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its original policy on electronic charts and publications. While the subject of this policy remained unchanged, the technical details changed so substantively that a re-organization of information was in order. This CH-1 to NVIC 01-16 revises Enclosure (1) and creates Enclosure (2). Enclosure (1) is revised to focus on the equivalency determination for charts, publications and, newly added, navigation functions. It only accepts certain electronic charts as described. It requires vessels that operate offshore to display charts on certain systems. It describes the minimum performance requirements for equipment receiving position information. Enclosure (2) is created to provide uniform guidance to Coast Guard marine inspectors and recommendations to vessel owners and operators.

6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS.

- a. The development of this NVIC and the general policies contained within it have been thoroughly reviewed by the originating office in conjunction with the Office of Environmental Management, and are categorically excluded (CE) under current USCG CE # 33 from further environmental analysis, in accordance with Section 2.B.2 and Figure 2-1 of the National Environmental Policy Act Implementing Procedures and Policy for Considering Environmental Impacts, COMDTINST M16475.1 (series).
- b. This directive will not have any of the following: significant cumulative impacts on the human environment; substantial controversy or substantial change to existing environmental conditions; or inconsistencies with any Federal, State, or local laws or administrative determinations relating to the environment. All future specific actions resulting from the general policies in this directive must be individually evaluated for compliance with the National Environmental Policy Act (NEPA), DHS and Coast Guard NEPA policy, and compliance with all other environmental mandates.

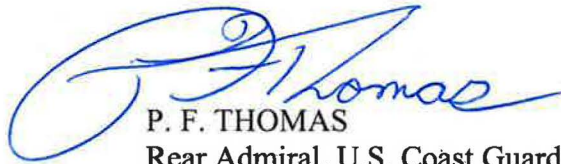
7. DISTRIBUTION. No paper distribution will be made of the Circular. An electronic version will be located on the following Commandant web sites; Internet: <http://www.uscg.mil/hq/cg5/nvic/default.asp>, and CGPortal: <https://cgportal2.uscg.mil/library/directives/SitePages/Home.aspx>.

8. PROCEDURE. If maintaining a paper library, remove NVIC 01-16 and Enclosure (1) and replace it with updated NVIC 01-16, including updated Enclosure (1) and new Enclosure (2).

9. RECORDS MANAGEMENT CONSIDERATIONS. This Circular has been thoroughly reviewed during the directives clearance process, and it has been determined there are no further records scheduling requirements, in accordance with Federal Records Act, 44 U.S.C. Chapter 31, NARA requirements, and Information and Life Cycle Management Manual, COMDTINST M5212.12 (series). This policy does not have any significant or substantial change to existing records management requirements.

10. FORMS/REPORTS. None.

11. REQUEST FOR CHANGES. Submit recommended changes or questions regarding this guidance to Coast Guard Headquarters, Office of Navigation Systems (CG-NAV-2), using the contact information provided in the above letterhead.



P. F. THOMAS

Rear Admiral, U.S. Coast Guard

Assistant Commandant for Prevention Policy

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NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 01-16

will assist marine inspectors and vessel owner/operators to identify safe equipment and practices regarding electronic navigation. Internet release authorized.

3. DIRECTIVES AFFECTED. *Use of Electronic Charts and Publications in lieu of Paper Charts, Maps and Publications*, NVIC 01-16, COMDTPUB P16700.4 is updated by this Circular.
4. BACKGROUND.

In 1966, the USCG mandated “charts” carriage on certain commercial vessels (31 FR 15264 at 15269, Dec 6, 1966). At that time, the only charts available to meet the requirements were paper charts. In 1977, the USCG recognized four entities through which mariners could obtain paper charts: National Oceanic and Atmospheric Administration (NOAA), United States Army Corps of Engineers (USACE), a river authority and foreign governments (42 FR 5956, Jan. 31, 1977). Since then, some of these entities have developed and distributed chart data sets in support of electronic navigation.

