Congressional Research Service
Informing the legislative debate since 1914

Frequently Asked Questions: Mapping of U.S. Ocean and Coastal Waters

Updated July 29, 2025

Congressional Research Service
https://crsreports.congress.gov
R47623

CRS REPORT
Prepared for Members and
Committees of Congress

Congressional Research Service
Informing the legislative debate since 1914

Frequently Asked Questions: Mapping of U.S. Ocean and Coastal Waters

Ocean and coastal mapping involves activities that collect data and information about the underwater terrain (i.e., seafloor or lakebed). These data and information may be used to support marine-based economies, safe navigation, and national security. As of January 2025, the most recent examination, the National Oceanic and Atmospheric Administration (NOAA) estimated that approximately 46% of the terrain beneath U.S. coastal, ocean, and Great Lakes waters remains unmapped.

For more than a century, Congress has directed multiple federal agencies, including NOAA, the U.S. Geological Survey (USGS), the Bureau of Ocean Energy Management, and the U.S. Army Corps of Engineers, to support and complete mapping of the terrain beneath U.S. ocean and coastal waters (including the Great Lakes). Congress has provided direction through the Ocean and Coastal Mapping Integration Act of 2009 (Title XII, Part II, Subtitle B, of P.L. 111-11) and the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (Division J, Title CIII, of P.L. 117-263), among other authorizing laws, as well as through appropriations laws and accompanying explanatory language.

Executive actions also have encouraged federal ocean and coastal mapping efforts, especially efforts to map the terrain beneath certain U.S. ocean and coastal waters that are least mapped (e.g., off the coast of Alaska). One such executive action (Executive Order 13840), issued by President Trump in 2018, established the Ocean Policy Committee, an interagency body that helps guide federal ocean policy. In 2020, the Ocean Policy Committee's Ocean Science and Technology Subcommittee developed the *National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, which identified several goals for federal ocean and coastal mapping activities, pursuant to a 2019 presidential memorandum. This strategy is commonly known as the National Ocean Mapping, Exploration, and Characterization (NOMEC) Strategy. In 2025, the Trump Administration issued executive orders that included ocean and coastal mapping priorities with respect to offshore energy and mineral resources.

Goals of the NOMEC Strategy included mapping the terrain beneath U.S. ocean and coastal areas by 2030 and 2040, respectively. The NOMEC Strategy recommended the creation of the NOMEC Council, which would consist of members from 12 federal agencies and be led by NOAA and the USGS. This council was established in 2020 and oversees two interagency working groups (IWGs): the IWG on Ocean and Coastal Mapping and the IWG on Ocean Exploration and Characterization. Together, the NOMEC Council and these two IWGs coordinate ocean and coastal mapping activities across multiple U.S. departments and agencies. Certain federal agencies and their partners have prioritized mapping U.S. ocean and coastal areas, including the Great Lakes, primarily through the collection of modern *bathymetric data*—the depth of the underwater terrain relative to the surface water level as collected by lidar or sonar instruments. The seafloor surrounding Alaska and the lakebeds of the Great Lakes remain the least mapped areas (by percentage) of U.S. ocean and coastal waters. In 2024, the NOMEC Council expanded the goals of the NOMEC Strategy to include the U.S. extended continental shelf (i.e., areas of the U.S. continental shelf that extend beyond the 200 nautical mile limit of the U.S. exclusive economic zone). At the current pace, federal agencies are unlikely to meet the mapping goals of the NOMEC Strategy by their target years (i.e., 2030 and 2040), according to the NOMEC Council.

Congress shapes U.S. ocean and coastal mapping efforts by authorizing and/or appropriating funding to certain agencies to engage in or support mapping activities specifically or broadly. In the 119th Congress, some Members introduced legislation that would direct agencies to focus on mapping efforts in specific U.S. regions (H.R. 2731) or for specific resources (H.R. 2556, H.R. 3803, H.R. 4018). Some Members also introduced legislation that would reauthorize the U.S. Integrated Ocean Observing System, which manages some public-private partnerships with a focus on mapping (H.R. 2294, S. 2126). In a broader context of the Trump Administration's efforts to reduce federal spending and the size of the federal government, Congress may assess the appropriate scale of federal support for ocean and coastal mapping efforts (including for federal ships and other maritime research infrastructure), the potential for efficiencies to reduce cost (including through private sector involvement), and the value of ocean mapping to other policy goals (including federal interest in offshore energy and mineral development and other national security concerns).

SUMMARY

R47623

July 29, 2025

Caitlin Keating-Bitonti, Coordinator
Specialist in Natural Resources Policy

Nicole T. Carter
Specialist in Natural Resources Policy

Laura B. Comay
Specialist in Natural Resources Policy

Eva Lipiec
Specialist in Natural Resource Policy

Linda R. Rowan
Analyst in Natural Resources and Earth Sciences

Contents

Figures

Tables

Appendixes

Contacts

Introduction

Ocean and coastal mapping involves activities that collect data and information about the underwater terrain (i.e., seafloor or lakebed).[1] Ocean and coastal mapping provides useful information for maritime commerce, commercial and recreational fisheries management, offshore energy production, marine tourism and recreation, national security, and other activities.[2] For more than a century, Congress has shown interest in ocean and coastal mapping activities. Congress has directed and funded certain federal departments and agencies to collect relevant data and information about U.S. ocean and coastal waters, including their underlying terrains.

Executive actions also have encouraged federal agencies to map the terrain beneath certain U.S. ocean and coastal waters. One such executive action, the 2018 Executive Order (E.O.) 13840, "Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States," issued by President Trump, established the Ocean Policy Committee, an interagency body that helps guide federal ocean policy.[3] As part of a strategic effort, several federal departments and agencies that participate in ocean and coastal mapping activities aim to completely map the terrain beneath U.S. ocean waters by 2030 and the terrain beneath U.S. coastal waters by 2040.[4]

The Ocean Policy Committee's Ocean Science and Technology Subcommittee identified these goals in the *National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, developed in 2021 pursuant to a 2019 presidential memorandum.[5] This strategy is commonly known as the National Ocean Mapping, Exploration, and Characterization (NOMEC) Strategy. In December 2024, the NOMEC Council, which consists of members from 12 federal agencies, released an update to the 2021 Implementation Plan for the NOMEC Strategy (hereinafter referred to as the 2024 NOMEC Implementation Plan).[6] The 2024 NOMEC

[1] Statutory language uses both "data and information" in defining the term *mapping* (33 U.S.C. §3407(3)). See "What Is Ocean and Coastal Mapping?" below.

[2] Ocean Policy Committee, Ocean Science and Technology Subcommittee (OST), National Ocean Mapping, Exploration, and Characterization (NOMEC) Council, *Implementation Plan for the National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, January 2021, p. 3 (hereinafter NOMEC Council, *Implementation Plan*); and Ocean Policy Committee, OST, NOMEC Council, *2024 Implementation Plan Update for the National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, December 2024, p. 4 (hereinafter NOMEC Council, *2024 Implementation Plan Update*).

[3] The Ocean Policy Committee was created by Executive Order (E.O.) 13840 of June 19, 2018, "Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States," 86 *Federal Register* 29431, June 22, 2018. The Ocean Policy Committee was codified by the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (Title X, Subtitle E, of P.L. 116-283; 10 U.S.C. §8932 (a)). For more information on the structure of the Office of Science and Technology Policy (OSTP), see CRS Report R47410, *The Office of Science and Technology Policy (OSTP): Overview and Issues for Congress*, by Emily G. Blevins.

[4] Ocean Policy Committee, OST, *National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, June 9, 2020, p. 9 (hereinafter NOMEC Strategy, 2020).

[5] White House, "Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska," presidential memorandum of November 19, 2019, 84 *Federal Register* 64699, November 22, 2019 (hereinafter presidential memorandum on ocean mapping of the U.S. exclusive economic zone [EEZ], 2019). The OST is a subcommittee of both the Ocean Policy Committee and the National Science and Technology Council (NSTC). Under the NSTC, it is referred to as the Subcommittee on Ocean Science and Technology. OST is led by the OSTP, National Science Foundation, National Oceanic and Atmospheric Administration (NOAA), and Office of Naval Research (NOAA, "Ocean Science and Technology Subcommittee (OST)," January 14, 2025, https://www.noaa.gov/ocean-science-and-technology-subcommittee).

[6] According to the NOMEC Council, the 2021 NOMEC Implementation Plan described the approach taken and the planned actions to accomplish the NOMEC Strategy goals pursuant to the presidential memorandum on ocean mapping (continued...)

Implementation Plan stated that, at the current pace, federal agencies are unlikely to meet the mapping goals of the NOMEC Strategy by their target years (i.e., 2030 and 2040).[7] According to the NOMEC Council, the actions recommended in the 2024 NOMEC Implementation Plan are "subject to the Administration's annual budget process and the availability of appropriations."[8]

In 2025, the Trump Administration issued E.O.s and a Department of the Interior (DOI) secretarial order (S.O.) that identified ocean and coastal mapping priorities with respect to offshore energy and mineral resources:

- E.O. 14154, "Unleashing American Energy," among other provisions, encouraged energy exploration on the outer continental shelf and directed the Secretary of the Interior to "prioritize efforts to accelerate the ongoing, detailed geologic mapping of the United States."[9]
- E.O. 14285, "Unleashing America's Offshore Critical Minerals and Resources," made it a policy of the United States to advance seabed mineral development by "supporting investment in deep sea science, mapping, and technology," among other policies.[10]
- DOI's S.O. 3418, "Unleashing American Energy," following E.O. 14154, directed DOI Assistant Secretaries to review all agency actions and submit a plan to the Secretary of the Interior that includes actions to prioritize mapping, among other efforts.[11]

This report answers questions about ocean and coastal mapping activities and relevant U.S. mapping efforts. In this report, mapping of U.S. coastal and ocean waters refers to the mapping of

- the seabed beneath coastal-state-controlled waters, which extend at least 3 nautical miles (nmi) from the shoreline;[12]
- the seabed beneath the U.S. exclusive economic zone (EEZ; i.e., the ocean area located generally between 3 nmi and 200 nmi from the shoreline);[13]

of the U.S. EEZ. The 2024 Implementation Plan provided recommended actions that are subject to the Administration's annual budget process and the availability of appropriations. NOMEC Council, *2024 Implementation Plan Update*, p. 1.

[7] NOMEC Council, *2024 Implementation Plan Update*, p. 1.

[8] NOMEC Council, *2024 Implementation Plan Update*, p. iii.

[9] E.O. 14154 of January 20, 2025, "Unleashing American Energy," 90 *Federal Register* 8353, January 29, 2025 (hereinafter E.O. 14154, "Unleashing American Energy").

[10] E.O. 14285 of April 24, 2025, "Unleashing America's Offshore Critical Minerals and Resources," 90 *Federal Register* 17735, April 29, 2025 (hereinafter E.O. 14285, "Unleashing America's Offshore Critical Minerals and Resources").

[11] U.S. Department of the Interior (DOI), Secretarial Order (S.O.) 3418, "Unleashing American Energy," February 3, 2025 (hereinafter S.O. 3418, "Unleashing American Energy").

[12] Most U.S. states have jurisdiction over an area extending 3 nautical miles (nmi) from their officially recognized coasts, under the Submerged Lands Act (43 U.S.C. §§1301 et seq.). Two states (Florida, along its Gulf coast, and Texas) have been held by the Supreme Court to have boundaries extending 9 nmi from shore. The Commonwealth of Puerto Rico also has jurisdiction over an area of 9 nmi from its coast, whereas other U.S. territories have jurisdiction over areas 3 nmi from their coasts.

[13] Presidential Proclamation 5030 of March 10, 1983, "Exclusive Economic Zone of the United States of America," 48 *Federal Register* 10605, March 14, 1983.

- the seabed of the U.S. extended continental shelf (ECS; i.e., areas of the seabed beyond the 200 nmi limit of the EEZ over which the United States claims jurisdiction);[14] and
- the lakebeds of the Great Lakes.

The NOMEC Council updated the 2021 NOMEC Implementation Plan in 2024 to include the U.S. ocean and coastal areas listed above.[15]

What Is Ocean and Coastal Mapping?

Mapping of ocean and coastal waters involves activities that collect data and information about the underwater terrain (i.e., seafloor or lakebed).[16] In general, U.S. ocean mapping involves mapping the seafloor beneath the U.S. EEZ and areas of the U.S. ECS, whereas U.S. coastal mapping involves mapping the seafloor beneath state-controlled waters (up to at least 3 nmi from the shoreline). Section 12208 of the Ocean and Coastal Mapping Integration Act of 2009 (Title XII, Part II, Subtitle B, of P.L. 111-11), as amended, defined *ocean and coastal mapping* as

> the acquisition, processing, management, maintenance, interpretation, certification, and dissemination of physical, biological, geological, chemical, and archaeological characteristics and boundaries of ocean and coastal areas, resources, and sea beds through the use of acoustics, satellites, aerial photogrammetry, light and imaging, direct sampling, and other mapping technologies.[17]

The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (Division J, Title CIII, of P.L. 117-263) defined *mapping* as "activities that provide comprehensive data and information needed to understand seafloor characteristics, such as depth, topography, bottom type, sediment composition and distribution, underlying geologic structure, and benthic flora and fauna."[18]

One aspect of mapping underwater terrain is the collection of data regarding the ocean or lake depth relative to the surface water level, known as *bathymetric data*.[19] Similar to topographic maps on land, bathymetric maps reveal three-dimensional features of the underwater terrain (**Figure 1**). To study the bottom type and sediment composition (e.g., muddy, sandy, rocky) of the underwater terrain, researchers use *backscatter data*.[20] Together, bathymetric and backscatter data allow researchers to create detailed maps.[21]

---

[14] Department of State, "Continental Shelf and Maritime Boundaries; Notice of Limits," 88 *Federal Register* 88470, December 21, 2023.

[15] The 2021 NOMEC Implementation Plan; NOMEC Strategy, 2020; and 2019 presidential memorandum on ocean mapping of the U.S. EEZ referred to mapping of the U.S. EEZ, which included the seabed beneath U.S. coastal-state-controlled waters and the U.S. EEZ and the lakebeds of the Great Lakes. The 2024 NOMEC Implementation Plan outlined revised actions, such as the inclusion of the U.S. extended continental shelf. See NOMEC Council, *2024 Implementation Plan Update*, p. 2.

[16] Congress included the Great Lakes as part of a federal ocean and coastal mapping plan (33 U.S.C. §3501).

[17] 33 U.S.C. §3507(5).

