United States of America

National Report

Arctic Regional Hydrographic Commission

3 & 6 October 2016

Iqaluit, Nunavut Territory, Canada

Office of Coast Survey
National Oceanographic & Atmospheric Administration
http://www.nauticalcharts.noaa.gov

Maritime Safety Office
National Geospatial-Intelligence Agency
http://msi.nga.mil/NGAPortal/MSI.portal

Naval Meteorology and Oceanography Command
United States Navy
http://www.navmetoccom.navy.mil

Table of Contents

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). U.S. domestic and international hydrographic services are primarily conducted by three government agencies: (i) The National Oceanic and Atmospheric Administration's (NOAA) Office of Coast Survey (OCS), (ii) the National Geospatial-Intelligence Agency (NGA), and the (iii) Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCCOM) and Hydrographer of the Navy. NOAA provides nautical charts and related hydrographic information within the nation's Economic Exclusion Zone (EEZ). COMNAVMETOCCOM conducts oceanographic, bathymetric, and hydrographic surveys worldwide to satisfy U.S. Navy requirements. NGA is the mapping and charting authority for the U.S. Department of Defense and commercial mariners worldwide, building a global suite of nautical products and services for the U.S. Navy and commercial mariners in areas the U.S. is considered to be the charting authority.

United States Strategies for the Arctic

The Arctic Region has long been characterized by its harsh environment. This has served as a barrier to routine maritime operations. Now, although many challenges persist, changing Arctic conditions are creating increased opportunity for peaceful interaction, collaboration, and pursuit of common interests.

As an Arctic Nation, the United States has broad and fundamental interests in the Arctic Region. The strategic approach is governed by the National Strategy for the Arctic Region, which focuses on three lines of effort: advance United States security interests, pursue responsible Arctic region stewardship, and strengthen international cooperation. Other strategic documents include the Implementation Plan for the National Strategy for the Arctic Region, the Department of Defense Arctic Strategy, the U.S. Coast Guard Arctic Strategy, and the U.S. Navy Arctic Roadmap (2014-2030). These documents align with the National Strategy and collectively describe in greater 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. will remain committed to exercising sovereignty, both preserving and protecting its interests as the region becomes more accessible due to diminishing ice cover. The U.S. envisions an Arctic that is stable and free of conflict, where nations act responsibly in a spirit of trust and cooperation. U.S. Strategies for the Arctic are available at:

https://www.whitehouse.gov/sites/default/files/docs/nat_arctic_strategy.pdf

http://www.defense.gov/Portals/1/Documents/pubs/2013_Arctic_Strategy.pdf

https://www.uscg.mil/seniorleadership/DOCS/CG_Arctic_Strategy.pdf

http://www.navy.mil/docs/USN_arctic_roadmap.pdf

http://www.arctic.noaa.gov/docs/NOAAArctic_V_S_2011.pdf

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 directed 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. This policy is available at: https://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf

Many hydrographic data, products and services produced by the U.S. Hydrographic Office's (HO's)are generally made available for download at no cost. For nautical products and services, web deliveries of digital versions of most data 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) can be obtained in GIS friendly format for non-traditional users, opening up HO data to a host of new customers and users. New map services are in place to allow others simple access to real time access to data, creating 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) is an example of the possibilities created by delivering data for broad customer use.

NGA fully supports the U.S. Open Data Policy and was a supporter of the 2015 GLACIER Conference (http://www.state.gov/e/oes/glacier/index.htm) and the Arctic Council. On September 02, 2015 NGA launched a public Arctic website (http://nga.maps.arcgis.com) to strengthen international cooperation, better understand and manage resources responsibly, enhance quality of life in the Arctic, and maintain valuable and vulnerable ecosystems. NGA's Arctic website also includes NGA nautical charts, sailing directions, Digital Elevation Models (DEMs), and a downloadable Pan-Arctic Map on its site. On September 01, 2016 NGA and the National Science Foundation publicly released new 3-D topographic maps of Alaska. These 3-D DEMs are the first to come from the ArcticDEM project, which was created after a January 2015 executive order calling for enhanced coordination of national efforts in the Arctic. Models of the entire Arctic are scheduled for release in 2017. The models are based on 2-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, which is limited in the inhospitable and remote polar region.

International Open Government Partnership (OGP)

OGP was launched in 2011 to provide an international platform committed to making their governments more open, accountable, and responsive to citizens. Since then, OGP has grown from 8 countries to the 65 participating countries. In all of these countries, government and civil society are working together to develop and implement ambitious open government reforms. Additional information regarding the OGP can be found at: http://www.opengovpartnership.org/