In order to standardize electronic charting data, in 2006, the International Maritime Organization (IMO) defined an Electronic Navigational Chart (ENC).² The International Hydrographic Organization (IHO) further narrowed this definition³ and created standards and specifications relevant to an ENC.⁴ They also recognized the display manufacturer’s role in ENC distribution by acknowledging and defining the loss-less transformation of the entire ENC contents and updates accessed by the display system (referred to as a System Electronic Navigational Chart).⁵ To address the features unique to the inland environment, the Inland ENC Harmonization Group (IEHG) developed an Inland ENC standard.⁶

In 2002, NOAA announced that their “Electronic navigation chart” met the Safety of Life at Sea definition of a “nautical chart” (67 FR 39695, June 10, 2002). They then renamed this product through rulemaking to “NOAA Electronic Navigational Charts” (NOAA ENC®) (70 FR 52906, Sept. 6, 2005). Similarly, in 2001, USACE began production of “Inland Electronic Navigation Charts” (IENC). During this time, foreign governments also began producing ENCs. Because these products meet the IHO’s ENC definition and the relevant standards and specifications, the USCG is announcing that the display of NOAA ENCs®,

² IMO Maritime Safety Committee Resolution MSC.232(82) – “the database...standardized... issued...by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution, and conform to the International Hydrographic Organization’s (IHO) standards.”

³ IHO S-32 Hydrographic Dictionary – see “electronic navigational chart”: http://hd.iho.int/en/index.php/electronic_navigational_chart.

⁴ See Standards & Publications on IHO website at: <https://www.iho.int> (IHO S-52 – Specifications for Chart Content and Display Aspects of ECDIS; IHO S-57 – IHO Transfer Standard for Digital Hydrographic Data; IHO S-58 – ENC Validation Checks; IHO S-63 – IHO Data Protection Scheme; IHO S-64 – IHO Test Data Sets for ECDIS; IHO S-65 – ENCs: Production, Maintenance and Distribution Guidance; IHO S-101- Electronic Navigational Chart Product Specification; IHO S-401- Inland Electronic Navigational Chart Product Specification).

⁵ IHO S-32 Hydrographic Dictionary – “system electronic navigational chart” - a database, in the manufacturer’s internal ECDIS [display system] format, resulting from the loss-less transformation of the entire ENC contents and its updates. It is this database that is accessed by ECDIS [the display system] for the display generation and other navigational functions, and is equivalent to an up-to-date paper chart.

⁶ IEHG Inland ECDIS Standard (series).

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USACE IENCs, and ENCs issued by a river authority or by the authority of a foreign government meets the chart carriage requirements in titles 33 and 46 of the C.F.R.

In 2002, the Coast Guard accepted electronic chart display and information systems (ECDIS) as meeting the “nautical chart regulation in 33 C.F.R. 164.33(a)(1), because the ECDIS meets the same navigational safety concerns as do paper nautical charts” (67 FR 53382, Aug 15, 2002 as amended by 69 FR 42192, July 14, 2004). Since 2002, charting system manufacturers have developed other systems, in addition to ECDIS, that can display ENC data. In light of this, the Coast Guard recognizes that an ECDIS is not the only way to display ENC data. ENC data and display use have improved such that the Coast Guard now considers that ENC data provide substantially more information and therefore may enhance navigational safety beyond that of paper nautical charts, and thus may reduce the potential for marine accidents.

For 150 years, NOAA produced paper nautical charts using lithographic printing presses. The government process not only ensured accuracy of the data but also the durability of the ink and paper. In 2013, NOAA stopped printing paper charts, instead turning to a commercial “Print-on-demand” paper chart service. Even though NOAA no longer prints charts, commercial chart providers still have to prove the durability of their products through a stress test (water tolerance, ultraviolet ray resistance and permanence during repeated handling, writing, and erasing). Likewise, an electronic charting system should meet a commensurate environmental standard. Therefore, vessels whose intended voyage is outside the territorial sea baseline⁷ must display ENC data on a system that meets more stringent environmental standards as discussed in the policy.

