INTERNATIONAL HYDROGRAPHIC ORGANIZATION

UNITED STATES OF AMERICA

National Report

19th Meso-American and Caribbean Sea Hydrographic Commission (MACHC)

Cartagena de Indias, Colombia

26 November-01 December 2018

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
https://www.nga.mil/Pages/Default.aspx

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

Contents[1]

[1] Based on "Structure for National Reports to Regional Hydrographic Commissions." See http://iho.int/mtg_docs/rhc/templates/Struct_NationalReports_Eng.pdf

1. HYDROGRAPHIC OFFICE/SERVICE

This National Report provides specific information pertaining to individual products and services of primary interest to the Meso American – Caribbean Sea Hydrographic Commission (MACHC) Region. Five government agencies are responsible for the management of U.S. domestic and international hydrographic products, services, and maintenance.

1.1 Government Agencies with hydrographic responsibilities in the MACHC Region

1.1.1 National Oceanic and Atmospheric Administration's (NOAA)[2] 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)[3] provides nautical charts and related hydrographic information and is the mapping and charting authority for the U.S. Department of Defense (DOD) and commercial mariners in areas outside the U.S. where the U.S. is the designated charting authority.

1.1.3 The U.S. Navy[4] conducts oceanographic, bathymetric, and hydrographic surveys worldwide to satisfy DOD and national security requirements.

1.1.4 The United States Coast Guard (USCG) provides multifaceted SOLAS support with the responsibility of care and maintenance of maritime aids to navigation used for nautical charting, publishing Local Notice to Marines for hazard avoidance, search and rescue, and security in the MACHC Region. Coast Guard Districts 7 and 8 serve the US portion within the MACHC[5]

1.1.5 The U.S. Army Corps of Engineers, is responsible for hydrographic surveys in designated federal waterways and inland rivers, and produces U.S. inland ENCs (IENCs).

For more information on NOAA, NGA, and NAVY hydrographic activities, see IHO Publication 5.

1.2 United States Strategies for the MACHC Region

The U.S. envisions a stable Meso American – Caribbean Sea area free of conflict, where nations act responsibly in a spirit of trust and cooperation. We have implemented a strategic approach in this region, outlined by a national strategy that focuses on three lines of effort: advance U.S. security interest, pursue responsible regional stewardship, and strengthen international cooperation.

[2] Primarily the Office of Coast Survey

[3] Primarily Source Operations and Management Directorate, Foundation Group, Maritime Safety Office (MSO).

[4] Primarily, Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCCOM) and the Hydrographer of the Navy

[5] www.atlanticarea.uscg.mil/Our-Organization/District-7/ and https://www.atlanticarea.uscg.mil/Our-Organization/District-8/

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

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[6] is the foundation of the U.S. Open data policy. With the exception of some data collected and/or obtained by the U.S. Navy through bilateral agreements, the open data policy has led to the public availability of most hydrographic data, products, and services produced by U.S. Hydrographic Offices (HO's) for data downloads at no cost. Further information on U.S. Navy collected data is provided in Section 2.2, below.

Much of this open data information is available on the NOAA and NGA websites.[7] Additionally, NOAA makes ENC data available for use in GIS applications via their ENC direct to GIS website.[8] NGA also makes data available to support crisis events and various initiatives.[9]

1.4 International Open Government Partnership (OGP)

OGP provides an international platform committed to making governments more open, accountable, and responsive to citizens. Since its inception, OGP has grown from 8 countries to 79 participating countries. In all of these countries, government and civil society are working together to develop and implement ambitious open government reforms. The OGP principles are very much in line with the MACHC Statutes of promoting technical cooperation and training, stimulation of all countries in the Region to expand their hydrographic capabilities, and coordination of hydrography and charting efforts within the Region in order to promote Safety of Navigation. Additional information about OGP is available on their website.[10]

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

NOAA is in the process of re-defining how hydrographic survey plans are generated and how survey priorities are identified in federal waters. NOAA hydrographic in-house field units or external

[6] Open Data Policy-Managing Information as an Asset. (2013). Retrieved from https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2013/m-13-13.pdf
[7] NOAA & NGA websites: https://nauticalcharts.noaa.gov/index.html & https://msi.nga.mil/NGAPortal/MSI.portal?_nfpb=true&_st=&_pageLabel=msi_faq_page
[8] NOAA ENC direct to GIS: https://nauticalcharts.noaa.gov/data/gis-data-and-services.html#enc-direct-to-gis
[9] NGA Crisis Support website: https://nga.maps.arcgis.com/home/index.html
[10] OGP website: http://www.opengovpartnership.org/

contractors then conduct surveys to meet these priorities. Data acquired from these surveys must meet the NOS Hydrographic Surveys Specifications and Deliverables[11], in compliance with the NOS data specification guide which is updated annually.

The main component of the new hydrographic survey priorities method is the hydrographic health model. The hydrographic health model is based on the idea of navigational risk. Navigational risk is the product of the likelihood of an adverse event and the consequence of that event occurring. The model incorporates likelihood parameters such as traffic density, known hazards to navigation, and reported ship groundings to estimate the likelihood of an adverse event. To estimate the consequence of an adverse event, the model incorporates parameters such as proximity to search and rescue stations, proximity to reefs or marine sanctuaries. The model also considers the necessary quality of data to support modern traffic relative to what is currently available, explicitly recognizing that the seafloor changes over time. Seafloor changeability takes into account the frequency of storms, current speed, and accumulation of marine debris, where the quality of data in highly changeable areas decreases faster than the quality of data in less changeable areas. Using historic knowledge of seafloor changeability, the model can also approximate the future quality of survey data and assess how often an area needs resurveying.