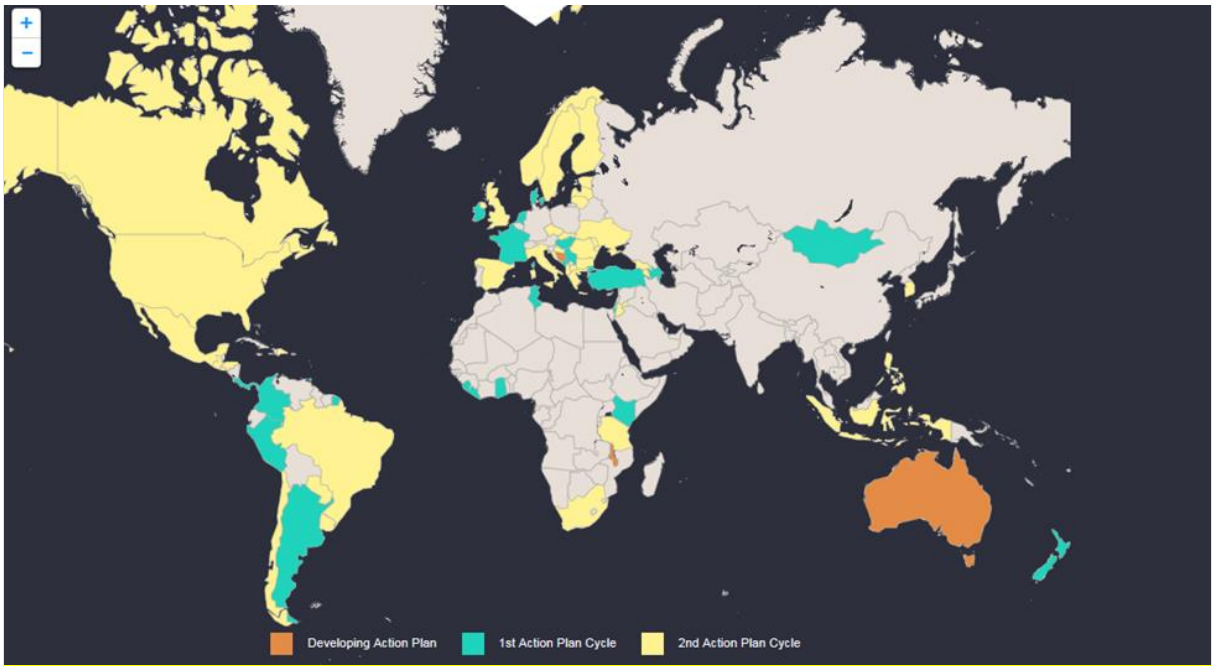


Figure 2: Participating ARHC member states within the OGP include: Canada, Denmark, Norway, and the United States.

2. Surveys

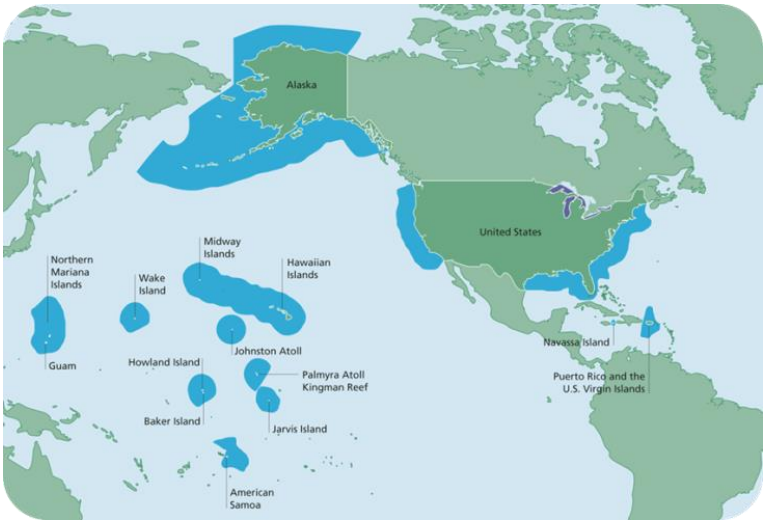


Figure 1: The U.S. EEZ.

A statutory mandate authorizes NOAA to provide 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 other commercial and industrial activities within the nation's 3.4 million square nautical mile EEZ and along its 95,000 miles of shoreline.

Coverage of New Surveys

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. *NOS Hydrographic Surveys Specifications and Deliverables* has been updated for 2016 and includes new specifications and changes made since the 2013 version. Those who acquire hydrographic survey data in accordance with NOS specifications should use the current version; 2016 Specifications and Deliverables available at http://www.nauticalcharts.noaa.gov/hsd/specs/specs.htm.

The U.S. Navy COMNAVMETOCCOM 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. The Naval Oceanographic Office (NAVOCEANO), a subordinate command of COMNAVMETOCCOM, currently has five Pathfinder Class 100-meter multi-purpose survey 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 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 9-meter SAFE boats (Defender-class) and Sea Arks, fitted with multi-beam and rapid littoral survey vehicles (ESVs) 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 has equipment to outfit boats of opportunity for survey. 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.

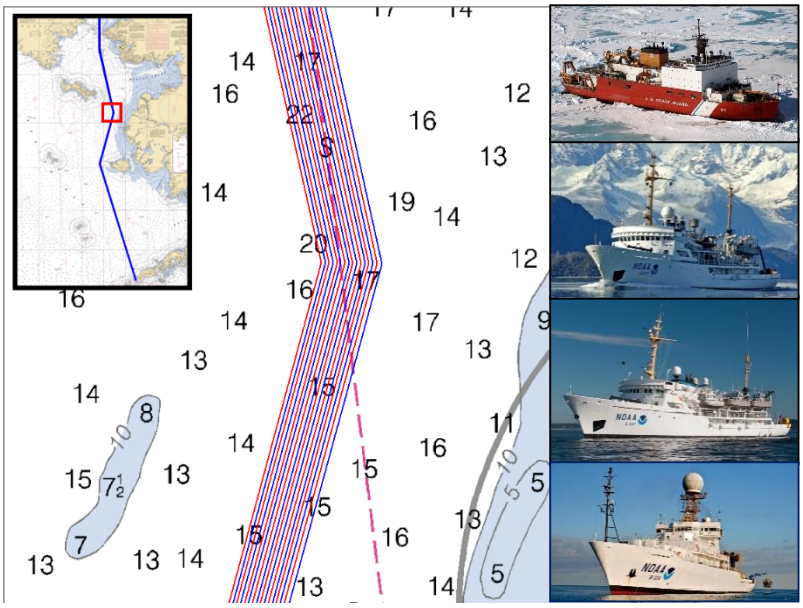
Using four NOAA ships (three of which are equipped with small boats for near shore work), six 28-foot survey boats, a research vessel, a lidar-capable aircraft, and private contractors, NOAA Coast Survey acquires hydrographic data that can update the nation's nautical charts with the accuracy and precision that is essential to maintain the public trust in navigational products.

