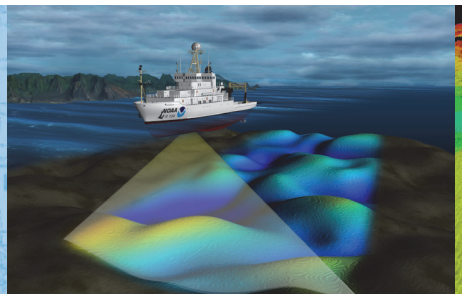
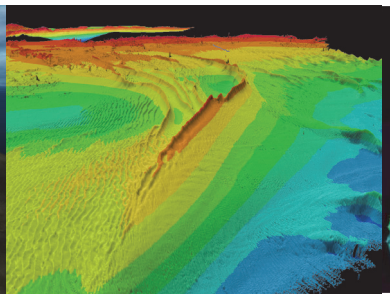
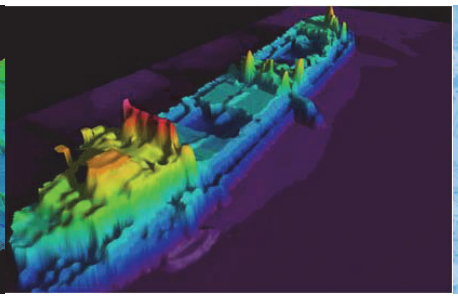
Office of
Coast Survey

NOAA Hydrographic Survey Priorities

2012 Edition

Available online at http://www.nauticalcharts.noaa.gov/hsd/NHSP.htm

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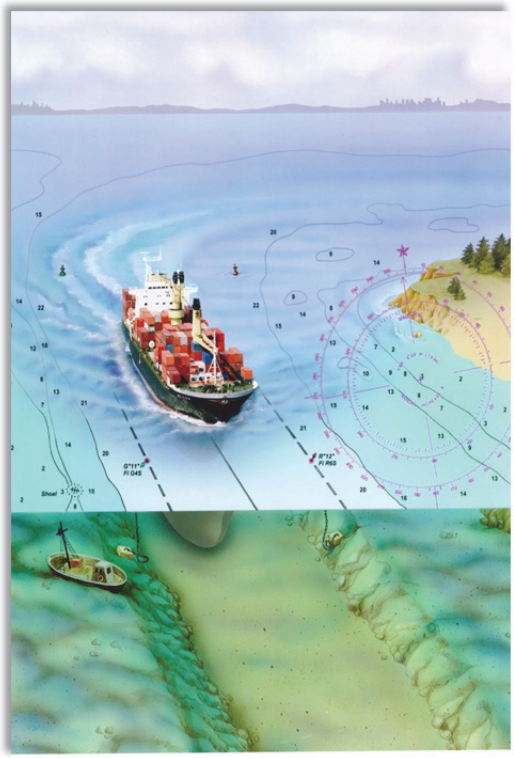
Introduction and Explanation

NOAA Hydrographic Survey Priorities

Introduction

The statutory mandate of the National Oceanic and Atmospheric Administration (NOAA) authorizes NOAA to provide nautical charts and related hydrographic information for the safe navigation of maritime commerce. It also authorizes NOAA to provide basic data for engineering, scientific, and other commercial and industrial activities. This mandate covers all U.S. territorial waters and the U.S. Exclusive Economic Zone (EEZ), a combined area of 3.4 million square nautical miles (SNM) that extends 200 nautical miles offshore from the nation's coastline. The production of high quality navigation charts to support the safety of marine transportation depends on the availability of up-to-date, reliable hydrographic survey data.



Safe and efficient movement of goods through U.S. ports is vital to maintaining a competitive standing in the global economy. Well over a billion tons of imports and exports, valued at $1.4 trillion, were shipped through U.S. ports in 2010.[1] Additionally, cruise ships carrying nearly 10 million passengers departed U.S. ports in 2010, with the cruise line industry accounting for $17 billion in direct spending in 2010[2]. U.S. ports, a key part of the maritime transportation system, face the challenge of rising freight movements over the next 10 to 15 years[3]. This steady growth in maritime commerce has already resulted in the evolution of the frequency, length, beam, and draft of ships carrying passengers or container vessels. They can now be as large as 1,300-foot long and 207-foot wide. Super tankers laden with petroleum or liquefied natural gas (LNG), that have greater than 60-foot drafts, are not uncommon on our nation's waterways today. Environmental damage caused by vessel groundings and collisions at sea is a continuing concern.

Recreational boating, another major contributor to the nation's economy, also relies on up-to-date nautical charts and supporting hydrographic survey data. As of 2010, there were over 12.4 million registered boats in the U.S.[4] The recreational boating industry contributed significantly to the U.S. economy, producing $30.4 billion in revenues during 2010[5].