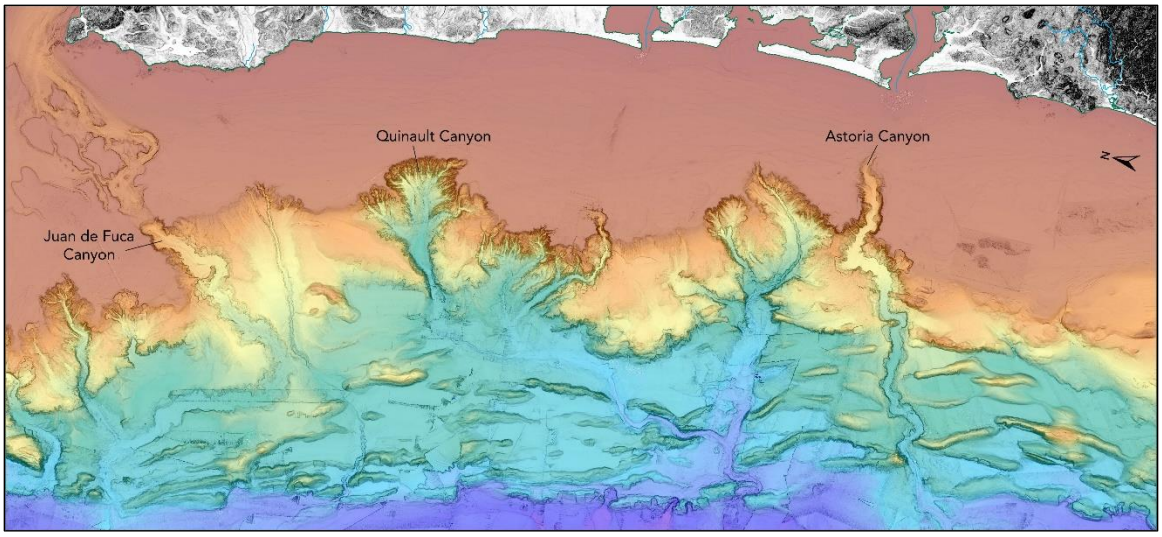
[18] 33 U.S.C. §3407(3). James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (P.L. 117-263), Division J, Title CIII, modified Section 12001 of the Omnibus Public Land Management Act of 2009 (33 U.S.C. §3401) by inserting this definition of *mapping*. It also applies the definition to *map*.

[19] NOAA, "What Is Bathymetry?," https://oceanservice.noaa.gov/facts/bathymetry.html.

[20] NOAA, "How Does Backscatter Help Us Understand the Sea Floor?," https://oceanservice.noaa.gov/facts/backscatter.html.

[21] For more information, see "How Are Ocean and Coastal Waters Mapped?" below.

Figure 1. Bathymetric Map of Offshore Washington State



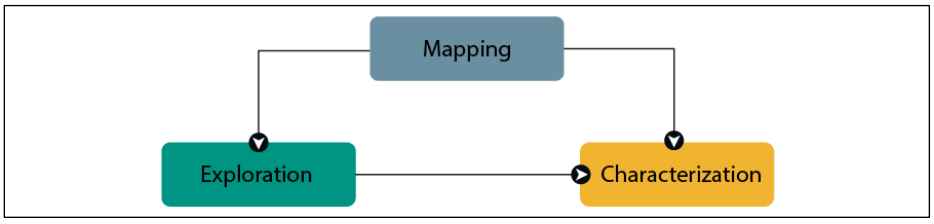
Source: U.S. Geological Survey, Pacific Coastal and Marine Science Center, "Bathymetric Map of Offshore Washington," https://www.usgs.gov/media/images/bathymetric-map-offshore-washington.

Notes: This bathymetric map reveals seafloor features, including submarine canyons, of offshore Washington state. Red represents shallower water depths, and blue represents deeper water depths. The gray-scale area at the top of the map is the relief of the land (i.e., topography); white represents lower elevation, and black represents higher elevation.

Bathymetric maps can inform site selection for *exploration* and *characterization* (**Figure 2**).[22] The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 defined *exploration* as "activities that provide (A) a multidisciplinary view of an unknown or poorly understood area of the seafloor, sub-bottom, or water column; and (B) an initial assessment of the physical, chemical, geological, biological, archeological, or other characteristics of such an area."[23] The act defined *characterization* as "activities that provide comprehensive data and interpretations for a specific area of interest of the sea floor, sub-bottom, water column, or hydrologic features, including water masses and currents, in direct support of specific research, environmental protection, resource management, policy making, or applied mission objective."

This report focuses on ocean and coastal mapping activities.

Figure 2. Relationship Between Mapping, Exploration, and Characterization



Source: Congressional Research Service, adapted from Ocean Policy Committee, Ocean Science and Technology Subcommittee, National Ocean Mapping, Exploration, and Characterization Council, *Implementation Plan for the National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, January 2021, p. 6.

[22] NOMEC Council, *Implementation Plan*, p. 7; and NOMEC Council, *2024 Implementation Plan Update*, p. 18.

[23] 33 U.S.C. §3407(2).

Notes: Ocean and coastal mapping can inform both exploration and characterization activities. Exploration can inform in-depth characterization.

What Are Some Benefits of Ocean and Coastal Mapping?

Some Members of Congress and various stakeholders have cited benefits of ocean and coastal water mapping. For example, Congress, in its 2022 amendments to several ocean and coastal mapping laws, noted that "mapping, exploration, and characterization of the ocean provides basic, essential information to protect and restore the marine environment, stimulate economic activity, and provide security for the United States."[24] According to the NOMEC Council, "Ocean mapping, exploration, and characterization … 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."[25]

Ocean and coastal mapping can aid in a range of activities, including

- exploring for and extracting offshore oil and gas and seabed minerals,[26]
- siting telecommunication and offshore wind-turbine-related cables,[27]
- locating submerged cultural sites and unidentified shipwrecks,[28]
- identifying navigational hazards for recreational boating and commercial shipping,[29]
- determining the extent of the U.S. continental shelf,[30]
- assessing marine geohazards,[31]
- tracking shoreline change and its impacts on erosion and flooding,[32] and

[24] Division J, Title CIII, §10301(6), of P.L. 117-263.

[25] NOMEC Council, *Implementation Plan*, p. 3. For more on the NOMEC Council, see "How Have Congress and the President Directed Federal Agencies to Support Ocean and Coastal Mapping Efforts?"

[26] Bureau of Ocean Energy Management (BOEM), "BOEM Mapping Resources," https://www.boem.gov/environment/boem-mapping-resources. For more information on applications of bathymetric data related to nonliving natural resources, see CRS Report R47021, *Federal Involvement in Ocean-Based Research and Development*, by Caitlin Keating-Bitonti.

[27] NOAA, "Why Map the Seafloor? To Keep Us—and Natural Resources—Safe," https://oceanexplorer.noaa.gov/world-oceans-day-2015/why-map-the-seafloor-to-keep-us-and-natural-resources-safe.html (hereinafter NOAA, "Why Map the Seafloor? To Keep Us—and Natural Resources—Safe").

[28] The Great Lakes Observing System (GLOS), *Lakebed 2030: Modern Mapping of the Great Lakes*, https://glos.org/wp-content/uploads/2021/12/Lakebed-2030-Poster.pdf (hereinafter GLOS, *Lakebed 2030: Modern Mapping of the Great Lakes*).

[29] NOAA, "Why Map the Seafloor? To Keep Us—and Natural Resources—Safe."

[30] For more information about the extent of the U.S. continental shelf, see CRS Report R47912, *Outer Limits of the U.S. Extended Continental Shelf: Background and Issues for Congress*, by Caitlin Keating-Bitonti.

[31] U.S. Geological Survey (USGS), "Marine Geohazards," https://www.usgs.gov/science/science-explorer/ocean/marine-geohazards.

[32] GLOS, *Lakebed 2030: Modern Mapping of the Great Lakes*; U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, 119th Cong., 1st sess., March 26, 2025, https://science.house.gov/2025/3/to-the-depths-and-beyond-examining-blue-economy-technologies (hereinafter Committee on Science, Space, and Technology, Subcommittee on (continued...)

- protecting marine environments and ecosystems of interest, such as *essential fish habitats*.[33]

What Are U.S. Goals for Ocean and Coastal Mapping?

In June 2020, the Ocean Science and Technology Subcommittee of the Ocean Policy Committee announced the NOMEC Strategy (for more information about federal committees, councils, and interagency working groups [IWGs] focused on ocean and coastal mapping, see "How Are Federal Ocean and Coastal Mapping Efforts Coordinated?"). The NOMEC Strategy established five goals,[34] and in 2024, the NOMEC Council broadened the implementation of these goals to apply to the U.S. ECS.[35]

> Goal 1: Coordinate interagency efforts and resources to map, explore, and characterize [U.S. waters]
>
> Goal 2: Map [U.S. waters]
>
> Goal 3: Explore and characterize priority areas of [U.S. waters][36]
>
> Goal 4: Develop and mature new and emerging science and technologies to map, explore, and characterize [U.S. waters]
>
> Goal 5: Build public and private partnerships beyond federal agencies to map, explore, and characterize [U.S. waters]

The NOMEC Strategy also provided deadlines to meet certain goals. For example, the strategy aimed to map the terrain beneath certain U.S. ocean waters (water depths greater than 40 meters [m], or 131.2 feet) by 2030.[37] Approximately 90% of the U.S. EEZ area has water depths greater than 40 m.[38] The strategy aims to map the terrain beneath U.S. coastal waters (water depths less than 40 m) by 2040.[39] According to the NOMEC Strategy, mapping U.S. coastal waters is estimated to require two-thirds of the total level of effort required to map the entire U.S. EEZ.[40] As mentioned above, the 2024 NOMEC Implementation Plan stated that, at the current pace, federal agencies are unlikely to meet the 2030 ocean and 2040 coastal mapping goals of the NOMEC Strategy by their target years.[41]

Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025); and USGS, "Dynamic Coastlines Along the Western U.S.," June 27, 2022, https://www.usgs.gov/centers/pcmsc/science/dynamic-coastlines-along-western-us.

[33] NOAA, "How Is Bathymetric Data Used?," https://oceanservice.noaa.gov/facts/bathyuses.html. The Magnuson-Stevens Fishery Conservation and Management Act, under 16 U.S.C. §1802(10), defines *essential fish habitat* as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (for more information, see CRS Report R47645, *U.S. Regional Fishery Management Councils*, by Anthony R. Marshak).

[34] NOMEC Strategy, 2020, p. 2.

[35] The update replaced "U.S. EEZ" with "U.S. waters" to reflect the U.S. ECS. NOMEC Council, *2024 Implementation Plan Update*, p. 2.

[36] U.S. exploration and characterization activities are focused on waters 40 meters and deeper. NOMEC Council, *Implementation Plan*, p. 15.

[37] NOMEC Strategy, 2020, p. 9.

[38] NOMEC Strategy, 2020, p. 9.

[39] NOMEC Strategy, 2020, p. 9.

[40] NOMEC Strategy, 2020, p. 9.

[41] NOMEC Council, *2024 Implementation Plan Update*, p. 1.

The NOMEC Strategy's goals to map the terrain beneath U.S. ocean and coastal waters may align with international goals. For instance, in 2022, the National Oceanic and Atmospheric Administration (NOAA) Administrator signed a memorandum of understanding that formalized U.S. participation in the Nippon Foundation-General Bathymetric Chart of the Oceans Seabed 2030 Project (Seabed 2030).[42] Seabed 2030 aims to map the entire global seafloor by 2030.[43]

How Much of U.S. Ocean and Coastal Waters Are Mapped?

NOAA periodically analyzes available modern (post-1960)[44] bathymetric data to evaluate U.S. ocean and coastal mapping progress.[45] NOAA completed its first such analysis in 2017 (**Table 1**). Following the 2019 presidential memorandum,[46] NOAA has released annual progress reports of unmapped U.S. waters (i.e., ocean and coastal waters and the Great Lakes).[47] These annual progress reports quantify the area of U.S. waters mapped during the previous year and present this information as the percentage of U.S. waters unmapped (**Table 1**).[48] For example, the January 2025 analysis revealed that 46% of U.S. coastal, ocean, and Great Lakes waters were unmapped as of 2024.[49] For this dataset, *unmapped areas* can mean that "either no direct measurements of the seafloor have been acquired over these areas or data [have] been collected and not shared for broader use" (for more on data acquisition, see "How Are U.S. Bathymetric Data Compiled and Made Available?").[50] According to NOAA, a specified area of the seafloor or lakebed of the Great Lakes is considered mapped when at least one sonar (sound navigation and ranging) or lidar (light detection and ranging) measurement has been collected for that area (for more on sonar and lidar, see "How Are Ocean and Coastal Waters Mapped?").[51]

[42] NOAA, "Seabed 2030," June 29, 2022, https://oceanservice.noaa.gov/news/jun22/seabed-2030.html; and Nippon Foundation and General Bathymetric Chart of the Oceans (GEBCO) Seabed 2030, "Our Partners," https://seabed2030.org/our-partners/.

[43] Nippon Foundation and GEBCO Seabed 2030, "About Us," https://seabed2030.org/about/.

[44] *Post-1960* refers to when the U.S. Navy declassified multibeam sonar technology for civil use (see Hydro International, "A Note on Fifty Years of Multi-Beam," May 22, 2013, https://www.hydro-international.com/content/article/a-note-on-fifty-years-of-multi-beam).

[45] NOAA, "U.S. Bathymetric Coverage and Gap Analysis," https://iocm.noaa.gov/seabed-2030-bathymetry.html (hereinafter NOAA, "U.S. Bathymetric Coverage and Gap Analysis"); and NOAA, "United States Bathymetric Gap Analysis," https://noaa.maps.arcgis.com/home/item.html?id=4d7d925fc96d47d9ace970dd5040df0a.

[46] Presidential memorandum on ocean mapping of the U.S. EEZ, 2019.

[47] The first annual progress report of unmapped U.S. waters was published in March 2020. NOAA, *Progress Report: Unmapped U.S. Waters, March 2020*, https://iocm.noaa.gov/seabed-2030/mapping-progress-report2020.pdf.

[48] NOAA, "U.S. Bathymetric Coverage and Gap Analysis."

[49] NOAA, *2025 Progress Report: Unmapped U.S. Waters*, March 2025, https://iocm.noaa.gov/documents/mapping-progress-report2025.pdf (hereinafter NOAA, *2025 Progress Report: Unmapped U.S. Waters*).

[50] NOAA, "Status of Seafloor Mapping Within U.S. Waters," https://iocm.noaa.gov/seabed-2030-status.html.

[51] NOAA considers a specific area (i.e., a grid cell measuring 100 x 100 meters) of the seafloor *minimally mapped* if the area contains at least one sonar or lidar measurement. NOAA refers to a grid cell that has three or more measurements as *better mapped*. NOAA, "U.S. Bathymetric Coverage and Gap Analysis."