The NOAA ship FAIRWEATHER is designed and outfitted primarily for conducting hydrographic surveys in support of nautical charting, but 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. Increased mission space and deck machinery enable FAIRWEATHER to be tasked with anything from buoy operations to fisheries research cruises. The FAIRWEATHER 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 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. Additional information including schedule, projects, and general specifications for both vessels is available at http://www.moc.noaa.gov/fa/ and http://www.moc.noaa.gov/ra/, respectively.

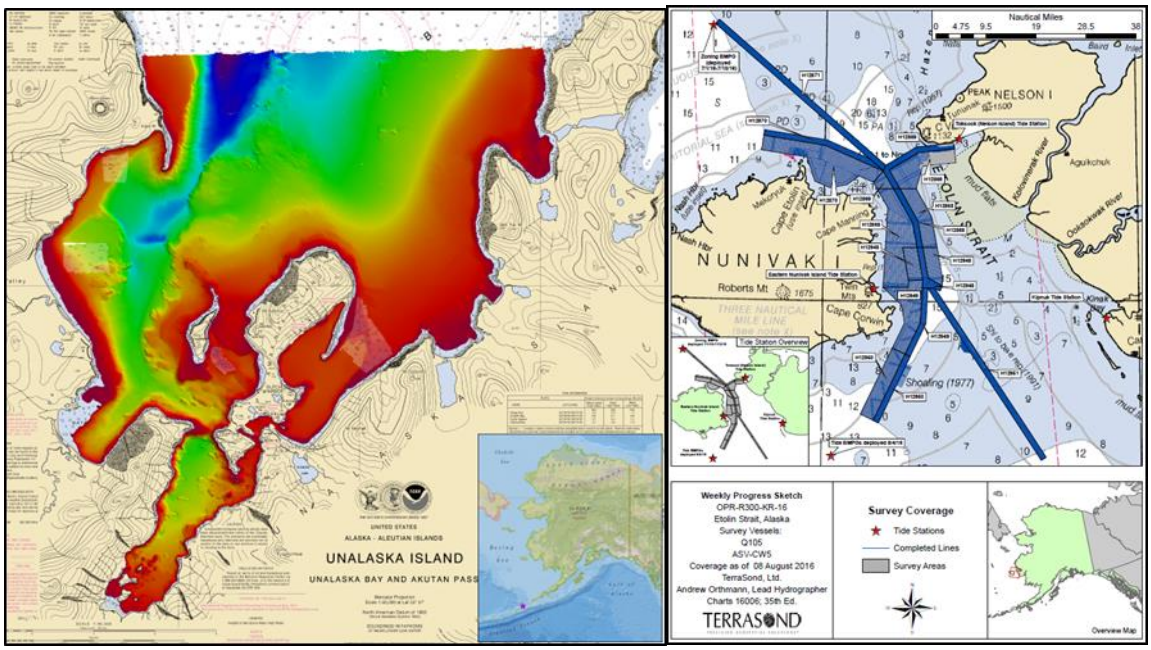
Current NOAA Arctic Activity

In 2015, NOAA Ships FAIRWEATHER and RAINIER acquired reconnaissance bathymetry along the main shipping route which extends from the Aleutians up through the Bering Strait as a joint effort with the USCG Cutter Healy. Preliminary results suggest the corridor to be free of any immediate hazards to surface navigation.



In 2015, NOAA Ships FAIRWEATHER and RAINIER conducted a summer hydrographic surveying project in the U.S. Arctic along the western coast of Alaska in Kotzebue Sound. In 2016, NOAA Ship FAIRWEATHER small boats acquired 38 SNM of hydrographic survey data off the North Coast of

Unalaska Island and NOAA contractor TerraSond acquired 570 SNM of hydrographic survey data in Etolin Strait, east of Nunivak Island.



