEC GOAL 5. Build Public and Private Partnerships to Map, Explore, and Characterize the United States EEZ

Fully mapping, exploring, and characterizing the United States EEZ will require efforts not only from Federal agencies but from State and Territorial agencies, the private sector, academia, NGOs, and Tribes. Federal agencies will participate and support these partnerships in order to ensure all of the NOMEC Strategy goals are completed by their target dates. Many of the Implementation Plan's Milestones provide opportunities to solicit stakeholder input, support and include stakeholders, and share best practices across sectors. This Goal outlines some of the broader approaches being applied to ensure that all sectors are engaged to implement the NOMEC Strategy.

Objective 5.1. Maximize Opportunities for Non-Federal Participation

This Objective provides a framework to coordinate efforts among Federal, State, and Territorial agencies, the private sector, academia, and NGOs. There are a variety of mechanisms that will be used to enhance the planning, coordination, and successful implementation of MEC activities within the United States EEZ. Participation from all sectors in the planning and implementation of these activities will be critical to success.

Measure of Success: Increase non-Federal participation and collaboration in ocean MEC activities and efficiencies to meet MEC goals.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
5.1.1	Coordinate MEC-related activities and associated technological development across Federal interagency committees and working groups, such as the IWG-OCM, IWG-OEC, IWG-Biodiversity, and the IWG-NOPP	NOMEC Council, IWG-OCM, IWG-OEC	Federal agencies, IWG-NOPP	NOMEC Council, IWG-OCM, and IWG-OEC conduct regular recurring meetings and share information with relevant interagency groups (e.g., NOPP) as appropriate; Sharing information across Federal agencies and interagency working groups will maximize opportunity to support synergies between these groups	Ongoing

5.1.2	Identify non-Federal assets (e.g., vessels and uncrewed systems) and projects (e.g., NGO supported funding) to identify ways to increase non-Federal participation in achieving MEC goals	NOMEC Council, IWG-OCM, IWG-OEC	Federal agencies, IWG-NOPP, IWG-FI	Existing non-Federal assets and upcoming projects identified that have capabilities to meet MEC objectives including potential opportunities for collaboration between Federal and non-Federal partners	2021, Ongoing
5.1.3	Promote broader use of identified innovative Federal funding mechanisms among Federal agencies and the private sector, academic, and NGO partners. Connect these mechanisms to help implementation and execution of NOMEC Strategy-guided exploration and characterization activities	NOMEC Council, IWG-OCM, IWG-OEC	Federal agencies, IWG-NOPP, IWG-Ocean Education, non-Federal partners	Identify opportunities for greater collaboration/leveraging mechanisms between Federal agencies and non-Federal partners to advance NOMEC goals and technologies	Dec. 2021, Ongoing thereafter
5.1.4	Improve and enable coordination with international efforts on S&T development	NOMEC Council, IWG-OCM, IWG-OEC	NCSG	NOMEC Strategy implementation enhanced by participation in international forums as appropriate; Incorporation of new best practices, shared protocols, development of MOUs, execution of shared missions; Awareness of any United States national security related interests is maintained (using the NCSG) while engaging international partners/efforts	Ongoing

Objective 5.2. Foster Cross-Sector Engagement

Partnerships provide an opportunity for multiple sectors to align the strengths of their respective Federal, State, and Territorial agencies or organization to achieve results that cannot be accomplished individually. To be successful, partners require a platform to communicate and strengthen the understanding of each other's interests and capacities. The NOMEC Council will provide direction for enterprise partnerships among Federal, State, and Territorial agencies, the private sector, academia, NGOs, and Tribes. Special consideration will be given to Alaska Native Organizations in order to minimize potential conflicts with subsistence and cultural activities. For example, MEC activities will avoid bowhead whale migration and other important subsistence time periods.