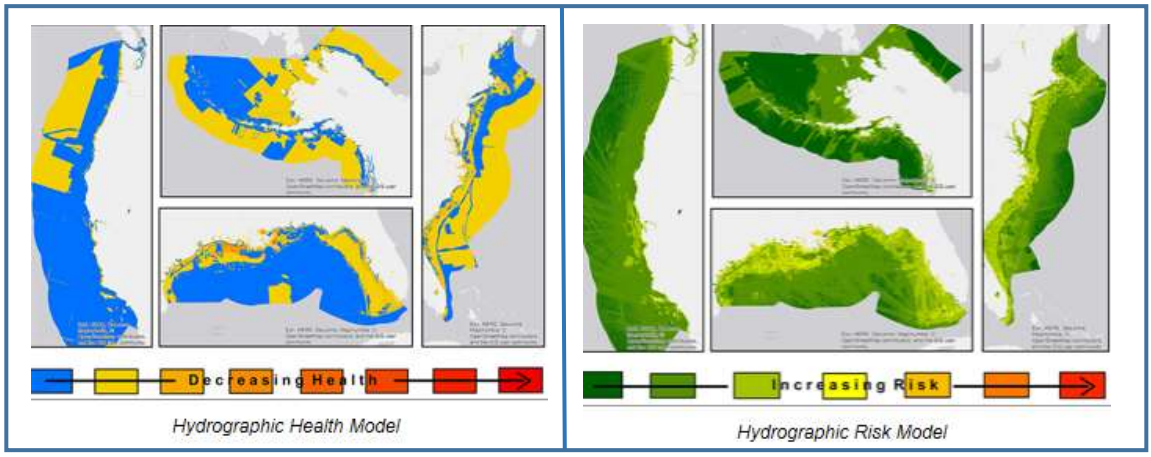

Figure 2.1: Hydrographic Health and Risk Conceptualization

The results of this model are available online in a geographic information system (GIS) interface and summarized in an annual report made available on the internet in FY18. Current information about the model and survey prioritization can be found at: https://nauticalcharts.noaa.gov/publications/national-hydrographic-survey-priorities.html.

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.

[11] Current version is 2018, https://nauticalcharts.noaa.gov/publications/docs/standards-and-requirements/specs/hssd-2018.pdf

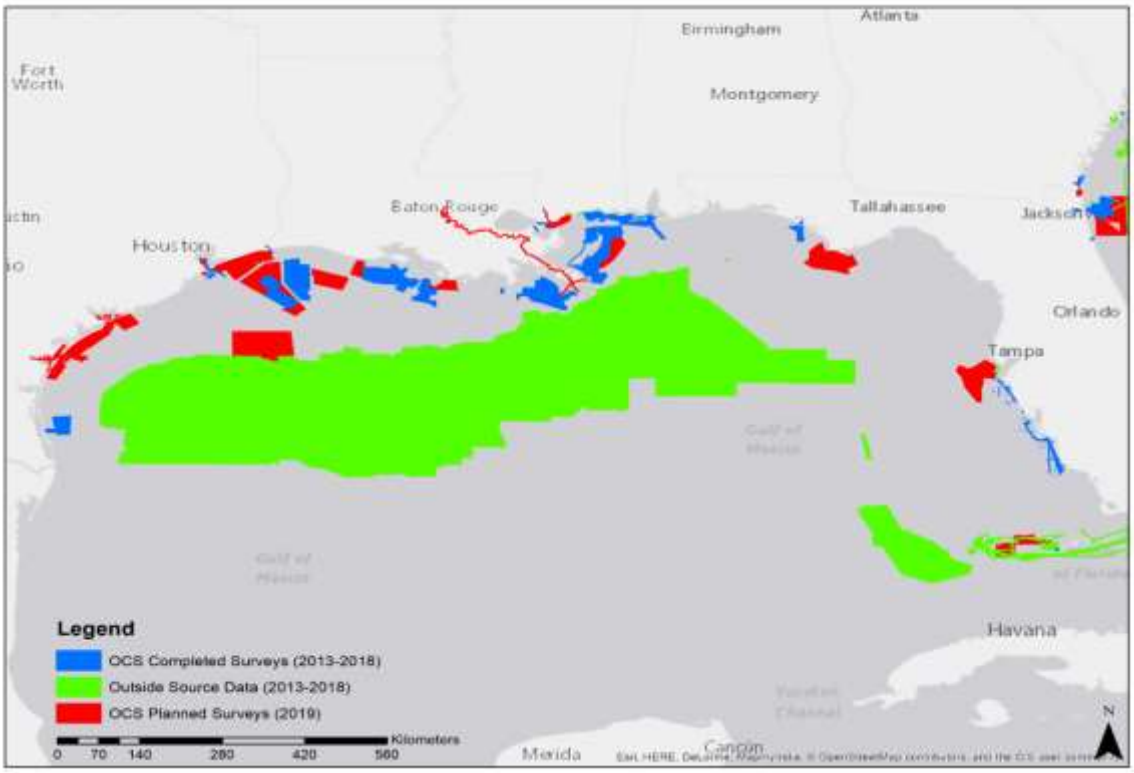

Fig 2.2: Hydrographic surveys conducted by NOAA's Office of Coast Survey between 2013-2018, planned for 2019 and external source data that was evaluated and applied to the charts in the Gulf of Mexico.