Table 1. Percentage of Unmapped U.S. Coastal, Ocean, and Great Lakes Waters

Region	Total Area in snmi	Area of ECS in smni[a] (% total area)	Percentage Unmapped							
			2017	2018	2019	2020	2021	2022	2023	2024[a]
All U.S. Waters	3,878,700	288,000 (7%)	59%	57%	54%	53%	52%	50%	48%	46%
Atlantic & Gulf of America	547,200	75,000 (14%)	49%	48%	43%	41%	40%	37%	36%	31%
Caribbean	61,500	—	45%	44%	42%	43%[b]	42%	30%	30%	30%
Alaska	1,283,500	203,100 (16%)	74%	73%	72%	72%	69%	66%	63%	62%
Pacific	249,300	9,500 (4%)	29%	29%	24%	22%	20%	19%	17%	15%
Hawaii & Pacific Remote Islands	1,692,200	400 (<1%)	55%	53%	50%	49%	48%	47%	47%	44%
Great Lakes	45,000	—	96%	96%	95%	95%	93%	92%	87%	85%

Sources: Congressional Research Service, compiled from National Oceanic and Atmospheric Administration, "Progress Report: Unmapped U.S. Waters," March 2020, https://iocm.noaa.gov/seabed-2030/mapping-progress-report2020.pdf; March 2021, https://iocm.noaa.gov/seabed-2030/mapping-progress-report2021.pdf; March 2022, https://iocm.noaa.gov/documents/mapping-progress-report2022.pdf; March 2023, https://iocm.noaa.gov/documents/mapping-progress-report2023.pdf; March 2024, https://iocm.noaa.gov/documents/mapping-progress-report2024.pdf; March 2025, https://iocm.noaa.gov/documents/mapping-progress-report2025.pdf; and U.S. Department of State, *The Outer Limits of the Extended Continental Shelf of the United States of America: Executive Summary*, December 19, 2023, p. 9.

Notes: ECS = extended continental shelf (i.e., areas of the seafloor that extend beyond 200 nautical miles that fall under U.S. jurisdiction). The total area and area of the ECS are reported in square nautical miles (snmi). The Department of State reported the area of the ECS in square kilometers; CRS converted this value to snmi and rounded to the nearest hundred. The Caribbean region includes Puerto Rico and the U.S. Virgin Islands. The Pacific region includes California, Oregon, and Washington. The Pacific Remote Islands include the Commonwealth of the Northern Mariana Islands, Guam, American Samoa, Wake Island, Johnston Atoll, Howland Island, Baker Island, Kingman Reef, Palmyra Atoll, and Jarvis Island.

a. The Department of State announced the outer limits of the U.S. ECS in December 2023. U.S. regions that have an ECS include the Atlantic and Gulf of America, Alaska, Pacific, and Hawaii and Pacific Remote Islands. The 2025 analysis was the first to include mapped areas of the U.S. ECS.

b. The Caribbean "lost" 600 snmi, equating to 1%, of mapping area in 2020 due to a correction to remove known bad/poor bathymetric data from the calculation.

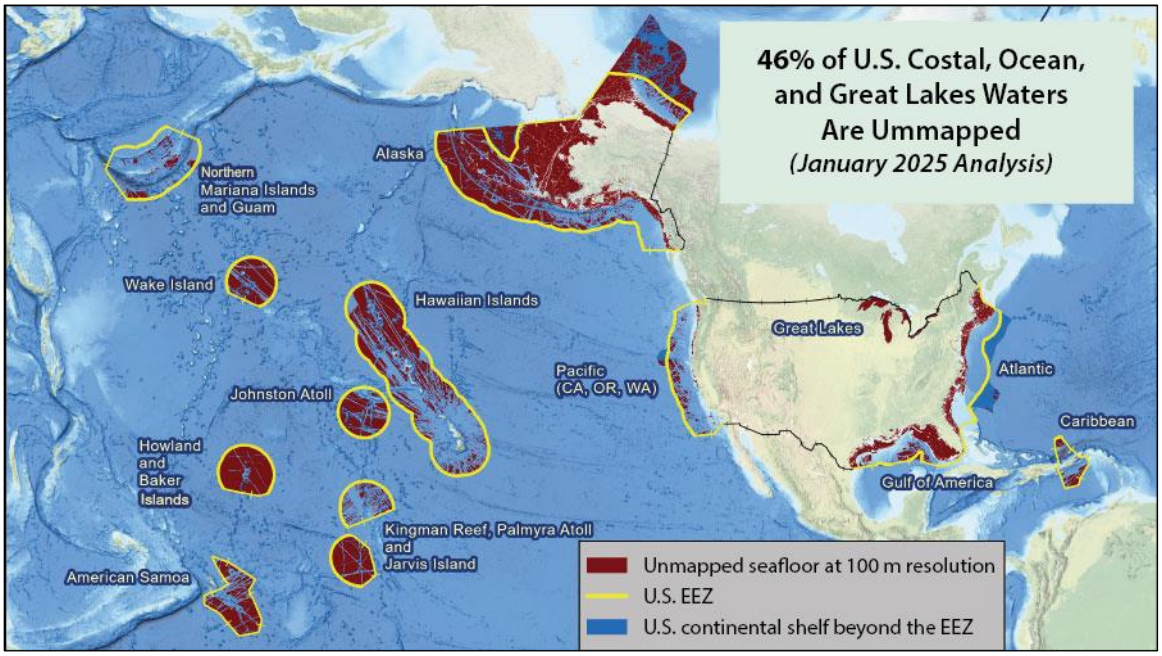
In December 2023, the Department of State announced the outer limits of the U.S. ECS.[52] In 2024, the NOMEC Council expanded the goals of the NOMEC Strategy to include the U.S. ECS.[53] The 2025 annual progress report of unmapped U.S. waters includes the U.S. ECS (**Figure 3**). Prior to the United States delimiting its ECS, this area of the seabed had not been considered part of the analysis (see "All U.S. Waters" in **Table 1**). The Department of State, NOAA, and the

[52] Department of State, "Continental Shelf and Maritime Boundaries; Notice of Limits," 88 *Federal Register* 88470, December 21, 2023.

[53] NOMEC Council, *2024 Implementation Plan Update*, p. 1.

U.S. Geological Survey (USGS) worked together through the U.S. Extended Continental Shelf Project to collect geological and geophysical data to map outer limits of the U.S. ECS.[54] According to the 2024 NOMEC Implementation Plan, 44% (approximately 126,700 square nmi) of the U.S. ECS remains unmapped as of January 2024.[55]

Figure 3. Unmapped U.S. Coastal, Ocean, and Great Lakes Waters in January 2025



Source: Congressional Research Service, adapted from National Oceanic and Atmospheric Administration (NOAA), "2025 Progress Report: Unmapped U.S. Waters," March 2025, https://iocm.noaa.gov/documents/mapping-progress-report2025.pdf.

Notes: EEZ = exclusive economic zone; m = meters. A January 2025 NOAA analysis estimated that 46% of U.S. coastal, ocean, and Great Lakes waters are unmapped (red areas). The seaward extent of U.S. EEZ (the ocean area located generally between 3 nautical miles and 200 nautical miles from the shoreline) is denoted by yellow lines.

How Are Ocean and Coastal Waters Mapped?

Underwater terrain is primarily mapped using bathymetric data.[56] Federal agencies, academic institutions, and private companies collect bathymetric data using sonar or lidar instruments (for more information on the involvement of federal agencies and departments, see "How Are Federal Ocean and Coastal Mapping Efforts Coordinated?"). In general, sonar instruments map the seafloor beneath the surface of the ocean and lidar instruments map the seafloor beneath coastal waters (up to a water depth of 80 m); sonar and lidar instruments also are used to map the lakebeds of the Great Lakes and other lakes (**Figure 4**). The NOMEC Strategy's goal to map U.S. waters with a depth greater than 40 m by 2030 would rely primarily on data collected via sonar

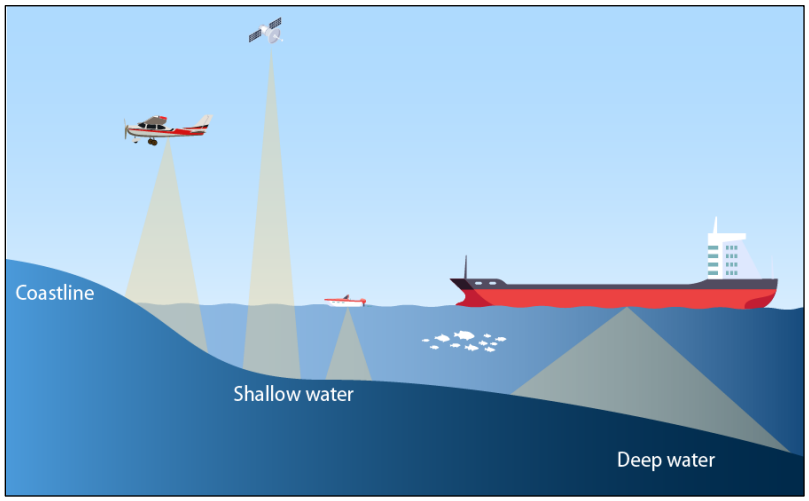
[54] Department of State, *The Outer Limits of the Extended Continental Shelf of the United States of America: Executive Summary*, December 19, 2023, pp. 11-12.

[55] NOMEC Council, *2024 Implementation Plan Update*, p. 4.

[56] For more information about oceanographic data and approaches for ocean mapping and characterization, see CRS Report R47021, *Federal Involvement in Ocean-Based Research and Development*, by Caitlin Keating-Bitonti.

instruments, whereas the goal to map U.S. waters with a depth less than 40 m by 2040 would rely on data collected via sonar and lidar instruments.[57]

Figure 4. Selected Assets Equipped with Multibeam Sonar and Lidar Instruments



Sources: Congressional Research Service, adapted from National Oceanic and Atmospheric Administration, "2025 Progress Report: Unmapped U.S. Waters," March 2025, https://iocm.noaa.gov/documents/mapping-progress-report2025.pdf.

Notes: The underwater terrain of the shallow coastal areas is generally mapped using aircraft and satellites equipped with lidar instruments. Lidar instruments can collect bathymetric data in certain waters up to 80 meters water depth. Small boats equipped with multibeam sonar instruments can be used to map the underwater terrain of shallow coastal areas but may be limited by navigation obstacles. Large vessels equipped with multibeam sonar technology are best suited for mapping the deep underwater terrain beneath open waters free of navigation hazards.

Mapping with Sonar

Sonar data provide information about the depths and shapes of the underwater terrain, and these data are used to create bathymetric maps. Sonar systems send sound pulses from a sensor—called a *transducer array*—attached to the bottom of a ship, or other water vehicle, to the underwater terrain. The amount of time it takes for sound pulses to leave the array, bounce off the underwater terrain, and return to the array is used to calculate the distance to the seafloor (i.e., water depth).[58] The faster a sound pulse returns to the array, the shallower the water depth. Commonly used sonar systems are *single beam sonars*, which use a single vertical sound pulse to collect data of the underwater terrain directly beneath the ship, and *multibeam sonars*, which use multiple splayed sound pulses to collect data of the underwater terrain directly beneath and out to each side of the ship.[59]

In addition to providing information about water depth, multibeam sonars can collect *backscatter* measurements, which correspond to the return beam's intensity. The return beam's intensity provides information about the seafloor's composition. For example, a mud surface absorbs most of the sound pulse, returning a weak signal to the receiver, whereas a rocky surface absorbs little

[57] See NOMEC Council, *2024 Implementation Plan Update*, p. 11.

[58] Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM), *Standard Ocean Mapping Protocol*, April 2024, p. 44 (hereinafter IWG-OCM, *Standard Ocean Mapping Protocol*).

[59] IWG-OCM, *Standard Ocean Mapping Protocol*, pp. 43-44.

of the sound pulse, returning a strong signal.[60] This type of information can be used to describe and classify ecosystems and biological communities of the immediate area, among other purposes.[61]

Mapping with Lidar

Coastal waters can be challenging and time consuming to map, because shallow waters may be inaccessible to oceanographic research vessels (ORVs).[62] Remote sensing technology can be used to overcome some of these challenges. Lidar is a remote sensing method commonly used on aircraft, but some satellites are also equipped with lidar instruments.[63] A lidar instrument primarily consists of a laser emitter-receiver scanning unit and a specialized global positioning system (GPS) unit; bathymetric lidar uses a laser emitting green light that penetrates through water. Similar to sonar, the amount of time it takes pulsed laser beams to reach the underwater terrain and return to a receiver fixed to an aircraft or satellite is used is calculate water depth.[64] Lidar is limited to relatively clear and calm coastal waters, as breaking waves or water containing sediment, marine vegetation, and other materials reduce the laser light's ability to penetrate through the water.[65]

The National Aeronautics and Space Administration (NASA), NOAA, and the U.S. Army Corps of Engineers (USACE) operate and use airborne lidar instruments equipped with a laser emitting green light to map and chart coastal waters (up to 80 m water depth). For example, the Joint Airborne Lidar Bathymetry Technical Center of Expertise, a multiagency effort led by USACE, uses airborne lidar bathymetry technology to map and chart coastal waters worldwide.[66] While USACE owns airborne lidar instruments, USACE contracts for the aircraft to fly the instruments.[67] As another example, NASA collects coastal bathymetric data using lidar and radar instruments on satellites (e.g., Ice, Cloud and Land Elevation Satellite 2 [ICESat-2] and Surface

[60] Bob Embley, "Sea Floor Mapping," NOAA, Pacific Marine Environmental Laboratory, https://oceanexplorer.noaa.gov/explorations/lewis_clark01/background/seafloormapping/seafloormapping.html.

[61] NOAA, "Ecological Classification – CMECS [Coastal and Marine Ecological Classification Standard]," https://iocm.noaa.gov/standards/cmecs-home.html.

[62] Shallow coastal waters may present hazards for ships and, in high latitude regions, coastal waters are more prone to freezing, thereby limiting data collection to ice-free seasons.

[63] Imaging and environment-monitoring instruments on commercial satellites, such as the Maxar satellite series, can be applied to coastal water mapping projects (Kyle Goodrich et al., "The Power of Bathymetry Now Available in SecureWatch," *Maxar*, April 8, 2020, https://blog.maxar.com/earth-intelligence/2020/the-power-of-bathymetry-now-available-in-securewatch). Some federally owned satellites (e.g., Landsat 8, Landsat 9, and ICESat-2) are also equipped with lidar technology that can be used to map coastal waters (USGS, "Satellite-Derived Bathymetry," August 12, 2019, https://www.usgs.gov/special-topics/coastal-national-elevation-database-%28coned%29-applications-project/science/satellite#overview; and National Aeronautics and Space Administration [NASA], "Sounding the Seafloor with Light," https://earthobservatory.nasa.gov/images/148246/sounding-the-seafloor-with-light [hereinafter NASA, "Sounding the Seafloor with Light"]). For more information, see CRS Report R46560, *Landsat 9 and the Future of the Sustainable Land Imaging Program*, by Anna E. Normand).

[64] IWG-OCM, *Standard Ocean Mapping Protocol*, p. 45.

[65] IWG-OCM, *Standard Ocean Mapping Protocol*, p. 45.