Measure of Success: All stakeholders have ample opportunity to provide input in NOMEC implementation and are full participants in NOMEC activities.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
5.2.1	Promote mechanisms to strengthen collaboration between Federal and non-Federal stakeholders	NOMEC Council	IWG-OEC, IWG-OCM, NCSG	NOAA on behalf of the NOMEC Council publishes RFIs in the Federal Register, conducts public listening sessions, provides opportunities for public input at relevant advisory committee meetings and	Oct. 2020, Ongoing

				workshops; List of relevant stakeholders created; List of all Federal agency activities relevant to the NOMEC Strategy that might result in cross-sector participation created	
5.2.2	Identify an opportunity to scope a Federal pilot interdisciplinary activity to coordinate on a specific mapping, exploration, and/or characterization effort	NOMEC Council	IWG-OCM, IWG-OEC, IWG-NOPP, IWG-Biodiversity, Federal agencies	Operational plan created for a multi-agency and/or cross-sector pilot interdisciplinary activity to make progress towards NOMEC Council's MEC goals	Winter 2021
5.2.3	Execute pilot interdisciplinary activity to coordinate on a specific mapping, exploration, and/or characterization effort	NOMEC Council	IWG-OCM, IWG-OEC, NCSG, IWG-NOPP, IWG-Biodiversity, Federal agencies	Pilot interdisciplinary activity conducted to coordinate on a specific mapping, exploration, and/or characterization effort	Spring 2022
5.2.4	Establish a formal ongoing mechanism for engaging multi-sectoral representatives in strategic planning of NOMEC implementation	NOMEC Council		Options for establishing a multi-sectoral group explored; Pros/cons and legal limitations of each mechanism considered; Appropriate mechanism selected and established; Sectoral representatives solicited and selected; Regular meetings held	Spring 2022

Objective 5.3. Inspire and Involve the Public

An inclusive science, technology, education, and mathematics (STEM)-literate and ocean-literate workforce is fundamental to ocean innovation and for the Nation to best harness the potential benefits gained from the NOMEC Strategy. Federal agencies will take action to expand the reach of existing MEC partnerships, focusing on all sectors and communities. Federal agencies should support educational outreach programs and grants that encourage the advancement and participation of underrepresented groups in ocean S&T. Special degree programs geared toward ocean work, hands-on experience, and professional development offered through partner and educational institutions can prepare students for marine occupations, including marine forecasters, ocean instrument technicians, scholars, and underwater remotely operated vehicle (ROV) developers. Continued investments in STEM education and outreach is critical for ensuring United States leadership, making certain that the next generation of Americans remains competitive in the growing international field of ocean S&T. Federal agencies will also promote and strengthen educational and professional development communities of practice relevant to ocean MEC. Federal agencies will increase opportunities for undergraduate and graduate students and early career professionals, particularly individuals from underrepresented groups, to participate in Federal and non-Federal ocean MEC activities.

Measure of Success: Development of an ocean literate society. Increased opportunities for STEM education and other public outreach, specifically targeting underrepresented groups, to help build an energized and diverse blue workforce.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
5.3.1	Identify and engage educational partners (K-12, universities, community colleges, museums, and STEM programs) to expand diversity of students learning skills to prepare for a career in the blue workforce	NOMEC Council	Federal agencies, IWG-Ocean Education, Smithsonian Institution	New partners engaged in educating the future blue workforce; Particular focus on engaging community and technical colleges to create a more diverse body of students for blue workforce job opportunities	2021
5.3.2	Create opportunities to support student education and research to help build a future diverse, equitable, and inclusive blue workforce	Federal agencies	IWG-Ocean Education, Smithsonian Institution	Expand Federal and non-governmental opportunities for student and early career internships, grants, fellowships, and/or scholarships, particularly for currently underrepresented communities; Innovative educational materials meeting national science standards will support learning thereby developing a blue workforce	2022
5.3.3	Inspire the public about NOMEC activities	NOMEC Council, IWG-OCM, IWG-OEC	Federal agencies, IWG-Ocean Education, Smithsonian Institution	Outreach opportunities supported by Federal and non-governmental entities including web content (e.g., progress tracking NOMEC goals), telepresence access to real-time exploration activities, museum and aquarium exhibits, citizen science projects on MEC S&T (see also Milestone 4.2.3)	Ongoing