Planned surveys will be a combination of either 200% side scan sonar/ object detection multibeam coverage in regions of critical under keel clearance, or 100% side scan sonar / complete coverage multibeam surveys where there is a relaxed requirement for feature detection. These plans do not reflect emerging storm response work

2.2 Surveys outside U.S. Waters

The U.S. Navy conducts hydrographic surveys outside the United States in international waters as well as in the territorial waters of partner nations through diplomatic channels and international agreements to enhance maritime commerce and security while supporting relationship and capacity building initiatives. In 2018, combined hydrographic surveys were conducted in Colombia, Honduras, and Suriname supporting these safety of navigation initiatives, with additional proposed or planned hydrographic surveys for Argentina, Belize, Haiti, and Honduras in 2019.

By U.S. Navy, Commander, Naval Meteorology and Oceanography Command Instruction 5510.1, Disclosure of Information to Foreign Governments and International Organizations, it is USN's Policy to treat all data collected through bi-lateral agreements as restricted from public release. Any further inquiries or requests for data regarding any of these surveys should be directed to the Hydrographic Service or Port Authority of the respective country.

2.3 U.S Hydrographic Survey Platforms

National Oceanic and Atmospheric Administration (NOAA)

NOAA survey platforms include six 28-foot survey boats, a research vessel, a LIDAR-capable aircraft, and private contractors and the following ships: NOAA Ship *Fairweather*, NOAA Ship *Rainier*, NOAA Ship *Thomas Jefferson*, and NOAA Ship *Ferdinand R. Hassler*.

Additional information on NOAA's hydrographic vessels can be found online at: https://nauticalcharts.noaa.gov/about/survey-vessels.html

U.S. NAVY

The Naval Oceanographic Office (NAVOCEANO), a subordinate command of the Naval Meteorology and Oceanography Command COMNAVMETOCCOM, currently has six Pathfinder Class 100-meter multi-purpose survey ships to conduct oceanographic, bathymetric, and hydrographic surveys in deep-ocean and coastal waters. Each ship carries two 10-meter hydrographic survey launches (HSLs).

NAVOCEANO also maintains the Airborne Coastal Survey (ACS) capability with the Optech, Inc., Coastal Zone Mapping and Imaging LIDAR (CZMIL) system. The system is flown on a Basler BT-67, a refurbished DC-3. NAVOCEANO's subordinate command, Fleet Survey Team (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."

3 NEW CHARTS AND UPDATES

3.1 National Charting Plan (NCP)

On November 1, 2017, NOAA released the National Charting Plan, a strategy to improve NOAA nautical chart coverage, products, and distribution. It describes the evolving state of marine navigation and nautical chart production, and outlines actions that will provide the customer with a suite of products that are more useful, up-to-date, and safer for navigation. It is not a plan for the maintenance of individual charts, but a strategy to improve all charts.

3.2 Electronic Navigational Chart (ENC)

The NOAA currently maintains 1,245 ENCs in U.S. domestic waters and 209 (figure 5) in waters within the MACHC region.

Figure 3.1: Existing 209 ENC's (U.S. MACHC 2018)

NGA produces ENCs in areas where the U.S. functions as the Prime Charting Authority outside U.S. domestic waters. These ENCs are maintained by NGA with new source information from the U.S., and our foreign partners as it becomes available. NGA is working to expand its ENC Portfolio within the MACHC Region in areas where the U.S. acts as the Prime Charting Authority.

U.S. 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. The ENCs, including newly created NGA ENCs, are distributed directly from the NOAA website at: https://nauticalcharts.noaa.gov/charts/noaa-enc.html. They are also available through the International Center for ENC's Distributors, http://www.ic-enc.org/Distribution.html.

ENC Band	1	2	3	4	5	6
Number of U.S. ENCs existing in MACHC Region (NOAA)	3	5	14	62	119	5
Number of U.S. ENCs existing in MACHC Region (NGA)	0	0	0	7	20	0

The table below shows the listing of NGA cells available in the MACHC Region.

NGA Cells		
Cell Name	Title	Posted
US409860	Approach to Panama Canal – North, Panama	02/15/2018
US409890	Punta Rincon to Isla Tupile, Panama	02/15/2018
US410840	Approaches to Les Cayes and Aquin, Haiti	03/04/2015
US410865	Navassa Island (US) to Cap Tiburon, Haiti	03/04/2015
US410880	Approach to Port-Au-Prince, Haiti	08/14/2018
US410915	Canal De La Tortue, Haiti	08/30/2018
US410930	Approaches to Cap-Haitien and Bahia de Monte Cristi, Haiti	09/19/2014
US509860	Panama Canal Northern End, Panama	Cancelled
US509890	Golfo De San Blas, Panama	07/22/2015
US510820	Jacmel, Haiti	09/12/2014
US510830	Aquin, Haiti	03/04/2015
US510840	Les Cayes, Haiti	03/04/2015
US510860	Miragoane, Haiti	08/30/2018
US510870	Petit Goave, Haiti	08/30/2018
US510880	Port-Au-Prince, Haiti	08/14/2018
US510885	Baie de Saint-Marc, Haiti	09/12/2014
US510890	LaFiteau, Haiti	08/30/2018
US510910	Gonaives, Haiti	09/12/2014
US510918	Mole Saint Nicolas, Haiti	08/30/2018
US510920	Port de Paix, Haiti	08/30/2018
US510922	Rada De La Basse Terre, Haiti	08/30/2018
US510925	Baie de L'Acul, Haiti	08/30/2018
US510930	Cap-Haitien, Haiti	11/28/2015
US515390	Panama Canal, Panama	Cancelled
US515410	Panama Canal Southern End, Panama	06/23/2016
US3HTI01	Haiti Coast	In Progress
US511050	Las Calderas, Dominican Republic	Completed
US510970	Monte Cristi, Dominican Republic	Completed
US510960	Pepillo Salcedo, Dominican Republic	08/30/2018
US511060	Puerto de Haina, Dominican Republic	In Progress
US510121	Cay Sal, Bahamas	05/31/2018