[66] Federal agencies included in the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) are the U.S. Army Corps of Engineers (USACE), U.S. Naval Meteorology and Oceanography Command, NOAA, and USGS (USACE, "About JALBTCX," https://jalbtcx.usace.army.mil/). Section 1123 of the Thomas R. Carper Water Resources Development Act of 2024 (Title I, Division A, of P.L. 118-272), directed USACE to "conduct research and development on bathymetric [lidar] and ancillary technologies necessary to advance coastal mapping capabilities in order to exploit data with increased efficiently and greater accuracy" (33 U.S.C. §2292a).

[67] USACE, remote briefing to CRS, April 25, 2023.

Water and Ocean Topography [SWOT]),[68] the International Space Station,[69] and aircraft.[70] Such satellite instruments were not necessarily designed primarily to collect bathymetric data, but their capabilities can be used for that purpose and others, such as measuring the height of the sea or lake surface and sea ice properties.[71]

How Do Oceanographic Research Vessels and Uncrewed Marine Systems Contribute to U.S. Mapping Capabilities?

Federal ocean and coastal mapping efforts depend on the availability of ORVs with mapping capability, including vessels in partnership with the federal government and U.S.-owned vessels (**Table 2**).[72] Two vessels in NOAA's fleet, NOAA Ships *Fairweather* and *Rainier*, are over 55 years old. The pending retirement of these two vessels may hinder NOAA's mapping capacity in the Pacific and Arctic Oceans (**Table 2**).[73] The U.S. Academic Research Fleet (ARF), a subset of the U.S. federal oceanographic fleet, currently consists of 17 ORVs that conduct research on the complex ocean, seafloor, and sub-seafloor environment, including the Great Lakes.[74] The list of ORVs in **Table 2** includes four ARF vessels that are owned by federal agencies and operated by U.S. academic oceanographic institutions through the University-National Oceanographic Laboratory System.[75]

[68] NASA, "Sounding the Seafloor with Light"; and NASA, "Oceanography," https://swot.jpl.nasa.gov/science/oceanography/.

[69] NASA, "Global Ecosystem Dynamics Investigation (GEDI)," https://www.earthdata.nasa.gov/sensors/gedi.

[70] NASA generally flies prototype instruments, which may include lidar, on aircraft before they are deployed into space on satellites (NASA, remote briefing to CRS, May 24, 2023).

[71] NASA, remote briefing to CRS, May 24, 2023.

[72] For example, while NOAA provides funding for research and mission input for Exploration Vessel (E/V) *Nautilus*, an exploration vessel owned and operated by the Ocean Exploration Trust, NOAA does not directly task or assign missions to this vessel (CRS email correspondence with NOAA, Congressional Affairs Specialist, Office of Legislative and Intergovernmental [OLIA] Affairs, April 18, 2023). E/V *Nautilus* is equipped with multibeam sonar that has been used to map the seafloor (NOAA, "Exploration Vessel *Nautilus*," https://oceanexplorer.noaa.gov/technology/vessels/nautilus/nautilus.html).

[73] NOAA, *The NOAA Fleet Plan: Building NOAA's 21st Century Fleet*, October 31, 2016, pp. 24, 27.

[74] University-National Oceanographic Laboratory System (UNOLS), "The U.S. Academic Research Fleet," https://www.unols.org/us-academic-research-fleet-0 (hereinafter UNOLS, "The U.S. Academic Research Fleet").

[75] UNOLS is a consortium of 58 academic oceanographic institutions that collaborate with U.S. federal agencies to ensure access to research vessels, submersibles, and related facilities for ocean science research and education purposes. UNOLS, https://www.unols.org/.

Table 2. Selected U.S.-Owned Oceanographic Research Vessels

Name	Type	Owner (Operator)	Home Port
*Atlantis**	Oceanographic	U.S. Navy (WHOI)	Woods Hole, MA
Fairweather	Hydrographic	NOAA (NOAA)	Ketchikan, AK
Ferdinand R. Hassler	Hydrographic	NOAA (NOAA)	New Castle, NH
Nancy Foster	Oceanographic	NOAA (NOAA)	Charleston, SC
Okeanos Explorer	Oceanographic	NOAA (NOAA)	Newport, RI
Rainier	Hydrographic	NOAA (NOAA)	Newport, OR
*Roger Revelle**	Oceanographic	U.S. Navy (Scripps Institution of Oceanography)	San Diego, CA
*Ronald H. Brown**	Oceanographic	NOAA (NOAA)	Charleston, SC
Thomas Jefferson	Hydrographic	NOAA (NOAA)	Norfolk, VA
*Thompson**	Oceanographic	U.S. Navy (UW School of Oceanography)	Seattle, WA

Sources: Congressional Research Service, compiled from National Oceanic and Atmospheric Administration (NOAA), "Observation Platforms: Vessels," https://oceanexplorer.noaa.gov/technology/vessels/vessels.html; NOAA, "Ship-Finder," https://www.omao.noaa.gov/mo/ship-finder; NOAA, "Marine Operations Center – Atlantic (MOC-A)," https://www.omao.noaa.gov/marine-operations/marine-operations-center-atlantic-moc; NOAA, "Marine Operations Center – Pacific," https://www.omao.noaa.gov/omao/marine-operations-center-pacific; University-National Oceanographic Laboratory System (UNOLS), "UNOLS Designated Vessels," https://www.unols.org/ships-facilities/unols-vessels; and CRS email correspondence with NOAA, Congressional Affairs Specialist, Office of Legislative and Intergovernmental Affairs, April 18, 2023.

Notes: UW = University of Washington; WHOI = Woods Hole Oceanographic Institution. Asterisk (*) denotes a UNOLS-designated vessel as part of the U.S. Academic Research Fleet.

According to NOAA's 2016 Fleet Plan, the most current plan as of the date of this publication, building new ships to meet growing demands for NOAA's environmental data is the agency's best long-term strategy to reliably and consistently sustain its at-sea data collection capacity.[76] In 2023, NOAA awarded a contract for the design and construction of two new vessels, NOAA Ships *Surveyor* and *Navigator*, using funding from P.L. 117-169 (commonly referred to as the Inflation Reduction Act of 2022).[77] NOAA expects *Surveyor* and *Navigator* to join the fleet in 2027 and 2028, respectively, and focus primarily on ocean mapping and nautical charting, serving as replacements for *Fairweather* and *Rainier*.[78]

[76] NOAA, *The NOAA Fleet Plan: Building NOAA's 21st Century Fleet*, October 31, 2016, pp. 3 and 7. The NOAA FY2026 budget request referenced the 2016 NOAA Fleet Plan in the context of vessel recapitalization and construction (NOAA, *Budget Estimates: Fiscal Year 2026*, p. OMAO-21).

[77] NOAA, "Contract for 2 NOAA Research Ships Awarded to Thoma-Sea Marine Constructors, LLC.," July 6, 2023, https://www.noaa.gov/news-release/contract-for-2-noaa-research-ships-awarded-to-thoma-sea-marine-constructors-llc (hereinafter NOAA, "Contract for 2 NOAA Research Ships"); NOAA, "Biden-Harris Administration Announces $2.6 Billion Framework Through Investing in America Agenda to Protect Coastal Communities and Restore Marine Resources," June 6, 2023, https://www.noaa.gov/news-releases/noaa-ira-framework-2023; and NOAA, "Surveyor and Navigator, NOAA's Newest Research Ships," September 27, 2024, https://www.omao.noaa.gov/omao/news-media/article/surveyor-and-navigator-noaa%E2%80%99s-newest-research-ships (hereinafter NOAA, "Surveyor and Navigator").

[78] NOAA, "Contract for 2 NOAA Research Ships"; NOAA, "Shipshape – Winter 2025," https://content.govdelivery.com/accounts/USNOAAOMAO/bulletins/3ce33c2 (hereinafter NOAA, "Shipshape – Winter 2025"); and NOAA, "Surveyor and Navigator."

The 118th Congress provided funding for the acquisition of two Class B vessels (i.e., vessels with primary missions of charting and surveying and of conducting living marine resource surveys) to reduce gaps in mission coverage.[79] NOAA also anticipates the acquisition of two other vessels, NOAA Ships *Oceanographer* and *Discoverer*, which may contribute to U.S. ocean mapping efforts.[80] Congress may consider oversight of NOAA's procurement timeline for its planned new vessels and upgrades to existing vessels in the NOAA fleet to monitor any procurement delays and cost growth.

In S.Rept. 118-62, referred to in the explanatory statement accompanying the Consolidated Appropriations Act, 2024 (P.L. 118-42), Congress directed NOAA to develop strategies to continue conducting surveys when vessels are out of commission for service. For example, as of winter 2025, NOAA continued to address "challenging ship repairs" for NOAA Ships *Rainier*, *Ronald H. Brown*, and *Fairweather*.[81] NOAA anticipates that NOAA Ship *Ronald H. Brown* will be delivered from the shipyard in August 2025.[82] Strategies were to include "contingency chartering agreements, uncrewed assets capable of operating independent[ly] of vessels, and commercial data purchase agreements."[83] S.Rept. 118-62 also provided funding and programmatic direction for autonomous and uncrewed operations for agencywide data acquisition from commercially available "mission-as-a-service" UMS in support of ocean exploration and hydrographic surveys, among other missions.[84] According to NOAA, government-owned uncrewed surface vessels are "more cost effective than data buys for ocean mapping when operating more than 70 days per year."[85]

NOAA and other stakeholders have continued to propose the use of *uncrewed marine systems* (UMS) to reduce the need for crewed ORVs and increase mapping efficiency.[86] Some industry

[79] U.S. Congress, Senate Appropriations Committee, *Departments of Commerce and Justice, Science, and Related Agencies Appropriations Bill, 2024*, report to accompany S. 2321, 118th Cong., 1st sess., S.Rept. 118-62, July 13, 2023, p. 63 (hereinafter S.Rept. 118-62). The Full-Year Continuing Appropriations and Extensions Act, 2025 (P.L. 119-4), which provided NOAA with funding for FY2025, did not provide direction regarding ocean and coastal mapping. The law also was not accompanied by an explanatory statement or committee reports; thus CRS was not able to identify ocean- and coastal-mapping-specific congressional direction for FY2025. P.L. 119-4 required certain agencies to submit spending plans to Congress with allocation of FY2025 funding information. It is unclear whether the spending plans will be made available to the public.

[80] NOAA Ship *Oceanographer* is expected to be homeported in Honolulu, HI, and NOAA Ship *Discoverer* is expected to be homeported in Newport, RI (Maritime Executive, "Construction Begins on NOAA's New Oceanographic Research Ships," June 16, 2022, https://maritime-executive.com/article/construction-begins-on-noaa-s-new-oceanographic-research-ships; and NOAA, *Budget Estimate: Fiscal Year 2025*, p. OMAO-11). Both vessels are expected to enter service in 2026 (NOAA, "Surveyor and Navigator").

[81] NOAA, "Shipshape – Winter 2025."

[82] CRS email correspondence with NOAA, Congressional Affairs Specialist, Office of Legislative and Intergovernmental Affairs (OLIA), July 25, 2025.

[83] S.Rept. 118-62, p. 58. See footnote 79.

[84] S.Rept. 118-62, p. 58. See footnote 79.

[85] NOAA, *Budget Estimates: Fiscal Year 2026*, p. OMAO-13.

[86] For example, NOAA, *Budget Estimates: Fiscal Year 2026*, pp. OMAO-13, OMAO-14; written testimony of Earl Childress, Senior Vice President, Chief Commercial Officer, Oceaneering International Inc., House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025, https://republicans-science.house.gov/_cache/files/0/3/037b37df-e30f-4f16-8d70-98f1cde3c8e4/4CF880E27073A5F30FB46EFEC79A3F84F52C2290B89B2492CDC8B1CE336F115B.childress-testimony.pdf (hereinafter written testimony of Earl Childress, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025); and testimony of Shepard Smith, Chief Technology Officer, XOCEAN, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, (continued...)

experts contend that UMS could help map around one-third of unmapped U.S. waters.[87] The NOAA Uncrewed Systems Operations Center operates a variety of UMS that contribute to seafloor mapping as well as other capabilities.[88] For example, in 2021, the center worked to operationalize DriX, an uncrewed surface vehicle, to collect seafloor mapping data, and by November 2024, DriX vehicles had collected bathymetric data across more than 2,600 linear nautical miles.[89] Congress may consider oversight of NOAA's use of UMS, whether owned by NOAA or contracted via private UMS operators, to better understand whether UMS are providing similar or superior data at lower costs compared to crewed vessels.

Stakeholders contend that UMS can reduce exposure of personnel to hazards, use less than 1% of the energy of conventional vessels, eliminate discharge for operations in sensitive marine environments, reduce risk of injury to marine mammals (due to slow speed and small size), reduce ORV demand, and reach areas that would otherwise be difficult to access, among other potential benefits.[90] Other stakeholders may argue that the replacement of traditional ORVs with UMS would displace offshore jobs and the U.S. shipbuilding industry, although some UMS are operated in tandem with or deployed from ORVs and other survey vessels.[91] On April 15, 2025, the Trump Administration issued E.O. 14269, "Restoring America's Maritime Dominance," to increase U.S. maritime manufacturing capabilities and strengthen the recruitment, training, and retention of the relevant workforce.[92] NOAA posits that its vessel recapitalization and construction program will contribute to the objectives of E.O. 14269.[93] The construction of ORVs forms a relatively small part of the overall workload for building ships for the U.S. government (including ships built for the U.S. Navy and other parts of the Department of Defense, U.S. Coast Guard, and Maritime Administration).

hearing, March 26, 2025, https://republicans-science.house.gov/_cache/files/1/7/17fcad09-4f5f-4018-87e4-dba78491f15f/0FE9264F09DA49A348EC671025289AEA24F1A2F7D22610CA72F3EEC2A1345C8B.smith-testimony.pdf (hereinafter written testimony of Shepard Smith, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025). According to NOAA, the term *uncrewed marine systems* (UMS) means "remotely operated or autonomous craft that can function without an onboard human presence, and that may include associated components such as control and communications. UMS do not include exclusively aerial systems of any kind. UMS include underwater, surface, and hybrid systems (i.e., systems that can operate both on and below the water's surface)." NOAA, *NAO 212-19: Uncrewed Marine Systems*, January 16, 2025.

[87] Written testimony of Shepard Smith, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[88] NOAA, *NAO 212-19: Uncrewed Marine Systems*, January 16, 2025.

[89] NOAA, "2024 Dual DriX Project," https://www.omao.noaa.gov/uncrewed-systems/news-media/article/2024-dual-drix-project. According to the NOAA FY2026 budget request, the NOAA Office of Marine and Aviation Operations acquired two DriX uncrewed surface vehicles in 2023 and 2024.

[90] NOAA, "Uncrewed Systems Operations Center 2024 Accomplishments," January 31, 2025, https://www.omao.noaa.gov/uncrewed-systems/news-media/article/uncrewed-systems-operations-center-2024-accomplishments; written testimony of Shepard Smith, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025; and written testimony of Earl Childress, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[91] According to NOAA, the agency plans to modify ships to deploy and recover uncrewed systems. NOAA, *Budget Estimates: Fiscal Year 2026*, p. OMAO-19.