Although primarily focused on addressing the backlog of critical hydrographic survey needs in commercial shipping areas, NOAA recognizes the importance of supporting the navigation safety requirements of recreational boaters on the nation's waterways, and will address them as available resources allow.

The nation's reliance on a reliable and safe marine transportation system requires NOAA's highly detailed nautical charts and supporting products.

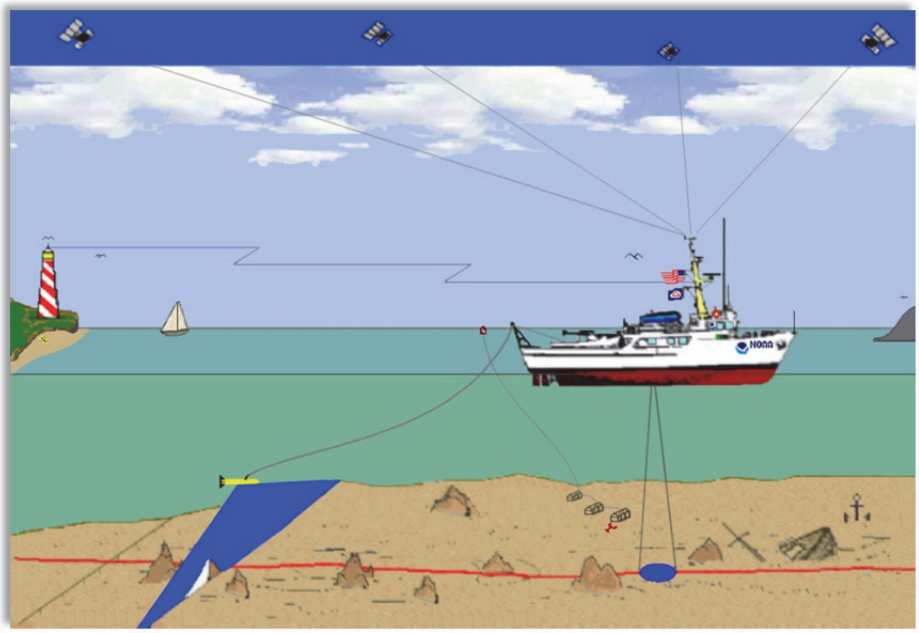
Navigational charts are the foundation of ocean transportation. America could not ship product overseas, fishermen could not gather the bounty of the oceans, and tankers could not bring oil to our refineries without the navigational charts produced by NOAA's Office of Coast Survey.

NOAA annually identifies and prioritizes the areas within its scope of navigation safety responsibilities, to determine which areas are in greatest need of hydrographic surveys, and to ensure the most efficient use of taxpayer-provided resources. *NOAA Hydrographic Survey Priorities* (NHSP) is a consolidated snapshot of generalized area outlines depicting the current hydrographic needs of the nation. The nation's survey requirements are reprioritized periodically to address the dynamic trends in waterborne commerce, the increasing size and draft of commercial vessels, sea-floor changes due to natural and man-made processes, and the ability to produce more precise hydrographic survey coverage utilizing modern technologies. The 2012 edition of the *NOAA Hydrographic Survey Priorities* is available on the Web at http://www.nauticalcharts.noaa.gov/hsd/NHSP.htm.

The 2012 Edition

The intent of the NHSP is twofold: provide a concise reference to the hydrographic survey needs of the nation; and outline planning priorities of survey projects.

This 2012 edition reflects all the surveys completed through the 2011 calendar year. An additional 908 square nautical miles (SNM) of critical area was completed since the 2011 edition of the *NHSP*. Of the established 43,000 SNM of critical area, 14,068 SNM remains to be surveyed.



Mileage Calculations in the NHSP and Limitations of the Area Delineations

The graphics and SNM area calculations in the NHSP are estimates based on generalized layouts, and are subject to imprecision of +/-10% or more. When a survey is conducted, the resulting data submitted for charting are typically represented at a scale ranging from 1:10,000 to 1:40,000. This is up to 200 times more detail than represented in the NHSP GIS files. Representation of the vast area under NOAA's mandated responsibility for hydrographic survey requires generalization, and must allow for imprecision in calculating area between the planned areas and actual accomplishments in the field.

Critical Need for Modern Surveys

To meet its charting mandate, NOAA maintains a suite of approximately 1,000 nautical charts that cover the EEZ. Many areas portrayed on nautical charts have never been adequately surveyed, largely because of the limitations of technology when the earlier surveys were conducted. Additionally, discrete point sounding distributions on smooth sheets can be more than 500 meters apart, potentially missing crucial shoals or other navigationally significant features, and may not reflect actual water depths throughout the surrounding area.