2016 NOAA Hydrographic Surveys conducted in U.S. Arctic waters

3. New Charts and Updates

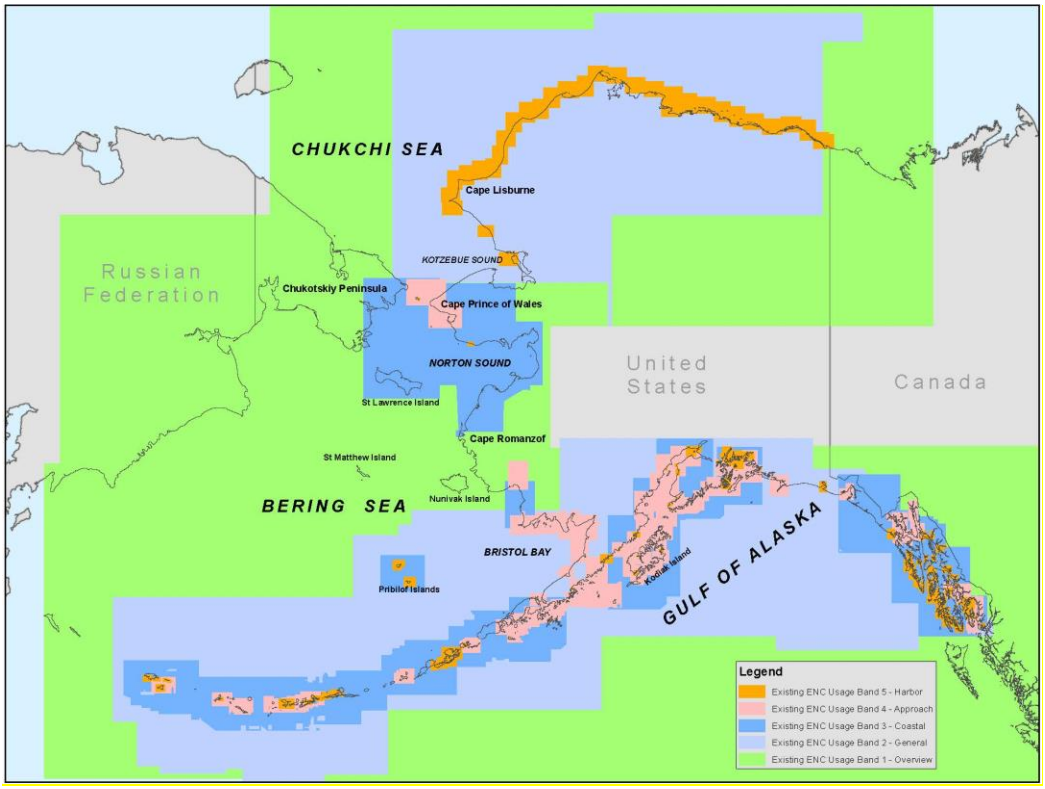
U.S. Arctic Nautical Charting Plan (2016)

The U.S. Arctic Nautical Charting Plan (2016) provides information about existing, recently added, and proposed new raster (paper) and ENC coverage in U.S. Arctic waters. Existing ENC coverage is shown in a series of graphics depicting the extent of different navigational purpose (or scale) bands. Recently added and proposed new 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 Plan also provides information about 15 new or proposed raster charts in U.S. Arctic waters. 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. The U.S. Arctic Nautical Charting Plan may be downloaded at http://www.nauticalcharts.noaa.gov/mcd/docs/Arctic_Nautical_Charting_Plan.pdf.

Electronic Nautical Charts (ENC)

The U.S. (NOAA) maintains 1,181 ENCs in U.S. domestic waters.



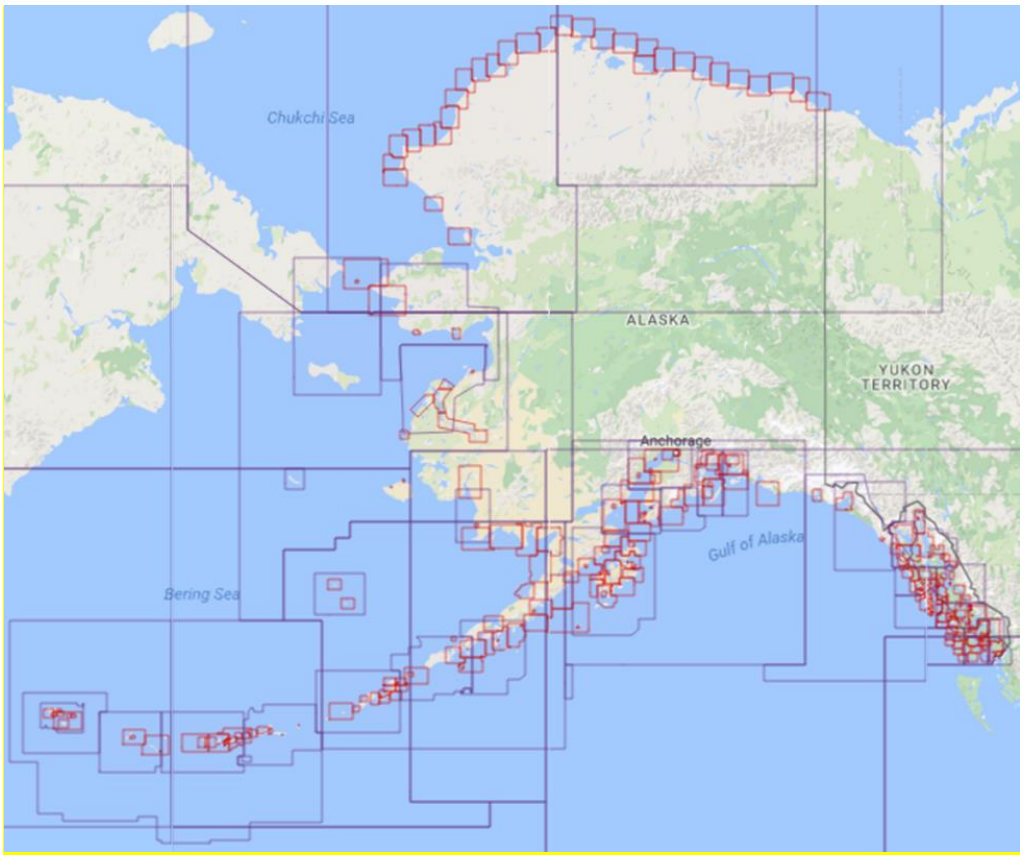


Figure 2: There are 308 existing ENCs in Alaska, shown here in the NOAA interactive chart catalog.

ENC distribution

U.S. 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

Company	Certification Type[1]
Baker Lyman and Co	CED
ChartWorld	CEVAD
C-MAP Norway	CEVAD
Creative Map Corp	CED
Maris	CED
National Geospatial-Intelligence Agency (NGA)	CED
Primar	CED
Titafin	CED
Transas	CEVAD
United Kingdom Hydrographic Office	CED

Regional ENC Coordinating Center (RENC) Membership

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.”

