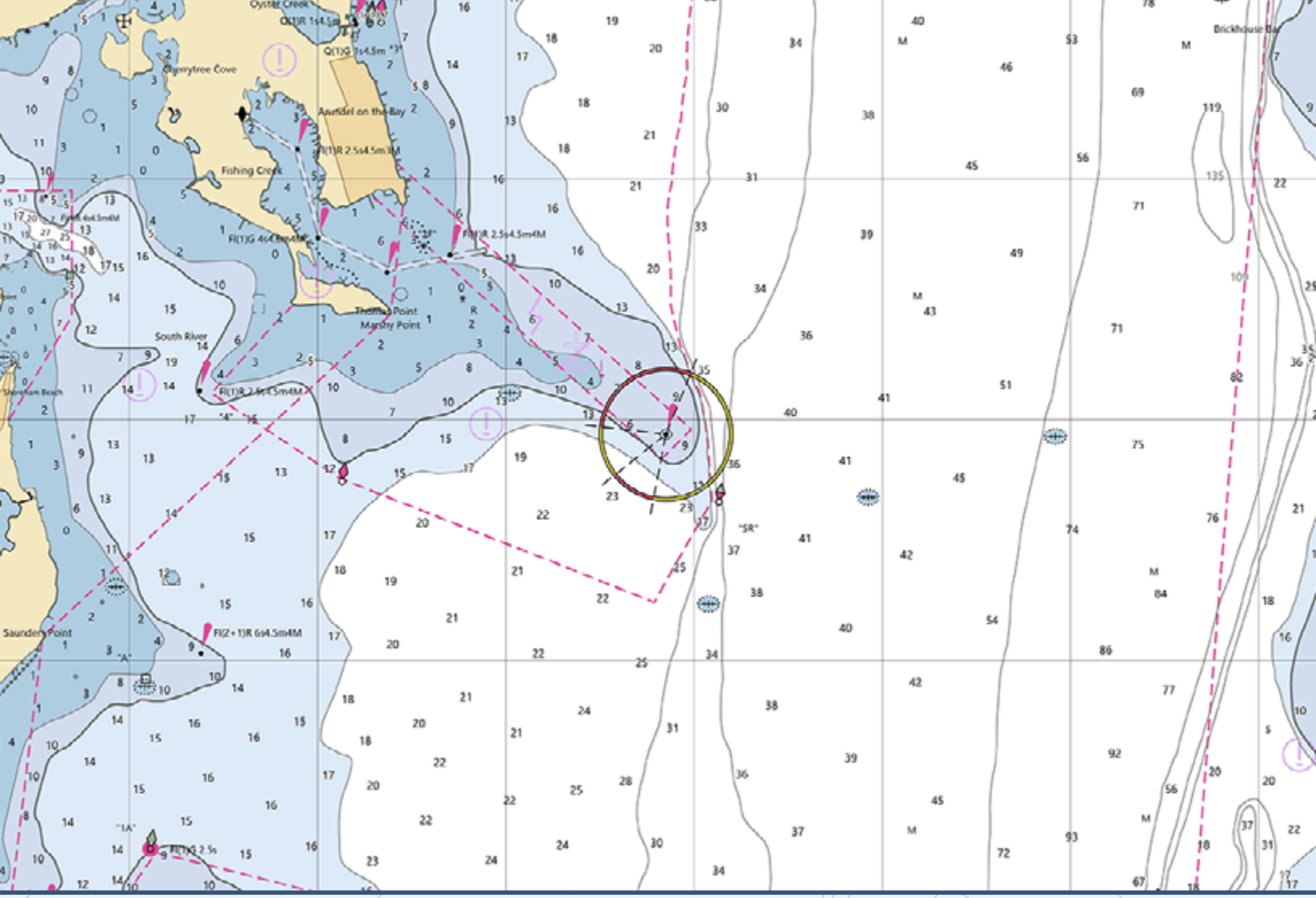

Nautical Charting Plan

Office of Coast Survey | Marine Chart Division

August 2023

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Dedicated to the memory of our friends and fellow cartographers.
Ken Forster ~ Rolland Gant ~ Gerry Koehl ~ Kenny O'Dell

TABLE OF CONTENTS

Introduction and Scope

President Thomas Jefferson created the U.S. Survey of the Coast in 1807 to provide nautical charts to support safe shipping, national defense, and demarcation of maritime boundaries for the young nation. Two centuries later, The Office of Coast Survey—now an office within the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS)—continues to provide navigation products and services that ensure safe and efficient maritime commerce on America's oceans and coastal waters, and in the Great Lakes.

This edition of the NOAA Nautical Charting Plan describes Coast Survey's continuing efforts to meet the needs of mariners and other users of nautical chart data into the future. This document supersedes the 2017 National Charting Plan and the 2019 Sunsetting Traditional NOAA Paper Charts documents. It also incorporates some of the content of the Transforming the NOAA ENC document, other parts of which will be compiled into a new NOAA ENC Design Handbook.

Summary

The focus of this plan, as with the previous charting plan, is the transition from the production and use of paper nautical charts to the production and use of NOAA electronic navigational charts (NOAA ENC®). NOAA is accomplishing this transition by shutting down production of traditional paper nautical charts to enable devoting additional resources to rescheming and improving ENC charts. Over half of NOAA's traditional paper nautical charts have now been canceled and over 20% of the new ENC cells that will replace legacy data in a new rectangular grid have been released. Several enhancements to the ENC are also underway, including the adoption of a new ENC product specification that will enable the integrated display and use of many other types of ancillary information.