Historic surveys prove insufficient on modern charts for many reasons. Present sounding inventories represent a partial description of the seafloor. Widely spaced survey lines may not contain enough soundings to detect rocks and obstructions that protrude above the sea bottom. Many navigation areas are dynamic – shifting shoals, wrecks, and changing shorelines are hazards that warrant routine measurement. Historical sounding positions are less accurate than positioning available to modern vessels using the Global Positioning System (GPS) and Electronic Chart Display and Information Systems (ECDIS). Navigators may not understand these and other accuracy limitations of data from historical surveys, and may inadvertently place their vessels at risk.

Hydrographic Surveying is the Foundation of Nautical Charts

The principle objectives of a hydrographic survey are data collection and compilation for nautical charts. Survey data also support a variety of maritime functions:, port and harbor maintenance (dredging), coastal engineering (subsidence assessments and restoration projects), coastal management, and offshore resource development. The primary data associated with hydrographic surveys are water depth (bathymetry) and object detection. However, there is also considerable interest in sea-floor texture and composition (i.e., sand, mud, rocks) because of implications for anchoring, dredging, marine construction, pipeline and cable routing, tsunamis, and storm surge modeling. The bathymetric, backscatter, and side scan sonar data also supports other NOAA missions, such as fish habitat characterization, bottom type classification, and submerged cultural resources management.

To acquire data for nautical chart updates, NOAA selects a survey area and deploys resources. After extensive planning, NOAA or contractor survey teams calibrate all echosounders and vessel orientation and positioning systems to assure proper equipment operation. Data accuracy must comply with predetermined specifications, and each individual depth measurement corrected for the speed of sound through the water column, vessel heave, pitch and roll, vessel configuration offsets, water level, and other factors in effect at the time each measurement was acquired. Field units conduct frequent conductivity, temperature, and depth measurements, to apply proper sound speed corrections to sounding data. Water level stations monitor water level variations in the survey area to provide corrections and reduce

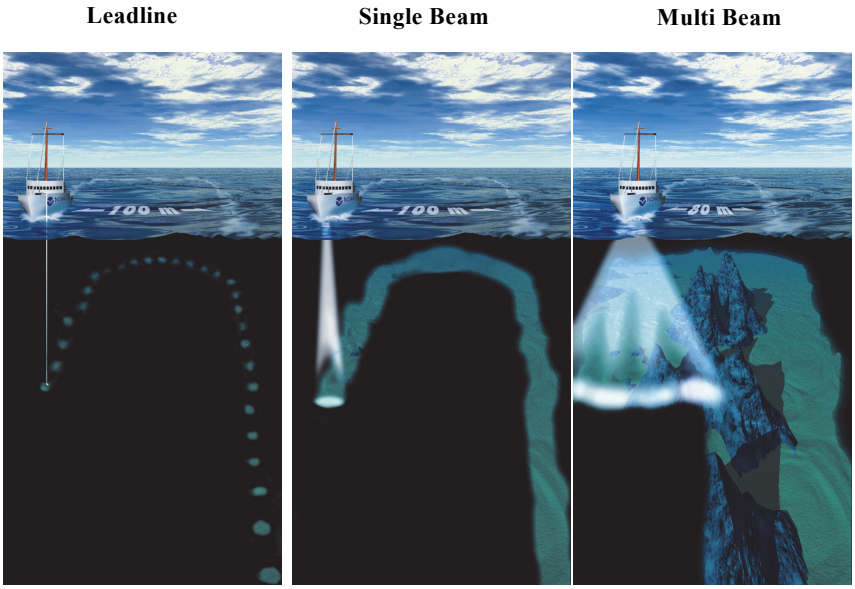
data to the proper tidal datum. NOAA Center for Operational Oceanographic Products and Services (CO-OPS) receives water level information via geostationary satellites and continuously monitors transmissions to detect instrument malfunctions.

GPS satellite systems provide precise positioning for survey data, and the U.S. Coast Guard Differential GPS (DGPS) network adds an additional assurance of accuracy.. Fixed land stations monitor variations in GPS satellite signals and transmit correctors to survey platforms during data acquisition. DGPS broadcast sites provide correctors for most survey areas, but remote areas, such as some areas in Alaska, require the placement and maintenance of independent DGPS ground reference stations.

Primary depth measurements are acquired with multibeam echosounder, or with a single beam echosounder if multibeam is not available. Multibeam technology obtains hundreds more soundings per unit time than single beam systems and covers a wide swath of the ocean floor. Some field units employ side scan sonar systems, which use a towed instrument to assist in detecting objects (wrecks, rocks, or other obstructions) that project from the sea floor. As potential hazards to navigation, these objects must be fully investigated and verified by multibeam or divers. Side scan sonar and multibeam are modern systems that provide nearly 100 percent bottom coverage of the sea floor, greatly enhancing the ability to detect hazards undiscovered by earlier, less modern surveys.

