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INTERNATIONAL HYDROGRAPHIC ORGANIZATION
NATIONAL REPORT FROM UNITED STATES TO THE
ARHC-07

Submitted by:



National Oceanographic & Atmospheric Administration
<http://www.nauticalcharts.noaa.gov>



National Geospatial-Intelligence Agency
<http://msi.nga.mil/NGAPortal/MSI.portal>



United States Navy
<http://www.navmetocom.navy.mil>

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1. HYDROGRAPHIC OFFICE/SERVICE

This National Report provides specific information pertaining to individual products and services of primary interest to the Arctic Regional Hydrographic Commission (ARHC). Three government agencies are responsible for the management of U.S. domestic and international hydrographic products and services.

1.1 Government Agencies with hydrographic responsibilities in the Arctic Region

- 1.1.1 National Oceanic and Atmospheric Administration's (NOAA)¹ conducts hydrographic surveys and produces nautical charts and related hydrographic information within the nation's Economic Exclusion Zone (EEZ).
- 1.1.2 National Geospatial-Intelligence Agency (NGA)² provides nautical charts and related hydrographic information *outside* of the U.S. Economic Exclusion Zone and is the mapping and charting authority for the US Department of Defense and commercial mariners in areas outside the US where the US is designated as the charting authority.
- 1.1.3 The U.S. Navy³ conducts oceanographic, bathymetric, and hydrographic surveys worldwide to satisfy US Navy requirements.

1.2 United States Strategies for the Arctic

The harsh environment of the arctic region has historically served as a barrier to routine maritime operations. Now, changing conditions in the arctic are creating increased opportunity for peaceful interaction, collaboration, and pursuit of common interests. The United States has broad and fundamental interests in the Arctic Region. The strategic approach to the region, outlined by a national strategy, focuses on three lines of effort: advance United States security interests, pursue responsible Arctic region stewardship, and strengthen international cooperation.

¹ Primarily the Office of Coast Survey.

² Primarily Source Operations and Management Directorate, Foundation Group, Maritime Safety Office (MSO)

³ Primarily, Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCOM) and the Hydrographer of the Navy

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The Implementation Plan for the National Strategy for the Arctic Region⁴, the Department of Defense Arctic Strategy⁵, the U.S. Coast Guard Arctic Strategy⁶, the U.S. Navy Arctic Roadmap (2014-2030)⁷ and the National Oceanic and Atmospheric Administration Arctic Action Plan⁸ are the primary guidelines for the regional strategy. These documents align with the national strategy and collectively describe in detail the goals, objectives, functions and organizational relationships within and between the U.S. government agencies. Additionally, each of these strategic documents acknowledges the importance of international partnerships in addressing common challenges. The U.S. envisions an Arctic that is stable and free of conflict, where nations act responsibly in a spirit of trust and cooperation.

1.3 United States Open Data Policy – Managing Information as an Asset

Information is a valuable national and global resource. The U.S. considers information a strategic asset to the U.S. Federal Government, its partners and the public. In order to ensure the U.S. Federal Government is taking full advantage of its information resources, agencies are working to increase operational efficiencies, reduce costs, improve services, support mission needs, and increase public access to valuable government information. The access to data and services, usable to the public, can help fuel entrepreneurship, innovation, and scientific discovery – all of which improve lives and contribute significantly to job creation.⁹

Many hydrographic data, products, and services produced by U.S. Hydrographic Offices (HO's) are available for download at no cost. NOAA provides nautical products, services, and web deliveries of digital versions of most data, which are available free to the public.

For access to survey data: <http://www.nauticalcharts.noaa.gov/hsd/hydrog.htm>

For access to charting data: <http://www.nauticalcharts.noaa.gov/staff/chartspubs.html>

In addition to Safety of Navigation products and services, the U.S. is committed to making the Safety of Navigation data available in a variety of formats for as many users as possible. ENC data (S-57) is available in GIS friendly format for non-traditional users, opening up HO data to a host of new customers and users. The U.S. has implemented new map services to allow others simple access to real-

⁴ National Strategy for the Arctic Region. (2013). Retrieved from https://obamawhitehouse.archives.gov/sites/default/files/docs/nat_arctic_strategy.pdf

⁵ Department of Defense Arctic Strategy. (2013). Retrieved from http://www.defense.gov/Portals/1/Documents/pubs/2013_Arctic_Strategy.pdf

⁶ U.S. Coast Guard Arctic Strategy. (2013). Retrieved from https://www.uscg.mil/seniorleadership/DOCS/CG_Arctic_Strategy.pdf

⁷ U.S. Navy Arctic Roadmap (2014 – 2030). (2014) Retrieved from http://www.navy.mil/docs/USN_arctic_roadmap.pdf

⁸ National Oceanic and Atmospheric Administration Arctic Action Plan. (2014). https://www.afsc.noaa.gov/Publications/misc_pdf/NOAAarcticactionplan2014.pdf

⁹ Open Data Policy-Managing Information as an Asset. (2013). Retrieved from <https://obamawhitehouse.archives.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf>

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time access to data and created opportunities for near real-time coastal intelligence via interactive map viewers.

The NOAA ENC Direct to GIS website, http://www.nauticalcharts.noaa.gov/csdl/ctp/encdirect_new.htm, allows users to display, query and download all available NOAA ENC data in a variety of GIS/CAD formats, using Internet mapping technology. The NOAA NowCOAST web site (<http://Nowcoast.noaa.gov>) exemplifies the possibilities created by delivering data for broad customer use.

NGA has a public Arctic website (<http://nga.maps.arcgis.com>) to support the past U.S. Chair of the Arctic Council and the January 2015 U.S. Presidential Executive Order on Enhancing Coordination of National Efforts in the Arctic. The site, which was launched in 2015, serves to strengthen international cooperation, better understand and manage resources responsibly, enhance quality of life in the Arctic, and maintain valuable and vulnerable ecosystems. The webpage offers open data for download in several commonly used, geospatial formats for use in GIS applications. Additionally, many datasets are provided as web services using a dataset's GeoService link or GeoJSON. NGA's Arctic website also includes NGA nautical charts, sailing directions, Digital Elevation Models (DEMs), and a downloadable Pan-Arctic Map.

In September 2016, NGA and the National Science Foundation publicly released new 3-D topographic maps of Alaska. With the most recent ArcticDEM release on June 02, 2017, high-resolution elevation data is publicly available for majority of the Arctic region. The next DEM release, scheduled for September 06, 2017, will provide complete coverage of the Arctic. See Figure 1 for a view of current coverage map. The models are based on 2-meter and 5-meter resolution images captured by Digital Globe commercial satellites. This technology is significant in polar mapping as it allows for more thorough coverage of the Arctic than did traditional imagery collection by aircraft. This DEM data proved very valuable as it was utilized by local authorities after the recent earthquake and tsunami near Nuugaatsiaq, Greenland.

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Figure 1: NGA Arctic Digital Elevation Model Coverage

1.4 International Open Government Partnership (OGP)

OGP, launched in 2011, provides an international platform committed to making their governments more open, accountable, and responsive to citizens. Since then, OGP has grown from eight countries to the 75 participating countries. In all of these countries, government and civil society are working together to develop and implement action plans for ambitious open government reforms. Additional information regarding the OGP can be found at <http://www.opengovpartnership.org/>