3.4 Raster Navigational Charts (RNC) & Electronic Navigational Charts (ENC) Distribution

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: https://nauticalcharts.noaa.gov/data/hydrographic-survey-data.html

For access to RNC Charts: https://nauticalcharts.noaa.gov/charts/noaa-raster-charts.html

For access to ENC Charts: https://nauticalcharts.noaa.gov/charts/noaa-enc.html
For access to the Coast Pilot: https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html

NOAA produces 184 RNC charts and 209 ENC charts in the domestic waters within the MACHC region. As of April 2014, NOAA no longer produces lithographic paper charts with traditional print cycles for new editions. All paper charts are updated weekly and available for download as Print-on-Demand (POD) products, or in paper form from one of 17 NOAA-certified chart-printing agents. (See Annex A for NOAA certified chart printing agents).

U.S. 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 the International Center for ENC's Distributors, http://www.ic-enc.org/Distribution.html.

3.5 Digital Nautical Chart (DNC)

The U.S. produces many DNCs in MACHC 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.

DNC consists of libraries in a variety of scales for complete worldwide coverage. MACHC data is included in DNC regions 13, 14, 15, and 16. See coverage below.

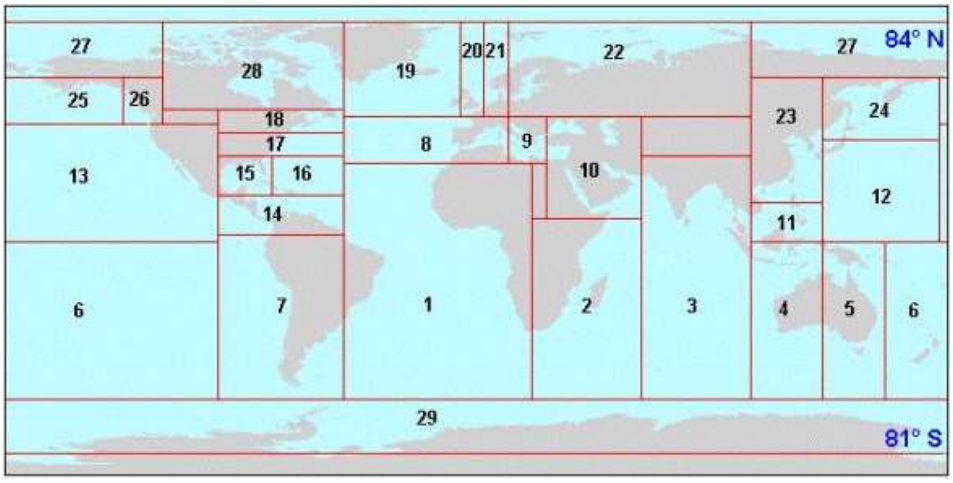

Figure 3.2: DNC Worldwide Coverage

DNC is maintained with new source information from the U.S. and foreign primary charting authorities. The DNC product is Limited Distribution and are not available for public sale or

download except for those that are within U.S. territorial waters or in areas where source data restrictions allow them to be released. However, DNC data can be shared with host nations for coverage in their territorial waters through formal bilateral exchange agreements.

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

3.6 Raster Navigational Charts (RNC) and Paper Charts

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.

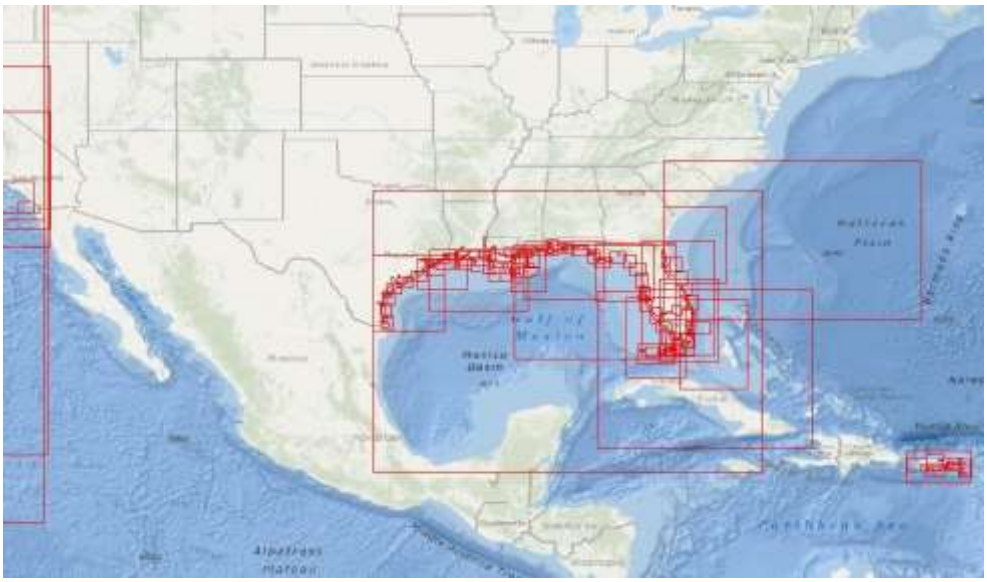

Figure 3.3: NOAA MACHC RNC

Shown above is a graphic of the MACHC region RNC coverage. A detailed catalog can be downloaded at: http://charts.noaa.gov/ChartCatalog/webimages/pdf/GulfCoastCatalog.pdf.