[92] E.O. 14269 of April 9, 2025, "Restoring America's Maritime Dominance," 90 *Federal Register* 15635, April 15, 2025.

[93] NOAA, *Budget Estimates: Fiscal Year 2026*, p. OMAO-21.

How Are U.S. Bathymetric Data Compiled and Made Available?

Congress, through the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023, directed a group of federal agencies and departments to

> establish standardized collection and data management protocols, including with respect to metadata, for ocean mapping, exploration, and characterization which—(i) are publicly accessible and locatable via appropriate Federal repositories; (ii) can facilitate the integration of ocean data into products and use innovations from non-Federal partners; and (iii) have appropriate safeguards on the public accessibility of data to protect national security.[94]

In April 2024, the IWG on Ocean and Coastal Mapping (IWG-OCM), a federal group established in law,[95] released a standardized technical protocol for acquisition, processing, and archiving of ocean and coastal mapping data.[96]

NOAA's National Centers for Environmental Information (NCEI) bathymetry archive is the primary source of bathymetric data.[97] NCEI, a source of atmospheric, coastal, geophysical, and oceanic data, is a central repository and archive for global single-beam and multibeam sonar bathymetry.[98] Between 2021 and December 2024, NOAA added approximately 400 multibeam surveys of U.S. waters to the NCEI bathymetric archive.[99] Bathymetric lidar data are archived by NCEI and NOAA's Digital Coast.[100] NCEI bathymetric holdings are compliant with the Geospatial Data Act of 2018 (Title VII, Subtitle F, of P.L. 115-254) as all of these data can be accessed and viewed through the NOAA Bathymetric Data Viewer.[101]

NCEI's bathymetric holdings include data collected by the federal government, states, academic institutions, nongovernmental institutions, the private sector, and crowdsource providers.[102] To establish a working relationship with NCEI, data providers must enter into a submission agreement with NCEI and submit data in standardized formats with appropriate metadata to ensure equal access and useability.[103] In cases where NCEI acquires data that are not in a standardized format, NCEI may need to process the data to extract bathymetric information.[104]

---

[94] 33 U.S.C. §3408(i)(2)(I).

[95] 33 U.S.C. §3502; and NOAA, "Interagency Working Group - Ocean and Coastal Mapping," https://iocm.noaa.gov/about/iwg-ocm.html. For information about the composition of IWG-OCM, see "How Are Federal Ocean and Coastal Mapping Efforts Coordinated?"

[96] IWG-OCM, *Standard Ocean Mapping Protocol*, April 2024.

[97] NOMEC Council, *2024 Implementation Plan Update*, p. 11.

[98] CRS email correspondence with NOAA, Congressional Affairs Specialist, OLIA, June 15, 2023 (hereinafter CRS email correspondence with NOAA, June 15, 2023). NOAA NCEI is also the repository for bathymetric grids created for the U.S. Extended Continental Shelf Project.

[99] NOMEC Council, *2024 Implementation Plan Update*, p. 11.

[100] See, NOAA, "Coastal Topographic LiDAR," https://coast.noaa.gov/digitalcoast/data/coastallidar.html.

[101] NOAA's Bathymetric Data Viewer can be accessed at https://www.ncei.noaa.gov/maps/bathymetry/ (hereinafter NOAA, "Bathymetric Data Viewer"). NOMEC Council, *2024 Implementation Plan Update*, p. 16. For more information on the Geospatial Data Act of 2018, see CRS Report R45348, *The Geospatial Data Act of 2018*, by Peter Folger.

[102] NOAA, "U.S. Bathymetric Coverage and Gap Analysis."

[103] CRS email correspondence with NOAA, June 15, 2023.

[104] CRS email correspondence with NOAA, June 15, 2023.

NCEI may not share all acquired bathymetric data for a couple reasons. First, NCEI must process and convert some data into a standardized format; in some instances, data processing could delay public access by a year or more.[105] Second, access to certain data could be restricted because of issues related to business proprietary information, ownership disputes, or national security concerns, among other reasons.

The acquisition, management, and availability of U.S. bathymetric data depends on having enough NOAA staff to process and share such data. Reportedly, NCEI suspended some of its activities due to limited staffing in April 2025.[106] An agency spokesperson attributed the reduced staffing to the "release of probationary employees, the Deferred Resignation Program[,] and employees retiring."[107] The NOAA FY2026 budget request proposed a decrease of $18 million for NCEI from FY2024 enacted levels.[108]

What Are Some Challenges to Ocean and Coastal Water Mapping Efforts?

The 2021 NOMEC Implementation Plan provided a blueprint to coordinate federal and nonfederal efforts aiming to achieve the goals of the NOMEC Strategy. During the development of the 2021 NOMEC Implementation Plan, the NOMEC Council identified several mapping limitations. These included the need to

- improve engagement with stakeholder groups to implement the NOMEC Strategy;
- incorporate marine cultural heritage, underwater archaeology, and *paleolandscapes* in ocean and coastal mapping priorities;[109]
- strengthen collaboration with the private sector to advance innovative development and use of uncrewed systems (e.g., UMS, aerial drones);
- align the types and specifications of data (e.g., bathymetric resolution, time series data, imaging) across sectors;
- manage and store data and make data accessible and usable;
- engage the next generation of hydrographers, ocean explorers, and scientists; and
- streamline the permitting process for ocean and coastal mapping activities.[110]

The 2024 NOMEC Implementation Plan further identified that "limited resources in terms of funding, infrastructure, ships, submersibles and vehicles, and personnel" present challenges for achieving the long-term ocean and coastal mapping goals of the United States.[111] Specific to

[105] CRS email correspondence with NOAA, June 15, 2023.

[106] Andrew Freedman, "Scoop: NOAA Monthly Media Calls on Climate Change Suspended," *Axios*, March 13, 2025 (hereinafter Freedman, "Scoop: NOAA Monthly Media Calls on Climate Change Suspended").

[107] Freedman, "Scoop: NOAA Monthly Media Calls on Climate Change Suspended."

[108] NOAA, *Budget Estimates: Fiscal Year 2026*, p. NESDIS-14.

[109] A *paleolandscape* is an ancient area of land that may preserve information about how people inhabited, occupied, and used the land. For example, see NOAA, "Paleolandscapes, Paleoecology, and Cultural Heritage on the Southern California Continental Shelf – Geophysical Mapping Phase," https://oceanexplorer.noaa.gov/explorations/21paleolandscapes/welcome.html.

[110] NOMEC Council, *Implementation Plan*, Appendix A.

[111] NOMEC Council, *2024 Implementation Plan Update*, p. 1.

ships, resource considerations associated with ORVs include staffing levels, staff training and expertise, funding, and competing research projects and priorities.[112]

Which U.S. Ocean and Coastal Waters Are the Least Mapped?

Mapping coverage of federal ocean and coastal areas is not evenly distributed across the United States (see **Table 1**). To help identify where the United States should focus its mapping efforts, the IWG-OCM queries ocean and coastal mapping partners, and those who rely on mapping data, to identify their priority areas. For example, one survey asked NOAA program offices to determine which areas of the ocean and Great Lakes they needed mapped, and why.[113] The IWG-OCM reviews these surveys to determine overlapping mapping interests to "coordinate and leverage resources where there is a shared mapping need."[114]

Both Congress and the President have directed specific federal agencies to focus on two of the least mapped areas in the United States: (1) the seafloor off Alaska's coast and (2) the lakebeds of the Great Lakes. For example, in the explanatory statement accompanying the Consolidated Appropriations Act, 2023 (P.L. 117-328), Congress directed NOAA to use certain funds "to continue coordinating and implementing an interagency mapping, exploration, and characterization strategy for the U.S. Exclusive Economic Zone, as well as the Strategy for Mapping the Arctic and Sub-Arctic Shoreline and Nearshore of Alaska."[115] (For more information, see "How Have Congress and the President Directed Federal Agencies to Support Ocean and Coastal Mapping Efforts?")

Ocean and Coastal Waters of Alaska

According to the 2019 presidential memorandum, Alaska "lack[s] the comprehensive shoreline and nearshore maps available for much of the rest of the Nation" (see **Table 1**).[116] As directed by this presidential memorandum, in 2020, NOAA, the State of Alaska, and the Alaska Mapping Executive Committee developed an Alaska coastal mapping strategy.[117] The strategy focuses on terrestrial nearshore and coastal waters that can be mapped with lidar (aircraft and satellite). The NOMEC Strategy also called for mapping federal ocean water areas off Alaska.[118]

[112] CRS email correspondence with NOAA, Congressional Affairs Specialist, OLIA, April 18, 2023. Funding can impact *days-at-sea*, a day which a NOAA ship is "underway, under its own power, for greater than one hour, conducting mission operations, training, sea trials, or calibration." See Department of Commerce, "NOAA – Total Funded Days-at-Sea for NOAA Ships," March 6, 2025, https://performance.commerce.gov/KPI-NOAA/NOAA-Total-Funded-Days-At-Sea-for-NOAA-ships/sh92-zaih/about_data.

[113] For example, NOAA, *NOAA Nationwide Spatial Priorities Study*, NOAA Technical Memorandum NOS CS 46, October 2021.

[114] NOAA, "Spatial Priority Studies," https://iocm.noaa.gov/planning/priorities.html.

[115] Sen. Patrick Leahy, "Regarding H.R. 2617, Consolidated Appropriations Act, 2023," remarks in the Senate, *Congressional Record*, daily edition, vol. 168 (December 20, 2022), p. S7907.

[116] Presidential memorandum on ocean mapping of the U.S. EEZ, 2019.

[117] The Alaska Mapping Executive Committee (AMEC) is composed of executives from the State of Alaska and 15 federal agencies and departments (AMEC, *Alaska Coastal Mapping Strategy: Implementation Plan 2020-2030*, June 28, 2022, p. 1).

[118] AMEC, *Alaska Coastal Mapping Strategy: Implementation Plan 2020-2030*, June 28, 2022., pp. 2, 4.

As previously discussed, in December 2023, the Department of State delineated the outer limits of the U.S. ECS.[119] Adding the seabed area of the ECS increased the total U.S. seabed area off Alaska by about 203,100 square nmi, close to a 16% change (**Table 1**). Seascape Alaska, a regional mapping campaign in collaboration with federal, tribal, state, and nongovernmental partners, has facilitated the sharing of bathymetric data collected by the private sector to help fill NOMEC bathymetric data gaps.[120]

Lakebeds of the Great Lakes

The Great Lakes are the least mapped ocean and coastal areas of the United States (**Table 1**). As of January 2025, 85% of the lakebeds of the Great Lakes remained unmapped with modern technology at a 100 m resolution.[121] According to the Great Lakes Observing System (GLOS),[122] a binational network of organizations from the United States and Canada that receives funding from NOAA, many existing bathymetric maps of the Great Lakes were created using old, sparsely collected, or low-resolution data (e.g., water depth measurements were collected using lead lines dropped off the edges of boats or using pre-1960 single-beam sonar instruments).[123] A priority of GLOS is the Lakebed 2030 initiative, which aims to harmonize new and existing (domestic and international) governmental and nongovernmental bathymetric data to create new, higher-resolution maps of the Great Lakes by 2030.[124] Some stakeholders have noted that modern bathymetric data are "critical for effective management, research, and innovation, particularly under mounting climate change threats and growing blue economy in the Great Lakes region."[125]

In the 119th Congress, some Members introduced H.R. 2731, which would direct NOAA to "conduct high-resolution surveying and mapping of the lakebeds of the Great Lakes" and to make the high-resolution map of the Great Lakes and its associated information publicly available no later than 180 days after completing the mapping effort. The bill would authorize $50 million for each of fiscal years 2025 through 2029 to NOAA for such activities.

[119] Department of State, "Continental Shelf and Maritime Boundaries; Notice of Limits," 88 *Federal Register* 88470, December 21, 2023.

[120] NOMEC Council, *2024 Implementation Plan Update*, p. 29; and Seascape Alaska, "Introducing Seascape Alaska," https://storymaps.arcgis.com/stories/094abb14281e4b2489146a3f3e030961.

[121] NOAA, *2025 Progress Report: Unmapped U.S. Waters*.

[122] GLOS is 1 of 11 Regional Associations that are part of the U.S. Integrated Ocean Observing System. NOAA, "Regional Associations," https://ioos.noaa.gov/about/regional-associations/.

[123] GLOS, "Lakebed 2030," https://glos.org/priorities/lakebed-2030/ (hereinafter GLOS, "Lakebed 2030"); NOAA, "Great Lakes Bathymetry," https://www.ncei.noaa.gov/products/great-lakes-bathymetry; and Great Lakes Now, "Researchers Race to Understand What Lies Beneath the Great Lakes," July 21, 2022, https://www.greatlakesnow.org/2022/07/researchers-race-to-understand-what-lies-beneath-the-great-lakes/.

[124] GLOS, "Lakebed 2030." Partners of Lakebed 2030 include GLOS, USGS, NOAA, Northwestern Michigan College, and the Canadian Hydrographic Service.

[125] GLOS, "Lakebed 2030." Some refer to the *blue economy* as the collective economic value of the resources, uses, and activities of the ocean and coasts. For more information about the blue economy, see CRS In Focus IF12188, *What Is the Blue Economy?*, by Caitlin Keating-Bitonti and Eva Lipiec.

How Have Congress and the President Directed Federal Agencies to Support Ocean and Coastal Mapping Efforts?

Congress has directed multiple federal agencies to support and complete ocean and coastal mapping over several decades. For example, Congress authorized and directed NOAA to carry out ocean and coastal mapping activities under the Coast and Geodetic Survey Act of 1947 (P.L. 80-737), the Hydrographic Services Improvement Acts (P.L. 105-384, P.L. 107-372, and P.L. 110-386), and the Ocean and Coastal Mapping Integration Act of 2009 (Title XII, Part II, Subtitle B, of P.L. 111-11), among other laws.[126] Various entities, such as the IWG-OCM, have identified additional statutory authorities related to ocean and coastal mapping (**Table 3**).[127] Congress has amended some of these authorities or provided additional directives in appropriations laws and accompanying congressional reports and explanatory statements;[128] those amendments and additional directives are not listed in **Table 3**. For example, the Hydrographic Services Improvement Act (P.L. 105-384) has been amended twice (P.L. 107-372 and P.L. 110-386). Federal departments and agencies engage in ocean and coastal mapping activities under both specific and general authorities provided by Congress (**Table 4**).

Table 3. Chronology of Selected Federal Ocean and Coastal-Mapping-Related Authorities

Year	Name	P.L. Number or Statute at Large
1807	Act of February 10, 1807 (established a precursor to NOAA's Office of Coast Survey)	2 Stat. 413
1870	Organic Act of 1870 (established a precursor to the National Weather Service)[a]	16 Stat. 369
1879	Organic Act of 1879 (established the U.S. Geological Survey)	20 Stat. 394
1916	Organic Act of 1916 (established the National Park Service)	P.L. 64-235
1938	Federal Food, Drug, and Cosmetic Act	P.L. 75-717
1947	Coast and Geodetic Survey Act of 1947	P.L. 80-737
1950	National Science Foundation Act of 1950	P.L. 81-507
1953	Submerged Lands Act	P.L. 83-31
	Outer Continental Shelf Lands Act	P.L. 83-212
1958	National Aeronautics and Space Act of 1958	P.L. 85-568

[126] CRS email correspondence with NOAA, Congressional Affairs Specialist, OLIA, April 18, 2023.