Conclusion

Review and Updating of Implementation Plan

The NOMEC Council, IWG-OCM, and IWG-OEC will review and update the NOMEC Implementation Plan in 2023 as required by the NOMEC Strategy and periodically thereafter. The updates will incorporate new capabilities and technologies, partnerships, and operational advancements of the MEC enterprise. This first Implementation Plan is focused on building the partnerships and developing shared priorities, standards, and practices that will be required to successfully implement the NOMEC Strategy.

Security Considerations

(U//FOUO) The NOMEC Council Security Subgroup has been established to coordinate NOMEC activities with the national security and intelligence community. Critical infrastructure, aggregate data protection, critical undersea expertise and technology transfer, critical and rare resource protection, supply chain integrity, and general counterintelligence concerns related to Great Power Competition will be considered. The NCSG membership consists of members of the NOMEC Council, IWG-OCM, and IWG-OEC who hold appropriate security clearance, and others from the national security and intelligence community with interests relevant to NOMEC activities. The NCSG will be preparing a classified addendum to the Implementation Plan. The first meeting of this group was October 27, 2020.

Synergies

The NOMEC Council will require close collaboration with both the "Alaska Coastal Mapping Strategy" (ACMS) and "Recommendations for Increasing the Efficiency of Permitting for Ocean Exploration, Mapping, and Research Activities" (Efficient Permitting) Implementation Plans that were developed pursuant to the Presidential Memorandum. The NOMEC Council will consider Alaska's mapping needs in their Implementation Plan to ensure topographic, bathymetric, and orthoimagery coverage of the Alaskan coastal zone by 2030. Specifically, shallow water acoustic bathymetry beyond the extinction depth of optical sensors is a high priority for Alaska and acquisition of this dataset is scheduled to be captured in the NOMEC Strategy. This will require close coordination with ACMS when being implemented. Goal 4 of the NOMEC Strategy and Goal 3 of ACMS both address the need to leverage innovation and support new and emerging technologies. Support for these initiatives will have a tremendous impact on the ability to effectively map Alaskan coastal waters. ACMS will be participating in and encouraging the implementation of NOMEC Goal 4 (*Develop and*

Mature New and Emerging Science and Technologies to Map, Explore, and Characterize the United States EEZ) in Alaskan waters.

Additionally, the NOMEC Council is specifically mentioned in both Goal 1 and Goal 2 of the Efficient Permitting Implementation Plan. Carrying out these objectives will require close coordination with the Ocean Resource Management Subcommittee of the Ocean Policy Committee. This includes developing a website that identifies and links to Federal agency programs, authorities, and regulations, specific to ocean exploration, mapping, and research activities, evaluating NOAA and Bureau of Ocean Energy Management's (BOEM's) OceanReports tool, facilitating use of categorical exclusions under the National Environmental Policy Act, and evaluating opportunities to use programmatic compliance approaches related to ocean exploration, mapping, and research.

When implementing the NOMEC Strategy, the NOMEC Council will coordinate on appropriate actions with other interagency working groups chartered under the Subcommittee on Ocean and Science Technology (e.g., Interagency Ocean Observation Committee, IWG on Ocean Acidification, IWG on Ocean Education, IWG on Ocean Sound and Marine Life, and the IWG-National Oceanographic Partnership Program) as well as other Federal entities.

Looking Forward

This Implementation Plan lays the groundwork for the United States to meet the ambitious mapping, exploration, and characterization goals outlined in the NOMEC Strategy. The Milestones and actions outlined in the Implementation Plan will significantly enhance interagency communication, cross-sector coordination, technological developments, progress tracking, and data provision. With sufficient funding over the next few years, pilot projects and workflows will serve as models for the next two decades of accomplishments and discoveries within United States waters as the NOMEC Council leads the Nation in achieving the goal of fully mapping, exploring, and characterizing the United States EEZ.