Title 33 of the C.F.R. section 164 requires that some vessels fix their position⁸ and other vessels fix and plot their position.⁹ When navigating on paper charts, by the time the person directing the movement of the vessel was informed of the vessel’s position, the vessel had advanced beyond that position. Thus, the information represented a past reality. When integrated with position information, properly displayed ENC data can provide real-time vessel location and predicted future movement. The USCG recognizes the benefit of real-time positioning data conveyed on an ENC, and that it can provide greater situational awareness than what could be achieved using paper charts. Therefore, USCG considers position information integrated into a displayed ENC equivalent to the fixing and plotting requirements in title 33 C.F.R. section 164.

Likewise, the International Convention for the Safety of Life at Sea and title 33 sections 164 and 161 and various sections of title 46 of the C.F.R. require that some vessels carry certain navigation publications.¹⁰ In 2010, USCG announced policy accepting some electronic publications in lieu of paper publications.¹¹ Other publications are still required in

⁷ 33 CFR 2.20

⁸ 33 CFR 164.11 & 164.78 – Self-propelled vessels 1600 or more gross tons and towing vessels 12 meters or more in length

⁹ 33 CFR 164.11 - Self-propelled vessels 1600 or more gross tons

¹⁰ These publications include: U.S. Coast Pilot, Sailing Directions, Coast Guard Light List, List of Lights, tide tables, tidal current and river current tables, Notice to Mariners, Local Notice to Mariners, Notices to Navigation Interests, and Vessel Traffic Service Rules.

¹¹ CG-543 Policy Letter 10-05 canceled and replaced by Navigation and Vessel Inspection Circular 01-16

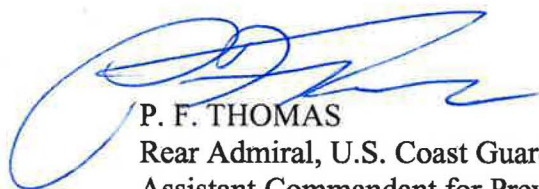
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hard copy because the relevant institution placed additional availability requirements (such as during emergencies or tactical situations). This announcement does not substantively change USCG publication policy, but rather consolidates information.

5. DISCLAIMER. This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is intended to provide operational guidance for Coast Guard personnel and is not intended to nor does it impose legally binding requirements on any party outside the Coast Guard. It represents the Coast Guard's current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other Federal and state regulators, in applying statutory and regulatory requirements. This Circular prescribes no new requirements for the maritime industry. As such, vessel owners and operators may continue using official paper charts and publications in accordance with References (a) and (b) until the relevant regulations therein are amended.
6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS.
 - a. The development of this NVIC and the general policies contained within it have been thoroughly reviewed by the originating office in conjunction with the Office of Environmental Management, and are categorically excluded (CE) under current USCG CE # 33 from further environmental analysis, in accordance with Section 2.B.2 and Figure 2-1 of the National Environmental Policy Act Implementing Procedures and Policy for Considering Environmental Impacts, COMDTINST M16475.1 (series).
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9. FORMS/REPORTS. None.

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10. REQUEST FOR CHANGES. Submit recommended changes or questions regarding this guidance to Coast Guard Headquarters, Office of Navigation Systems (CG-NAV-2), using the contact information provided in the above letterhead.



P. F. THOMAS
Rear Admiral, U.S. Coast Guard
Assistant Commandant for Prevention Policy

- Encl: (1) Equivalency determination for "Marine Charts," "Charts," or "Maps;" "Publications;" and navigation functions
(2) Guidelines for inspecting and using electronic charts and publications

Equivalency determination for “Marine Charts,” “Charts,” or “Maps;” “Publications;” and navigation functions

This guidance applies to U.S. vessels subject to U.S. chart (or map), publication and Electronic Position Fixing Device carriage requirements who choose the voluntary equivalency announced in this Circular. Vessels may continue to comply with carriage requirements using official paper charts, maps, publications and Electronic Position Fixing Device as required by titles 33 and 46 of the C.F.R. This guidance provides an equivalency only for domestic requirements and does not provide an equivalency for requirements contained in the International Convention for the Safety of Life at Sea, 1974 (SOLAS) or for the purposes of SOLAS certificates.