NOAA also uses Light Detection and Ranging (LIDAR) technology to collect hydrographic data in near shore areas where conditions are suitable. This technology increases safety and efficiency of launch operations by allowing the vessels to spend less time in shallow hazardous regions where the echosounder swath widths are smallest. LIDAR, however, does not provide the object detection capabilities of multibeam, so some follow-up multibeam work is generally required in irregular sea-floor areas to resolve ambiguities in the LIDAR data and to perform least depth measurements on significant obstructions.

Bottom Coverage Comparison by Survey Method



Once data is acquired by hydrographers, it must undergo substantial processing, both in the field and then in Coast Survey's hydrographic branches. The technicians use strict quality controls to produce a digital

version of the survey that is validated and compiled for updating nautical charts and archiving. A descriptive report accompanies each survey and provides detailed descriptions of items that cannot be explained in graphic form. Official survey products are available at the National Geophysical Data Center website http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html.

A hydrographic survey incorporates other measurements or observations, including precise positioning of aids to navigation, conspicuous landmarks, and offshore drilling structures. The survey may also incorporate reports from sampling of the sea floor bottom material, to determine adequate anchorage areas. It also documents the variations in the shoreline location or features along the shore (new piers, pilings, bulkheads).

Prioritizing Survey Needs

NOAA must prioritize areas in need of surveying to maximize limited resources. To accomplish this, NOAA first examined the 3.4 million square nautical miles of the EEZ for navigational significance, based on water depth, draft of ships utilizing the regions, and potential for pinnacle rocks or other dangers to marine navigation due to irregular seafloor topography. From this examination, NOAA determined that approximately 500,000 square nautical miles of the EEZ are "navigationally significant." The navigationally significant areas were then prioritized using a number of factors: 1) shipping tonnage and trends; 2) vintage of surveys in the area (year, equipment, and processes utilized); 3) under-keel clearance of vessels; 4) potential for unknown dangers to navigation due to dynamic bottom or human influence; and 5) requests for surveys from Pilot Associations, the U.S. Coast Guard, and the marine community through NOAA's Regional Navigation Managers.

Defining "Navigationally Significant"

Because of varying characteristics of the seafloor, navigationally significant areas are defined by different criteria. For instance, the offshore limit of the navigationally significant area of southern Alaska and the Pacific Islands is defined to be 100 fathoms, because of the rugged nature of the bottom. From shore, depths increase rapidly, but offshore rocky pinnacles rise from great depths to create potential hazards to navigation. Along the East and West Coasts, where this type of bottom configuration is much less likely to occur, a 20-fathom offshore limit is adequate to protect against likely natural hazards.

The offshore depth limits of navigationally significant areas are defined as:

- 20 fathoms (120 feet) along the Atlantic and Pacific coasts
- 20 fathoms (120 feet) in the eastern Gulf of Mexico
- 50 fathoms (300 feet) in the western Gulf of Mexico
- 20 fathoms (120 feet) along the north slope of Alaska
- 50 fathoms (300 feet) in western Alaska (from the Pribilof Islands North)
- 100 fathoms (600 feet) in the remainder of Alaska
- 20 fathoms (120 feet) in the Caribbean around Puerto Rico and Virgin Islands
- 100 fathoms (600 feet) in the Pacific Islands

The fjords and sounds of the Pacific Northwest and Alaska are an exception to the depth limit. In these narrow waterways, the navigationally significant area extends from shoreline to shoreline, regardless of

depth, to avoid a narrow strip of unprioritized (and unsurveyed) area down the center of the fjord. In addition, in the Great Lakes, the navigationally significant area also extends from shoreline to shoreline or from shore to the U.S./Canada maritime border.

Identifying Critical Areas

NOAA then subdivides navigationally significant areas, based on the need for hydrographic surveys. The highest priority areas are "critical areas." Critical survey areas are waterways with high commercial traffic volumes (cargo, fishing vessels, cruise ships, ferries, etc.); extensive petroleum, liquefied natural gas or hazardous material transport; compelling requests from users; or transiting vessels with low under-keel clearance over the seafloor.

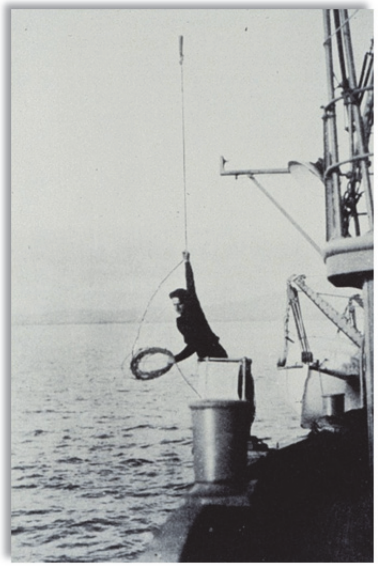
In 1994, NOAA identified approximately 43,000 square nautical miles, primarily coastal shipping lanes and approaches to major U.S. ports, as critical areas. NOAA reviews and updates the classification of these critical areas periodically.