U.S. RNCs are downloadable 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 produces 566 paper charts for the MACHC region in their Region 1 & Region 2 portfolios. Most of these charts are not available via public sale but can be requested by bilateral partners via bilateral agreements. The only charts that NGA distributes to the public are those where NGA serves as the primary charting authority. These charts are in areas where the U.S. conducts the surveys, compiles and issues charts, and there is no fully functioning national authority or NGA has specific authority (e.g. Trust Territory of the Pacific).

Chart	Chart Title	Edition Date	Distribution
24502	Barranquilla, Colombia	March 2017	LIM DIS
27085	Bahia de la Habana, Cuba	April 2017	LIM DIS
24465	Sint Anna Baai and Schottegat, Curacao, Netherland Antilles	July 2017	LIM DIS
24462	Curacao, Netherland Antilles	August 2017	LIM DIS
21478	Puerto Madero (Puerto Chiapas), Mexico	November 2017	LIM DIS
21483	Puerto San Jose and Puerto Quetzal, Guatemala	November 2017	
21489	Approaches to San Jose, Guatemala	December 2017	
26128	Kingston Harbor, Jamaica	July 2018	LIM DIS
24375	Approaches to Suriname River, Suriname	August 2018	LIM DIS
24376	Paramaribo, Suriname	August 2018	LIM DIS
27105	Bahia de Cabanas, Cuba	August 2018	LIM DIS
24400	East Coast of Trinidad Including Tobago, Trinidad and Tobago	October 2018	LIM DIS
27090	Bahia de Matanzas, Cuba	October 2018	LIM DIS
27005	Key West to San Juan	In work	
27083	Bahia del Mariel, Cuba	In Work	

3.7 International (INT) Charts

NOAA and NGA share INT chart responsibility within the MACHC region. The U.S. is responsible for 12 international series charts in the MACHC, ranging in scales between 1:300,000 to 1:2,750,000.

INT No.	Nat No.	Producing Agency	Title	Edition Date
401	401	NGA	Gulf of Mexico	1991
811	503	NGA	Mexico to Ecuador	1996
4015	11004	NOAA	Mississippi River to Rio Grande	2014
4016	11006	NOAA	Gulf Coast - Key West to Mississippi River	2013
4017	11013	NOAA	Straits of Florida	2012
4021	26025	NGA	Eastern Cuba to Puerto Rico	FY2019
4145	11300	NOAA	Galveston to Rio Grande	2018
4146	11340	NOAA	Mississippi River to Galveston	2017
4147	11360	NOAA	Cape St. George to Mississippi Passes	2010
4148	11420	NOAA	Havana to Tampa Bay	2017
4149	11549	NOAA	Straits of Florida Eastern Part	2017
4178	25640	NOAA	Puerto Rico and Virgin Islands	2013

4 NEW PUBLICATIONS AND UPDATES

4.1 New Publications

None for comment.

4.2 Updated Publications

- The American Practical Navigator, first published in 1802 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

The following publications are continuously updated in accordance with SOLAS:

- 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. *Coast Pilots 4, 5,* and *7* provide information for the MACHC region. U.S. Coast Pilot now offers completely updated every week. U.S. Coast Pilots can be downloaded at: https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html

- Produced and maintained by NGA, **Sailing Directions** consists of useful information important to navigators of coastal waters. Information for the MACHC region is contained in following Publications:

Publication	Edition Date
Sailing Directions 120 – Pacific Ocean and Southeast Asia (Planning)	2018 Edition
Sailing Directions 140 – North Atlantic Ocean and Adjacent Seas (Planning)	2017 Edition
Sailing Directions 124 – East Coast of South America (Enroute)	2017 Edition
Sailing Directions 147 – Caribbean Vol. 1 (Enroute)	2015 Edition
Sailing Directions 148 – Caribbean Vol. 2 (Enroute)	2017 Edition
Sailing Directions 153 – West Coast of Mexico and South America (Enroute)	2017 Edition

Digital updates can be downloaded from NGA at: http://msi.nga.mil/NGAPortal/MSI.portal .

- ***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.

- 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. Two (2) volumes of List of Lights cover the MACHC region:

Publication	Edition Date
List of Lights Pub. 110 (Greenland, E. Coast N & S America and W. Indies, excluding USA)	2018 Edition
List of Lights Pub. 111 (W. Coast N & S America (excluding USA), Australia, Tasmania, NZ, and Islands in the N/S Pacific Ocean	2018 Edition

5 MARITIME SAFETY INFORMATION (MSI)

5.1 Existing infrastructure for transmission

Maritime Safety Information (MSI) is navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships in accordance with the International Convention for the Safety of Life at Sea, 1974, as amended. Another component of MSI is the U.S. Notice to Mariners, which provides timely 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 provides for the correction of unclassified nautical charts, the unclassified NGA/DLA 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, NOAA, and the USCG.

5.2 Notice to Mariners

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

Local Notice to Mariners are updated weekly and available for download in several formats. U.S. Coast Guard Districts 7 and 8 are responsible for publishing Notice to Mariners in the MACHC Region and notices are available at www.atlanticarea.uscg.mil/Our-Organization/District-7/ and https://www.atlanticarea.uscg.mil/Our-Organization/District-8/.