The *NOAA Nautical Charting Plan* provides updated information on these initiatives:

- Ending production of NOAA traditional paper and raster nautical chart products and services by January 2025.
- Rescheming and enhancing NOAA ENC coverage to create about 7,200 new (often larger scale, more detailed) ENC cells. The initial gridding phase is scheduled to be completed by the end of 2026. Ultimately, rescheming will improve the data available to mariners and facilitate the conversion of ENCs into the new S-101 format.
- Recompiling ENC depth contours and depth areas from feet and fathoms to meters. Also adding topographic contours and roads to ENCs.
- Enhancing the NOAA Custom Chart application that enables users to create customized paper charts directly from NOAA ENC data and to save and share custom charts in a personal chart catalog.
- Changing the frequency and format used by the U. S. Coast Guard for Local Notices to Mariners and NOAA notification of updates to ENCs.
- Rules and regulations for carriage of ENCs, including new rulemaking by the U.S. Coast Guard.
- Developing new products based on the International Hydrographic Organization (IHO) S-100 Universal Hydrographic Data Model.
- Transitioning production from the ENC format specified in the IHO S-57 standard to the new IHO S-101 ENC Product Specification and starting a dual product distribution capability by 2026.
- Transitioning from large scale High Definition ENCs to IHO S-102 Bathymetric Surface data by the end of 2025.
- ENC data display services and Geographic Information System (GIS) compatible data download options to provide a base map for a wide variety of non-navigational uses.
- Future edition of U.S. Chart No. 1, a document that describes the symbols used on nautical charts produced by NOAA and the National Geospatial-Intelligence Agency.

End of Traditional Paper Nautical Chart Production

In a November 2019 notice in the Federal Register, NOAA announced the sunsetting of its traditional paper and raster nautical chart products. Ending traditional chart production has enabled NOAA to devote more resources to improving the electronic navigational chart (NOAA ENC®) product suite, discussed in the *Rescheming Electronic Navigational Charts* section. Cancellation of the first of NOAA's 1007 paper nautical charts started in 2021. About 30 charts per month are being taken out of production and the entire product line will be shut down by January 2025.

Six months before a chart is canceled, NOAA updates the chart with a note in the lower left corner stating the chart's status as a "last edition" and the date on which it will be canceled, as shown in Figure 1. Concurrently, the U.S. Coast Guard issues a Local Notice to Mariners to announce that no new editions of the chart will be published and the date it will be canceled. The NOAA Chart Dates of Latest Editions webpage has a list of all canceled charts and a list of pending chart cancellations.

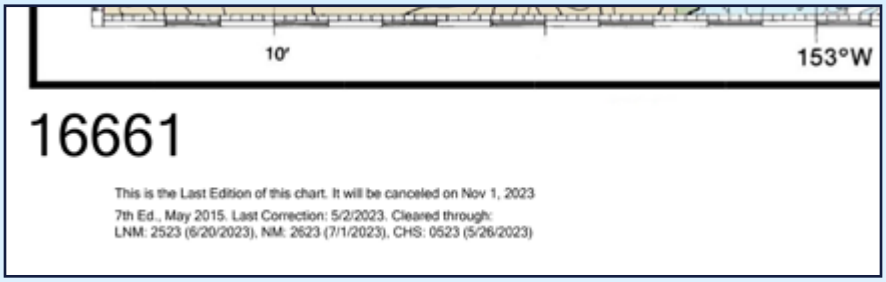

Figure 1. Example of a last edition note.

Other NOAA raster products that are based on the paper chart images are also being canceled when the corresponding paper chart is canceled. These are:

- Raster navigational charts (NOAA RNC®)—full-size, geo-referenced, digital images of NOAA paper nautical charts. These are sometimes referred to as "BSB format" charts and are compatible with some electronic chart display systems.
- Full-size nautical chart PDF images—full-size, geo-referenced, digital images of NOAA paper nautical charts in Adobe Portable Document Format (PDF).
- BookletCharts™—reduced-size replicas of standard NOAA paper nautical charts, divided into a dozen or more 8.5" x 11" pages.

The RNC Tile Service, Seamless RNC Service, and Online RNC Viewer, which provided ways to display raster chart images in third-party applications or online web maps have been shut down. These have all been replaced with similar services that display ENC data, discussed in the ENC Display Services section.

More information is available on NOAA Coast Survey's Farewell to Traditional Nautical Charts webpage.

Archived canceled charts and Training charts

Suitable for framing or as a historical reference, previous editions of all NOAA charts—including canceled last editions—may be downloaded for free from the NOAA Historical Map and Chart Collection. Nautical charts, other maps, and documents, such as the U.S. Coast Pilot®, dating back to the mid-1800s are included in the collection.

Traditional training charts are "frozen in time" and are used in many mariner training and testing institutions. Training chart numbers include a "TR" suffix, such as 1210TR, "Martha's Vineyard to Block Island" and are marked, "For instructional purposes only. Not to be used for navigation." The Historical Map and Chart site has a direct link to Training Charts and paper copies may also be purchased from many commercial providers for about $10.

Rescheming Electronic Navigational Charts

In the early 1990s, NOAA began digitizing paper nautical charts to create a new digital chart product, the electronic navigational chart. ENCs are vector data sets that support all types of marine navigation. Originally designed for large commercial vessels using a sophisticated navigational computer called an Electronic Chart Display and Information System (ECDIS), ENCs are now also used on simpler electronic chart systems and "chart plotters" on many types of ships and recreational vessels. ENCs enable real-time ship positioning, as well as collision and grounding avoidance with ECDIS and some other electronic chart displays. The first NOAA ENC was released to the public in 1993. The scale and limits of each ENC chart (also called a cell) were inherited directly from its corresponding paper chart. Separate ENCs were also created for most paper chart insets. Ultimately, the ENC product suite grew to over 1,200 irregularly shaped ENC cells, compiled in over 100 scales.

Paper and Digital Chart Schemes

The arrangement or layout of a set of chart "footprints" is called a chart scheme. The scheme for traditional paper nautical charts is devised with charts at various scales for different navigational purposes. The smallest scale (least detailed) "Overview" and "General" charts are used for basic voyage planning. The largest scales (most detailed) "Harbor" and "Berthing" charts are used for navigating into harbor and maneuvering to a pier, respectively. The orientation, scale, and paper size used for any given paper chart was determined by its intended purpose and the nature of the area that the chart covered.

Mariners generally use one paper chart at a time and replot a ship's position from one chart to the next as their ship nears the area portrayed at the chart edge. Therefore, the area covered on adjoining charts overlaps to provide room to transfer one's position before running up against the edge of the chart. Paper chart schemes strive to position chart footprints so that dangerous passages and other key navigational features are not near the edge of the chart and harbors are not split across two charts. Although most paper chart scales are at even breaks, such as 1:50,000, 1:100,000, 1:200,000, etc., quite a few have odd scales, such as 1:210,668. These odd scales are usually the result of "squeezing" the area covered within a given paper size to include important harbors or other significant features that are at opposite sides of a chart. This is one reason why NOAA's paper chart suite consisted of so many different scales.