[127] NOAA, "Integrated Ocean & Coastal Mapping, Mandates and Drivers," https://iocm.noaa.gov/about/mandates.html (hereinafter NOAA, "Integrated Ocean & Coastal Mapping, Mandates and Drivers").

[128] For example, in S.Rept. 118-62, referred to in the explanatory statement accompanying the Consolidated Appropriations Act, 2024 (P.L. 118-42), Congress directed NOAA to use certain funds for the NOAA Center of Excellence for Operational Ocean and Great Lakes Mapping, specifying that the "Center shall work in unison with and leverage existing capabilities, including the Joint Hydrographic Center, and across NOAA line offices, including NOS [National Ocean Service], the Office of Oceanic and Atmospheric Research [OAR], and the Office of Marine and Aviation Operations [OMAO], to support and grow the Nation's deep water, shallow water, and coastal mapping capabilities and data holdings, in partnership with industry."

Year	Name	P.L. Number or Statute at Large
1966	Soil Surveys Act	P.L. 89-560
	National Historic Preservation Act	P.L. 89-665
	National Wildlife Refuge System Administration Act	P.L. 89-669
1969	National Environmental Policy Act	P.L. 91-190
1972	Marine Mammal Protection Act	P.L. 92-522
	National Marine Sanctuaries Act	P.L. 92-532, Title III
	Coastal Zone Management Act	P.L. 92-583
1973	Endangered Species Act	P.L. 93-205
1974	Deepwater Port Act of 1974	P.L. 93-627
1976	Magnuson-Stevens Fishery Conservation and Management Act	P.L. 94-265
1979	Archaeological Resources Protection Act of 1979	P.L. 96-95
1984	Arctic Research and Policy Act of 1984	P.L. 98-373
1986	Emergency Wetlands Resources Act of 1986	P.L. 99-645
	Water Resources Development Act of 1986	P.L. 99-662
1987	Great Lakes Shoreline Mapping Act of 1987	P.L. 100-220, Title III, Subtitle B
1990	Oil Pollution Act of 1990	P.L. 101-380
	Global Change Research Act of 1990	P.L. 101-606
1996	Sustainable Fisheries Act of 1996	P.L. 104-297
1998	Hydrographic Services Improvement Act	P.L. 105-384
2002	Maritime Transportation Security Act of 2002	P.L. 107-295
2005	Energy Policy Act of 2005	P.L. 109-58
2007	Energy Independence and Security Act	P.L. 110-140
	Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2007	P.L. 109-479
2009	Omnibus Public Land Management Act	P.L. 111-11
	NOAA Undersea Research Program Act of 2009	P.L. 111-11, Title XII, Subtitle A, Part II
	Ocean and Coastal Mapping Integration Act of 2009	P.L. 111-11, Title XII, Subtitle B
	Integrated Coastal and Ocean Observation System Act of 2009	P.L. 111-11, Title XII, Subtitle C
2011	National Defense Authorization Act for Fiscal Year 2012	P.L. 112-81, Title III, Subtitle G
2015	Consolidated Appropriations Act, 2016[b]	P.L. 114-113
2017	Weather Research and Forecasting Innovation Act of 2017	P.L. 115-25
2018	Geospatial Data Act of 2018	P.L. 115-254, Title VII, Subtitle F
2020	Digital Coast Act	P.L. 116-223

Year	Name	P.L. Number or Statute at Large
2022	James M. Inhofe National Defense Authorization Act for Fiscal Year 2023	P.L. 117-263, Division J, Title CIII, and Division H, Title LXXXI, §8110
2025	Thomas R. Carper Water Resources Development Act of 2024	P.L. 118-272, Division A, Title I

Sources: Congressional Research Service, compiled from National Oceanic and Atmospheric Administration (NOAA), "Integrated Ocean & Coastal Mapping, Mandates and Drivers," https://iocm.noaa.gov/about/mandates.html; NOAA, "History of the LMRFC," https://www.weather.gov/lmrfc/additionalinfo_office_history; and NOAA, "USC&GS History," https://geodesy.noaa.gov/web/about_ngs/history/indexhUSCGS.shtml.

Notes: LMRFC = Lower Mississippi River Forecast Center. The table does not include a comprehensive list of laws pertaining to ocean and coastal mapping. Laws passed before 2017 were in part identified from a list provided on the website of the Interagency Working Group on Ocean and Coastal Mapping.

a. The Organic Act of 1890 transferred all civilian weather and related river services from the War Department into the Department of the Agriculture (as part of the newly established Weather Bureau).

b. The Consolidated Appropriations Act, 2016, established the Great Lakes Restoration Initiative.

In addition to congressional directives, the IWG-OCM identified executive actions that further direct federal ocean and coastal mapping.[129] These actions include E.O. 13547, "Stewardship of the Ocean, Our Coasts, and the Great Lakes;[130] E.O. 13817, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals";[131] E.O. 13840, "Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States"; and the 2019 presidential memorandum. As discussed above, in 2025, the Trump Administration issued two E.O.s and a DOI S.O. that identified ocean and coastal mapping priorities in the context of offshore energy and mineral resources.[132]

[129] NOAA, "Integrated Ocean & Coastal Mapping, Mandates and Drivers."

[130] E.O. 13547 of July 19, 2010, "Stewardship of the Ocean, Our Coasts, and the Great Lakes," 75 *Federal Register* 43021, July 22, 2010.

[131] E.O. 13817 of December 20, 2017, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals," 82 *Federal Register* 60835, December 26, 2017.

[132] E.O. 14285, "Unleashing America's Offshore Critical Minerals and Resources"; E.O. 14154, "Unleashing American Energy"; and S.O. 3418, "Unleashing American Energy."

Table 4. Selected Federal Departments and Agencies Involved in U.S. Ocean and Coastal Mapping

(listed alphabetically by department and agency)

Department and Agency	Summary of Mapping Activities
Department of Agriculture	
Natural Resources Conservation Service (NRCS)	NRCS maps soil resources, including those in coastal zone areas.
U.S. Forest Service (FS)	FS works with the USGS to create topographic mapping products of U.S. surface waters, including estuaries (i.e., where rivers meet the sea).
Department of Commerce	
National Oceanic and Atmospheric Administration (NOAA)*	NOAA conducts mapping activities in state, federal, and international waters. NOAA collects, uses, and manages ocean and coastal mapping data to support its research, stewardship, and public outreach missions. For example, NOAA's Office of Coast Survey provides navigation products and services to ensure safe and efficient maritime commerce, NOAA's Office for Coastal Management contributes to Great Lakes *benthic* (i.e., anything associated with or occurring on the bottom of a body of water) habitat mapping, and NOAA's National Marine Fisheries Service (NMFS) maps marine habitats for certain species. NOAA also partners with federal, state, and local agencies; academia; nongovernmental organizations; and the private sector to develop mapping standards and techniques, manage data, and implement projects.
Department of Defense	
National Geospatial-Intelligence Agency (NGA)*	NGA provides mapping resources for coastal flood hazard analysis.
U.S. Army Corps of Engineers (USACE)*	USACE conducts coastal mapping for its water resource projects and responsibilities, which primarily occur in state-controlled waters. The USACE National Coastal Mapping Program collects elevation and imagery data around certain U.S. coastlines about every five years in support of its civil works activities, including for the purposes of regional sediment management. USACE collaborates with the U.S. Navy, NOAA, and USGS, along with contractor support, to conduct its coastal mapping and charting. This collaboration is known as the Joint Airborne Lidar Bathymetry Technical Center of Expertise.
U.S. Navy*	The U.S. Navy collects oceanographic, hydrographic, bathymetric, geophysical, and acoustic data worldwide to provide the warfighter with knowledge of the battle space. The Office of Naval Research maps and characterizes the seafloor and water column in support of naval missions and for some civilian purposes.
Department of Homeland Security	
Federal Emergency Management Agency (FEMA)*	FEMA uses coastal lidar data collected by NOAA and USACE to conduct mapping studies to produce Flood Insurance Rate Maps and other products to inform coastal communities about flood risk and other natural hazards. FEMA evaluates and updates flood maps along populated U.S. coastlines in collaboration with other federal agencies, states, local communities, nonprofits, academic institutions, and the private sector.

Department and Agency	Summary of Mapping Activities
U.S. Coast Guard (USCG)*	USCG coordinates with NOAA's Office of Coast Survey and other federal agencies on mapping missions, including on USCG cutters, and maintains more than 50,000 navigation aids, including buoys, lighthouses, beacons, and radio-navigation signals, on U.S. waterways.
Department of State	
Bureau of Oceans and International Environmental and Scientific Affairs	The Office of Ocean and Polar Affairs facilitates diplomatic marine scientific research consent for U.S. scientists to conduct research cruises, including mapping efforts, in certain coastal countries, while allowing some foreign scientists to conduct research in U.S. waters.
Department of the Interior	
Bureau of Ocean Energy Management (BOEM)*	BOEM collects and uses ocean mapping data as part of its management of offshore energy and mineral development in federal waters. The data inform resource assessments, site characterization, and environmental analysis, among other purposes. BOEM collaborates with partners including NOAA's National Centers for Coastal Ocean Science, NMFS, and USGS to map, explore, and characterize deep-water benthic environments. BOEM also collects and manages data, such as geological and geophysical survey data, from offshore permittees and lessees.
National Park Service (NPS)*	NPS administers more than 80 ocean and coastal parks and engages in benthic habitat mapping at and around these locations. NPS's Ocean and Coastal Resources Program has partnered with government agencies and universities to map submerged habitat in parks.
U.S. Fish and Wildlife Service (FWS)*	FWS uses coastal and ocean mapping data to manage resources within the U.S. marine and coastal zone, including Marine National Monuments and National Wildlife Refuges, among others. FWS also uses these data to identify future waters for resource management. FWS manages the National Wetlands Inventory, which provides information on the extent of wetland and submerged aquatic vegetation habitats within the U.S. coastal zone.
U.S. Geological Survey (USGS)*	The USGS collects, uses, and manages ocean and coastal mapping data for geologic, mineral, and hazard-related assessments. The USGS Coastal National Elevation Database develops integrated topobathymetric models for U.S. coastal areas, the Great Lakes, and certain Western Pacific islands and atolls. Topobathymetric models are used to map storm surge from hurricanes and potential changes in flood zone from sea-level rise.[a]
Independent	
Environmental Protection Agency (EPA)*	The EPA maintains EnviroAtlas, an interactive mapping application comprising over 500 maps that provides information about *ecosystem services* (i.e., ecosystem goods and services that provide natural benefits). EnviroAtlas includes maps displaying scenarios of sea-level rise inundation modeled by NOAA. Most of these maps are for the onshore continental United States.
National Aeronautics and Space Administration (NASA)*	NASA uses ocean remote sensing technologies to map and characterize coastal regions as part of its ocean observing and modeling strategy. Satellite missions that have contributed to bathymetric mapping include the Ice, Cloud and Land Elevation Satellite 2 (ICESat-2); Surface Water and Ocean Topography (SWOT); and Joint Altimetry Satellite Oceanography Network (JASON) series.[b]

Department and Agency	Summary of Mapping Activities
National Science Foundation (NSF)*	NSF's Geosciences Directorate provides federal funding for basic research at academic institutions, and its Division of Ocean Sciences (OCE) supports ocean science-based projects. All ocean mapping and characterization data collected under OCE awards, by the U.S. Academic Research Fleet (ARF), which consists of University-National Oceanographic Laboratory System-designated vessels (also known as ARF vessels), or via other mechanisms are made publicly available within two years of collection. NSF also supports the Global Multi-Resolution Topography Data Synthesis initiative, a compilation of edited multibeam sonar data collected by scientists and institutions worldwide.

Sources: Congressional Research Service, compiled from NOAA, "Integrated Ocean & Coastal Mapping, Interagency Working Group—Ocean and Coastal Mapping," https://iocm.noaa.gov/about/iwg-ocm.html; NOAA, "Integrated Ocean & Coastal Mapping, NOAA IOCM Coordination Team," https://iocm.noaa.gov/about/noaa-iocm-team.html; USACE, "About JALBTCX," https://jalbtcx.usace.army.mil/; and University-National Oceanographic Laboratory System, "UNOLS Charter," https://www.unols.org/what-unols/unols-charter.

Notes: IOCM = Integrated Ocean & Coastal Mapping; JALBTCX = Joint Airborne Lidar Bathymetry Technical Center of Expertise; UNOLS = University-National Oceanographic Laboratory System. Agencies followed by an asterisk (*) are required to be a part of the Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM; 33 U.S.C. §3502(b)). Other selected agencies included in the table were in part identified from a list provided on the IWG-OCM's website.

a. Topobathymetric models rely on lidar technologies to measure three types of surfaces: land, water, and underwater terrain.

b. For more information on selected satellites, see CRS Report R46560, *Landsat 9 and the Future of the Sustainable Land Imaging Program*, by Anna E. Normand, and CRS Report R47021, *Federal Involvement in Ocean-Based Research and Development*, by Caitlin Keating-Bitonti.

How Are Federal Ocean and Coastal Mapping Efforts Coordinated?

According to the NOMEC Council, prior to the 2021 NOMEC Implementation Plan, "there was no formal process for strategic coordination of [U.S. ocean and coastal mapping, exploration, and characterization] activities across the federal government."[133] Strategic coordination was initiated through the 2019 presidential memorandum, which directed certain departments and agencies to support federal ocean and coastal mapping efforts.[134] The presidential memorandum required the Ocean Policy Committee, working through its Ocean Science and Technology Subcommittee (both established under E.O. 13840), to develop a mapping strategy for the U.S. EEZ.[135] The strategy recommended the creation of the NOMEC Council.[136] The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 codified the NOMEC Council.[137]

The NOMEC Council consists of members from 12 federal entities: Department of Commerce (NOAA), Department of Defense, DOI (Bureau of Ocean Energy Management [BOEM], Bureau of Safety and Environmental Enforcement, USGS), Department of Transportation, NASA, National Science Foundation (NSF), Office of the Director of National Intelligence, U.S. Coast

[133] NOMEC Council, *2024 Implementation Plan Update*, p. 7.

[134] Presidential memorandum on ocean mapping of the U.S. EEZ, 2019.

[135] 10 U.S.C. §8932(a).