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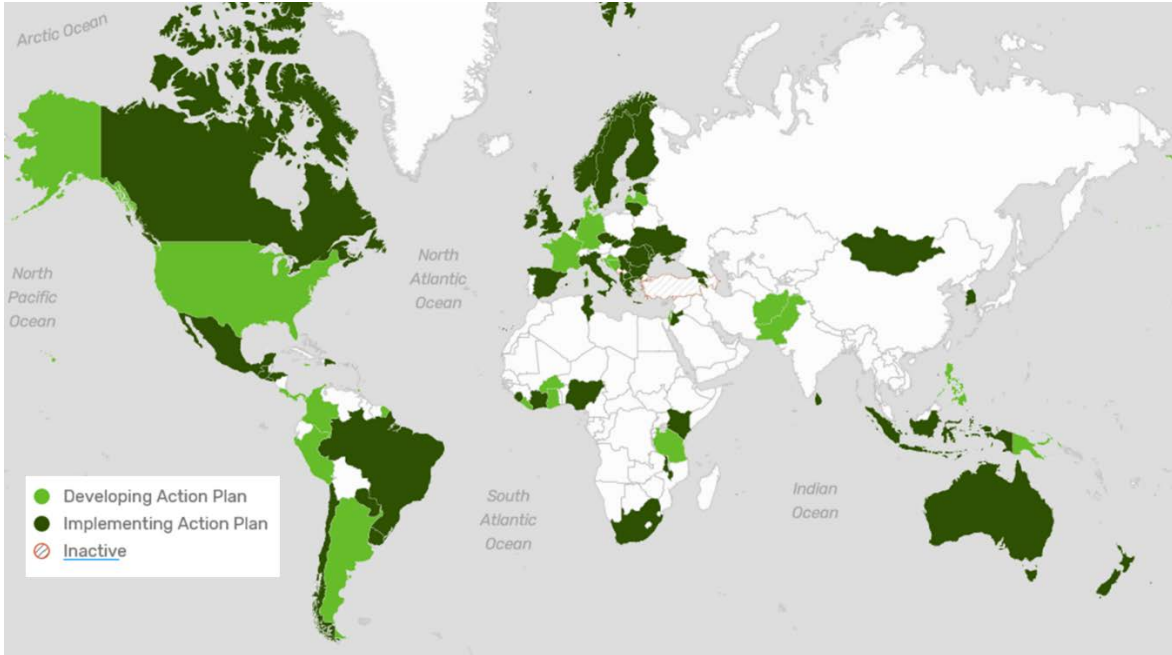


Figure 2: Participating ARHC member states within the OGP include Canada, Denmark, Norway, and the United States

2. SURVEYS

2.1 Surveys in U.S. Waters

NOAA provides nautical charts and related hydrographic information for the safe and efficient navigation of maritime commerce as well as providing basic data for engineering, scientific, and

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other commercial and industrial activities within the nation's 3.4 million square nautical mile EEZ and along its 95,000 miles of shoreline (Figure 3).

The NOAA Hydrographic Survey Priorities (<http://www.nauticalcharts.noaa.gov/hsd/NHSP.htm>) defines the methodology NOAA uses to identify survey priorities across the U.S. EEZ. NOAA hydrographic in-house field units or external contractors then conduct surveys to meet these priorities. Data acquired from these surveys must meet the NOS Hydrographic Surveys Specifications and Deliverables, an annually updated data specification guide. Those who acquire hydrographic survey data in accordance with NOS specifications should use the most up-to-date version of the document available at <http://www.nauticalcharts.noaa.gov/hsd/specs/specs.htm>.

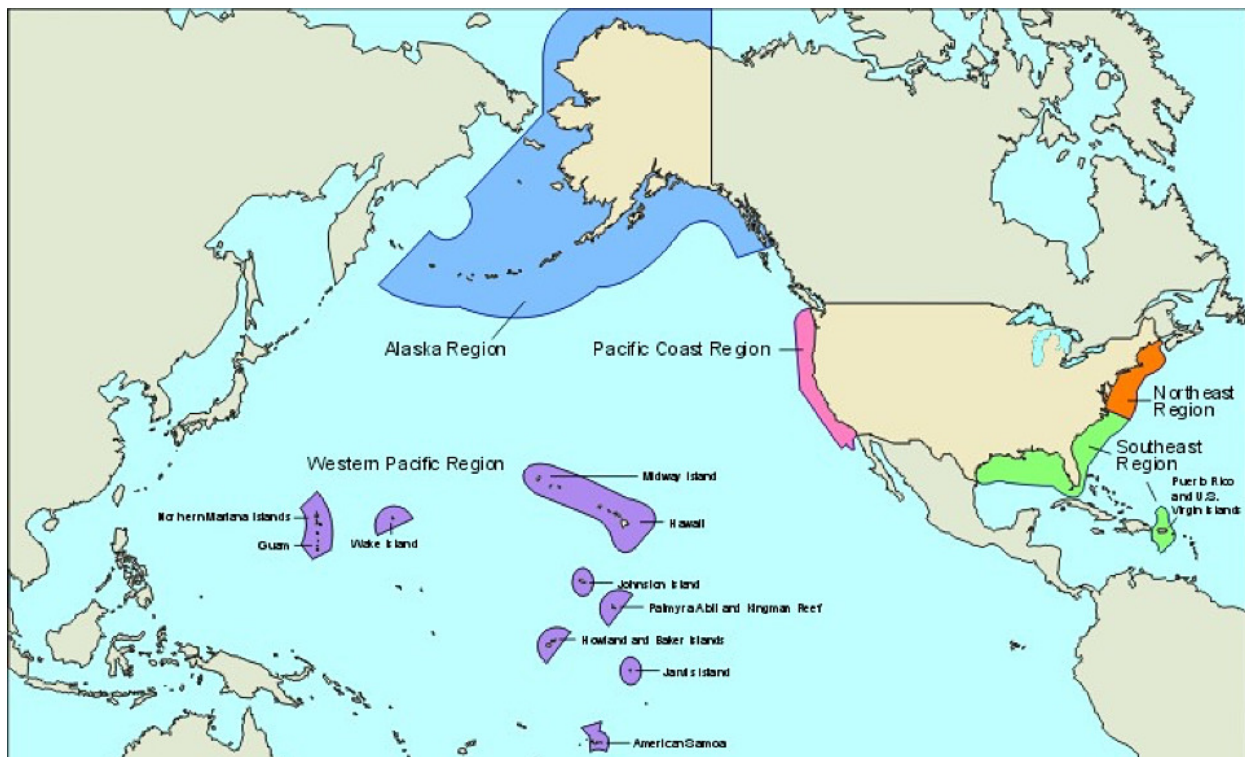


Figure 3: U.S Converge and EEZ

2.2 Surveys outside U.S. Waters

The U.S. Navy surveys waters outside the United States and in the territorial waters of other nations through diplomatic channels and international agreements. Hydrographic data and information from surveys conducted in territorial waters are shared between the US and the Host Nation.

2.3 U.S Hydrographic Survey Vessels

2.3.1 U.S. NAVY

The Naval Oceanographic Office (NAVOCEANO), a subordinate command of COMNAVMETCOM, currently has five Pathfinder Class 100-meter multi-purpose survey

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ships to conduct oceanographic, bathymetric, and hydrographic surveys in deep-ocean and coastal waters. These ships are USNS PATHFINDER (T-AGS 60), USNS MARY SEARS (T-AGS 65), USNS BOWDITCH (T-AGS 62), USNS HENSON (T-AGS 63), and USNS BRUCE C. HEEZEN (T-AGS 64). BOWDITCH, HENSON, and HEEZEN each carry two 10-meter hydrographic survey launches (HSLs).

USNS SUMNER (T-AGS 61) was inactivated in 2014 but the. The new ship, USNS MAURY (T-AGS 66), is being fitted out and will be delivered in early 2016 bringing NAVOCEANO's survey fleet back up to six ships. Maury is eight meters longer than previous ships of the class to accommodate a moon pool for operating unmanned underwater vehicles (UUV).

NAVOCEANO has upgraded its Airborne Coastal Survey (ACS) capability with the new Optech, Inc., Coastal Zone Mapping and Imaging LIDAR (CZMIL) system. The system is flown on a Basler BT-67, a refurbished DC-3. NAVOCEANO is currently using the new system to conduct airborne hydrographic surveys.

Fleet Survey Team (FST), a subordinate command of NAVOCEANO is comprised of approximately 65 military and civilian surveyors. FST employs various small craft for survey including two 9 meter Workskiff with amidships transducer moon pools and two Sea Arks, fitted with multi-beam and rapid littoral survey vehicles (RLSVs) which are personal water crafts fitted with a single beam echo sounder and side scan sonar. All FST craft can be transported aboard C-130 aircraft for rapid deployment. FST also maintains a year round stand by Fly-Away Team consisting of four personnel and survey gear to outfit boats of opportunity. This capability is used to address standard Navy survey requirements, but has also been employed to ensure clear approach corridors in support of humanitarian aid and disaster relief.

NAVOCEANO's survey ships, ACS aircraft, and FST have all been utilized in the past to conduct cooperative hydrographic surveys through Memoranda of Agreements (MOA) with countries in the region

2.3.2 National Oceanic and Atmospheric Administration

Using four NOAA ships, six 28-foot survey boats, a research vessel, a LIDAR-capable aircraft, and private contractors, NOAA acquires hydrographic data that can update the nation's nautical charts with the accuracy and precision that is essential to maintain the public trust in navigational products.