Many of the characteristics of a good paper chart scheme are not applicable for digital chart schemes. ENCs also have a set of six scale bands for different navigational purposes, as shown in Table 1, but none of the other considerations described above are necessary for a digital chart scheme. While paper charts are essentially used one at a time, adjoining ENCs are presented in a seamless manner on electronic navigation systems with no overlap. Because adjacent charts are displayed side-by-side, even small differences in the compilation scale of each adjoining ENC cell can be noticeable. This is especially true if there are differences in the number of depth contours depicted or there are minor variations in the manner in which shorelines or other linear features are compiled in adjacent ENC cells.

Table 1. Standard scales used in reschemed ENCs

Band Number	ENC Usage Band Name	Reschemed ENC Scale
1	Overview	1:5,120,000 1:2,560,000
2	General	1:1,280,000 1:640,000
3	Coastal	1:320,000 1:160,000
4	Approach	1:80,000 1:40,000
5	Harbor	1:20,000 1:10,000
6	Berthing	1:5,000 1:2,500

The new ENC scheme uses only 12 scales, two for each of the six usage bands, as shown in Table 1. After NOAA established these 12 standard scales, the International Hydrographic Organization finalized the minimum and maximum display scales defined in the new S-101 ENC Product Specification. The transition to use the new S-101 ENCs will start in 2026. To prepare for production of the new ENC format, NOAA will begin migrating to a slightly different set of S-101 scales, as ENC cells are recompiled in the metrification phase of the rescheming process described below.

Use of standard scales will reduce discontinuities across adjoining ENCs and make maintenance of the product suite easier. Fewer scales will also improve the display of ENCs in ECDIS and other navigation systems, as well as the output of the NOAA Custom Chart application and online ENC Display Services, enabling a seamless display of data without jarring scale shifts.

Reschemed ENCs will also show a greater level of detail. Over two-thirds of the cells in bands 1, 2, and 3 and over half of the cells in bands 4 and 5 will be at a larger scale than the coverage available in the original ENC scheme.

NOAA has started rescheming ENCs, replacing the irregular cell footprints and scales inherited from paper charts, with a regular gridded layout of cells. There is one exception for a few dozen band 6 ENCs. Like all other legacy ENCs, the current band 6 ENCs—which were generally created from large scale paper chart insets of isolated harbors—will be reschemed into one of two standard scales for their band. However, reschemed band 6 ENCs will retain their original shape and size. Most of these legacy band 6 ENC cells are rectangular, but none of them fit into the standard rectangular grid established for reschemed ENCs. However, they may be transitioned into the standard grid in the future.

An example of reschemed band 4 cells is shown in Figure 2. Typically, several cells in the new rectangular grid fit inside the footprints of the older cells that they are replacing. The smaller size of the reschemed cells enables more efficient ENC production and distribution processes, as well as quicker loading and display of the ENC data.

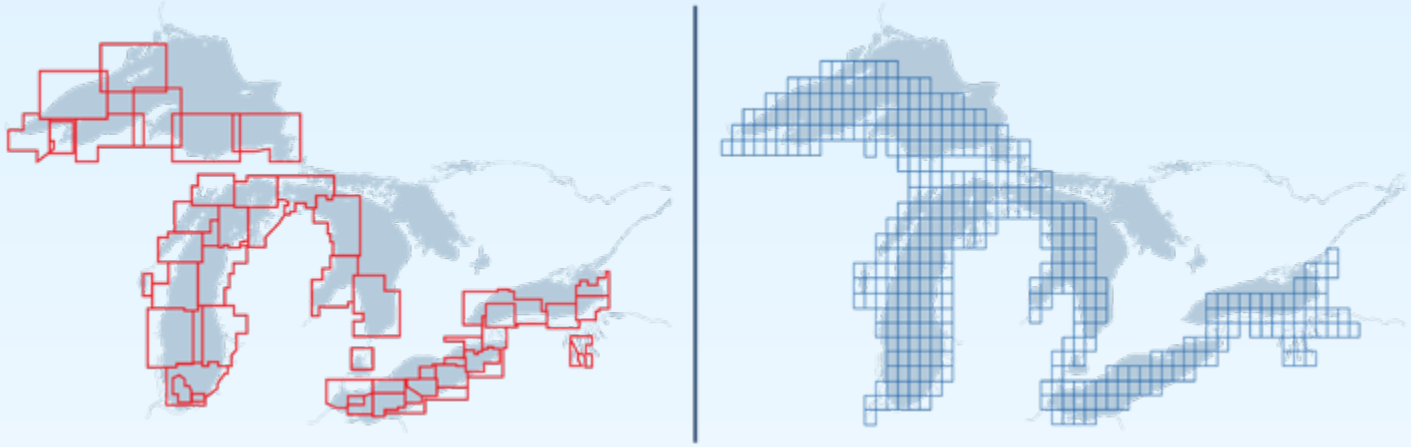

Figure 2. Comparison of the old (red outlines) and new (blue rectangles) ENC band 4 schemes for the Great Lakes

Phases of the ENC Rescheming Process

The rescheming of each legacy ENC cell is accomplished in several phases, shown in Figure 3. When a reschemed ENC cell is released to the public, it reflects changes and improvements made during one or more of these phases, which may be applied in various orders and combinations.

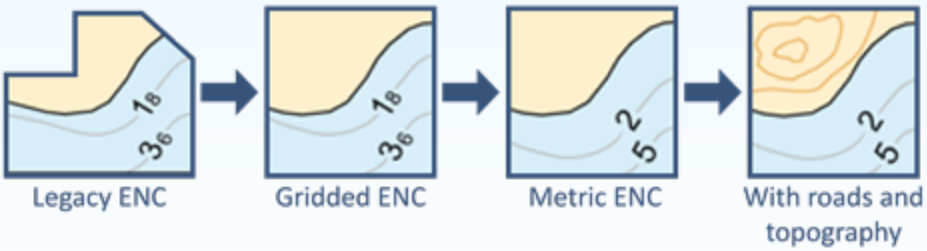

Figure 3. General progression of rescheming process. Gridding always occurs first, metrification usually occurs next, but not always.