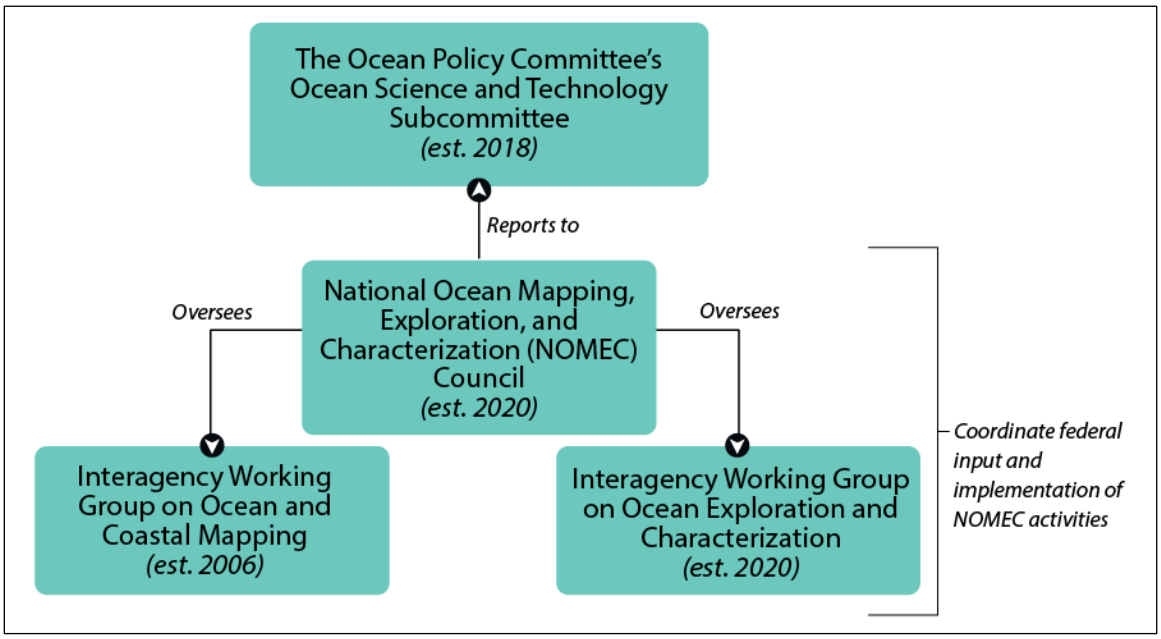
[136] NOMEC Strategy, 2020, p. 6.

[137] 33 U.S.C. §3408.

Guard, White House Office of Management and Budget, and White House Office of Science and Technology Policy.[138] The NOMEC Council is cochaired by two senior-level representatives from NOAA and one senior-level representative from DOI.[139] In the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023, Congress required the NOMEC Council to report to the Ocean Science and Technology Subcommittee and to oversee the work of the IWG-OCM and the IWG on Ocean Exploration and Characterization (IWG-OEC; **Figure 5**).[140] Federal agency membership may overlap or differ across the NOMEC Council, IWG-OCM, and the IWG-OEC (**Table A-1**). Some stakeholders contend that, in recent years, federal ocean and coastal mapping efforts have become "well-coordinated" with "no duplication of effort."[141]

Independently of the goals of the NOMEC Strategy, the Thomas R. Carper Water Resources Development Act of 2024 (Title I, Division A, §1123, of P.L. 118-272) directed USACE to coordinate with the Naval Meteorology and Oceanography Command, NOAA, USGS, and any other relevant federal agencies to carry out a national coastal mapping program.[142] How the USACE National Coastal Mapping Program complements or differs from the NOMEC Strategy remains unclear.

Figure 5. Structure of the Interagency Committees, Councils, and Working Groups with Primary Mapping, Exploration, and Characterization Responsibilities



Sources: Congressional Research Service, adapted from Ocean Policy Committee, Ocean Science and Technology Subcommittee, *National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone*, June 2020, p. 7.

[138] NOAA, "NOMEC Council and Member Agencies," https://www.noaa.gov/nomec/nomec-council-and-member-agencies (hereinafter NOAA, "NOMEC Council and Member Agencies").

[139] A representative from the USGS, a part of DOI, serves as a cochair of the NOMEC Council. NOAA, "NOMEC Council and Member Agencies"; and 33 U.S.C. §3408(e).

[140] 33 U.S.C. §3408(h). Division J, Title CIII, of P.L. 117-263, codified the Interagency Working Group on Ocean Exploration and Characterization.

[141] House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[142] 33 U.S.C. §2292a.

Notes: The Ocean Policy Committee was created by Executive Order 13840 of June 19, 2018, "Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States," 83 *Federal Register* 29431, June 22, 2018, and was later codified by the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (Title X, Subtitle E, of P.L. 116-283; 10 U.S.C. §8932(a)). The Ocean Science and Technology Subcommittee, NOMEC Council, and Interagency Working Group on Ocean Exploration and Characterization were codified by James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (Division J, Title CIII, of P.L. 117-263; 10 U.S.C. §8932(c), 33 U.S.C. §3408, and 33 U.S.C. §3408(h), respectively). The Interagency Working Group on Ocean and Coastal Mapping was codified by the Ocean and Coastal Mapping Integration Act of 2009 (Title XII, Part II, Subtitle B, of P.L. 111-11; 33 U.S.C. §3502).

How Are Crowdsourced Data and Nonfederal Partners Included in Federal Ocean and Coastal Mapping Efforts?

Crowdsourced bathymetric data have supplemented U.S. federal efforts to map U.S. ocean and coastal waters.[143] Crowdsourced bathymetric data are water-depth measurements collected using standard navigation instruments (e.g., from vessels engaged in routine maritime operations). These data may help determine whether an ocean or coastal area needs to be remapped and fill data gaps, such as in complex coastline areas that are difficult for traditional survey vessels to access. NOAA manages crowdsourced bathymetric data contributed by several providers, including GLOS.[144] International seabed mapping efforts, including Seabed 2030, Lakebed 2030, and the International Hydrographic Organization, also use crowdsourced data.[145]

Federal agencies partner with nonfederal entities to help map U.S. ocean and coastal waters. Nonfederal partners may contribute bathymetric data and provide resources to help collect data. For example, USACE contracts for the aircraft to fly its lidar instruments.[146] Offshore energy developers also generate and share some ocean mapping data with the federal government. For example, oil and gas companies and offshore wind developers collect geological and geophysical survey data to locate resources or inform project siting on the outer continental shelf.[147] Under the Outer Continental Shelf Lands Act (43 U.S.C. §§1331-1356c) and implementing regulations, BOEM is authorized to acquire such industry-collected data.[148] BOEM uses the information to support its energy resource assessments, studies of the composition and volume of seafloor sediment deposits, identification of geological hazards and benthic habitats, and other

[143] For example, see NOAA, "NOAA Announces Launch of Crowdsourced Bathymetry Database," May 31, 2018, https://nauticalcharts.noaa.gov/updates/noaa-announces-launch-of-crowdsourced-bathymetry-database/.

[144] NOAA, "Bathymetric Data Viewer."

[145] See NOAA, "Bathymetric Data Viewer"; GLOS, "GLOS-Funded Crowdsourced Bathymetry Is Now Live on a Public Database," October 18, 2022, https://glos.org/glos-funded-crowdsourced-bathymetry-is-now-live-on-a-public-database/; and International Hydrographic Organization, "IHO Data Centre for Digital Bathymetry (DCDB)" https://www.ngdc.noaa.gov/iho/.

[146] USACE, remote briefing to CRS, April 25, 2023.

[147] For more information, see BOEM, "Geological and Geophysical (G&G) Surveys," fact sheet, November 2018, https://www.boem.gov/sites/default/files/about-boem/BOEM-Regions/Atlantic-Region/GandG-Overview.pdf.

[148] 43 U.S.C. §1352, 30 C.F.R. Part 551, 30 C.F.R. §§580.40-580.73, and 30 C.F.R. §§585.610-585.611.

activities.[149] However, privileged and proprietary data must be kept confidential for specified time periods (generally ranging from 10 to 50 years), pursuant to statutory provisions.[150]

Nonfederal partners also may help the federal government meet its NOMEC goals (see "What Are U.S. Goals for Ocean and Coastal Mapping?").[151] According to the NOMEC Strategy,

> Academic and non-profit institutions and cooperative institutes provide the expertise for ocean and coastal mapping, exploration, and characterization. These partnerships provide access to a wealth of ocean exploration resources, including ships, autonomous and remotely operated vehicles, expertise, and opportunities for technology testing and development.[152]

In the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023, Congress directed the NOMEC Council to "promote new and existing partnerships among Federal and State agencies, Indian Tribes, private industry, academia, and non-governmental organizations to conduct or support ocean mapping, exploration, and characterization activities and technological development needs."[153] These partnerships may be employed through mechanisms such as federal contracts, competitive grants, and cooperative research and development agreements. For example, NOAA announced the creation of the Brennan Ocean Mapping Matching Fund in 2021 to encourage nonfederal entities to partner with NOAA to acquire more ocean and coastal survey data. In 2022, Congress codified the fund through the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023.[154] For FY2025, NOAA received and accepted three proposals for projects through the Brennan Ocean Mapping Matching Fund.[155] One project, a partnership between NOAA and the City of Valdez, AK, is to provide high resolution bathymetry and backscatter data of Port Valdez to help city emergency managers understand and prepare for potential impacts of submarine landslides.[156] On June 17, 2025, NOAA released a notice requesting partnership proposals for the Brennan Ocean Mapping Matching Fund.[157]

What Are Some Potential Issues for the 119th Congress?

The 119th Congress may consider a range of issues related to U.S. ocean and coastal mapping. These issues may include

1. federal investment in ships;

[149] See, for example, BOEM, *Gulf of Mexico OCS Proposed Geological and Geophysical Activities: Final Programmatic Environmental Impact Statement*, August 2017, chapter 1, p. 4, https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Assessment/NEPA/BOEM-2017-051-v1.pdf.

[150] 43 U.S.C. §1352(c); 30 C.F.R. §§551.14, 580.71.

[151] NOMEC Strategy, 2020, p. 17.

[152] NOMEC Strategy, 2020, pp. 17-18.

[153] 33 U.S.C. §3408(i)(2)(G).

[154] 33 U.S.C. §3504a.

[155] NOMEC Council, *2024 Implementation Plan Update*, p. 29.

[156] NOAA, "NOAA Announces Plans to Survey Port Valdez and Solicits Proposals for 2026 Funding Opportunity," August 22, 2024, https://nauticalcharts.noaa.gov/updates/noaa-announces-plans-to-survey-port-valdez-and-solicits-proposals-for-2026-funding-opportunity/.

[157] NOAA, "Notice of Brennan Ocean Mapping Fund Opportunity for Ocean and Coastal Mapping and Request for Partnership Proposals," 90 *Federal Register* 25588, June 17, 2025.

2. the status of the federal workforce and U.S. leadership in ocean science and technology (S&T);
3. federal support of public-private partnerships related to ocean and coastal mapping efforts, including the reauthorization of relevant programs; and
4. potential national security and economic implications related to ocean and coastal mapping.

The 2024 NOMEC Implementation Plan made recommendations related to some of these issues but stated that its recommendations would be "subject to the Administration's annual budget process and the availability of appropriations."[158] More broadly, Congress may weigh trade-offs between furthering the NOMEC Strategy and meeting other federal funding demands.

Federal Investment in Ships

Some scientists have claimed that sustained federal investment, particularly in ships and other maritime research infrastructure, is "essential" and long-term research projects would be "difficult to restart" if interrupted.[159] Some experts attribute the United States' relatively high proportion of its seabed mapped compared with other nations to U.S. open-source initiatives, such as the Rolling Deck to Repository (R2R) Program.[160] Since 2009, R2R "has supported the acquisition, documentation, preservation, and enhanced usability" of ARF data, including bathymetric data.[161] NSF provides approximately 70% of the total operating costs of the ARF.[162] The NSF FY2026 budget request proposes a nearly 40% reduction for the ARF, which would provide "partial support" to some ships.[163] A potential consideration for Congress is the extent of funding for ocean-based research and exploration within an Administration goal to reduce federal research funding. Congress may choose to decrease federal investment in maritime research infrastructure to prioritize other funding demands. Reductions in federal funding of research activities, including maritime research infrastructure, could inhibit some U.S. ocean policy objectives, such as NOMEC goals and other U.S. ocean exploration objectives (for offshore energy and mineral resources). The bathymetric data to map U.S. ocean and coastal waters may still be acquired despite a reduction in federal funding for new ships, but it may take longer than the time proposed in the NOMEC Strategy.

Federal Workforce and U.S. Leadership in Ocean Science and Technology

As discussed above, NOAA and the 2024 NOMEC Implementation Plan identified personnel shortages, among other factors, as potentially limiting the United States' ability to achieve its

[158] NOMEC Council, *2024 Implementation Plan Update*, p. iii.

[159] Testimony of Margaret Leinen, Vice Chancellor Marine Sciences, Director, Scripps Institution of Oceanography, University of California San Diego, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[160] Yakufu Niyazi et al., "Status of Global Seafloor Mapping Effort and Priority Areas for Future Mapping," *Frontiers in Marine Science*, vol. 12 (May 30, 2025), p. 12.

[161] Rolling Deck to Repository (R2R) Program, "Mission & R2R Team," https://www.rvdata.us/about/mission-and-team.

[162] The U.S. Academic Research Fleet (ARF) consists of 17 oceanographic vessels and various submersibles/autonomous vehicles owned by NSF, the Office of Naval Research, and U.S. universities and laboratories. The ARF operating costs are divided proportionally among vessel users based on usage. UNOLS, "The U.S. Academic Research Fleet."

[163] NSF, *FY2026 Budget Request to Congress*, May 30, 2025, pp. Facilities – 3 and Facilities – 5.

ocean and coastal mapping goals.[164] The Trump Administration has made or proposed changes to federal agency staffing and funding to agencies that conduct or support U.S. ocean and coastal mapping.[165] As of April 25, 2025, NOAA's workforce has been reduced by reportedly nearly 20% since the start of the Trump Administration.[166] The NOAA FY2026 budget request proposed cutting more than 2,000 (17% of the total workforce) full-time equivalent positions across the agency.[167] The extent to which existing staffing reductions align with those proposed in the FY2026 budget request is unknown.

Personnel changes in federal agencies that conduct or support mapping activities may limit the agencies' ability to achieve the NOMEC Strategy goals. For example, the NOAA FY2026 budget request proposed a decrease in staffing levels for some NOAA programs relevant to ocean mapping activities or bathymetric data management (e.g., for NCEI) but proposed maintaining levels for other programs, such as the Office of Ocean Exploration and Research, which prioritizes data collection in unknown deep-sea areas of the U.S. EEZ and contributes to the execution of the NOMEC Implementation Plan.[168] Congress may consider potential trade-offs between limitations to ocean mapping capabilities resulting from staff decreases and other priorities, such as reducing the federal budget, that may result from reductions in the federal workforce.