Appendix

Appendix A: Public Input Process and Summary for the NOMEC Implementation Plan

Opportunities for Public Input on NOMEC Implementation Plan

The NOMEC Council solicited public input throughout the creation of the NOMEC Strategy as well as the Implementation Plan. In Fall 2020, the NOMEC Council used the following mechanisms to reach various stakeholders and provide opportunities for written and oral comment: Federal Advisory Committee meetings, workshops, RFIs published in the Federal Register, and public listening sessions (see Table 1 for details). The two virtual public listening sessions took place on November 16 and November 18, 2020. These 1.5 hour sessions included small group breakout discussions for interested members of the public to learn about the NOMEC Strategy and provide informal comments.

Table 1. NOMEC Council Public Input Mechanisms Fall 2020

Mechanism	Name	Date	Description	Audience	Feedback
Federal Advisory Committees to NOAA	Hydrographic Services Review Panel (HSRP)	Sept. 23-24, 2020	Advises NOAA on improving the quality, efficiency, and usefulness of NOAA's navigation-related products, data, and services	Navigation and Coastal stakeholders	HSRP NOMEC Position Paper; 26 written comments, recommendation letter to the NOAA Administrator
	Ocean Exploration Advisory Board	Oct. 1-2, 2020	Advises NOAA leadership on strategic planning, exploration priorities, competitive ocean exploration grant programs, and other matters as requested	Exploration stakeholders	Awareness
	Consortium for Ocean Leadership Workshop to Identify National Ocean Exploration Priorities in the Pacific	July-Sept. 2020	Focused discussion on National ocean exploration priorities in the Pacific	Federal agencies, Private Sector, Academia, NGOs	Workshop Discussion and Report
	NSF Smart Oceans Workshop	Oct. 5, 2020	Explored ongoing challenges and emerging opportunities in ocean	Federal agencies, Private Sector,	Awareness and related breakout session on seafloor

Workshops/ Conferences			innovation, exploration, and utilization	Academia, NGOs	mapping
	IWG-OCM Standard Ocean Mapping Protocol (SOMP) Symposium	Oct. 6-7, 2020	Focused discussion with non-Federal stakeholders to learn about the protocol and provide written or verbal comment	Federal agencies, mapping stakeholders	255 participants on day 1 and 198 on day 2; workshop report to inform the SOMP
Request for Information (RFI)	Implementation Plan	Oct. 13-Nov. 12, 2020	RFI published in the Federal Register to seek input on development of the Implementation Plan and exploration and characterization priorities	Interested Public*	17 written comments
	Strategic Priorities	Oct. 13-Nov. 12, 2020		Interested Public†	10 written comments
Public Listening Sessions	Two Virtual Listening Sessions (with breakout session discussions)	Nov. 16 & 18, 2020	Listening sessions with the NOMEC Council to seek input from non-Federal stakeholders on both the Implementation Plan and exploration and characterization priorities	Interested Public‡	298 participants for session 1 and 196 participants in session 2

* Including but not limited to: private sector, academia, NGOs.

† Including but not limited to: private sector, academia, NGOs.

‡ Including but not limited to: Federal, State, local, and Tribal governments including U.S. Congress, academia, private sector, NGOs, international organizations, and the general public.

Major Themes of Public Input

The NOMEC Council, IWG-OCM, and IWG-OEC reviewed and considered all comments received and, where appropriate, incorporated the input into the Implementation Plan. They will continue to incorporate these comments and future public input into the subsequent actions. The NOMEC Council recognizes that the public input process must be iterative and sustained to foster meaningful partnerships, as discussed in Objective 5.2. Through the RFIs, the public also provided input on priority areas for exploration and characterization and this information will be incorporated in the implementation of NOMEC Goal 3, "Identify Strategic Ocean Exploration and Characterization Priorities." The public input received included specific recommendations, clarifying questions, and expressions of enthusiasm for the NOMEC Strategy. The public input throughout the two listening sessions illustrated general support and enthusiasm for the NOMEC Strategy. Stakeholders were appreciative of the opportunity to learn about the NOMEC Strategy and expressed interest in continuing to engage in its planning and execution. Six major themes emerged from the public input process:

1. **Develop transparent and sustained paths for partnerships and stakeholder engagement**

All stakeholder groups expressed a strong desire to engage directly in implementing the NOMEC Strategy early, often, and comprehensively. The scale of the public's desire to engage ranged from wanting general awareness of NOMEC Strategy implementation to advocating for non-Federal entities to be actively involved in decision making implementing the NOMEC Strategy.

The NOMEC Council received many recommendations that highlighted specific groups, organizations, sectors, or bodies that should be engaged in implementing the NOMEC Strategy, including Tribal governments and indigenous groups, State, Territorial, and local governments, research partnerships and consortia, industry associations, and international entities. Many recommendations highlighted the importance of including diverse sectors beyond those that usually participate in ocean mapping, exploration, and characterization (MEC), such as offshore energy development, tourism, recreation, fishing industries and fishery management councils research institutions, and local environmental organizations. The public also recommended that the NOMEC Council engage with stakeholders in the forums relevant to each stakeholder group, such as academic conferences, industry trade shows, regional meetings, and international forums. A few comments recommended that the NOMEC Council create an email listserv and website. It was important for some groups that the NOMEC Council goes beyond traditional engagement through Federal Register notices and formal funding opportunity announcements to more creative and proactive engagement.

The NOMEC Council recognizes that successfully accomplishing the NOMEC Strategy will require a 'whole of community' approach, and that partnerships and public engagement will be critical to the success of the NOMEC Strategy. Cross-sectoral input was integral to drafting the Implementation Plan (See Milestones 1.2.1 and 1.2.3) and is included in all of the Implementation Plan goals. Public input will inform standards and protocols to ensure data are useful to all relevant stakeholders (See Milestones 2.1.2, 2.1.4, 2.3.2, 3.2.1, 3.2.3, 3.3.3). Throughout Goals 2 and 3, public input will be an ongoing component for developing data management best practices (See Milestones 2.1.1, 2.1.2,2.1.5, 3.2.2, 3.2.3), planning and conducting campaigns (See Milestones 2.2.2, 2.2.3, 2.2.5, 3.3.1,3.3.3), and encouraging technology development (See Milestones 4.1.1, 4.1.2, 4.2.1, 4.2.3, 4.3.2, 4.3.3). Further, the NOMEC Council will identify a mechanism to stand up a cross-sectoral body for relevant entities to contribute directly in strategic planning and execution of implementation activities (See Milestone 5.2.4). The NOMEC Council, IWG-OCM, and IWG-OEC, and member agencies will conduct targeted engagement

with the many specific organizations, groups, and entities who expressed interest in participating in implementing the NOMEC Strategy (See Milestones 1.1.3 and 1.1.4).

The public emphasized that improving the flexibility and sustainability of Federal funding vehicles for ocean MEC activities through cost sharing, crowdsourcing, prize competitions, and other mechanisms will greatly improve private sector and local government participation. The NOMEC Council will seek to evaluate and support innovative Federal funding mechanisms to improve the collaboration and leveraging on NOMEC-related activities (See Milestones 4.2.1 and 5.1.3).

2. **Include marine cultural heritage, underwater archaeology, and paleolandscapes in NOMEC Strategy implementation**

Stakeholders emphasized the importance of including underwater cultural heritage sites, archaeological resources, and paleolandscapes in the MEC priorities for the NOMEC Strategy. Recognizing and including the study of cultural heritage sites and archaeological sites requires outreach and engagement with academia, local communities, and local, State, Territorial, and Tribal governments. The NOMEC Council adapted this Implementation Plan to respond to this growing field of study (See Goal 3.1 and Milestone 3.1.1).