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. Mariners are responsible to safely navigate and follow applicable regulatory requirements.

A. Electronic Navigational Charts.

1. For the purposes of this policy, “marine charts,” “charts,” or “maps” as required by titles 33 and 46 of the C.F.R., can be data that conforms to the International Hydrographic Organization’s definition of an Electronic Navigational Chart (ENC), issued by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution. Furthermore, “marine charts,” “charts,” or “maps” can be data that conforms to the Inland ENC Harmonization Group (IEHG) standard (e.g. Inland Electronic Navigational Chart [IENC]) and meets the issuing criteria detailed above. ENC and IENC are henceforward referred to, generically, as ENC for the ease of reading.
2. ENCs must be of the area to be transited, displayed in a large enough scale, and portray enough detail to make safe navigation of the area possible. The ENC, and all updates to it, must be displayed without any degradation of their information content according to the relevant chart content and display standard, as specified by the issuing authority.¹ ENCs used shall be the latest version reasonably available, including the latest update. All downloaded ENC data intended for portrayal must be displayable.² New features provided by the relevant charting authority must be displayable within one year of adoption. Upon demand, the display system shall indicate the issuing authority, cell name, edition, and associated update(s) of an ENC.³

¹ For ENCs the relevant standard is IHO S-52 – Specifications for Chart Content and Display Aspects of ECDIS. For IENCs the relevant standard is IHO S-52 & IEHG Inland ECDIS Standard (series). Where content display standards are not specified, manufactures are still responsible to portray the features.

² Manufacturers can ensure their systems display all data by testing their product to the appropriate test set(s). IHO S-64 – IHO Test Data Sets for ECDIS and/or the USACE IENC Standard Exchange Set (series).

³ NOAA charts can be checked at: https://www.nauticalcharts.noaa.gov/mcd/enc/up-to-date_enc.htm.
USACE charts at: http://ienccloud.us/ienc/web/main/ienc_009.cfm.

- B. ENC Display. ENC's must be displayed on a system sufficient for the intended voyage.
1. If any part of the vessel's intended voyage is seaward of the territorial sea baseline (as defined by 33 C.F.R 2.20), then the display system must be tested against and meet the International Electrotechnical Committee's Maritime Navigation and Radiocommunication Equipment and Systems Standard (IEC 60945) or be a Radio Technical Commission for Maritime Services Electronic Chart System.
 2. Vessels that operate solely inside the territorial sea baseline may display ENC's on a system of their choice so long as it displays the ENC in a large enough scale and portrays enough detail to make safe navigation of the area possible.
- C. Navigation Functions. Position information that is integrated into an ENC display is equivalent to the fixing and plotting requirements in title 33 of the C.F.R.
1. Position updates must be real-time (delivered less than every 2 seconds), sound (8 - 20 meter accuracy) and a minimum resolution of 0.001 minutes.⁴
 2. Devices dependent on cellular connection are not acceptable.
- D. Electronic Publications. "Publications," as required by the International Convention for the Safety of Life at Sea Chapter V Regulation 27 and title 33 sections 161.4, 164.33, and 164.72 and title 46 of the C.F.R., can be kept in electronic format. They must be the latest version, including the latest update reasonably available, displayed and accessible to the bridge crew while underway. This equivalency does not apply to publications with a "ready-reference"⁵ or "hard-copy"⁶ requirement.

⁴ Description derived from the Federal Radionavigation Plan (2014), IMO Resolution MSC.112(73) and IEC 61108-1. Position information may not come from cellular tower triangulations.

