

Coast Survey's Role in Global Ocean Mapping

"You can't use an old map to explore a new world."
Albert Einstein

There are 3.7 million square miles of land mass in the United States. However, there is a part of the U.S. even greater in size that most Americans have never seen - that vast tracts of submerged lands beneath our oceans in our Exclusive Economic Zone (EEZ). The 4.5 million square miles (3.4 million square nautical miles) of our EEZ stretches at least 200 miles offshore and have the potential to get even larger should the U.S. claim be ratified under Article 76 of the United Nations Law of the Sea treaty. In addition to being largely unseen, this area is also largely unmapped and unexplored. A recent study showed that only 30% has been mapped using modern multibeam echosounders. It is estimated that only an additional 10% has been mapped with any method at all - including lead line soundings.

Ocean Mapping is Global, National, NOAA-wide, and Program Specific

In June 2016 the Nippon Foundation, in collaboration with the General Bathymetric Chart of the Ocean (GEBCO), convened a workshop to inspire a global campaign to map all the world's oceans with modern technology. Called Seabed 2030, this initiative acknowledges that 70% of the Earth's surface is covered by our oceans, that they are fundamental to sustaining life, controlling climate, and are a vast source of resources and economic wealth and therefore must be mapped. All member nations were called upon to do their part and work to achieve the goal of mapping the world's oceans by 2030. The **global** effort "Seabed 2030" is led by GEBCO, a joint project of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission of UNESCO. The US is engaged through both IHO and IOC, as well as hosting a data center in support.

The US coordinates **domestic** ocean mapping activities through the "Integrated Ocean and Coastal Mapping (IOCM)" program, hosted at NOAA, but with participation from all federal, state, and non-governmental entities engaged in ocean mapping activities. The IOCM program is sponsoring an expansion of the National Enhanced Elevation Assessment (NEEA) that will quantify the economic value of mapping the "hidden America," using a methodology similar to the 2012 economic analysis of topographic elevation data needs commissioned by the U.S. Geological Survey (USGS). In addition, National Ocean Mapping Strategy in development by the Interagency Working Group on Ocean and Coastal Mapping (co-chaired by NOAA, the U.S. Army Corps of Engineers and the USGS, and includes many other federal agency mapping partners). This strategy builds from the 2016 National Coastal Mapping Strategy, extending offshore into the EEZ and Outer Continental Shelf.

NOAA envisions a **NOAA-wide** coordinated ocean mapping enterprise to leverage expertise, equipment, and resources across the agency. This effort will encompass those requirements that are held in common across different NOAA mission areas, and will be documented in the "NOAA Ocean Mapping Plan," under development.

Coast Survey has broad responsibilities for ocean mapping in the US EEZ, but also has specific responsibilities for maintaining nautical charts for safe navigation. The remainder of this

document addresses both these unique requirements and the intersection of these requirements with the NOAA-wide effort. Coast Survey will continue to publish a NOAA Hydrographic Surveys Priorities document, which will serve as the 3-5 year execution plan.

Coast Survey has three major priorities that will fit within the NOAA Ocean Mapping Plan:

1) Discrepancies

NOAA Charts represent data from various sources. New features are added daily to our charts from mariner reports. These features do not always contain an accurate position, and in some cases may not contain a position at all, but are charted with an abundance of caution to help inform the mariner of potential dangers in the area. Over time, these charting discrepancies may build up on certain charts and erode the mariners confidence in the chart's accuracy. They can be identified on the chart with abbreviations like "ED" for existence doubtful, or "PA" for position approximate, or simply a wreck or obstruction with an attached note saying "reported" to indicate no official or accurate information exists. There are around 10,000 discrepancies on NOAA charts. Coast Survey will target charted discrepancies that come through both official federal channels as well as unofficial channels from our partner organizations like the U.S. Power Squadron and Active Captain reports, and either accurately position, map, and identify these discrepancies, or disprove their existence to improve the veracity of NOAA chart products.