3. **Collaborate with private sector, including small businesses, to advance innovative S&T development**

The public expressed support for the ongoing development and use of uncrewed systems, including but not limited to remotely operated vehicles, autonomous underwater vehicles, drones, gliders, and autonomous surface vehicles. There was a common sentiment that the use and improvement of these platforms will greatly improve the chances of success at meeting the goals of the NOMEC Strategy. In addition to the funding required to deploy these systems, some comments also outlined the importance of improving the environment for small businesses that specialize in developing these types of novel platforms. The NOMEC Council recognizes the value of autonomous sampling tools, platforms, and technologies. As outlined in this Implementation Plan, advances in this sector will be crucial to the success of implementing the NOMEC Strategy over the next twenty years. The NOMEC Council and working groups will continue to look at fair and equitable mechanisms to partner with emerging small businesses (See Goals 4 & 5).

4. **Ensure shallow water mapping for multiple applications is carried out**

The NOMEC Council received robust feedback from stakeholders who were concerned that the NOMEC Strategy focused on mapping, exploring, and characterizing waters

greater than 40 m at the expense of mapping nearshore shallower waters. Representatives from State and local governments, academia, leisure craft manufacturers, and select marine navigation stakeholders expressed some concern that navigation safety, small harbors, waterways, and nearshore bathymetry would be overlooked under the NOMEC Strategy. The NOMEC Council and Implementation Plan will continue to highlight that one of the major goals of the NOMEC Strategy is to map coastal waters (<40 m) by 2040. The NOMEC Strategy and Implementation Plan emphasize that S&T development will be necessary to feasibly map the entire shallow water areas of the United States EEZ, through the use of autonomous systems, artificial intelligence, and machine learning (See Goals 2 and 4).

5. **Align technical specifications and protocols related to specific fields of study or management applications**

The public provided extensive input on the types and specifications of data that would address individual sector's interests and needs, such as specific bathymetry resolution, time series data, ecological habitat data, exploration for carbon capture potential, temperature, ocean acidification, environmental DNA (eDNA), and imaging. The public also raised questions regarding the importance of data management, storage, and interoperability and usability. Another topic that arose frequently during conversations was the importance of verifying ocean MEC data. All of this feedback has been documented and will inform the IWG-OCM the IWG-OEC in developing the SOMP and the Standards and Protocols for Ocean Exploration and Characterization (See Objectives 2.1 and 3.2). The development of both protocols will include extensive public input through open symposiums, workshops, and opportunities for public comment (See Milestones 2.1.2, 2.1.4, 2.1.5, and 3.2.1).

6. **Engagement the next generation of ocean mappers and explorers**

The NOMEC Council heard from stakeholders that training and engaging the next generation of hydrographers, ocean explorers, and scientists will be crucial for the success of the NOMEC Strategy. Specific recommendations include promoting internships, apprenticeships, Teacher at Sea programs, and improving K-12 ocean education curriculum. Both private sector and academic representatives highlighted the need for a skilled and diverse workforce. The NOMEC Council recognizes this need and will work with Federal agencies to inspire and engage the public to develop an ocean-literate workforce (See Goal 5.3).

Permitting and regulatory concerns for ocean MEC activities

A few stakeholders expressed concern and frustration with the permitting process for activities outlined in the NOMEC Strategy and advocated for streamlining the permitting process. The Ocean Policy Committee's Ocean Resources Management

Subcommittee (ORM) was tasked with developing a separate but related "Implementation Plan to Increase the Efficiency of Permitting for Ocean Exploration, Mapping, and Research Activities." The NOMEC Council is looking forward to collaborating with the ORM to implement their recommendations.[1]

As evidenced by the many opportunities for engaging the public that are included in the NOMEC Implementation Plan, soliciting, responding to, and incorporating public input will be an ongoing and integral part of implementing the NOMEC Strategy.

[1] https://www.whitehouse.gov/wp-content/uploads/2020/01/2001007-FINAL-CLEAN-Implementation-Plan-for-Ocean-Mapping-PM-Section-4.pdf