⁵ 33 CFR 83.1(g) – Inland Navigation Rule 1

⁶ IMO Maritime Safety Committee and Marine Environment Protection Committee MSC-MEPC.2/Circ.2 – IMO requirements on carriage of publications on-board ships

Guidelines for inspecting and using electronic charts and publications

This guidance applies to U.S. vessels subject to U.S. chart (or map) publication and electronic position fixing device carriage requirements who choose the voluntary equivalency announced in this Circular). Vessels may continue to comply with carriage requirements using official paper charts, maps, publications and electronic position fixing devices as required by titles 33 and 46 of the C.F.R. This guidance provides an equivalency only for domestic requirements and does not provide an equivalency for requirements contained in the International Convention for the Safety of Life at Sea, 1974 (SOLAS) or for the purposes of SOLAS certificates.

A. Electronic Navigational Charts. As detailed in Enclosure (1) of this Circular, “marine charts,” “charts,” or “maps” as required by titles 33 and 46 of the C.F.R., can be a displayed Electronic Navigational Chart (ENC) or Inland Electronic Navigational Chart (IENC) issued by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution.¹

1. Marine inspectors can determine whether or not a chart is an ENC by the same means used to validate the authenticity of a paper chart (e.g. issuing authority, edition, latest update, and visual inspection). For familiarization, NOAA ENC® and U. S. Army Corps of Engineers IENCs can be viewed online². However, as a caution, the chart viewers may not portray all features using the full presentation library. Viewing NOAA and USACE ENCs on the agency’s provided viewer should be used to guide a general sense of an authentic ENC, not an exact portrayal.
2. Like official paper charts, ENCs have edition numbers and are updated as necessary. ENC updates may be called various names such as “revisions”. When a current edition is combined with its associated revisions, they make a complete, updated ENC database. Issuance of a new edition supersedes all previous editions and associated revisions. Mariners should produce evidence that ENCs are the latest reasonably available edition and revision. Marine inspectors should familiarize themselves with NOAA³ and USACE’s⁴ latest ENC editions and revisions prior to commencing inspections.

B. ENC Display. An ENC cannot be equivalent to a paper chart unless the information can be viewed. ENCs on a portable storage device without a display system are insufficient. The Coast Guard considers a reliable display, sufficient for the voyage, necessary for safe navigation.

¹ ENC and IENC are henceforward referred to, generically, as ENC for the ease of reading.

² Currently, NOAA ENCs be viewed at <https://www.nauticalcharts.noaa.gov/ENConline/enconline.html>; USACE ENCs can be viewed at www.ienccloud.us/ienc/web/main/ienc_014.cfm. These links may change as NOAA and USACE update their ENC processes.

³ NOAA ENC edition table is located at: https://www.nauticalcharts.noaa.gov/mcd/enc/up-to-date_enc.htm

⁴ USACE IENC edition table is located at: http://ec2-54-235-76-27.compute-1.amazonaws.com/ienc/web/main/ienc_009.cfm

1. As outlined in Enclosure (1), the ENC data intended for portrayal must be displayable. The purpose of this is to ensure that the system has the ability to show all the features provided by the issuing authority. Display system manufacturers should provide means for the user to ascertain that their ENC and display system meets the latest standards. Display system manufacturers are encouraged to inform their customers when changes have occurred and develop appropriate procedures for updating. Display system manufacturers are the usual entity for conducting tests on data set(s) to ensure the ENC data are displayable.
2. Marine inspectors can determine whether or not a display system (e.g. Electronic Chart Display and Information System [ECDIS]) can display all features by reviewing the system type-approval documentation or a manufacturer's declaration of conformity, which clearly states that the display system was tested against the appropriate test data set(s). Display systems should be tested prior to market release and re-tested after new chart features are adopted by the charting authority. Systems that fail to display features, including new features within one year of adoption, will no longer meet the chart equivalency.
3. Since the ENC is being displayed on a computer, marine inspectors should determine if the display system itself is being maintained and up-to-date with manufacturer's specifications. Many display systems will present a single screen, easily accessible; with "dashboard" information (e.g. chart information and status, notices to mariners applied and date, list of standards the system conforms to, last software update, and system check indicating if the hardware meets the minimum performance requirements of the software.)
4. One way to ensure display systems are operating correctly, displaying all relevant features and continuing to be an equivalent to paper charts is for manufacturers and users to maintain communication through the display system's service life. Users are encouraged to be aware of the latest information and updates available from their ENC authority and/or display system manufacturer. As an added layer of confidence for ECDIS users, vessel owners and operators can validate their system using a check data set⁵. Likewise, manufactures are encouraged to track their display units and the software/hardware versions in use. When updates are available, manufacturers should contact their users in order to encourage them to update their systems.
5. Manufacturers should provide certainty to users as to the authenticity of updates.
6. While the Coast Guard does not mandate a specific screen size, marine inspectors should consider whether or not the size shows enough detail in a large enough scale to make safe navigation possible. Those that fail to do so should be declared