Gridding

This is the essential first step in which the first edition of a new, reschemed ENC cell is created. The extent of the new rectangular cell is established—based on specifications in NOAA's Marine Chart Division, Nautical Chart Manual—and the appropriate data for the scale of the ENC is extracted from the ENC production database to populate the new cell. If the scale of the old ENC and the new ENC are the same, this is a relatively simple process. If the scale of the reschemed cell is different, then additional data compilation, generalization and edge matching procedures must be undertaken.

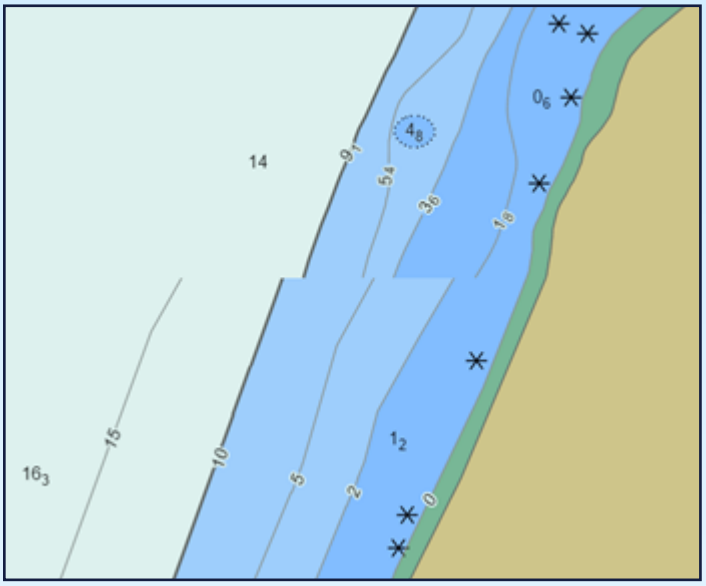

Figure 4. All depth contours in this image are displayed in meters. The contours in the area at the top were compiled for 6, 12, 18, and 30-foot intervals. The contours in the area at the bottom are typical for 1:20,000 scale reschemed ENCs, compiled for 2, 5, 10, and 15-meter intervals.

Metrification

Nearly all of NOAA's paper nautical charts had individual soundings and depth contours compiled in feet or fathoms. The IHO S-57 product specification for ENC requires depths and depth contours to be encoded in meters. When ENCs were initially created, the unit conversion from feet and fathoms to meters was accomplished during the chart digitization process. Soundings deeper than 30 meters are encoded and displayed in full (integer) meter values; shallower soundings are encoded and shown as meters and tenths of meters (decimeters) using a subscript.

Figure 4 shows an area of ENC coverage in which the depth contours in the top portion are compiled in feet. The four contours for 6, 12, 18, and 30 feet are displayed in their metric equivalents—rounded down to the nearest tenth. The bottom portion shows newly "metrified" contours compiled for 2, 5, 10, and 15 meters. Ultimately, reschemed ENCs will show the even meter contours specified for S-57 and S-101 ENCs. For a 1:10,000 harbor scale, band 5 ENC cell, the meter depth contours could be as dense as 2, 3, 4, 5, 6, 7, 8, 10, 15, 20, 30, 50, 100, 150, 200, 300, etc., for areas with a gently sloping seabed. Steeper areas will show fewer contours.

Since reschemed ENCs will often be at a larger scale than the ENCs they are replacing, there will likely be a greater density of depth contours. This enhances the safety of navigation, not only by providing mariners with a more accurate depiction of the sea floor, but also enabling an ECDIS and other electronic navigation systems to initiate automatic alarms and other indications of dangers more suitable to a vessel's specific draft.

Based on a mariner's entry of their ship's "safety contour" value—ship draft plus a safety factor for under keel clearance and to account for squat—an ECDIS will tailor the display of shallow water, route planning feedback, and alarms initiated while underway to suit a particular ship. If the safety contour value entered into an ECDIS is not in the available ENC data, the system will select the next deeper contour available in the ENC for the safety contour that is used to initiate alarms. The fewer depth contours that are available in the ENC data, the greater chance there is of an ECDIS "taking away safe water" from the ship in the navigation system, because the system must select a deeper contour to use as the "safety contour." More depth contours in the ENC data allows an ECDIS to more closely tailor its responses to the actual characteristics of any given ship.

Recompiling new metric depth contours requires interpolating even meter depth values between soundings, but the distribution of soundings shown on nautical charts is not dense enough to accomplish this. New metric contours are compiled from NOAA's National Bathymetric Source. This is high-resolution bathymetry composed of the best available historic and newly acquired data from NOAA and U.S. Army Corps of Engineers hydrographic surveys, and other sources. The National Bathymetric Source combines these sources into one nationwide model of the seafloor. Ultimately, all reschemed ENCs will show even meter contours. Having metric depths will provide uniformity with ENC data provided by all other ENC producing nations over their own waters and international waters. Many ECDIS and other electronic navigation systems enable users to toggle the display of depth units between meters and feet.

Transportation Features and Topographic Contours

Traditional paper nautical charts show roads, railroads, and topographic contours. Most ENCs do not show these features, but they are now being added in the final phase of ENC rescheming. Transportation network features and topography can provide a valuable reference for mariners, especially in remote areas where few other landmarks exist. Figure 5 shows transportation features and topographic contours on a reschemed ENC.

Figure 5. Portion of reschemed ENC Cell US5PHLFJ showing a dark brown urban tint near Trenton, NJ, roads and highways in thick brown lines, and a few topographic contours in thinner brown lines.

Tracking Rescheming Progress

The reschemed ENC product suite is expected to comprise 7,260 cells across the six ENC usage bands. NOAA is adding additional resources to the gridding process and expects to complete gridding the entire suite by the end of 2026.