The NOAA ship Fairweather is a survey vessel designed and outfitted primarily for conducting hydrographic surveys to support nautical charting however, the ship is capable of many other missions in support of NOAA programs. The ship is equipped with the latest in hydrographic survey technology –: multi-beam survey systems; high-speed, high-resolution side-scan sonar; position and orientation systems, hydrographic survey launches, and an on-board data-processing server. With increased mission space and deck machinery, the Fairweather can be tasked with

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anything from buoy operations to fisheries research cruises. The Fairweather primarily operates in Alaskan coastal waters.

NOAA Ship Rainier is one of the most modern and productive hydrographic survey platforms of its type in the world. The ship is a survey vessel designed and outfitted for conducting coastal hydrographic surveys in support of NOAA's nautical charting program. The ship supports high-precision near-shore surveys. The ship operates off the U.S. Pacific Coast, and in Alaskan coastal waters.

Homeported in Norfolk, Virginia, NOAA Ship Thomas Jefferson is a hydrographic survey vessel that maps the ocean to aid maritime commerce, improve coastal resilience, and understand the marine environment.

Homeported in New Castle, New Hampshire, NOAA Ship Ferdinand R. Hassler is one of the newest ships in NOAA's fleet of research and survey vessels that map the ocean to aid maritime commerce, improve coastal resilience, and understand the marine environment.

2.4 Current NOAA Arctic Activity

During 2017, NOAA is focusing Alaskan data acquisition operations in the following priority areas: George Inlet, Carroll Inlet, and Approaches to George and Carroll Inlets. In July 2017, *Fairweather* surveyed a portion of the Bering Strait Corridor, from the U.S. Coast Guard Port Access Route Study (PARS) corridor to offshore of the Yukon River delta. The PARS region is part of a NOAA-led Arctic marine corridor project, in collaboration with the U.S. Coast Guard, which assesses the safety of a potential Arctic shipping route from Unimak Island through the Bering Strait to the Chukchi Sea. In addition to data acquisition on the larger survey vessel, the *Fairweather*, two hydrographic launches acquired survey data in the Approaches to Yukon River. Data acquisition during this portion of the survey identified some channels, collected data to check satellite derived bathymetry and surveyed in some areas with less than 2 m under keel.

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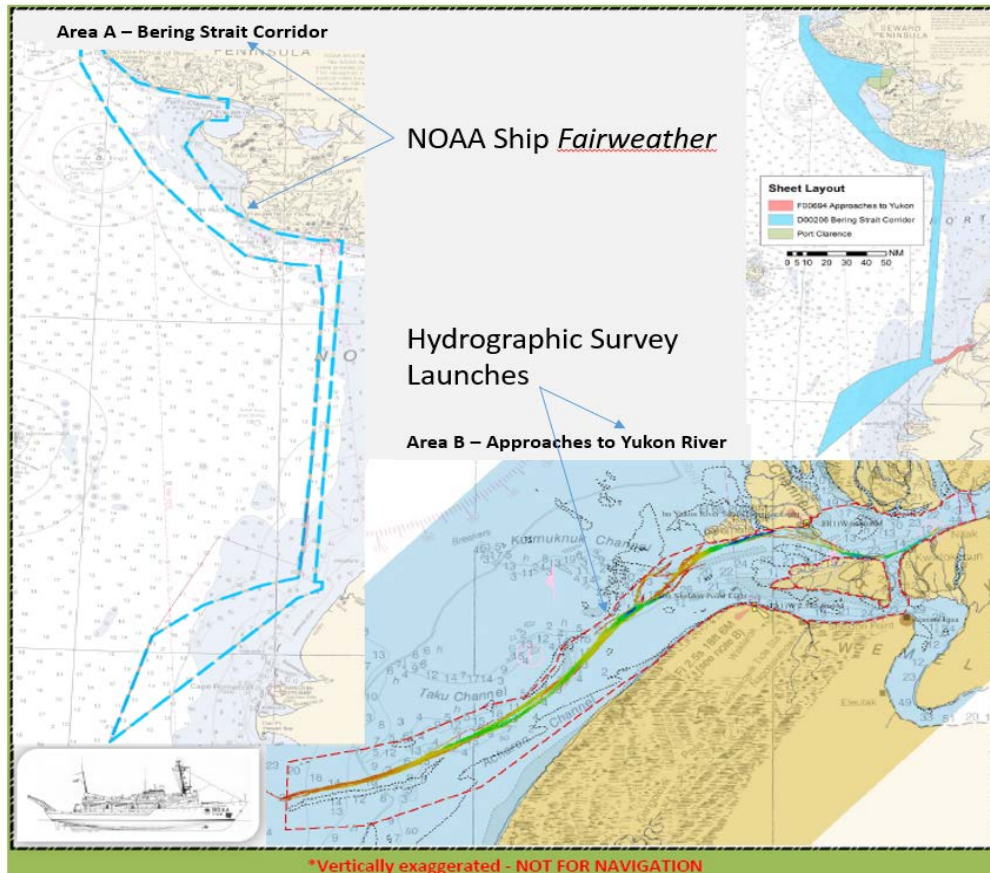


Figure 4: Current Arctic Hydrographic Survey Activities

NOAA's tribal liaison office that has a handbook on how to interact with local communities, and detailing the requirements for consultation. NOAA's Office of Coast Survey utilizes its navigation manager of Alaska in this capacity to conduct outreach with the local villages and communities to make sure that there will be no conflict due the survey operations. Additionally, NOAA is working closely with the native hunting groups to identify when and where hunting activities take place and ensure NOAA vessels schedule around these dates and locations.

NOAA is also currently identifying funding streams and partnerships to utilize local native communities to conduct the hydrographic surveys in shoal waters along the coast and up rivers in western and high Arctic Alaska. With these communities relying on barge traffic to reach them for resupply, the local community has an interest in getting these this commerce to them in a more efficient and safe manner. NOAA is looking at grants and partnerships with education institutes, grants or other federal agencies to find ways for the local community to learn how to collect the data and send it to NOAA for processing. The idea is to make this effort expandable to other fields of observation and science, and to make this model valid for our international partners as well.

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3. NEW CHARTS AND UPDATES

3.1 National Charting Plan (NCP)

The NCP¹⁰ is a strategy to improve NOAA nautical chart coverage, products, and distribution. The NCP briefly describes the evolving state of marine navigation, data collection, and chart compilation and explains how changes in technology will affect both the raster and vector NOAA marine chart suites. The plan also describes some of the steps that NOAA will be taking to improve our chart products in the short term, including changes to chart formats, scales, data compilation, as well as some considerations on the future of NOAA navigational products beyond the short term. The goal of NOAA's Office of Coast Survey is to deliver products that are more useful, more up-to-date, and safer to navigate with, and at the same time optimize the use of the government resources employed to maintain the navigational products and services that are increasingly required to support higher levels of precision and timeliness.

3.2 U.S. Arctic Nautical Charting Plan (2016)

The U.S. Arctic Nautical Charting Plan (2016)¹¹ provides information about existing, recently added, and proposed new raster (paper) charts and ENC coverage in U.S. Arctic waters. The plan consists of existing ENC coverage shown in a series of graphics depicting the extent of different navigational purpose (or scale) bands. The plan also provides information about 15 new or proposed raster charts in U.S. Arctic waters. Recently added and newly proposed ENC coverage is based on existing or proposed raster chart footprints. The final extent and display scale of the ENCs may vary slightly from their corresponding raster chart counterparts. The primary purpose of the plan is to propose new chart coverage in the Arctic and to encourage feedback from stakeholders on the extent, scale and other aspects of the proposed new coverage.

3.3 Electronic Nautical Charts (ENC)

The NOAA ENC is a vector database of chart features built to the International Hydrographic Organization's (IHO) S-57 standard. NOAA's Office of Coast Survey, as the U.S. national hydrographic office, is exclusively responsible for production and authorization of NOAA ENC data in U.S. waters. The NOAA maintains 1,181 ENCs in U.S. domestic waters and 308 (figure 5) in waters in an around Alaska.

¹⁰ National Charting Plan. (2017). <https://www.nauticalcharts.noaa.gov/mcd/docs/NationalChartingPlan.pdf>

¹¹ U.S. Arctic Nautical Charting Plan. (2016). http://www.nauticalcharts.noaa.gov/mcd/docs/Arctic_Nautical_Charting_Plan.pdf.