The critical survey area encompasses less than 1.5 percent of the entire U.S. EEZ; and represents only 9 percent of the navigationally significant areas. Over 40 percent of all critical survey areas are in Alaskan waters.

Designating "Emerging Critical Area"

"Emerging critical areas" meet the definition of critical area, but are can be tracked separately from the 43,000 SNM estimate established in 1994. NOAA delineated emerging critical areas in the Gulf of Mexico and in Alaskan waters surrounding Kodiak Island.

Portions of the Gulf were last surveyed in the 1800s using leadline technology. These areas have major hubs for deeper draft commercial traffic due to growth in the petroleum industry. Some charted areas have reported discrepancies of tens of feet from actual depths.



Kodiak, Alaska, is another area with expansive areas of 1800s vintage – or no – survey coverage at all. The area has seen an increase in commercial fishing and eco-tour traffic that hug the coastline, and has significant tectonic forces that have altered the seafloor since earlier surveys.

Establishing "Resurvey Areas"

The examination of an area with modern survey methods does not preclude the need for subsequent surveys. Some areas require periodic survey due to naturally occurring changes (e.g., silting, shoal migration, earthquakes), use by increased size vessels, or other changes in the navigational use of the area. Because most resurvey requirements are driven by natural changes to the seafloor, the time frame for resurveying varies by area. For example, Fire Island Shoal in Anchorage, Alaska, should be resurveyed every two to three years, while portions of the approaches to Chesapeake Bay and Delaware Bay should be resurveyed every five to seven years. The resurvey area delineations are more generalized than the critical and priority area delineations. Over 9,200 square nautical miles have been defined as resurvey areas.

Priority 1 – 5 Areas

The remaining navigationally significant areas have been subdivided into five priority levels, based on the age of prior surveys and, to a lesser extent, vessel usage. There are three technological eras: pre-1940 surveys, done with leadline soundings and sextant positioning; 1940 to 1970 surveys, using single beam echo sounders and improved positioning methods (including some electronic positioning); and 1970 to 1993 surveys, utilizing modern automated survey technologies, electronic positioning and, in later years, DGPS positioning.

Priority One

Assigned to navigationally significant areas that have pre-1940 surveys and annual:

petroleum transports over 1,000,000 tons; or
coal transports over 600,000; or
chemical transport over 100,000 tons; or
cargo traffic over 5,000,000 tons; or
passenger transport over 10,000 persons.

Priority One classification was also assigned to some areas not classified as critical, but containing charted safety fairways, anchorages, increasing traffic volume, or a potential for previously undetected or recently created man-made or natural obstructions

Approximately 46,500 SNM are defined as Priority One.

Priority Two

Assigned to navigationally significant areas that have pre-1940 surveys, but no specified traffic level.

Approximately 116,800 SNM are defined as Priority Two.

Priority Three

Assigned to navigationally significant areas that have pre-1970 surveys that have not been categorized previously as Priority One or Two.

Approximately 99,100 SNM are defined as Priority Three.

Priority Four

Assigned to those areas with surveys completed between 1970 and 1994 that have not been defined as a critical area. Surveys conducted between 1970 and 1994 utilized electronic navigation and digital data acquisition and processing systems. However, these surveys were not necessarily performed with the near full bottom coverage technology used today.

Approximately 58,300 SNM are defined as Priority Four.

Priority Five

Assigned to areas in the Gulf of Mexico and Alaska regions that are of greater depth, 20-50 fathoms in the Gulf of Mexico, and 50-100 fathoms in Alaska, which have unsurveyed areas or pre-1940 prior surveys. Although posing less risk to navigation due to the deeper waters, these areas need to be surveyed because there is still a potential for obstructions (e.g. submerged wellheads) or highly irregular sea-floor topography with pinnacle rocks.

Approximately 131,700 SNM are defined as Priority Five.

Completed Surveys Assigned to "Full Bottom Coverage Era"

Areas surveyed since the beginning of 1994 are classified as "full bottom coverage era" surveys, and are represented on the prioritization graphics. This era reflects the common use of modern side scan sonar, multibeam, and LIDAR technologies that provide ensonification of the bottom. These technologies greatly reduce detection errors, in contrast with earlier generation technology that utilized point or line sampling that may not detect dangerous bottom features.

Some areas surveyed during this era may need periodic resurvey due to the high potential for changes in the seafloor due to natural or man-made factors. As of the date of this edition, NOAA has surveyed approximately 39,100 SNM of navigationally significant area from the full bottom coverage era. NOAA will continue to add completed surveys to this classification each year.