The U.S. Notice to Mariners are posted at the NGA Maritime Safety website at http://msi.nga.mil/NGAPortal/MSI.portal

5.3 Navigation Warnings

Figure 5.1: Radio Navigational Warning Systems

As the NAVAREA IV and XII Coordinator, NGA issues the navigational warnings for these areas and are broadcast and uploaded to http://msi.nga.mil/NGAPortal/MSI.portal. NGA requests the assistance of all member states within these two NAVAREA regions to relay pertinent maritime safety information for promulgation to navsafety@nga.mil .

The International Maritime Organization has designated NAVTEX as the primary means for transmitting coastal urgent marine safety for instantly distributing maritime navigational warnings, weather forecasts and warnings, search and rescue notices and similar information to ships worldwide. Eleven NAVTEX stations are operational in NAVAREA IV and XII and is broadcasted from Coast Guard facilities in Cape Cod, Chesapeake VA, Savannah GA, Miami FL, New Orleans LA, San Juan PR, Cambria CA, Pt. Reyes CA, Astoria OR, Kodiak AK, Honolulu HI, and Guam. The broadcast coverage area for NAVTEX stations vary between 200 and 500 nautical miles from shore.

The NAVAREA coordinator is the authority charged with coordinating, collating and issuing navigational warnings for a designated NAVAREA within the IMO/IHO World-Wide Navigational Warning Service (WWNWS) (see figure below).

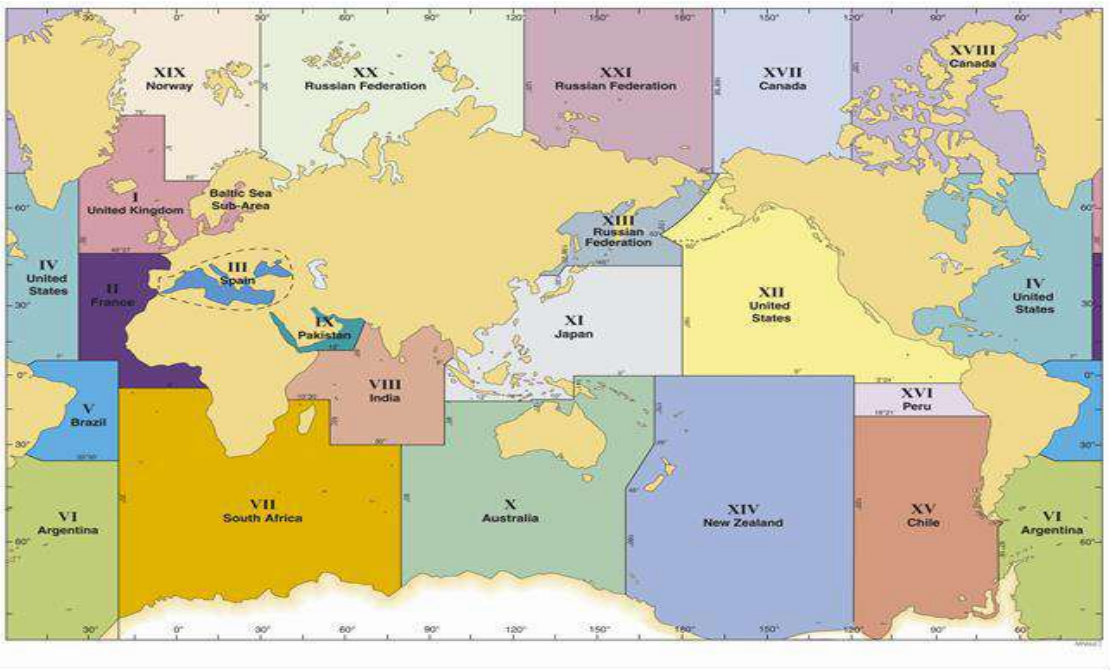

Figure 5.2: NAVAREAS for coordinating and promulgating navigational warnings under the World-Wide Navigational Warning Service

6. C-55[12]

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:

The status of hydrographic surveys of navigable waters in the U.S. portion of the MACHC Region (Gulf of Mexico and Puerto Rico) out to the limits of the EEZ is as follows:

A = percentage which is adequately surveyed
B = percentage which requires re-survey at larger scale or to modern standards
C = percentage which has never been systematically surveyed

	A	B	C
Depths < 200m	10%	57%	33%
Depths > 200m	70%	05%	25%

[12] Source: March 2018 IHO U.S. C-55. https://www.iho.int/iho_pubs/CB/C-55/c55.pdf

6.2 Nautical Chart Coverage Available:

Coverage of charts published by the U.S. in the MACHC region (Gulf of Mexico Coast of the Continental U.S.), where:

A = percentage covered by INT series, or a paper chart series meeting the standards in M-4
B = percentage covered by Raster Navigational Charts (RNCs) meeting the standards in S-61
C = percentage covered by ENCs meeting the standards in S-57

Purpose/Scale	A	B	C
Offshore passage/Small	100%	100%	100%
Landfall and Coastal passage/Medium	100%	100%	100%
Approaches and Ports/Large	100%	100%	100%
Percentage of Group A showing depths in metres	<1.0%		
Percentage of Group A referenced to a satellite datum	100%		

Coverage of charts published by the U.S. in the MACHC region (Puerto Rico and U.S. Virgin Islands and Navassa Island), are:

Purpose/Scale	A	B	C
Offshore passage/Small	100%	100%	100%
Landfall and Coastal passage/Medium	100%	100%	100%
Approaches and Ports/Large	100%	100%	100%
Percentage of Group A showing depths in metres	3.0%		
Percentage of Group A referenced to a satellite datum	100%		

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 provides support to nations through on site and remote guidance and advice as they grow their hydrographic capacity.