Cartographic practice normally calls for compiling data by applying increasing levels of generalization from the largest to smallest scales. Thus, the rescheming process is generally starting with the largest scale ENCs—usage bands 6, 5, and 4—and will successively rescheme the ENC cells in bands 3, 2, and finally band 1. Table 2 shows the estimated number of reschemed ENCs in each usage band.

Table 2. Estimated final number of reschemed ENCs to be created in each usage band

Band Number	ENC Usage Band Name	Estimated number of reschemed cells
1	Overview	21
2	General	93
3	Coastal	351
4	Approach	2,385
5	Harbor	4,388
6	Berthing	22

The new scheme for all NOAA ENCs is shown on the Status of New NOAA ENCs web map, which also shows the ongoing progress of creating new reschemed ENC cells. Much of the early efforts were focused in New York and the New England states. Work is now proceeding in all parts of ENC coverage.

NOAA Custom Chart application

The NOAA Custom Chart (NCC) application is an online application that enables users to create their own customized nautical charts directly from the latest official NOAA ENC data. An example of a custom chart is shown in Figure 6. NOAA and the U.S. Coast Guard (USCG) both advise mariners to use ENCs and a digital chart display as their primary means of navigation. Charts output by the NCC application can be used to augment the use of ENCs and are suitable as a backup, for general situational awareness, and smaller scale charts are also useful for overall route planning. NCC charts are not recommended as the primary chart for navigation.

The application outputs geospatially referenced Portable Document Format (PDF) files using the paper size, scale, and chart location parameters input by the user. Users may save and share their chart parameters in a "personal chart catalog," which makes it easy to recreate an updated version of the same chart whenever new ENC data is available.

NCC charts do not have numbers and USCG Local Notice to Mariners will not be issued for NCC charts. However, NOAA is developing a new version of the Weekly Chart Update website that will enable NCC users to input chart parameters from a personal chart catalog to quickly identify all the changes that have been made to the applicable ENC data since the NCC chart was last updated.

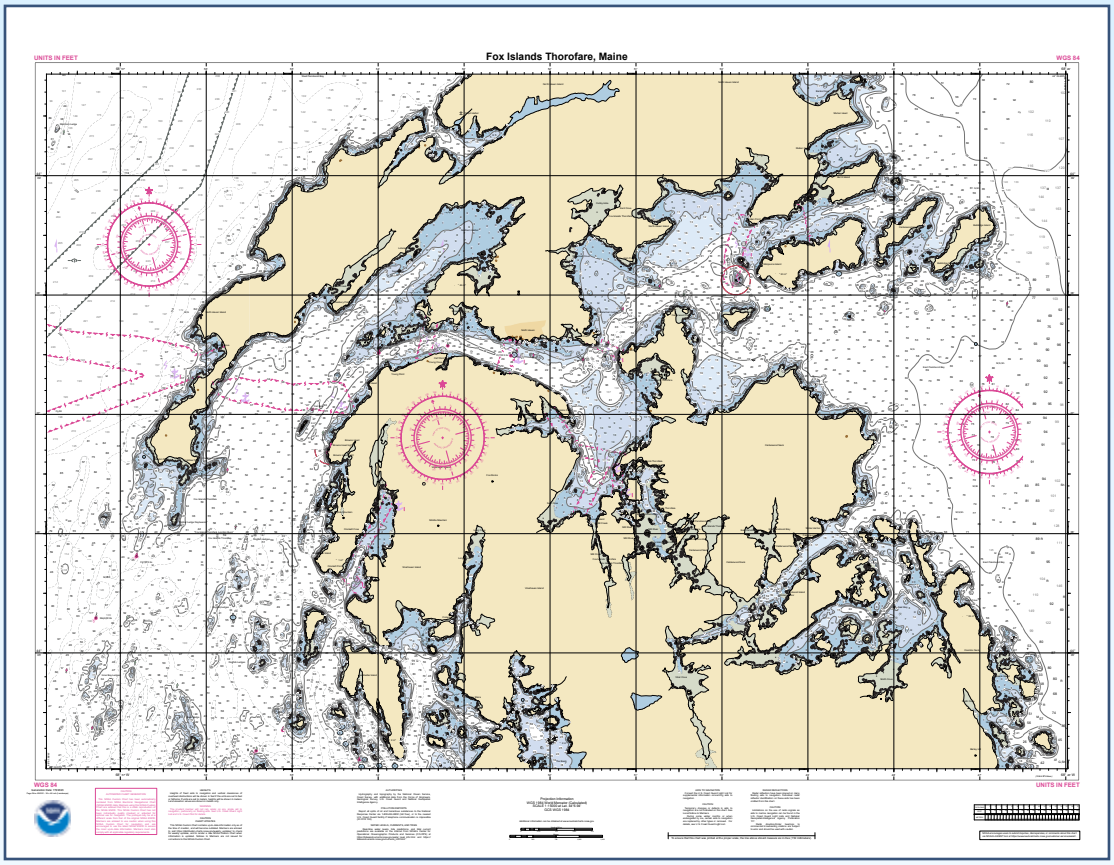

Figure 6. NOAA Custom Chart of Fox Islands Thorofare, Maine.

NCC charts look a little different than traditional paper nautical charts (Figure 7). They are composed in a standard rectangular format featuring a single chart panel; that is, there are no chart insets. The data inside the chart panel is presented in a manner similar to traditional paper nautical charts, showing shoreline, soundings, buoys, beacons and other aids to navigation, compass roses and the like, although some chart symbology may differ slightly. A graphic and a representative-fraction scale, and other marginalia appear below the chart panel. Separate 8.5" x 11" PDF pages contain notes and a zone of confidence diagram, similar to the survey source diagrams seen on traditional nautical charts.