The level of federal support for S&T research may affect the ability to increase the rate or effectiveness of U.S. ocean and coastal mapping efforts. Federally supported advances in S&T have increased the resolution of ocean mapping and the ability to obtain mapping data through different modalities, such as satellites.[169] The Trump Administration is reviewing and has proposed reducing federal spending in research and development generally, leading some stakeholders to express concerns about the level of federal support for ocean research.[170] For example, in response to the Trump Administration's actions, the University of California San Diego's Scripps Institution of Oceanography decreased its graduate student admissions by half in 2025 compared to 2024.[171] The NOMEC Strategy asserted that continued investments in science, technology, engineering, and mathematics "education is critical for ensuring United States leadership and that the next generation of Americans remains competitive in the growing

[164] See "What Are Some Challenges to Ocean and Coastal Water Mapping Efforts?" above.

[165] For examples of changes made or proposed by the Trump Administration, see memorandum from Russell T. Vought, Director, Office of Management and Budget, and Charles Ezell, Acting Director, Office of Personal Management, to heads of executive departments and agencies, "Guidance on Agency RIF and Reorganization Plans Requested by Implementing the President's "Department of Government Efficiency" Workforce Optimization Initiative," February 26, 2025.

[166] For example, Daniel Cusick, "More than 1,000 NOAA Staffers Take Early Retirement," April 25, 2025, *E&E News*; and Raymond Zhong et al., "NOAA Said to Be Planning to Shrink Staff by 20%," *New York Times*, March 8, 2025.

[167] NOAA, *Budget Estimates: Fiscal Year 2026*, p. Control Table-14. For more information about NOAA's organization, see CRS Report R47636, *National Oceanic and Atmospheric Administration (NOAA): Organization Overview and Issues for Congress*, by Eva Lipiec.

[168] NOAA, *Budget Estimates: Fiscal Year 2026*, pp. NOAA-15 and NOS-9. NOAA's FY2026 budget request proposes transitioning the Office of Ocean Exploration and Research from the Oceanic and Atmospheric Research line office to the National Oceanic Service line office.

[169] See "How Are Ocean and Coastal Waters Mapped?" above.

[170] For example, remarks from Rep. Gabe Amo, Ranking Member of the Subcommittee on Environment, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[171] For example, testimony of Margaret Leinen and Shephard Smith, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

international field of ocean S&T."[172] In S.Rept. 118-62, Congress encouraged NOAA "to collaborate with university and industry partners on education and training programs needed to support the demand for advanced bathymetric [lidar] engineers."[173]

Congress also may consider the need for education and training for UMS as demand and interest in the use of these systems grows.[174] Congress could, for example, examine the relationship between undergraduate and graduate student enrollments and whether those student pools will be available to supply the perceived needs for UMS.

Federal Support of Public-Private Partnerships

Congress continues to debate the degree to which the federal government and the private sector should each contribute to mapping activities and the nature of the partnership. During a hearing of the House Science, Space, and Technology Committee's Subcommittee on Environment in the 119th Congress, one Member expressed his view on the importance of private sector contribution, stressing that "NOAA cannot meet these mapping goals all on its own."[175] A witness from the private sector, on the other hand, testified that although NOAA's partnerships with the private sector drove U.S. leadership in ocean science, "there is no scenario where private industry could simply take over."[176]

Some stakeholders have proposed the use of commercial UMS or commercial data buys from private sector UMS service providers to complement federal coastal and ocean mapping efforts.[177] As previously discussed, government-owned UMS may be more cost effective than data buys for ocean mapping activities.[178] Congress may choose to request or require NOAA to complete a cost estimate with full costs for the agency to

- develop and operate its own ORVs and UMS;
- contract with private UMS operators; and
- purchase commercial data from private sector UMS service providers for U.S. ocean and coastal mapping objectives.

A cost estimate for these different options may elucidate how to allocate federal resources for mapping activities.

---

[172] NOMEC Strategy, 2020, p. 19.

[173] S.Rept. 118-62, p. 30. See footnote 79.

[174] For example, NOAA, "About NOAA Uncrewed Systems Operations," https://www.omao.noaa.gov/uncrewed-systems/about-noaa-uncrewed-systems-operations.

[175] U.S. Congress, House Committee on Science, Space, and Technology, "Opening Statement of Environment Subcommittee Chairman Scott Franklin at To the Depths, and Beyond: Examining Blue Economy Technologies," March 26, 2025, https://science.house.gov/2025/3/opening-statement-of-environment-subcommittee-chairman-scott-franklin-on.

[176] Testimony of Tim Janssen, Chief Executive Officer, Sofar Ocean Technologies, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[177] For example, H.Rept. 118-582, accompanying the Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2025 (H.R. 9026); written testimony of Earl Childress, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025; testimony of Shepard Smith, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025; and NOAA, *Budget Estimates: Fiscal Year 2026*, p. OMAO-11.

[178] See "How Do Oceanographic Research Vessels and Uncrewed Marine Systems Contribute to U.S. Mapping Capabilities?" NOAA, *Budget Estimates: Fiscal Year 2026*, p. OMAO-13.

In the 119th Congress, some Members have proposed directing federal agencies to coordinate with nonfederal partners to achieve certain mapping objectives. The NOMEC Council had recommended the "expansion of public-private partnerships" to quicken the pace of U.S. ocean and coastal mapping.[179] The Great Lakes Mapping Act of 2025 (H.R. 2731) would direct NOAA to partner with the GLOS Lakebed 2030 initiative and would authorize appropriations of $250 million over five years to carry out the mapping efforts. In addition, H.R. 2294 and S. 2126 in the 119th Congress would reauthorize the Integrated Coastal and Ocean Observation System Act of 2009 (Title XII, Subtitle C, of P.L. 111-11), which established the U.S. Integrated Ocean Observing System (IOOS). The U.S. IOOS manages public-private partnerships and oversees the 11 IOOS regional associations, including GLOS, among other ocean observation responsibilities. Congress also may evaluate the work and progress of existing partnership programs aimed at collecting and analyzing new bathymetric data to determine the effectiveness of these partnerships at mapping unmapped areas of U.S. ocean and coastal waters.

Public-private partnerships include contracts between federal agencies and private companies, and stakeholders have raised concerns that contracting with the federal government is complicated, requiring the involvement of legal experts.[180] Congressional oversight may determine whether—and, if so, the extent to which—contracting mechanisms are deterring private companies from partnering with federal agencies on ocean and coastal mapping initiatives.

U.S. National Security and Economic Interest

Congress may consider any potential U.S. national security and/or economic implications related to not meeting the NOMEC Strategy mapping goals within a certain time frame. For example, U.S. ocean mapping, exploration, and characterization contribute to the identification of offshore energy and mineral resources, which may contribute to national security and economic prosperity.[181] U.S. ocean and coastal mapping also provides greater understanding of living marine resources and their habitats, which might lead to better management of said resources. As an example, benthic habitat mapping conducted by NOAA's National Marine Fisheries Service and partners helps identify essential fish habitats.

Some Members in the 119th Congress have expressed concerns over how, in one Member's words, the People's Republic of China (PRC, or China) is "supercharging its ocean mapping and drilling enterprise."[182] They call attention to how detailed seafloor mapping by foreign adversaries may present national security concerns as these data have numerous applications, including for military use. PRC research ships are equipped with sonar for collecting bathymetric

[179] NOMEC Council, *2024 Implementation Plan Update*, p. 1.

[180] Written testimony of Earl Childress, Senior Vice President, Chief Commercial Officer, Oceaneering International Inc., House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025; and testimony of Tim Janssen, Chief Executive Officer, Sofar Ocean Technologies, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

[181] For example, according to NOAA, the ocean mapping efforts of the Office of Ocean Exploration and Research "guide[] site-selection for U.S. applicants in support of E.O. 14285 'Unleashing America's Offshore Critical Minerals and Resources.'" NOAA, *Budget Estimates: Fiscal Year 2026*, p. NOS-6.

[182] Remarks from Rep. Brian Babin, Chairman of the Committee on Science, Space, and Technology, House Committee on Science, Space, and Technology, Subcommittee on Environment, *To the Depths, and Beyond: Examining Blue Economy Technologies*, hearing, March 26, 2025.

data or are capable of deploying UMS.[183] Ocean mapping activities could enhance China's undersea and seabed warfare capabilities by supporting, among other things,

- operations by China's submarines and uncrewed underwater vehicles (UUVs),
- operations by China to counter U.S. or other militaries' submarines and UUVs,
- operations by China to defend its undersea cables, and
- operations by China to tap into or cut others' undersea cables.

From 2022 to 2024, the PRC expanded the geographic range of its ocean research ships from waters primarily close to its coast into the Western Pacific.[184] Some stakeholders contend that the expanded range of PRC research ships includes areas of potential interest to China's military, such as areas near Taiwan or the United States (i.e., Guam, a U.S. territory that hosts U.S. military forces).[185] China's expanded research fleet could provide China an advantage in competing with the United States in the maritime domain by enhancing China's seabed mining operations or fishing operations. Congress may consider what the appropriate level of investment in ocean and coastal mapping, including investment in ORVs, might be given the current comparative advantage China possesses.

Some stakeholders may contend that the implementation of E.O.s or legislation would help the United States better compete with the PRC in ocean exploration and mapping. For example, H.R. 2556 in the 119th Congress would aim to enhance national security and energy independence through offshore energy resource assessment and mapping. The bill would direct the Secretary of Energy, the Secretary of the Interior, and the Secretary of State, in partnership with NSF, NOAA, the Office of Naval Research, and other relevant federal agencies, to utilize any existing maritime vessels and other mapping technologies to identify U.S. transboundary hydrocarbon reservoirs for future exploration, development, and production, among other tasks.[186] As another example, E.O. 14154, "Unleashing American Energy," and E.O. 14285, "Unleashing America's Offshore Critical Minerals and Resources," prioritized mapping of federal lands, which include the outer continental shelf, to identify critical mineral deposits, citing economic and national security implications.[187] In the 119th Congress, H.R. 3803 and H.R. 4018 would codify and adapt E.O. 14285. For example, H.R. 3803 would direct the Secretary of Commerce, in consultation with other federal agencies, to develop a plan to map priority areas of the seabed with abundant or accessible resources, and H.R. 4018 would direct the Secretary of the Interior to do so.

[183] Chris Buckley, "China Surveys Seabeds Where Naval Rivals May One Day Clash," *New York Times*, July 10, 2025, (hereinafter Buckley, "China Surveys Seabeds Where Naval Rivals May One Day Clash"); and Austin Ramzy, "China Is Mapping the Seabed to Unlock New Edge in Warfare," *Wall Street Journal*, March 12, 2025 (hereinafter Ramzy, "China Is Mapping the Seabed to Unlock New Edge in Warfare").

[184] Buckley, "China Surveys Seabeds Where Naval Rivals May One Day Clash."

[185] Buckley, "China Surveys Seabeds Where Naval Rivals May One Day Clash"; Ramzy, "China Is Mapping the Seabed to Unlock New Edge in Warfare"; and "China Is Itching to Mine the Ocean Floor," *Economist*, July 28, 2024.

[186] See H.R. 2556, §2, 119th Congress.

[187] For more information about offshore critical minerals and the federal government's role in identifying such resources within U.S. waters, see CRS Report R48302, *Critical Minerals on the U.S. Outer Continental Shelf: The Bureau of Ocean Energy Management's Role and Issues for Congress*, by Caitlin Keating-Bitonti and Laura B. Comay.

Appendix.

Over 20 federal agencies, departments, and offices participate in aspects of ocean and coastal mapping, exploration, or characterization. Federal agency membership may overlap or differ across the National Ocean Mapping, Exploration, and Characterization (NOMEC) Council, Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM), and Interagency Working Group on Ocean Exploration and Characterization (IWG-OEC). (See **Table A-1**.)

Table A-1. Selected Federal Departments, Agencies, and Offices Involved in U.S. Ocean and Coastal Mapping

	Coordination Body Membership		
Federal Department, Agency, or Office	**NOMEC Council[a]**	**IWG-OCM[b]**	**IWG-OEC[c]**
Bureau of Ocean Energy Management	X	X*	X
Bureau of Safety and Environmental Enforcement	X	—	—
Department of Defense	X	—	—
Department of Energy	—	X	X
Department of State	—	X	—
Department of the Interior, Office of the Assistant Secretary for Fish, Wildlife, and Parks	—	X*	—
Department of Transportation	X	—	—
Environmental Protection Agency	—	X*	—
Federal Emergency Management Agency	—	X*	—
National Aeronautics and Space Administration	X	X*	X
National Geospatial-Intelligence Agency	—	X*	—
National Oceanic and Atmospheric Administration	X	X*	X
National Park Service	—	X	—
National Science Foundation	X	X*	X
Natural Resources Conservation Service	—	X	—
Office of the Secretary of Defense	—	—	X
U.S. Arctic Research Commission	—	X	—
U.S. Army Corps of Engineers	—	X*	—
U.S. Coast Guard	X	X*	—
U.S. Fish and Wildlife Service	—	X	—
U.S. Food and Drug Administration	—	—	X
U.S. Forest Service	—	X	—
U.S. Geological Survey	X	X*	X
U.S. Navy	—	X*	X
White House Office of Management and Budget	X	—	X
White House Office of Science and Technology Policy	X	—	X

Federal Department, Agency, or Office	Coordination Body Membership		
	NOMEC Council[a]	IWG-OCM[b]	IWG-OEC[c]
White House Office of the Director of National Intelligence	X	X	X

Source: Congressional Research Service.

Notes: IWG-OCM = Interagency Working Group on Ocean and Coastal Mapping; IWG-OEC = Interagency Working Group on Ocean Exploration and Characterization; NOMEC = National Ocean Mapping, Exploration, and Characterization.

a. Membership identified from National Oceanic and Atmospheric Administration (NOAA), "NOMEC Council and Member Agencies," https://www.noaa.gov/nomec/nomec-council-and-member-agencies.

b. Membership identified in 33 U.S.C. §3502(b) and from NOAA, "Interagency Working Group - Ocean and Coastal Mapping," https://iocm.noaa.gov/about/iwg-ocm.html. Asterisk (*) denotes membership required in statute. While the IWG-OCM was established within the Subcommittee on Ocean Science and Technology, which is cochaired by the White House Office of Science and Technology Policy, the activities of the IWG appear to be primarily executed by agency members (for more information, see CRS Report R47410, *The Office of Science and Technology Policy (OSTP): Overview and Issues for Congress*, by Emily G. Blevins).

c. Membership identified from the IWG-OEC, *Strategic Priorities for Ocean Exploration and Characterization of the United States Exclusive Economic Zone*, October 2022, p. 4.

Author Information

Caitlin Keating-Bitonti, Coordinator
Specialist in Natural Resources Policy

Nicole T. Carter
Specialist in Natural Resources Policy

Laura B. Comay
Specialist in Natural Resources Policy

Eva Lipiec
Specialist in Natural Resource Policy

Linda R. Rowan
Analyst in Natural Resources and Earth Sciences

Acknowledgments

Anna Normand, Specialist in Natural Resources Policy, and Tony Marshak, Analyst in Natural Resources Policy, contributed to the 2025 update of this report.

Disclaimer