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)[13]
- The University of New Hampshire (UNH)[14]

[13] https://www.usm.edu/marine/hydrographic-science

[14] https://marine.unh.edu/program/center-coastal-and-ocean-mappingjoint-hydrographic-center

- NGA

  Category-B Competence Training for Nautical Cartography - The National Geospatial-Intelligence Agency (NGA) commenced training with an IHO/ICA/FIG IBSC approved portable S-8 Category B Nautical Cartography class in 2017. NGA teamed up with IIC Technologies to provide training to analysts with a comprehensive 20-week instructor led course and a six-week final project. Each session will run for one to three weeks at a time over the course of two years. The pilot session started in June 2017 in Springfield, VA and consists of 10 students. The second session started in St. Louis, MO in January 2018, also with 10 students. A combination of lectures, hands-on compilation techniques, and homework assignments will prepare the students for the final project, the creation of a finished ENC product for NGA users. NGA plans on adding several additional sessions throughout the next several years.

- NOAA

  Category-B Competence Training for Nautical Cartography -- In March, 2017 the IBSC approved the NOAA program for Category B in Cartography. Eleven students graduated from the first class (August 2017 till August 2018). The second class began in August 2018 with 12 students, including foreign national student from the Nigerian Navy that is now participating in this one year competence training program. An announcement for the third class (August 2019 - August 2020) will be in early 2019. For more information, please contact Dr. Shachak Peeri. (shachak.peeri@noaa.gov).

  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).

- Chart Adequacy Workshop

  NOAA's Office of Coast Survey hosts an annual three-day long workshop on nautical chart adequacy assessment for approximately a dozen students from around the world. The participants receive training in techniques to evaluate the suitability of nautical chart products using chart quality assessment techniques with publicly available information. The fifth annual workshop is scheduled to take place sometime in July-August 2019 in Silver Spring, MD. For more information, please contact Dr. Shachak Pe'eri. (shachak.peeri@noaa.gov).

- NAVY

  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.

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).

Seabed 2030 was officially launched at the United Nations Ocean Conference in 2017. Seabed 2030 (https://seabed2030.gebco.net/) aims to bring together all available bathymetric data to produce the definitive map of the world ocean floor, at the best possible resolution within practical limits, by 2030 and make it available to all. It builds on more than 100 years of GEBCO's history in global seafloor mapping. The project seeks to encourage both data collectors and data managers of governmental, academic and private interests to work together to improve the quality of publicly available data and grids of the ocean floor.

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.

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/iho_dcdb/.

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 have written a CSB Guidance Document for layman mariners who wish to collect and contribute CSB 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.

9. OTHER ACTIVITIES

9.1 Marine Spatial Data Infrastructures (MSDI) Progress

9.1.1 International

The International Hydrographic Organization Data Centre for Digital Bathymetry (IHO DCDB) was established in 1988 to steward worldwide bathymetric data on behalf of the IHO Member States. The Centre provides long term archive of and access to single and multibeam deep and shallow water ocean depths contributed by a range of mariners. The IHO DCDB welcomes bathymetric data and metadata, accepts descriptions and spatial footprints of data that is already online and of data that are not publicly available to provide easy search and discovery. Information can be obtained at https://www.ngdc.noaa.gov/iho/.

The U.S. holds active roles in supporting the work of several international MSDI-focused working groups:

- IHO MSDIWG
- UN-GGIM Marine Geospatial Information Working Group (MGIWG)
- Open Geospatial Consortium Marine Domain Working Group (Marine DWG)

9.2.1 National Marine Spatial Data Infrastructures (MSDI) Progress

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, and local governments, non-Federal collaborates, communities, constituents, and professional bodies providing the enabling foundation of standards, data catalogs, partnerships, and tools that make up the National SDI (NSDI). For more information visit: https://www.fgdc.gov/.

Related to MSDI is the U.S., “MarineCadastre.gov.” This is an integrated marine information system that provides data, tools, and technical support for ocean planning. The team for MarineCadastre.gov continually works “to increase access to data through data and map services. The services are designed to deliver data without replication and directly from the

source." MarineCadastre.gov supports complementary efforts: Digital Coast, Data.gov, and Geoplatform.gov (a FGDC initiative). For more information see: https://marinecadastre.gov/.

The Office of Coast Survey contributes to these larger initiatives by supplying chart data in GIS formats via an application called ENC Direct to GIS. This application allows users to request chart data in shapefile format through a geospatially enabled viewer. In addition, Theme Layers are distributed via OGC compliant Web Services. Theme Layers are developed taking into account suggestions from the IHO MSDIWG on core MSDI data layers. This application and the applicable Theme Layers are being redeveloped in 2018-2019 in order to ensure consistency across products, and increase application stability. For more information: https://nauticalcharts.noaa.gov/data/gis-data-and-services.html.

Additionally, several U.S.-regional initiatives exist that further develop MSDI within the country:

- Mid-Atlantic Ocean Data Portal (http://portal.midatlanticocean.org/)

- Northeast Ocean Data Portal (https://www.northeastoceandata.org/).

NGA is supporting and organizing a project – the Marine Spatial Data Infrastructures - Concept Development Study (MSDI-CDS) – along with the Open Geospatial Consortium (OGC) on behalf of the IHO and international marine communities. The aim of this project is to assess the current state of data/product management and exchange technologies used in the marine domain. The knowledge gained from the CDS will be captured in a technical report that will provide the foundation for development of a potential future pilot that will in turn advance the state of Spatial Data Infrastructures (SDIs) that support marine data across the globe. The first MSDI-CDS workshops took place in October to gather information and help focus the effort for the future.