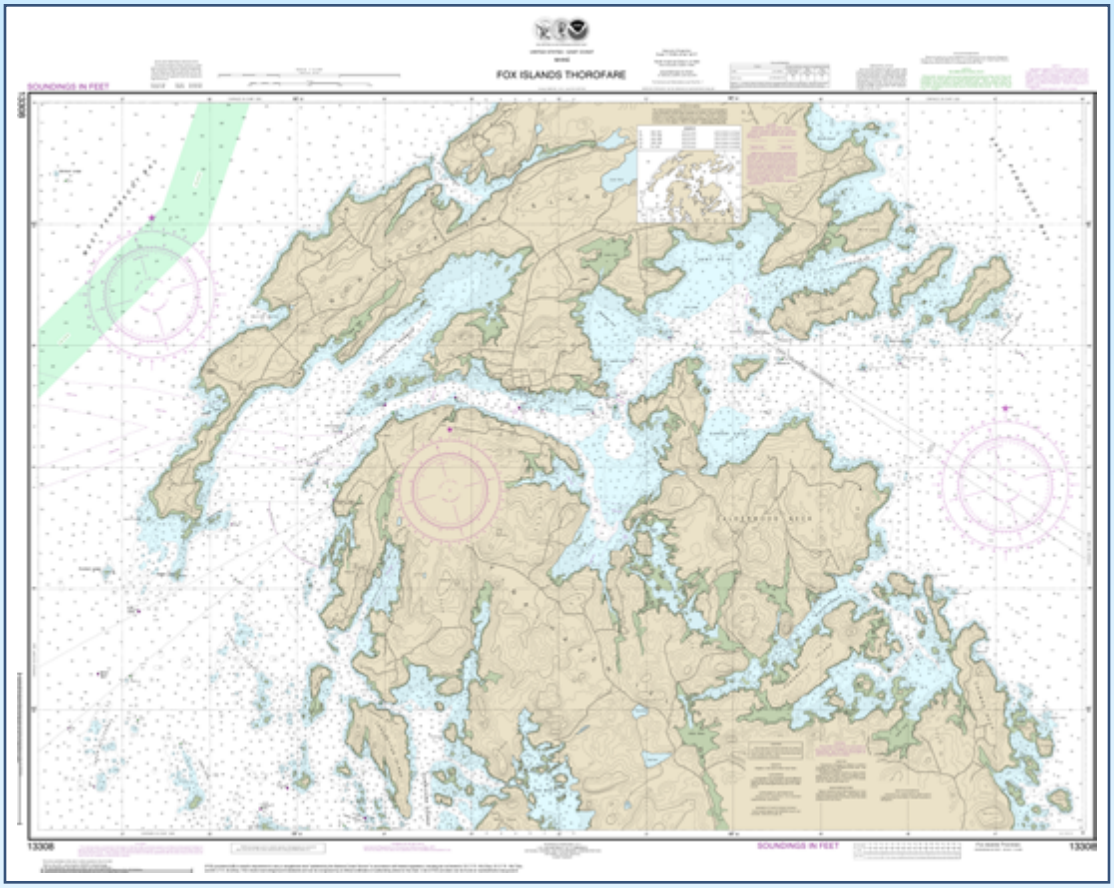

Figure 7. Traditional NOAA Paper Chart 13308 of Fox Islands Thorofare, Maine.

Chart Updates

USCG Local Notice to Mariners

The USCG does not issue chart corrections in the Local Notices to Mariners (LNM) for canceled charts. By 2025, all traditional NOAA paper nautical charts will be canceled and the "Chart Corrections" section of the LNM will be replaced with an "Aids to Navigation Changes" section. Additional changes being implemented as part of the Coast Guard's LNM modernization program include replacing the "General" section with a new "Categories of Information" section. This will include notifications of various types, including "Hazards to Navigation." USCG will also increase the frequency of LNMs from weekly to daily.

Notifications of changes in the LNM will no longer be grouped by NOAA chart numbers. Instead, the general location of changes will be indicated by "waterway names," in addition to the precise geographic coordinates (latitude and longitude) for each feature or area. The Waterway Harmonization Project developed consistent names and geographic definitions for navigable waterways in the United States. This allows the principal agencies managing coastal and inland waters, the USCG, NOAA, and the U. S. Army Corps of Engineers to share data about navigational aids and other information more efficiently and precisely. This will also enable improving the geographic representation of waterways across the federal government. NOAA is also removing paper chart numbers and ENC names from its U.S. Coast Pilot sailing directions and replacing the references with harmonized waterway names.

NOAA ENC Product Updates

NOAA's Weekly Chart Updates web map provides information about critical and routine updates made to NOAA ENCs and paper nautical charts for any given single week. This online service will continue until all NOAA paper charts are canceled on or before January 2025. A new update service is being developed that will provide users with a list of all changes to NOAA ENC data for a particular area over a range of several weeks or months. Users will be able to query the updates database by ENC cell name, waterway, USCG District and Sector, or over the footprint of a NOAA Custom Chart for which an NCC personal chart catalog entry has been created.

ENC Related Regulations

There are many federal and international regulations pertaining to marine navigation. The three types discussed below are especially significant as they explicitly require or promote the use of ENCs over paper nautical charts. These regulations contributed to NOAA's decision to discontinue its production of paper charts and to focus on improving ENC coverage in U.S. waters.

ECDIS and ENCs Required on most International Voyages

The International Convention on the Safety of Life at Sea (SOLAS) is the primary international treaty regulating the safety of merchant ships, first adopted in 1914 in response to the Titanic disaster. Chapter V, Regulation 19 of the current version of SOLAS requires all newly built passenger ships of 500 gross tonnage and larger, as well as tankers and newly built cargo ships of 3,000 gross tonnage and larger, that are on international voyages to be fitted with an Electronic Chart Display and Information System (ECDIS) and to use official ENCs from the authoritative hydrographic office for the waters in which they operate. An ECDIS is used for voyage planning, as well as voyage monitoring while underway by showing the real-time position of a ship within an ENC chart display. ECDIS is integrated with other ship sensors, such as global positioning systems (GPS), automatic identification systems (AIS), radar, gyro compass, echo sounder, and ship's log. NOAA has ENC coverage of all U.S. waters to support ECDIS use.

Optional use of ENCs on U.S. Domestic Voyages

In 2016, the U. S. Coast Guard published Navigation and Vessel Inspection Circular (NVIC) 01-16, which provides guidance on electronic navigation information, equipment and practices. Furthermore, NVIC 01-16 announces what the Coast Guard considers equivalent to chart and publication carriage and certain navigation functions required by titles 33 and 46 of the U.S. Code of Federal Regulations. ENCs may be used in navigation systems other than ECDIS, the general characteristics of which are described in the NVIC.