Regional IC-ENC offices conduct full and independent validation of all ENC data from regional members before it is published. They also handle data distribution to value-added resellers on behalf of their members.

[1] 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.

ENC Overlaps

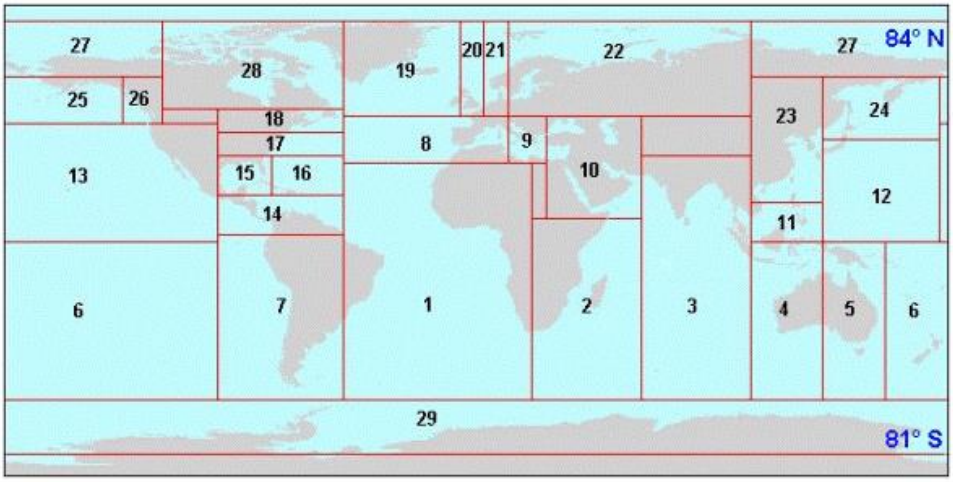
There are currently several overlapping ENCs within the U.S. and Russian Federation usage bands 2, 3, and 4 coverage. The overlapping cells are listed in the table below. The U.S. and the Russian Federation are continuing discussions to resolve these overlaps.

Band 4	
RU4OH1S0	US4AK8DM
Band 3	
RU3O90B9	US3AK89M
RU3OE090	
RU3OH0B0	
Band 2	
RU2N0Y50	US2AK95M
RU2NAZ60	US2AK7XM
RU2O5Z00	US2AK92M
RU2OG0T9	

Digital Nautical Chart (DNC)

The U.S. produces many DNCs in the ARHC waters. The DNC is produced by the National Geospatial-Intelligence Agency (NGA) and 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.



They 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 except within U.S territorial waters and where source data restrictions allow. However, data can be shared with host nations based on Bi-lateral agreements.

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

Raster Navigational Charts (RNC)

In 2014, the U.S. Government ceased printing of lithographic nautical charts. 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.

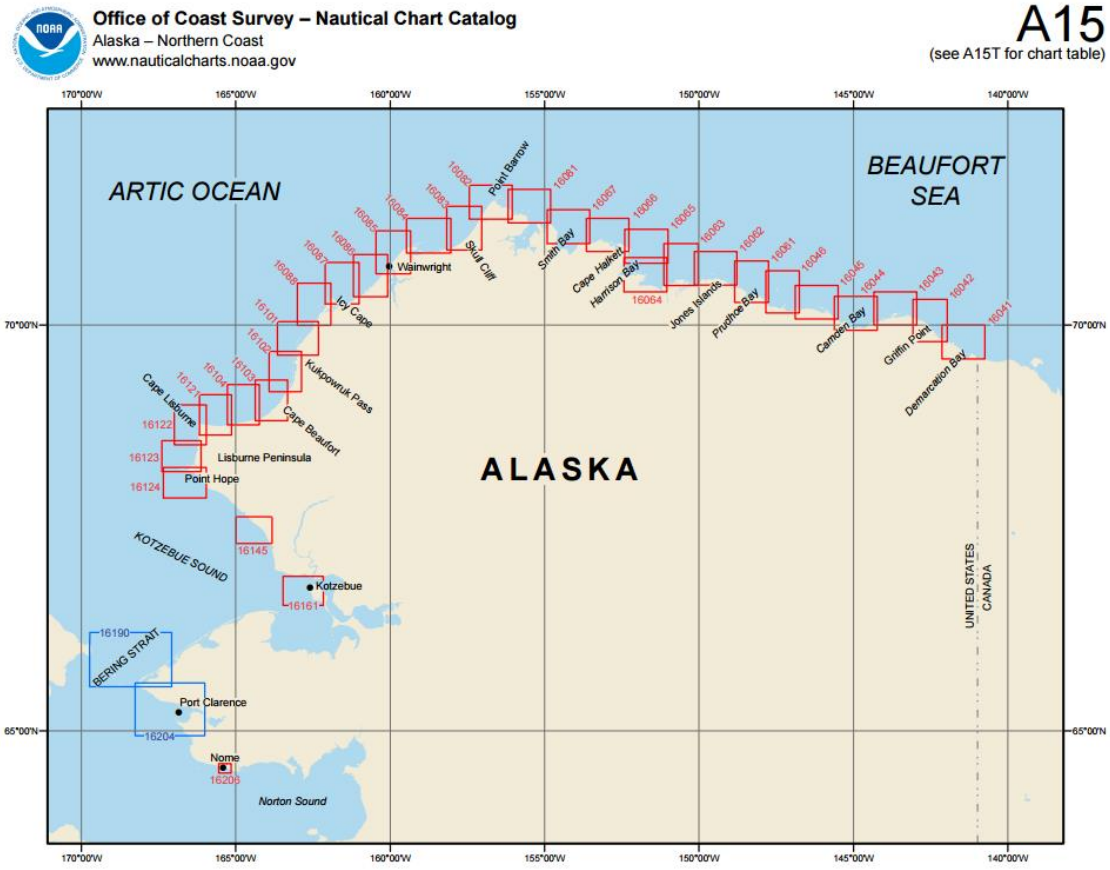


Figure 3: A printer friendly version of the Alaska RNC catalog is at: http://www.nauticalcharts.noaa.gov/catalog/images/2014Alaska.pdf

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

NGA does not produce RNCs.