Square Nautical Mile Breakout of NHSP Priority Categories

The table below shows the estimated mileage breakout, in square nautical miles, of each NHSP category. These figures were calculated using GIS tools, and are subject to imprecision due to the generalized nature of the priority and historical survey area delineations, and the represented scale of the NHSP.

Square Nautical Mile Breakout* of NHSP Priority Categories**

	Navig. Significant	Critical Areas	Emerging Critical	Priority 1 Areas	Priority 2 Areas	Priority 3 Areas	Priority 4 Areas	Priority 5 Areas	Completed (post-1993 survey)
East Coast	53,419	1,966	0	6,945	5,789	15,560	14,299	0	8,860
Gulf of Mexico	73,459	7,552	2,055	10,812	7,976	14,355	8,596	14,368	7,745
West Coast	5,397	109	6	39	1,803	786	737	0	1,917
Alaska	324,465	4,169	3,540	23,752	93,761	34,463	28,175	117,350	19,255
Great Lakes	46,136	215	0	4,915	3,002	32,593	5,324	0	87
Hawaii and Pacific Is.	6,617	22	0	1	4,286	962	648	0	698
Caribbean Islands	1,558	22	0	38	184	339	524	0	451
Total	511,051	14,055	5,601	46,502	116,801	99,058	58,303	131,718	39,013

*Calculations derived from generalized area delineations; estimated accuracy is +/- 10%

**There are approximately 9,200 SNM of resurvey area for the U.S.

Planning the Annual Survey

The NHSP is the base reference for long-term scheduling of hydrographic survey projects. For more short-term scheduling, the critical and priority areas are matched against urgent needs (recent groundings, accidents, etc.); compelling requests from the user community; traffic volume; and greatest potential for dangers to navigation. Other operational constraints (e.g. sea ice, seasonal weather patterns) are taken into account when developing annual survey plans.

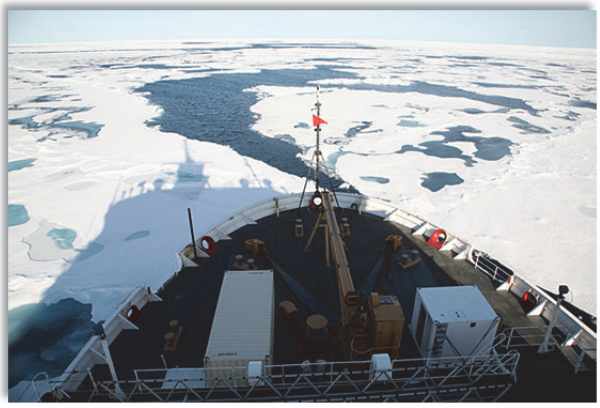
NOAA schedules large-scale regional activities several years in advance. Programs supporting hydrographic surveys then have sufficient time to provide detailed shoreline data from remote sensing sources, and to establish tide zoning and gauge requirements for water level corrections. NOAA strives to

address critical areas first, and will survey priority and resurvey areas in conjunction with critical areas to make the most efficient use of survey platforms.

Preparing for Emerging Arctic Priorities

"For centuries annual sea ice has protected the Arctic and its inhabitants. Now the Arctic, both on land and sea, is being transformed by significant warming. The melting of sea ice in the Arctic Ocean is happening at a faster pace than we had predicted, and an ice-diminished Arctic Ocean is creating many new opportunities."

Dr. Jane Lubchenco, NOAA Administrator



Changes in the Arctic – defined here as contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi Seas; and the Aleutian Chain[6] are affecting the scope and distribution of navigation in the region. To meet these emerging needs, NOAA Office of Coast Survey has engaged the Arctic maritime community to develop a plan. (See Appendix II.) In 2011, Coast Survey completed surveys in Kotzebue Sound, Kuskokwim River, and the Krenitzin Islands. In 2012, Coast Survey will complete a reconnaissance survey from Dutch Harbor through the Bering Strait and extending east through the Chuckchi and Beaufort Seas to the U.S.-Canadian maritime border..