USCG Rulemaking for Nautical Chart Carriage

On March 28, 2022, the USCG published an Advance Notice or Proposal of Rule Making for Electronic Chart and Navigational Equipment Carriage Requirements to gather public input regarding the modification of the chart and navigational equipment carriage requirements in the U.S. Code of Federal Regulations. The public comment period ended June 27, 2022. As was the case when the USCG developed NVIC 01-16, and in other cases related to nautical chart carriage requirements, NOAA continues to work alongside our USCG partners as they proceed with this comprehensive rulemaking process to update regulations regarding use and carriage of charts.

IHO S-100 Based Products

The S-100 Universal Hydrographic Data Model is a geospatial data standard that provides a framework to support the development and use of a wide variety of "S-series" hydrographic products, some of which are described below. The simultaneous display and use of several S-100 based products will be enabled within navigation systems currently being developed. The data from the new IHO S-101 ENC product will serve as the base navigational layer over which data from other S-100 based products may be displayed.

Transition from S-57 to S-101 ENC Production

The S-101 ENC Product Specification complies with the IHO S-100 Universal Hydrographic Data Model and S-101 ENCs will ultimately replace the current S-57-based ENC format. The content of an S-101 ENC is not radically different from an S-57 ENC, although there are changes to the structure and encoding of some features and attributes that will enhance the characterization and display of certain features. The full potential of S-101 will be realized when other S-100 based products are fully developed. These include products for the transfer, use, and display of data, such as surface currents, water levels, high resolution bathymetry, vessel traffic services, oceanography, meteorology, and marine protected areas. Once these interoperable products are available, they may be displayed and used with the S-101 ENCs in ECDIS and other S-100 compliant systems. Some of the S-100 based products that will start to become available around 2025 are described on the Universal Hydrographic Data Model page of NOAA's Precision Marine Navigation website. Precision marine navigation is the ability of vessels to safely and efficiently navigate and operate in close proximity to the seafloor, narrow channels, overhead bridges and cables, and other hazards, facilitated by these new products and other resources.

A recent International Maritime Organization (IMO) resolution will allow ECDIS manufacturers to start installing S-100 and S-101 enabled ECDIS systems in January 2026 and will require all new ECDIS installations to be S-100 and S-101 enabled after January 2029. The IMO has not established the date on which all other SOLAS regulated ships will be required to use S-101 ENCs, but it will likely be at least 10 or 15 years away (see Figure 8). Hydrographic offices around the world, including NOAA, will be producing ENC data in both formats for some years to come. During this interim, many ECDIS and other navigation and chart display systems will be "dual-fueled" and be able to ingest either ENC format.

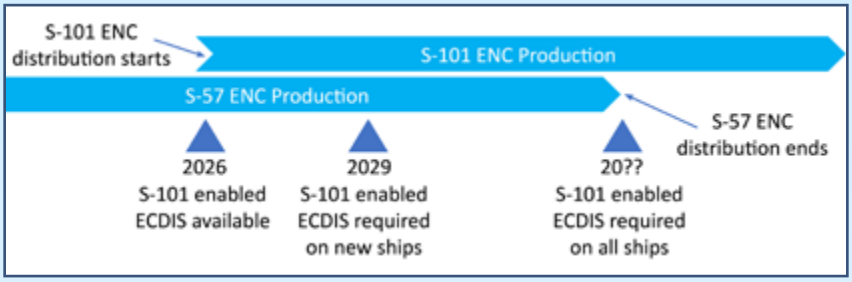

Figure 8. ECDIS functionality milestones for ships subject to IMO SOLAS regulations, and timelines for the start of S-101 ENC distribution and end of S-57 ENC distribution.

ENC producers and distributors, chart production software developers, ECDIS and other ENC display manufacturers, ship owners and operators, mariners, and other stakeholders are preparing for the transition in a number of ways. NOAA's ENC production system will need to be upgraded to produce S-101 ENCs. System testing, cartographer training for new software and techniques, and modifications to existing processes will start soon. The means for the concurrent distribution of both ENC products will also need to be developed. These are major engineering efforts that have already begun. They are distinct from and in addition to the ongoing ENC rescheming effort, but ENC rescheming is an essential step that will make the transition to S-101 ENC production more efficient.

Transition of HD ENCs to the S-102 Bathymetric Surface Product

There are currently 15 reschemed band 6 ENCs covering the harbors of Los Angeles and Long Beach, California. These "high definition" or HD ENCs have depth contours compiled at one-meter intervals to a depth of about 30 meters. This is five times the depth contour resolution specified for ordinary ENCs in the S-57 and S-101 ENC product specifications. Development of HD ENCs helped NOAA, Los Angeles and Long Beach Harbor pilots, mariners and others explore how this additional level of detail could assist large ships operating in these ports with scant under keel clearances.

When these HD ENCs were released in 2020, it was expected that additional HD ENC coverage in other major ports and in the lower Mississippi River would follow. However, S-100 based S-102 Bathymetric Surface product coverage is now being developed for Los Angeles, Long Beach, and other harbors that will provide an even higher resolution bathymetric model to support real-time navigation decision making. Therefore, NOAA is ceasing any additional HD ENC product development and maintenance. The original HD ENCs will be replaced with S-102 data and these band 6 ENCs will be converted to "ordinary" 1:10,000 scale band 5 ENCs by the end of 2025.

ENC Display Services

Two ENC display services—the ECDIS Display Service and the NOAA Chart Display Service—provide simple interfaces that developers can use to integrate the display of ENC-based chart images into online and offline applications. These services are often used to provide a base map over which other data are displayed. The chart images are rendered from the latest NOAA ENC data. The ENC data and the chart images derived from it are updated weekly. Each of the ENC display services portrays the ENC data with a different symbology set.

ECDIS Display Service

The ECDIS Display Service uses symbology developed by the IHO for the display of ENC data on Electronic Chart Display and Information Systems (ECDIS) that large ocean-going vessels and many smaller commercial ships use for navigation (see Figure 9). This symbol set is commonly referred to by its IHO specification number, "S-52," or as "ECDIS symbology." The NOAA ENC Viewer also portrays ENC data using this ECDIS symbology.