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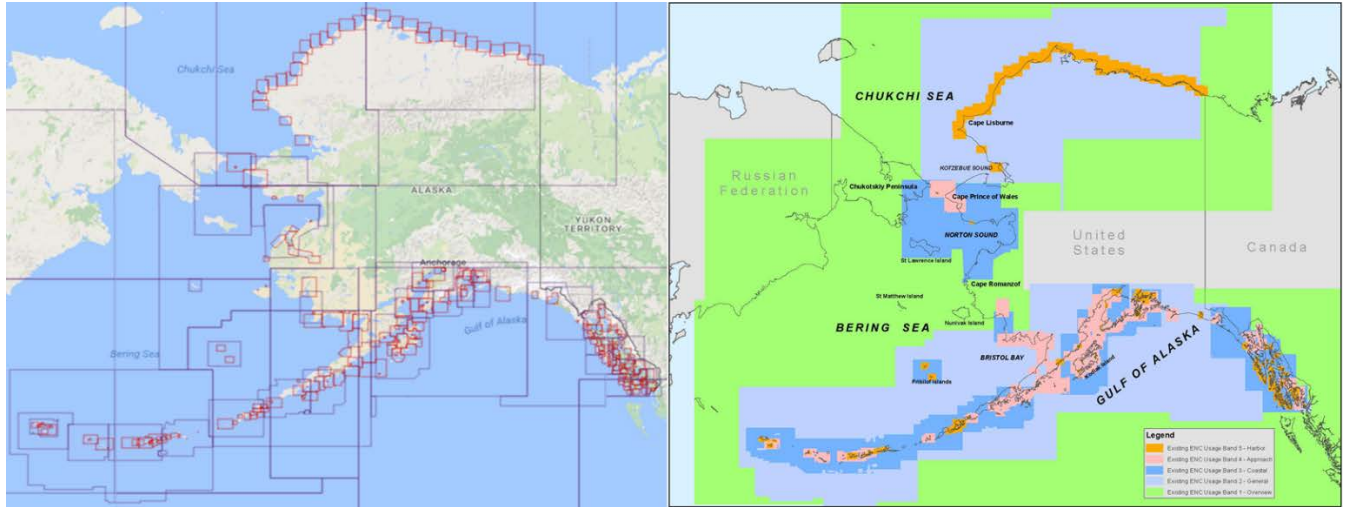


Figure 5: Existing 308 ENC in Alaska, shown above, U.S. Arctic Nautical Charting Plan (2016)

3.4 ENC Distribution

NOAA ENCs are available as free downloads from the internet. Mariners who wish to download NOAA ENCs directly and use the data to fuel ECDIS or ECS may do so. ENCs, including newly created NGA ENCs, are distributed directly from NOAA on the web at www.nauticalcharts.noaa.gov. They are also available through NOAA ENC® Distributors.

NOAA ENC® Distributors are shown in the following table:

Company	Certification Type ¹²
Baker Lyman and Co	CED
ChartWorld	CEVAD
C-MAP Norway	CEVAD
Creative Map Corp	CED
Maris	CED
National Geospatial-Intelligence Agency (NGA)	CED

¹² A CED is a "Certified NOAA ENC® Distributor" who is permitted to download NOAA ENC® files, perform exact copying, and redistribute those copies of NOAA ENC® data. A CEVAD is a "Certified NOAA ENC® Value Added Distributor" who is permitted to reformat official NOAA ENC® data into a System Electronic Navigational Chart (SENC) using type-approved software, and may distribute the SENC.

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Primar	CED
Titafin	CED
Transas	CEVAD
United Kingdom Hydrographic Office	CED

Table 1: List of NOAA ENC Distributors

3.5 Regional ENC Coordinating Center (RENC) Membership

The International Centre for ENCs (IC-ENC) is a low cost, not for profit organization that was set up in 2002 with a remit to assist Hydrographic Offices (HOs) in harmonizing the production and distribution of high quality ENCs. This is achieved through ENC validation and distribution processes, always with the mariner in mind. IC-ENC is a Regional ENC Coordinating Centre (RENC), which supports the achievement of the IHO Worldwide Electronic Navigational Chart Database (WEND) principles.

At the annual meeting of its steering committee in September 2015, the International Centre for Electronic Navigational Charts (IC-ENC) agreed to accept NOAA as a member of its organization and to establish an IC-ENC regional office, "IC-ENC North America." NOAA currently maintains their partnership with the non-profit organization.

3.6 ENC Overlaps

The Marine Chart Division of NOAA's Office of Coast survey is actively engaged in reviewing ENC overlaps. There are currently several overlapping ENCs within the U.S. and Russian Federation. In April 2017, the Electronic Charting Centre (ECC), which is associated with the Primar Regional ENC Coordination Centre, notified the Chair of the ARHC of two sets of overlapping ENCs:

- RU2OQ0T1, US2AK92M
- RU2O9091, US2AK92M, US2AK95M

3.7 Digital Nautical Chart (DNC)



The U.S. produces many DNCs in the ARHC waters. The DNC, produced by the National Geospatial-Intelligence Agency (NGA), is an unclassified, vector-based, digital database containing maritime significant features essential for safe marine navigation.

The DNC uses the Vector Product Format, which is a NATO standard for digital military map and chart data. Additional details can be located at:

<http://msi.nga.mil/NGAPortal/DNC.portal>, or
http://www.nauticalcharts.noaa.gov/mcd/learn_diffENC_DNC.html

DNC consists of libraries in a variety of scales for complete worldwide coverage. Arctic data is included in DNC regions 19, 20, 21, 22, 27, and 28. See coverage below.

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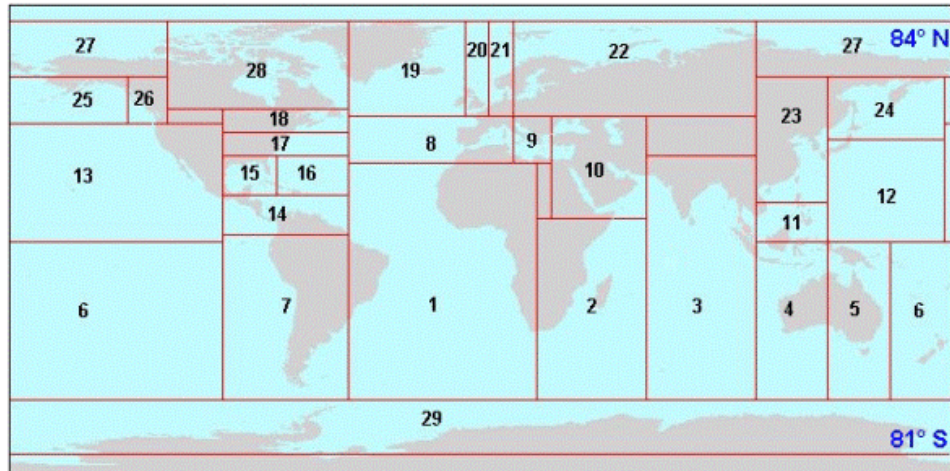


Figure 6: DNC Worldwide Coverage

DNC libraries are maintained by NGA with new source information from the U.S. and prime foreign hydrographic authorities. This product is Limited Distribution and is not available for public sale or download with the exception of U.S territorial waters and where source data restrictions allow. Although DNCs have Limited Distribution, the product data can be shared with host nations based on Bi-lateral agreements.

For requests regarding DNC data, please contact maritime.international@nga.mil

3.8 Raster Navigational Charts (RNC)

The NOAA RNC® are geo-referenced, digital images of NOAA navigational charts. Because the images are geo-referenced, the end user can display a vessel's position on the chart image if a computer-based navigation system is connected to a global positioning system (GPS). RNCs, developed under the IHO S-61 product specification, are unique to NOAA. NGA does not produce RNCs.

In 2014, the U.S. Government ceased printing of lithographic nautical charts also known as the paper version of the RNC. U.S. paper charts are available on a Print on Demand basis from NOAA Certified Printers. The list of NOAA Certified Printers is available at http://www.nauticalcharts.noaa.gov/staff/print_agents.html.