2) Ports, Harbors, Anchorages, and Fairways

Since 2000, the total value of international trade has risen by over 40% and is becoming a larger part of our national economy. The combined value of foreign trade (imports and exports) represented 13% of GDP in 1990, rising to nearly 22% in 2006. If this trend continues, it is projected that the value of U.S. foreign trade will be equivalent to 35% of the Nation's GDP in 2020 and 60% in 2030. Marine transportation will become even more important to our economy as 95% of America's foreign trade is moved by ship. In 2016 alone, the U.S. maritime transportation system carried \$1.5 trillion of cargo through U.S. seaports to and from our international trading partners. Ensuring these trade routes are safe and well-maintained is vital to our country. As the sizes of ships continue to grow and they test the limits of the waterways they traverse, it is even more important that these waterways remain well-surveyed.

There are more than 68,000 square nautical miles of ports, harbors, anchorages, and fairways in the U.S. Only 500 square nautical miles of this area are surveyed with any regularity as a result of dredging operations. NOAA's annual survey production rate ranges between 2,800-3,000 square nautical miles per year. In order to maintain these waterways to support the increased usage they will see, it will be important for NOAA to increase this production rate significantly. These production increases can be achieved through increased appropriations for contract surveys, investment in automated processes and unmanned systems, and recapitalizing NOAA's aging fleet of hydrographic survey ships.

3) Interdisciplinary Mapping

There is broad interest in ocean mapping both within NOAA and across state and federal agencies, academia, NGOs, and the private sector. Coast Survey's expertise enables a value-added, interdisciplinary approach to its own and partner mapping projects per the Integrated Ocean and Coastal Mapping initiative to "map once, use many times." Coast Survey will work to combine funding, resources, and expertise wherever possible to logically and methodically map

the U.S. EEZ with other partners to maximize the value to the American public. It will also aggressively seek out existing data acquired by other federal, state, and local agencies where it exists. These actions are the most effective means to achieve a high resolution map of our EEZ to benefit the safe and efficient management of our submerged territory.

Coast Survey has a proven system for managing hydrographic surveys that can be offered as in-kind services to potential collaborators. These include:

1. Hydrographic expertise ahead of, during and/or after survey projects.
2. Developing hydrographic survey specification and deliverables.
3. Providing existing contract vehicles.
4. Executing large survey contracts.
5. Managing these contracts during acquisition and delivery.
6. Applying sound engineering practice to ensure the quality of these data.
7. Helping partners ensure they meet the Presidential mandate to make data collected with federal funds accessible to the public through the Public Access to Research Results (PARR) by managing metadata and submission requirement to the National Center for Environmental Information (NCEI).

We believe organized collaboration with a common vision offers the most effective way to map the entire EEZ and continue to perfect this approach. These three strategic ocean mapping priorities provide a sound foundation upon which to continue to provide quality navigation products to the maritime community while exploring the 50% of our nation that lies underwater and contains a trove of natural resources to be discovered, managed, and protected.

Table of Regional Ocean Mapping Coverage

<i>Region</i>	<i>EEZ Area (km²)</i>	<i>Surveyed Area (2009) (km²)</i>	<i>Surveyed Area (2015) (km²)</i>	<i>% Surveyed (2009)</i>	<i>% Surveyed (2015)</i>
Alaska - Arctic	512,047	33,687	43,201	7%	8%
Alaska - Bering Sea/Aleutian Islands/Gulf of Alaska/SE Alaska	3,193,774	508,491	398,291	16%	12%
American Samoa	404,364	79,113	108,526	20%	27%
Caribbean	211,074	78,716	106,364	37%	50%
East Coast	909,520	369,778	338,902	41%	37%
Gulf of Mexico	712,776	212,951	224,802	30%	32%
Hawaiian Islands and Johnston Atoll	2,916,999	645,865	1,120,073	22%	38%
Howland and Baker Islands	434,890	17,920	18,324	4%	4%

N. Mariana Islands	970,800	323,441	573,822	33%	59%
Palmyra Atoll-Kingman Reef Jarvis Island	661,500	60,086	193,695	9%	29%
Wake Island	407,779	8,348	44,367	2%	11%
West Coast	822,202	496,921	436,555	60%	53%
Totals	12,157,725	2,835,317	3,606,924	23%	30%

(Multibeam Sonar Survey Coverage of the U.S. Exclusive Economic Zone, November, 2015,
Mashkooor Malik^a, Evan Robertson^b and Barry W. Eakins^b)

^aNOAA Office of Ocean Exploration and Research (OER), Silver Spring, MD

^bCooperative Institute for Research in Environmental Sciences (CIRES), NOAA National Centers for Environmental Information (NCEI), Colorado Boulder.