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 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. Other factors include 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 cooperation of nations within a region to allow 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

International (INT) Charts

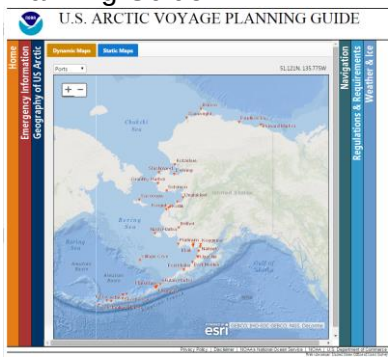
The U.S. does not produce INT charts but does offer "INT Chart Equivalents." Contributions to the S-11 Region N (Edition 2.0.0 September 2013) are currently being provided and coordinated with Norway as the ARHC INT Chart Coordinator.

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

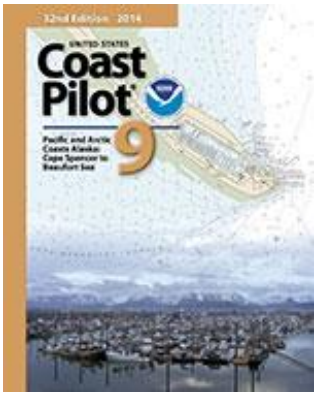
Updated Publications

United States Arctic Voyage Planning Guide



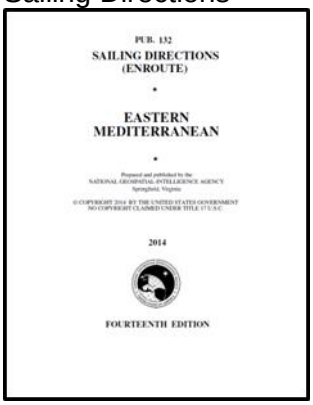
In 2015, the U.S. produced the first version of a U.S. Arctic Voyage Planning Guide to assist mariners and the public access and acquire information relevant to maritime transit in the U.S. Arctic Waters. The U.S. Arctic Voyage Planning Guide is a compilation of official U.S. Government information and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

United States Coast Pilot



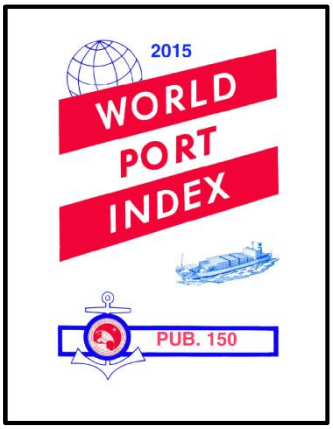
The United States Coast Pilot consists of a series of nine regionally-focused nautical books that cover a variety of useful information important to navigators for coastal and intra-coastal waters and the U.S. Great Lakes. For the ARHC region, Coast Pilot 9 covers Alaska. U.S. Coast Pilot now offers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

Sailing Directions



Sailing Directions are produced and maintained by NGA. It 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.

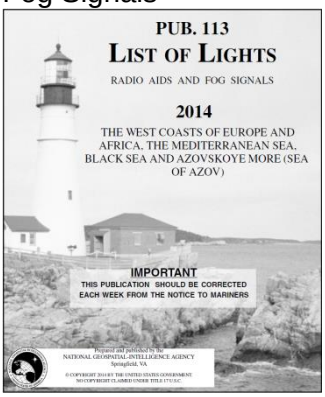
World Port Index



World Port Index (Pub150) is produced and maintained by NGA. It contains the location and physical characteristics as well as the facilities and services offered by major ports and terminals world-wide.

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

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)

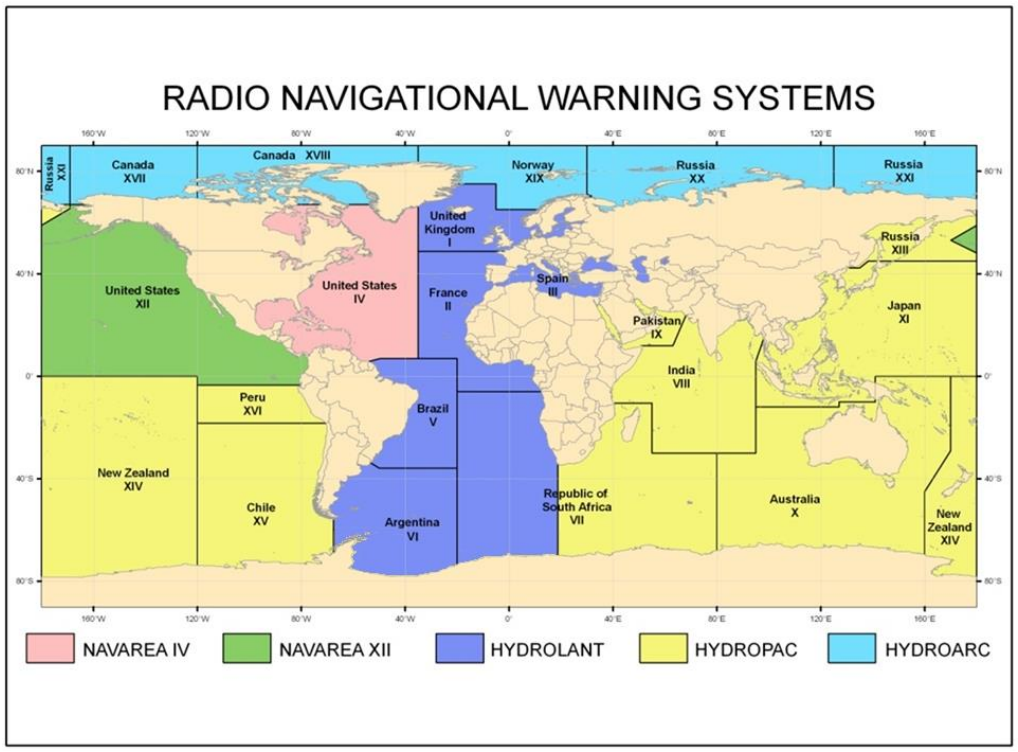
Existing infrastructure for transmission