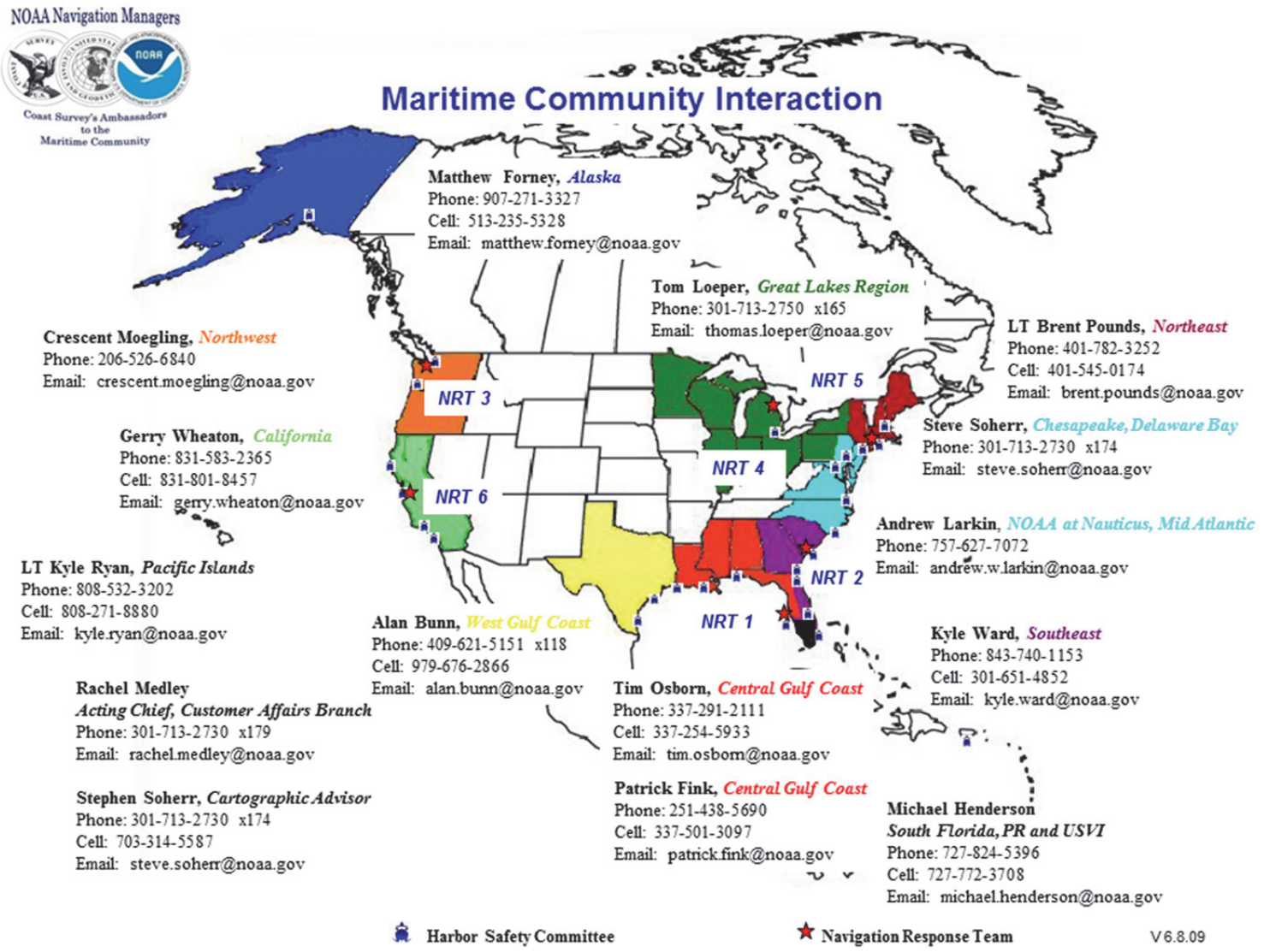
Due to the vast area needing surveys (almost 40,000 SNM) and our ongoing efforts to understand the changing requirements, we have not yet integrated these new priorities into this document. As NOAA continues to work with the Arctic community, Coast Survey will roll the new priorities into this document.

How to Submit Hydrographic Survey Needs to NOAA

This document is dynamic and evolves over time. The graphics are a snapshot of the current priorities. The areas and associated square mileage calculations are revised as surveys are completed and as shipping pattern change. For example, a port that is not defined today as "critical" may attain that status if shipping levels increase or if a new oil or liquefied natural gas terminal is built. Conversely, an area defined as "critical" today may drop to a lower priority if shipping levels decrease or a terminal closes.

We encourage the maritime transportation community to submit information to NOAA, to assist in prioritizing the nation's hydrographic survey needs. Please submit information and requests for hydrographic surveys or other NOAA navigation products and services through Office of Coast Survey's Regional Navigation Managers. (Contact information is provided in Appendix I.) Please submit any comments or questions regarding the *NOAA Hydrographic Survey Priorities* document to the Chief, Hydrographic Surveys Division of the Office of Coast Survey, at http://ocsdata.ncd.noaa.gov/dr/inquiry.asp.