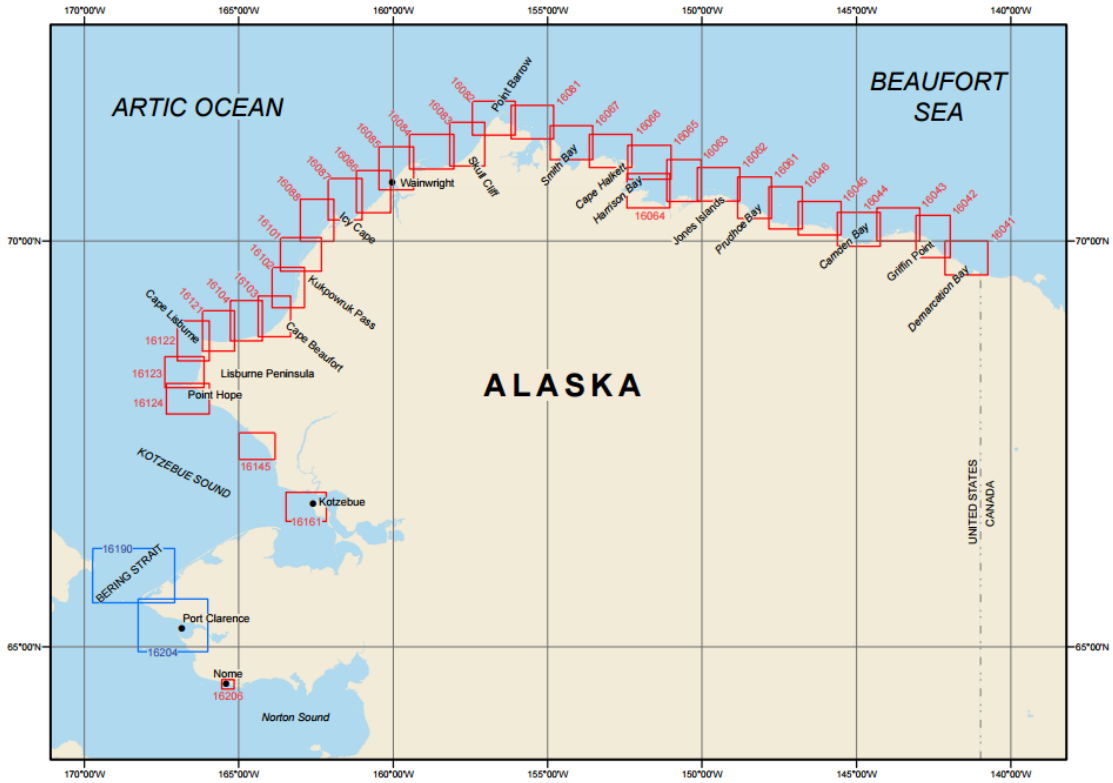


Figure 7: Alaskan RNC Catalog

Shown above is a graphic of the Alaskan RNC catalog, a printer friendly version of the Alaska RNC catalog is at: <http://www.nauticalcharts.noaa.gov/catalog/images/2014Alaska.pdf>

U.S. RNCs may be downloaded from a list at <http://www.charts.noaa.gov/RNCs/RNCs.shtml> or through the Coast Survey's Nautical Products Catalog at <http://www.charts.noaa.gov/InteractiveCatalog/nrnc.shtml>

3.9 Standard Nautical Charts (SNC)



NGA produces many Standard Nautical Charts (SNC) for the ARHC region in their SNC portfolio and not all are publicly available; however. However, NGA currently has 24 SNCs posted to its public Arctic website. NGA is withdrawing many SNCs from public sale due to intellectual property issues as they produce new edition charts. NGA will continue to distribute to the public charts where NGA and the U.S have historically been the primary charting authority and areas where the U.S. conducts the surveys, compiles and issues the chart, and there is no functioning national authority or NGA has specific authority. NGA seeks the cooperation of nations within a given region to allow for the

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public distribution of data, products, and services that are national and regional assets to be used to promote economic benefit.

NOAA produces many SNC in the ARHC region. The charts and the dates of latest editions are updated weekly can be obtained at the NOAA chart library: <http://nauticalcharts.noaa.gov/mcd/dole.htm>

3.10 International (INC) Charts

The U.S. does not produce INT charts but does offer “INT Chart Equivalents.” Contributions to the S-11 Region N (Edition 2.0.0 September 2013) coordinated with and provided to Norway as the ARHC INT Chart Coordinator.

NGA does not share INT chart responsibility within the ARHC region. However, NGA does build its chart schemes and DNC library limits from these INT schemes, if practical.

4. NEW PUBLICATIONS AND UPDATES

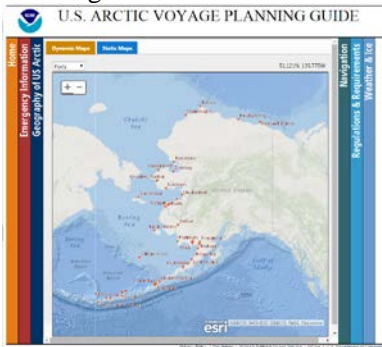
New Publications

The American Practical Navigator, first published in 1802, is described as the "epitome of navigation" by its original author, Nathaniel Bowditch. As advances in navigation practices continues to serve as a valuable reference for marine navigation in the modern day the text has accordingly evolved. The publication describes in detail the principles and factors of navigation, including piloting, electronic navigation, celestial navigation, mathematics, safety, oceanography and meteorology. It also contains various tables used in typical navigational calculations and solutions, including the formulas used to derive the tabular data. The 2017 edition of the American Practical Navigator returns to a two-volume format, which can be downloaded as complete PDF documents from the following website:

https://msi.nga.mil/NGAPortal/MSI.portal?_nfpb=true&_pageLabel=msi_portal_page_62&pubCode=0002

Updated Publications

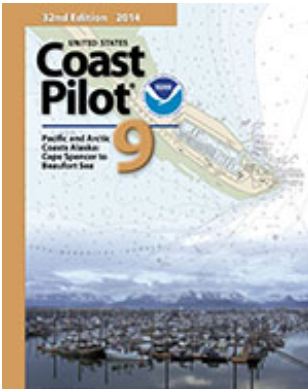
United States Arctic Voyage Planning Guide



In 2015, the U.S. produced the first version of a U.S. Arctic Voyage Planning Guide to assist mariners and the public access and acquire information relevant to maritime transit in the U.S. Arctic Waters. The U.S. Arctic Voyage Planning Guide is a compilation of official U.S. Government information and references to sources of information that may serve as a consultation source for mariners planning a voyage into or through U.S. Arctic waters. It is available at <http://www.nauticalcharts.noaa.gov/avpg/guide.htm>.

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United States Coast Pilot



The United States Coast Pilot consists of a series of nine regionally-focused nautical books that cover a variety of useful information important to navigators for coastal and intra-coastal waters and the U.S. Great Lakes. For the ARHC region, Coast Pilot 9 covers Alaska. U.S. Coast Pilot now offers completely updated publications every week. U.S. Coast Pilots can be downloaded at:

<http://www.nauticalcharts.noaa.gov/nsd/cpdownload.htm>

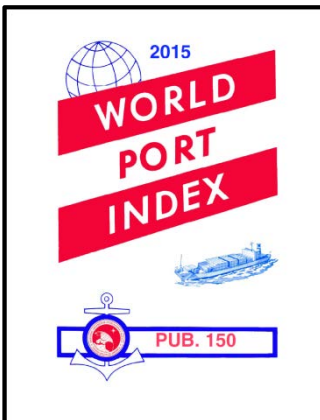
Sailing Directions



Produced and maintained by NGA, Sailing Directions consists of useful information important to navigators of coastal waters. Information for the ARHC region is contained in Publications 145 – Nova Scotia and the St. Lawrence, 146 – Newfoundland, Labrador, and Hudson Bay, 181 – Greenland and Iceland, 182 – North and West Coasts of Norway, and 183 – North Coast of Russia.

Digital updates can be downloaded from NGA at <http://msi.nga.mil/NGAPortal/MSI.portal> and are also available at its public [Arctic website](#).

World Port Index

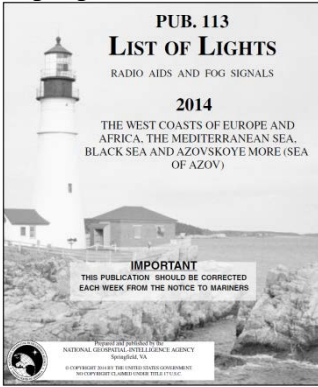


World Port Index (Pub150) is a publication maintained by NGA. It contains the location and physical characteristics as well as the facilities and services offered by major ports and terminals worldwide.

Digital updates are available to the public and posted at the NGA Maritime Safety website, at <http://msi.nga.mil/NGAPortal/MSI.portal>.