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 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 .

Navigation Warnings



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.

Assessment of chart adequacy for U.S. Arctic Waters

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 initial findings of the assessment were provided by the ARHC Vice Chair (Canada) to the Arctic Council Protection of the Marine Environment Working Group in September 2014. Further updates will be provided at PAME II (2015) in September 2015 in Tromso, Norway by ARHC member state Norway.

The assessment methodology was documented and presented to the U.S. Hydrographic Conference in March 2015. "A Risk-based Methodology of Assessing the Adequacy of Charting Products in the Arctic Region: Identifying the Survey Priorities of the Future" is available at: http://www.hypack.com/ushydro/2015/papers/pdf/USHydro_Risk_based_Methodology_Gonsalves.pdf. A PowerPoint summary of the assessment is available at: http://www.hypack.com/ushydro/2015/papers/slides/3-Gonsalves_Arctic_Chart_Priority.pdf.

Please see Appendix A for a summary of the initial conclusions of the assessment for U.S. waters. The methodology is being further replicated and developed for other waters of the U.S. to assist in setting survey priorities.

6. C-55[2]

Area: INT Region N – Norway-Alaska

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

Area: All Regions - US

	A	B	C
Depths < 200m	11%	39%	50%
Depths > 200m	16%	4%	80%

7. Capacity Building

Offer of and/or demand for Capacity Building

The United States is an active participant in the IHO Capacity Building Sub-Committee (CBSC), and 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 ad advice as they grow their hydrographic capacity.

Training offered

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

[2] Source: July 2016 draft U.S. C-55 submission.

- The University of Southern Mississippi (USM)
    - www.marine.usm.edu/hs.php
- The University of New Hampshire (UNH)
    - www.marine.unh.edu/research/ccom.html

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).

In July 2016, NOAA, the University of New Hampshire (JHC), and GEBCO conducted the second Chart Adequacy Evaluation Workshop. The Workshop was held in Silver Spring, Maryland and co-sponsored by NOAA and the UKHO with 15 participants from 13 nations attending. This workshop provided training regarding a chart adequacy assessment procedure using automatic-identification system (AIS) data and satellite-derived bathymetry (SDB). Currently, the U.S. is exploring opportunities to offer the course again in latter 2017. Currently, there are only two spots left for this year. For further information, please contact Anthony.Klemm@noaa.gov or Dr. Shachak Pe'eri at shachak.peeri@noaa.gov.

8. Oceanographic Activities

General Bathymetric Chart of the Oceans (GEBCO)

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 data base 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.

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 Office of Coast Survey is providing financial support for an 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. NOAA is 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.

Tide Gauge Network

NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) operate nine permanent National Water Level Observation Network (NWLON) tidal stations located at Unalaska, Nikolski, Atka, Adak, Port Moller, Village Cove, Nome, Red Dog, and Prudhoe. 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.

In 2016, CO-OPS, in partnership with NOAA's National Weather Service (NWS), installed a station in Unalakleet, Alaska on the eastern end of Norton Sound. CO-OPS has 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 shore line erosion. These gaps have been 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 CO-OPS 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 time 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

MSDI Progress

NGA is currently hosting a NGA Arctic Support 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 service enabled in several formats allowing for easy interoperability between applications of a Spatial Data Infrastructure (SDI). Representatives from NGA and NOAA met with the US Geological Survey (USGS), the current lead of the Artic SDI, to learn more about the organization and discuss how an Arctic MSDI could collaborate and cooperate with National Mapping Agencies of the Arctic SDI. NGA's Maritime Safety Office and NOAA's Coast Survey are already providing open data to the Open Geospatial Consortium (OGC) Arctic Spatial Data Pilot (Arctic SDP): http://www.opengeospatial.org/projects/initiatives/arcticsdp.