9.2 Earth Gravity Model (EGM) Update

NGA is in the process of updating the Earth Gravity Model (EGM) to reflect the variance in gravity based on the uneven mass distributions found across the irregularly shaped Earth. This gravity difference can effect air, land, and sea navigation if there is no instrument compensation to account for the difference in gravity across the Earth's surface. This model is also important in establishing Mean Sea Level (MSL), which is a component of the World Geodetic System (WGS) system. The next EGM is planned for release in 2020. EGM updates are planned for a 10-year cycle after 2020.

9.3 World Magnetic Model (WMM) Update

The World Magnetic Model (WMM) helps define the difference between true north and magnetic north. This correction is required to safely navigate across the Earth surface. This model changes over time because of magma changes in the Earth's molten iron core. Historically, the shift in the WMM has been consistent over time. However, in recent years the shift has accelerated leading to the need

for NGA to create an out-of-cycle update to the WMM in 2019. This accelerated shift has the greatest effect on navigation in the northern latitudes of the Earth. Accurate compass headings are essential for a wide range of positioning and navigation system applications that use the Earth's geomagnetic field, including most aircraft, ships, submarines and GPS receivers. NGA also plans to release the regular 5-year release of the WMM in 2020 as well.

9.4 Enterprise Engine – Notice to Mariners (E2-NTM)

NGA has developed the Enterprise Engine – Notice to Mariner (E2-NTM) to automate and streamline the Notice to Mariner analytical process. This system allows analysts to visualize chart correction information on source charts and NGA products to more quickly and efficiently evaluate the new notice to mariner information. This E2-NTM capability will help reduce the Notice to Mariner backlog ensuring the chart updates get out to the customer in a timely fashion.

ANNEX A

NOAA CERTIFIED RASTER CHART (PAPER CHART) PRINTERS

Company	Phone Number	Additional Services*
The Copy Shop	770-682-6600	
Frugal Navigator	509-426-4472	FO
Weilbach A/S	+45 33 34 35 60	
Marine Press	514-866-8342	UO
Eagle Enterprises Safety Solutions	800-478-2331	
Bluewater Books & Charts	954-763-6533	WP
Richardson's Maptech (Edgewater Marine Ind., LLC)	508-990-9020	WP
East End Blueprint and Reprographics Services, LLC	631-726-2583	
Pacific Publishers	912-472-4373	WP
TrakMaps	1-877-861-8725	WP
My Nautical Chart	401-499-3842	
The Map Shop	800-532-6675	WP, BC, UO
OceanGrafix	877-562-4278	WP, UO, FO, BC
Map House	Coming Soon	
Maritime Services Ltd.	888-387-8667	
Stanfords	+44 (0)20 7836 1321	
Milwaukee Map Service, Inc. (Meacham Enterprises)	800-525-3822	
East View Geospatial	877-856-6705	BC, FO, UO, WP
William & Heintz Map Corporation	800-338-6228	FO
Captains Charts – Tiger Printing Group, LLC	215-799-0500	UO, WP
Hyannis Marina	508-790-4000 x 2	
Paradise Cay Publications	707-822-9063	WP, FO, BC
Datema Nautical Safety	+31 (0)596 63 52 52	
Granville Printing	203-254-3090	

Additional Services:
Book Chart (**BC**), Folio Charts (**FO**), User Overlays (**UO**), Waterproof Charts (**WP)**

ANNEX B

US IHO Representation (2018)

Acronym	Name	NGA Rep.	NOAA Rep.	NAVY Rep.
IRCC	Inter-Regional Coordination Committee	Keith Dominic	John Nyberg	Stanley Harvey
HSSC	Hydrographic Services and Standards Committee	Albert Armstrong	Dr. Neil Weston	Rodney Ladner
S-100WG	S-100 Working Group	Josh Clayton	Julia Powell	David Brazier
ENCWG	S-101 ENC (S-101) Working Group	Eric Lee	Megan Bartlett	
S-102 subWG	S-102 Sub Working Group	TBD	Julia Powell	
ENCWG (S-101)	ENC	Albert Armstrong	Megan Bartlett	
NIPWG	Nautical Information Provision	Mike Kushla	Tom Loeper	
NCWG	Nautical Cartography	Sean McGurgan	Colby Harmon	
DQWG	Data Quality	Chris Petrof	Sean Legeer	
MSDIWG	Marine Spatial Data Infrastructure	Sebastian Carisio	Patrick Keown	
TWLCWG	Tides & Water Levels and Surface Currents	Doug Roush	Kurt Hess/Peter Stone	
HDWG	Hydrographic Dictionary	TBD	NA	
ABLOS	Advisory Board on Law of the Sea	John Lowell	Leland Snyder	
WWNWS	World Wide Navigational Warning Service	Chris Janus	NA	
CBSC	Capacity Building Sub-Committee		TBD	Calvin Martin
WEND	World Wide ENC Database	Gerry Walter	John Nyberg	
IBSC	Int'l Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers		Andy Armstrong	
GEBCO	General Bathymetric Charts of the Ocean	James Ford	Andy Armstrong	Ray Sawyer
CSBWG	Crowd Sourced Bathymetry Working Group		Jennifer Jencks	
SCRUM	GEBCO Sub Committee on regional undersea mapping	James Ford		
SCUFN	GEBCO Sub Committee on Undersea Feature Names	Trent Palmer		