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List of Lights, Radio Aids and Fog Signals



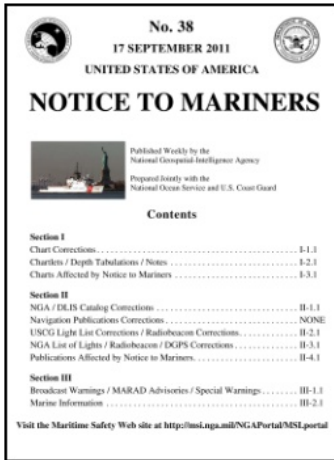
The NGA *List of Lights, Radio Aids and Fog Signals* and their digital updates are available to the public and posted at the NGA Maritime Safety website, at <http://msi.nga.mil/NGAPortal/MSI.portal>. Publications 110 – Greenland, the East Coasts of North and South America, 111 – The West Coasts of North and South America, and 115 – Norway, Iceland, and Arctic Ocean cover the ARHC region.

5. MARITIME SAFETY INFORMATION (MSI)

5.1 Existing infrastructure for transmission

The U.S. Coast Guard issues Notices to Mariners for NOAA charts, while NGA issues Notices to Mariners for NGA charts in the ARHC region.

Notice to Mariners



The U.S. Notice to Mariners provides timely Marine Safety Information (MSI) for the correction of all U.S. Government navigation charts and publications from a wide variety of sources, both foreign and domestic. Information published in Notice to Mariners provide for the correction of unclassified nautical charts, the unclassified NGA/DLIS Catalog of Hydrographic Products, United States Coast Pilots, NGA List of Lights, U.S. Coast Guard (USCG) Light Lists, and other related nautical publications produced by NGA, National Ocean Service (NOS), and the USCG. The U.S. Notice to Mariners corrects NGA and NOS charts using information collected from many sources, among them the Local Notice to Mariners published by the nine U.S. Coast Guard Districts. The U.S. Notice to Mariners are posted at the NGA Maritime Safety website at <http://msi.nga.mil/NGAPortal/MSI.portal>.

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5.2 Navigation Warnings

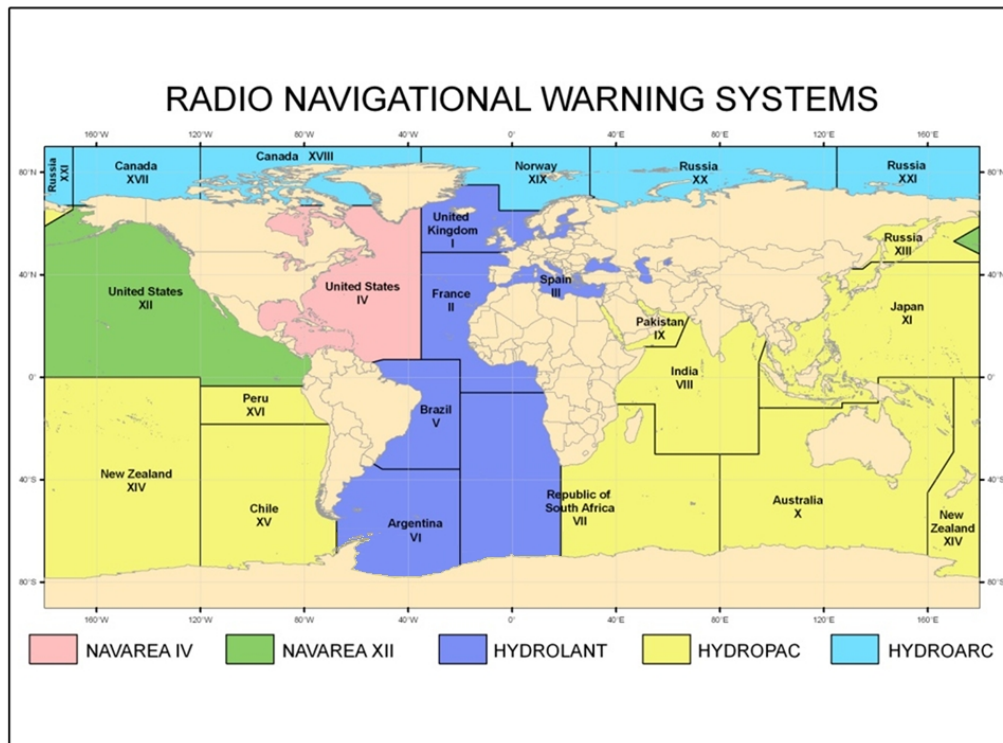


Figure 6: Radio Navigational Warning Systems

Canada (NAVAREA XVII and XVIII), Russia, (NAVAREA XX), Norway (NAVAREA XIX) and USA (XII for U.S. definition of the “Arctic” including the Bering Sea) are the NAVAREA Coordinators for Arctic regions. All member states within the ARHC Region are encouraged to relay pertinent maritime safety information to those authorities for widespread promulgation. Assistance with promulgating Notices to Mariners and MSI information can be obtained from the product producer nation. Regional and specific question can be directed to the appropriate authority, or other hydrographic offices operating within the region.

Announced Jun 29, 2017

“E-MAIL SUBSCRIPTION SERVICE FOR BROADCAST WARNINGS.

1. THE MARITIME SAFETY WATCH AT NGA HAS SET UP A VOLUNTARY SUBSCRIPTION SERVICE FOR ALL BROADCAST WARNINGS (NAVAREA IV / NAVAREA XII / HYDROLANT / HYDROPAC / HYDROARC) AND US MARITIME ADVISORY/ALERTS.

2. THE AVAILABILITY OF NAVIGATIONAL WARNINGS VIA THIS NGA SUBSCRIPTION SERVICE DOES NOT RELIEVE MASTERS / CAPTAINS OF THE

REQUIREMENT TO RECEIVE NAVIGATIONAL WARNINGS THROUGH IMO APPROVED BROADCAST SERVICES IN ACCORDANCE WITH THE PROVISIONS

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OF THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA (SOLAS).

THIS INFORMATION IS PROVIDED AS A SUPPLEMENT TO THOSE APPROVED SERVICES.

3. THIS SERVICE IS AVAILABLE THROUGH THE MARITIME SAFETY WEB PAGE (MSI.NGA.MIL) AND SELECTING 'SUBSCRIBE TO BW'. FOLLOW THE PROMPTS TO SUBSCRIBE."

As it is both an IHO and IMO obligation per SOLAS, NGA requests the assistance of all member states within the ARHC Region to relay pertinent maritime safety information for promulgation to navsafety@nga.mil as well as the NAVAREA coordinator.

NGA also was the promulgation agency for Special Warnings (issued by the Department of State) and Maritime Administration (MARAD) Advisories. These were issued infrequently and contain information about potential hazards caused by the global political climate. This system has been replaced by the U.S. Maritime Advisory System as outlined in the following message (Note: Special Warnings and MARAD Advisories still in effect have not been redesignated):

U.S. MARITIME ADVISORY 2017-001

Threat Type(s): N/A

Geographic Area: Global

1. This message announces the launch of the new *U.S. Maritime Advisory System*, which represents the most significant update since 1939 to the U.S. government process for issuing maritime security alerts and advisories. The new system establishes a single federal process to expeditiously provide maritime threat information to maritime industry stakeholders including vessels at sea. In response to valuable feedback from stakeholders, the Maritime Advisory System was developed to streamline, consolidate, and replace maritime threat information previously disseminated in three separate government agency instruments: Special Warnings, MARAD Advisories, and global maritime security related Marine Safety Information Bulletins.
2. The *U.S. Maritime Advisory System* includes two types of notifications: A U.S. Maritime Alert and a U.S. Maritime Advisory. Maritime Alerts quickly provide basic threat information to the maritime industry. When amplifying information is available, a more detailed U.S. Maritime Advisory may be issued on a threat and could include recommendations and identify available resources. U.S. Maritime Alerts and U.S. Maritime Advisories will be broadcast by the National Geospatial-Intelligence Agency, emailed to maritime industry stakeholders, and posted to the Maritime Security Communications with Industry (MSCI) web portal, at www.marad.dot.gov/MSCI.
3. The *U.S. Maritime Advisory System* is a whole-of-government notification mechanism. The Departments of State, Defense, Justice, Transportation, and Homeland Security, and the intelligence community, supported the development of

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this new system in coordination with representatives from the U.S. maritime industry through the Alerts, Warnings and Notifications Working Group.

4. Questions regarding the *U.S. Maritime Advisory System* may be emailed to MARADSecurity@dot.gov. Additional contact information is available on the MSCI web portal.
5. This message will automatically expire on July 6, 2017.

5.3 Assessment of Chart Adequacy for U.S. Arctic Waters: Possible 2018 update

In 2014, NOAA, together with members of the ARHC, developed a risk-based methodology to assess the adequacy of Charting Products in the Arctic. The methodology examined water depth, survey coverage, seafloor complexity, and AIS data from June 2012-July 2013. The findings are available at: https://www.star.nesdis.noaa.gov/star/documents/meetings/Ice2015/posters/Fandel_C.pdf.