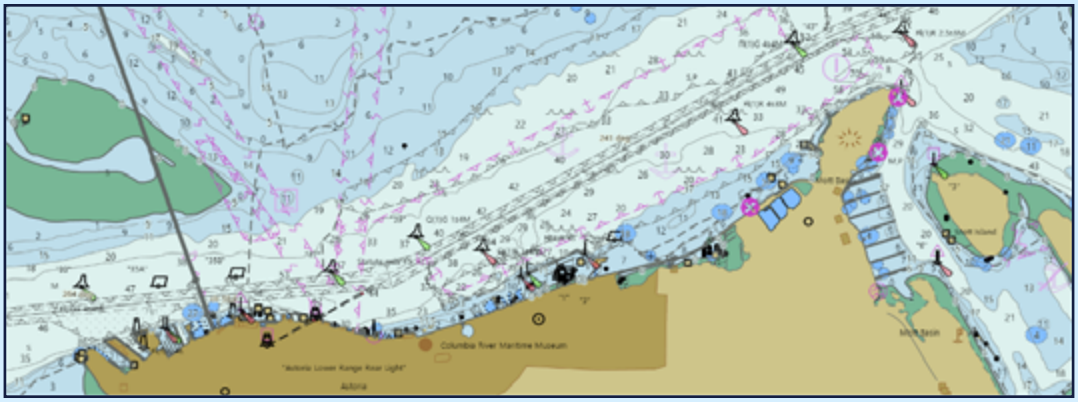

Figure 9. ECDIS Display Service rendering of ENC along the Columbia River with symbology specified by the IHO.

NOAA Chart Display Service

The NOAA Chart Display Service renders NOAA ENC data with "traditional paper chart" symbols, labels, and color schemes familiar to those who have used NOAA paper nautical charts or the NOAA Custom Chart application. The NOAA Chart Display Viewer also portrays ENC data using this traditional symbology, as shown in Figure 10.

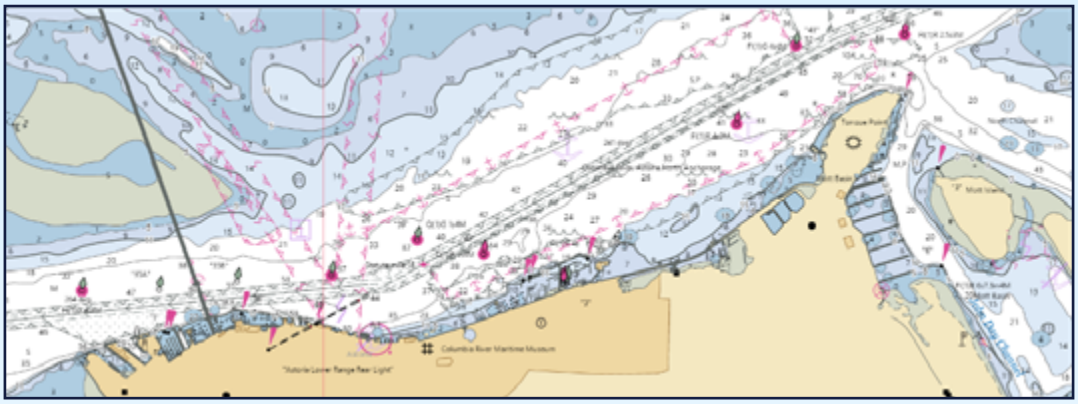

Figure 10. NOAA Chart Display Service rendering of ENC data along the Columbia River with traditional paper chart symbology.

More information about display service formats is on the ENC Display Services webpage.

ENC Geographic Information System (GIS) Support

NOAA's ENC Direct to GIS webpage allows users to display, query, and download base editions of NOAA ENC data in a variety of GIS/CAD formats. NOAA ENC data provides a detailed representation of the U.S. coastal and marine environment. Users may select all or specific IHO S-57 object classes within the ENC data to download seamlessly across any ENCs within the same ENC usage scale band. Three pre-built theme layers—Coastal Maintained Channels, U.S. Maritime Limits and Boundaries, and Shipping Lanes and Regulations—can be viewed or obtained for the entire United States. These standardized data sets are based on several Federal Geographic Data Committee (FGDC) and Open Geospatial Consortium (OGC) standards.

U.S. Chart No. 1

The U.S. Chart No. 1 is a 130-page document that describes the symbols, abbreviations, and terms used on nautical charts produced by NOAA and the National Geospatial-Intelligence Agency (NGA). Many chart producing nations publish similar documents for their own paper charts. The U.S. is one of the few countries that also includes a guide to the symbols used to portray ENC data on ECDIS. After January 2025, NOAA will no longer produce traditional paper nautical charts, but NGA will continue to provide paper charts for its Department of Defense customers, mostly over non-U.S. waters. Thus, the U.S. Chart No. 1 will be available for some time to come.

The mix of symbology used for NOAA Custom Charts is evolving. It is currently a combination of traditional NOAA chart symbols, such as the unique rhombus shaped buoys, and other standard symbols established by the IHO for paper charts. NOAA continues to refine NCC symbology and labels. NOAA is also participating in the IHO's development of a standard, baseline symbology set to enable creating uniform paper chart output from any ENC data. Once these efforts are more mature, NOAA may consider revising the current U.S. Chart No. 1 format to include one or both of these ENC-based paper chart symbol sets.

Conclusion

NOAA's Office of Coast Survey continues to adapt its products and services to better serve the needs of the commercial and private maritime community. Major programs are underway to improve the format, content, and distribution of digital navigational products and to develop new products that will provide a more comprehensive portrayal of the coastal and ocean environment. By 2025, the Coast Survey's Marine Chart Division will sunset the production of traditional paper nautical charts. In 2026, the gridding phase of rescheming the current S-57 based ENC product suite will be completed and production of S-101 based ENC data will commence. This will improve the safety and efficiency of marine transportation for professional mariners and recreational boaters, as well as support the needs of other users for coastal management, disaster preparedness, rescue and recovery operations, fishing, environmental protection, and many other activities on or near our Nation's waters.