The Artic SDP is sponsored by the USGS and Natural Recourses Canada for the OGC to execute a study to understand how a SDI for the Arctic might be developed, with interoperability and open standards at the core, while taking in to consideration other requirements of the people/organizations accessing and contributing. In June 2016, the OGC Marine Domain Working Group (Marine DWG) became formalized under the OGC Technical Committee at the 99th OGC TC Meeting in Dublin, Ireland. The Marine DWG operates under the mission "to broaden the use of marine data through the understanding of the interoperability-related requirements for relevant use cases" and work closely with the International Hydrographic Organization (IHO) Marine Spatial Data Infrastructure Working Group (MSDIWG) and its adjacent IHO groups to ensure both evolving IHO standards and OGC standards are being considered by each body. NGA is a named, charter member of the Marine DWG. The most recent information about the

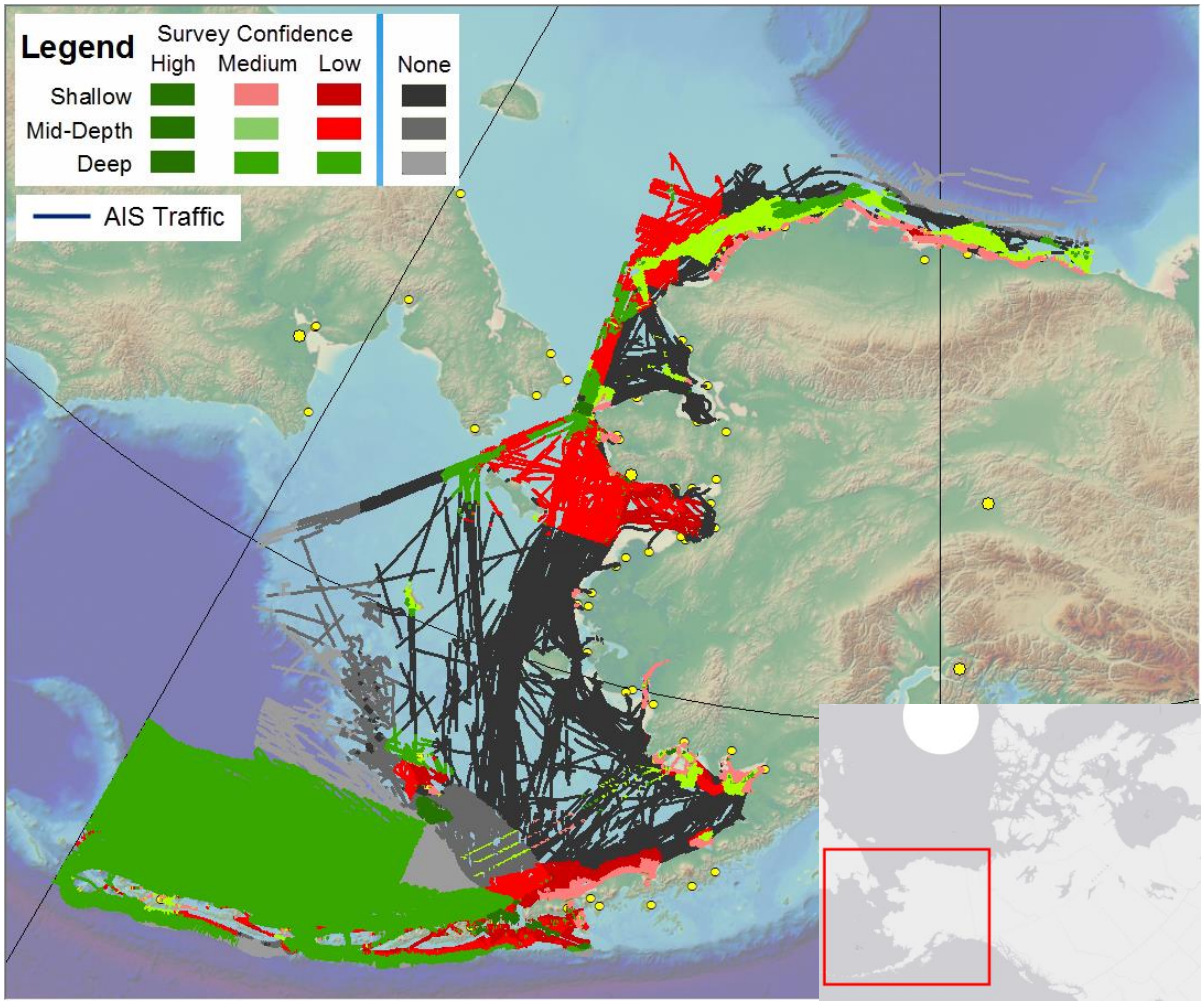
Marine DWG can be found here:
http://external.opengeospatial.org/twiki_public/MarineDWG/WebHome

Appendix A

Assessment of Navigation Risk in the U.S. Arctic Region

Source: "*A Risk-based Methodology of Assessing the Adequacy of Charting Products in the Arctic Region: Identifying the Survey Priorities of the Future*." Full Paper available at: http://www.hypack.com/ushydro/2015/papers/pdf/USHydro_Risk_based_Methodology_Gonsalves.pdf.

PowerPoint Presentation available at: http://www.hypack.com/ushydro/2015/papers/slides/3-Gonsalves_Arctic_Chart_Priority.pdf



Transit lengths of "high risk" vessels within each depth/confidence regime within the Arctic, in the vicinity of the United States, in linear nautical miles (LNM). Within the table, entries further to both the bottom and left represent areas of lower concern (e.g. high confidence with deep depths); whereas

		Vicinity of United States							
		Confidence Level							
		High		Medium		Low		Unassessed	
		LNM	%Total	LNM	%Total	LNM	%Total	LNM	%Total
Depth (m)	Shallow	5,595	0.3%	31,657	1.4%	11,598	0.5%	160,641	7.3%
	Mid-Depth	2,034	0.1%	40,244	1.8%	66,028	3.0%	24,854	1.1%
	Deep	320,822	14.5%	21,633	1.0%	1,393,156	62.9%	137,675	6.2%
Total		328,451	14.8%	93,534	4.2%	1,470,782	66.4%	323,170	14.6%

* - Depth ranges (0-20m, 20-50m, >50m)

Total Linear Nautical Miles of Traffic (USA): 2,214,721