The ARHC will consider completely updating this assessment with more current data at its August 2017 meeting.

6. C-55¹³

The aim of IHO Publication C-55 is to present a clear picture of the worldwide coverage of surveys and nautical charts and of the extent of effective organizations for the timely promulgation of navigational safety information. The following tables outline the survey and nautical chart coverage in the U.S.

6.1 Hydrographic Coverage Available:

Area*: U.S INT Region N – Alaska and Arctic (including Aleutian Islands) (N)

	A	B	C
Depths < 200m	18%	28%	54%
Depths > 200m	0%	0%	100%

Table 2: Hydrographic Coverage, Area U.S. INT Region N

Area*: CONUS Regions – U.S.

	A	B	C
Depths < 200m	11%	39%	50%

¹³ Source: January 2017 IHO U.S. C-55 submission.

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Depths > 200m	16%	4%	80%
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Table 3: Hydrographic Coverage, Area CONUS U.S

*Area is defined by the total hydrographic survey coverage available where A = adequately surveyed, B = Re-survey required, and C = never systematically surveyed.

6.2 Nautical Chart Coverage Available:

U.S. INT Region N – Alaska and Arctic (including Aleutian Islands) (N)

	A*	B*	C*
Offshore Passage	100%	100%	100%
Landfall and Coastal Passage	100%	100%	97%
Approaches and Ports	100%	100%	100%

Table 4: Nautical Chart Coverage, U.S. INT Region N

*Where A = charting coverage by INT or other paper charts meeting S-4, B = charting covered by RNC meeting S-61, and C = charting covered by ENC meeting S-57

CONUS Regions – U.S.

	A*	B*	C*
Offshore Passage	100%	100%	95%
Landfall and Coastal Passage	100%	100%	100%
Approaches and Ports	100%	100%	80%

Table 5: Nautical Chart Coverage, CONUS U.S.

*Where A = charting coverage by INT or other paper charts meeting S-4, B = charting covered by RNC meeting S-61, and C = charting covered by ENC meeting S-57

7. CAPACITY BUILDING

7.1 Offer of and/or Demand for Capacity Building

The United States is an active participant in the IHO Capacity Building Sub-Committee (CBSC). The US (NGA) directly supports the IHO Maritime Safety Information (MSI) training course as well as provide support to nations through on site and remote guidance and advice as they grow their hydrographic capacity.

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7.2 Training offered

Training opportunities are available at various institutions in the United States. Two Category A certified hydrographic programs are available through:

- The University of Southern Mississippi (USM)
 - <https://www.usm.edu/marine/hydrographic-science>
- The University of New Hampshire (UNH)
 - <https://marine.unh.edu/program/center-coastal-and-ocean-mappingjoint-hydrographic-center>
- NOAA

Category-B Competence Training for Nautical Cartography - In March, 2017 the IBSC approved the NOAA program for Category B in Cartography. The first class will start the end of August 2017 and will have 10 cartographers.

COMNAVMETOCCOM and USM are partners in their Category A program and NOAA has a similar arrangement with UNH for their Category A program. COMNAVMETOCCOM also offers a six-month category B International Hydrographic Management and Engineering Program and mobile training via its Naval Meteorology and Oceanography Professional Development Center in Gulfport, Mississippi. COMNAVMETOCCOM's Category A and B programs and mobile training also qualify for Security Cooperation assistance.

Capt. Andrew Armstrong, NOAA (ret.), NOAA co-director of the Joint Hydrographic Center at UNH, is a member of the FIG/IHO/ICA International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers. As a member of the board, Capt. Armstrong is available to advise institutions on establishing hydrographic training curricula and preparing submissions to the International Board for Category A or Category B recognition. (andy.armstrong@noaa.gov).

7.3 Chart Adequacy Workshop

In July 2017, NOAA's Office of Coast Survey hosted its third annual workshop on nautical chart adequacy. Twelve students participated in the training and learned techniques to evaluate the suitability of nautical chart products using chart quality and publicly available information. The 2017 workshop emphasized cartography and the ability to transfer NOAA procedures to the students' charting products. The workshop provided a theoretical background on:

- Chart production at NOAA
- Review of NOAA charted symbols and abbreviations
- Review of automatic identification systems (AIS) and satellite-derived bathymetry (SDB)
- Overview of the chart adequacy procedure

Participants came from Egypt, Israel, Japan, Madagascar, Mauritius, Nigeria, Panama, Philippines, Russia, Spain, Taiwan, and Thailand. The workshop followed NOAA's open house on nautical cartography on July 7, an event held in conjunction with the 28th annual International Cartographic Conference 2017 (ICC) in Washington, D.C. For more information on the Chart Adequacy Workshop contact, Dr. Shachak Peeri (shachak.peeri@noaa.gov).

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8. OCEANOGRAPHIC ACTIVITIES

8.1 General Bathymetric Chart of the Oceans and Seabed 2030

The United States participates on the IOC-IHO Guiding Committee for GEBCO, and hosts the IHO Data Centre for Digital Bathymetry at NOAA's National Centers for Environmental Information (NCEI) (formerly the National Geophysical Data Center, NGDC).

NOAA distributes the International Bathymetric Chart of the Arctic Ocean (IBCAO) digital grid at <http://www.ibcao.org/>. The goal of this initiative is to develop a digital database that contains all available bathymetric data north of 64° north, for use by mapmakers, researchers, institutions, and others whose work requires a detailed and accurate knowledge of the depth and the shape of the Arctic seabed. Initiated in 1997, this undertaking has so far engaged the volunteer efforts of investigators who are affiliated with 24 institutions in 10 countries. ARHC members (Canada, Denmark, Norway, Russia, and the U.S.A) contribute to this initiative, as does the ARHC observer member state Iceland.

In the opening address of the Future of Ocean Floor Mapping (FFOFM) in Monaco in June 2016, Mr. Sasakawa, Chairman of The Nippon Foundation, set forth an initiative to partner with GEBCO to cooperatively work towards mapping 100% of the World Ocean bathymetry by 2030. This initiative led to the formulation of Seabed 2030, a global project within the framework of the General Bathymetric Chart of the Oceans (GEBCO) with the focused goal of leaving no features of the World Ocean floor larger than 100 m unmapped by the year 2030. At the 33rd meeting of the GEBCO Guiding Committee, the Seabed 2030 Project was approved. Seabed 2030 sets the goal of collecting, using and sharing, data of the world's oceans. The project seeks to encourage the data collectors and data managers of governmental, academic and private interests to work together to improve the quality of publicly available grids of the ocean floor. This project is focused on the goal of compiling a high-resolution, openly available, Digital Bathymetric Model (DBM). This DBM should efficiently provide bathymetric information to end users and leave no features of the World Ocean floor smaller than 100 m unmapped by the completion of the program. The Seabed 2030 project has great potential to create partnerships and cooperation between interested parties, significantly improving our understanding of the sea floor and empower sustainable ocean management in the coming century.

Based on GEBCO's successful experiences of working with Regional Mapping Projects, the structure of Seabed 2030 rests on the establishment of two types of new technical mapping centers, a Global Data Assembly and Coordination Center (GDACC) and Regional Data Assembly and Coordination Centers (RDACCs). The regional centers will be responsible for championing regional mapping activities as well as assembling and synthesizing bathymetric information within their prescribed region. The global center will be responsible for producing centralized GEBCO products and centralized data management for non-regionally sourced data. In ocean regions where strong mapping initiative already are operational, Seabed 2030 will strive to avoid duplication and instead work towards fostering a close collaboration for the most efficient use of global resources.

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The US joins other nations in support of improvements to the GEBCO gridded models of the world's seafloor, and note great benefit in supporting their continuing improvement. To do this, nations must make ocean depth data available to the project. One simple way is by sharing ENC soundings, and where national policy allows, sharing full resolution data sets. Several US agencies have provided data and data management resources for improvements GEBCO 30" model, and continue to support the development of crowd-sourced data sharing through the IHO Data Center for Bathymetry Digital (DBDC). These IHO projects establish the framework and encourage data sharing which benefits the global international maritime and oceanographic community.

8.2 Crowdsourced Bathymetry

Crowdsourced bathymetric data can be used to identify areas where nautical charts are inadequate and proper hydrographic surveys are needed or can be applied to nautical charts when the source and uncertainties of the data are well understood. The key to successful CSB efforts are volunteer observers who operate vessels-of-opportunity in places where charts are poor or where the seafloor is changeable and hydrographic assets are not easily available.