The NHSP can be viewed on-line at http://www.nauticalcharts.noaa.gov/hsd/NHSP.htm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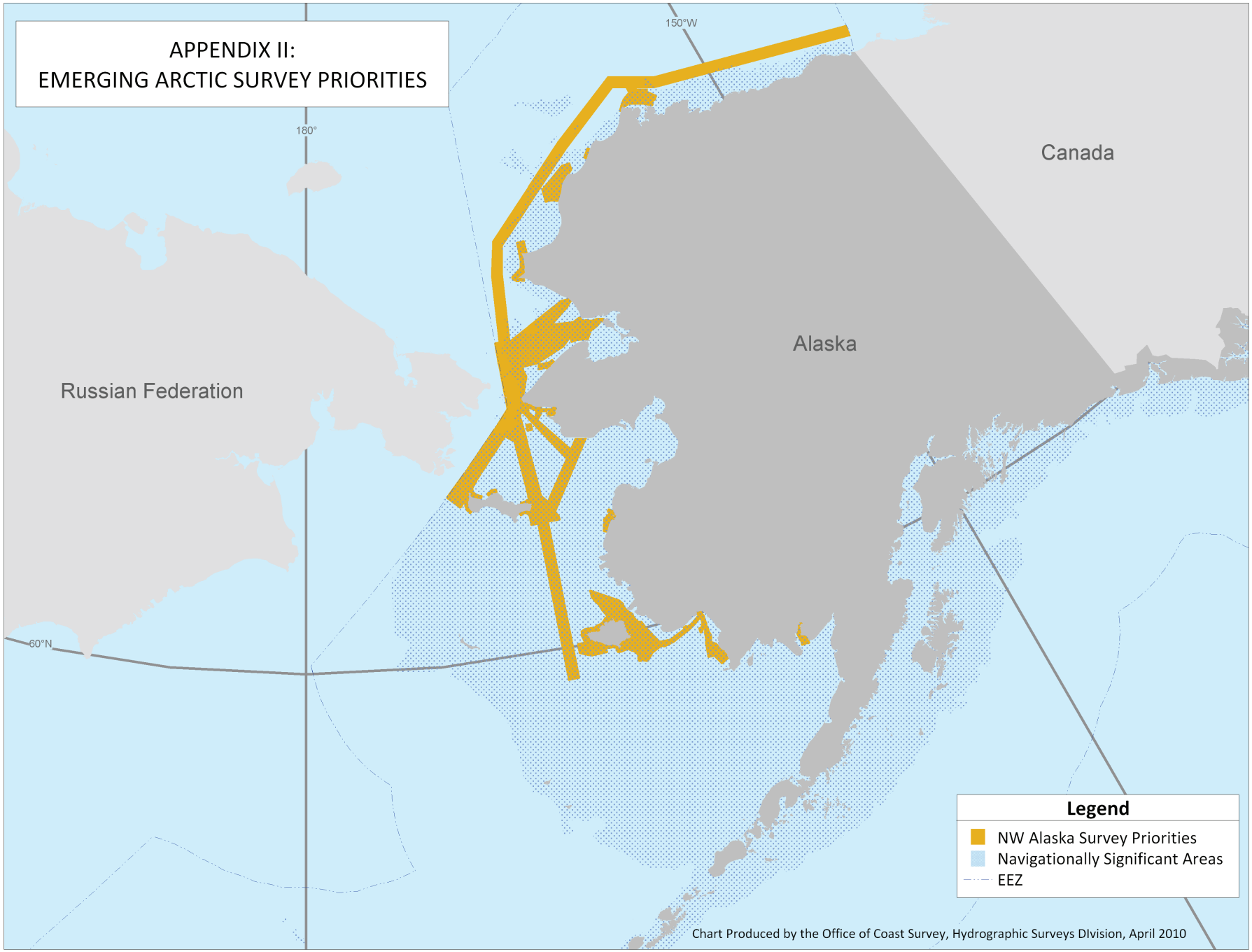
APPENDIX II:
EMERGING ARCTIC SURVEY PRIORITIES
150°W
180°
Canada
Alaska
Russian Federation
60°N
Legend
NW Alaska Survey Priorities
Navigationally Significant Areas
EEZ
Chart Produced by the Office of Coast Survey, Hydrographic Surveys DIvision, April 2010

REFERENCES

1. U.S. Department of Transportation, Bureau of Transportation Statistics, Research and Innovative Technology Administration, *Pocket Guide to Transportation 2012*, (January 2012).

2. Business Research & Economic Advisors (prepared for the Cruise Lines International Association), *Executive Summary – The Contribution of the North American Cruise Industry to the U.S. Economy in 2010*, (July 2011)

3. U.S. Department of Transportation, Maritime Administration (MARAD), *Leading the Future, 2008-2013 Strategic Plan*, (August 2008).

4. U.S. Department of Homeland Security, U.S. Coast Guard, Office of Auxiliary and Boating Safety, *Recreational Boating Statistics 2010*, (June 2011).

5. National Marine Manufacturers Association (NMMA), Industry Statistics and Research, *2010 Recreational Boating Statistical Abstract*, (2011).

6. U.S. Arctic Research Commission, *Arctic Boundary as defined by the Arctic Research and Policy Act (ARPA)*, (2009).