The NOAA provides financial support for the IHO-initiated project to develop a global database for crowdsourced bathymetry hosted by the IHO Data Centre for Digital Bathymetry (IHO DCDB). The IHO DCDB, co-located with NOAA's National Centers for Environmental Information (NCEI), is building the infrastructure necessary to provide archiving, discovery, display and retrieval of global crowdsourced bathymetry data from mariners around the world. The online database can be found at <https://maps.ngdc.noaa.gov/viewers/csb/>.

NOAA is also coordinating with the Association of Arctic Expedition Cruise Operators (AECO) to ingest Arctic data to test the new system. The vision is to tap into the enthusiasm for mapping the ocean floor by enabling trusted mariners to easily contribute data to fill the gaps in our current bathymetric coverage. NOAA and NGA are active participants in the IHO Crowd-Sourced Bathymetry Working Group (CSBWG), and together, with other CSBWG members, they are compiling a CSB Guidance Document for layman mariners who wish to contribute data to the IHO DCDB. This document will provide volunteer collectors with information about CSB, the installation and use of CSB data loggers, data quality issues, and instructions for submitting the data to the IHO data repository.

8.4 Tide Gauge Network

NOAA¹⁴ operates several permanent National Water Level Observation Network (NWLON) tidal stations located throughout Alaska. The NWLON network in Alaska consist of 26 active sensors, with

¹⁴ Primarily the Center for Operational Oceanographic Products and Services (COOPS)

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more sensors planned for installation. These stations are ice hardened and designed to act as long term controls for temporary water level gauges installed for hydrographic surveys. These stations produce data every six minutes which is transmitted back to headquarters in Silver Spring, Maryland, quality controlled and disseminated to the public in near real time. In most cases the primary water level sensor these NWLON stations are generally pressure sensors and there is a normally a backup sensor in case the primary fails. Most stations also include a suite of meteorological sensors. Data from which, is transmitted in near real time along with the water level information.

NOAA performed a gap analysis for the National Water Level Observation Network and identified 20 gaps in the US Arctic region where permanent water level stations are needed to adequately maintain datum control. An additional number of permanent stations are required to monitor storm surge and assist in tracking shoreline erosion. These gaps were identified through analysis and stakeholder engagement and do not include temporary water level stations needed for nautical charting and VDatum.

Given the lack of infrastructure in the Arctic, NOAA has been developing a bottom mounted water level measurement system that has the capability to transmit data in real time. This platform measures water levels in remote regions with very limited infrastructure. The system consists of two primary components linked by wireless underwater acoustic modems: a bottom mounted oceanographic sensor platform and, during ice-free periods, a surface buoy with a meteorological station and satellite communications system. During ice season, data can be stored internally and accessed on demand through an acoustic modem drilled through the ice. This system is designed to support seasonal real time data applications and long-term data needs where real time data is not a necessity.

9. OTHER ACTIVITIES

9.1 Native Outreach: Alaska Region

NOAA's Office of Coast Survey has been in years past and continues to build relationships with local communities and subsistence hunting groups to ensure that traditional knowledge is harnessed and conflict avoidance is ensured. NOAA recognizes that native Alaskans contribute a wealth of hunting, fishing and gathering knowledge to the region as well as key information about navigable waters in local areas. Below is a map that outlines some of the native entities in Alaska.

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Figure 7: Native Entities in Alaska

In 2010, NOAA Ship *Fairweather* conducted a bathymetric survey on the eastern side of the International Dateline. This survey was preceded by extensive outreach to the village located on Little Diomedede Island. The outreach included contacting the village elders, the native corporation, the village government, and the borough government. Prior to beginning any work in the area, representatives from the ship went to the village and provided a brief of the anticipated activities. During the operations, ship personnel continually updated the village representatives of anticipated schedules. One evening the village hosted the shipboard personnel to visit the island of Little Diomedede and had a celebration with traditional song and dance. Prior to departure from the area, the ship reciprocated and hosted 12 representatives from the village for lunch and a tour of the vessel. This model carried on through subsequent years of high arctic operations for bathymetric surveying activities.

In following years, additional outreach and communications were sought. During the winter, the Alaska Eskimo Whaling Commission meets regularly to discuss best practices and policies associated with subsistence hunting of the Bowhead Whales that migrate through the Chukchi and Beaufort Seas in Spring and Fall. NOAA has been reaching out to this community to ensure a transparent plan of operations and planning so de-confliction of the waterways is made possible for all users.

In 2015, the Arctic Waterways Safety Committee (formerly the Alaska Marine Mammal Coalition) was formed to bring all maritime operators, subsistence hunters, and oil and gas companies to a discussion about operations and hunting activities. The purpose of this meeting is to identify voluntary programs that all users can agree on to de-conflict the arctic waterways of the Chukchi and

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Beaufort Seas. This group has come up with a draft Standard of Care¹⁵ for Research Vessels. This document is a notification plan for the vessel operators to maintain a transparent plan for conducting operations in the US high arctic. The Standard of Care calls for a brief to occur at the Alaska Eskimo Whaling commission advising the planned operations one year prior to commencing. Additionally, this plan would be communicated at that Arctic Waterways Safety Committee. Prior to entering within 30 nautical miles of a whaling village, 50 nautical miles of Barrow, and 12 nautical miles of the rest of the coast, notification would take place to village and regional leaders to ensure conflict avoidance. Finally, research results and findings would then be shared with the local communities at the following Alaska Eskimo Whaling Commission mini convention in the winter.

This model of communication and notification is dynamic and continues to be refined through trust and commitment from our agency and the other research groups operating in the US arctic Region.

9.2 Marine Spatial Data Infrastructures (MSDI) Progress

9.2.1 International

The United States leads of the ARMSDIWG and as the recent lead of the Arctic Spatial Data Infrastructure (Arctic SDI), NGA and the US Geological Survey (USGS) respectively, coordinated the first in-person meeting of the two working groups in Copenhagen, Denmark during April 2017. These working groups discussed areas of opportunity and collaboration.

NGA continues to host a NGA Arctic Support 2017 page found in the NGA GEOINT Services: <https://nga.maps.arcgis.com/home/index.html>. Much of the data found on the NGA Arctic Support page is both service enabled and available in several formats allowing for interoperability between applications.

The US provided their freely and publically available, open data for use in OGC Arctic Spatial Data Pilot (Arctic SDP). The results of this pilot can be found here:

<http://www.opengeospatial.org/pub/ArcticSDP/index.html>

9.2.2 National

The Federal Geospatial Data Committee (FGDC) is an organized structure of federal geospatial professionals that provide executive, managerial, and advisory direction and oversight for geospatial decisions and initiatives across the United States federal government. FGDC works collaboratively with federal, state, tribal, and local governments, non-Federal

¹⁵ Standard of Care. (2017).

<http://nebula.wsimg.com/3f6e3c7518e6de0f4b323a47884e6748?AccessKeyId=4913A243119CE1325FB9&disposition=0&alloworigin=1>

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collaborates, communities, constituents, and professional bodies providing the enabling foundation of standards, data catalogs, partnerships, and tools that make up the National SDI (NSDI). The FGDC website can be accessed here: <https://www.fgdc.gov/>.

In December 2016, the FGDC released the National Spatial Data Infrastructure Strategic Framework¹⁶ providing a “High-level plan for the continuing development and expansion of the NSDI.”

U.S. Geospatial Economic Impact

\$73 billion

The U.S. geospatial services industry is a \$73 billion business.²



500,000 jobs

The U.S. geospatial industry employs at least 500,000 people in ‘high wage’ geo-related jobs.²

\$1.6 trillion

Geospatial services companies drive \$1.6 trillion in revenue and \$1.4 trillion in cost savings throughout the U.S. economy.²



\$690 million

Economic benefit of 3D elevation data in the U.S. is conservatively estimated at \$690 million per year.¹

65%

The majority of records in the nation’s open data catalog are geospatial.³



10%

Economic impact of geospatial services in marketing, logistics, and strategic decision-making will grow by at least 10% over the next five years.²

¹ USGS, 2012

² Boston Consulting Group, 2012

³ Data.gov, 2016

Figure 8: U.S Geospatial Economic Impact

Image Source: <https://www.fgdc.gov/nsdi-plan/2017/nsdi-strategic-framework.pdf>

¹⁶ National Spatial Data Infrastructure Strategic Framework. (2016). <https://www.fgdc.gov/nsdi-plan/2017/nsdi-strategic-framework.pdf>