⁵ Check data set and instructions are available at:
http://www.iho.int/srv1/index.php?option=com_content&view=article&id=585:news&catid=166:1news-links&lang=en

not equivalent.

7. As outlined in Enclosure (1), vessels that transit outside the territorial sea baseline⁶ must display ENC's on a system appropriate for the environment. Currently, we are aware of one standard that sufficiently tests equipment to the likely conditions: International Electrotechnical Committee's Maritime Navigation and Radiocommunication Equipment and Systems Standard (IEC 60945). Additionally, we are aware of three display systems that meet both the ENC requirements and hardware requirements required by Enclosure (1). They are an ECDIS⁷, a Chart Radar⁸ and a Radio Technical Commission for Maritime Services (RTCM) Electronic Chart System (ECS)⁹.
 - a. For those areas where the territorial sea baseline is not depicted on charts (e.g. Great Lakes, Puget Sound and others) Officers in Charge of Marine Inspections (OCMIs) should define a line for the purposes of this policy. OCMIs should compare the area in question to similar bodies of water where territorial sea baselines are defined. As a guiding principle, waters outside the baseline have greater environmental risks and/or there are limited visual aids to navigation.
 - b. OCMIs who establish lines of applicability should make that determination known to respective vessel owners and/or operators. Vessel owners and/or operators should coordinate with their OCMIs to understand the expected requirements prior to making capital investments in charting systems.
 - c. Marine inspectors should expect chart display systems that meet IEC 60945 to be type-approved (e.g. ECDIS or chart radar) or be shown a manufacturer's declaration of conformity which clearly states that the device meets the Radio Technical Commission for Maritime Services (RTCM) Electronic Chart System (ECS) standard.
 8. IEC 60945 is the internationally recognized equipment standard for maritime navigation systems. IEC 60945 tested chart displays give users confidence in the system's durability in the maritime environment and compatibility with other bridge equipment. However, the Coast Guard recognizes that equipment tested to this standard may not be necessary for safe operations inside the territorial sea baseline. This, however, does not diminish the fact that displays subjected to testing are a proven way to ensure durability and compatibility.
- C. Incorporated Information. An ENC display system is most functional for navigational safety when used as a collection point of navigational information. The Coast Guard recommends interfacing installed navigation sensors to decrease

⁶ 33 C.F.R. § 2.20

⁷ IEC 61174 (series)

⁸ Chart Radar that meets IEC 60936-3 (series)

⁹ Radio Technical Commission for Maritime Services Standard 10900 series for Electronic Chart Systems

operator distraction and enhance safety.

1. Type-approved electronic position-fixing devices (EPFD)¹⁰ provide the best position information. Vessels that are not required to carry a type-approved EPFD but desire to take advantage of the equivalency announced in Enclosure (1) must use a device that can, at a minimum, meet the requirements outlined therein.
2. Marine inspectors should ensure position sensor data comes from a type-approved EPFD, a type-approved Automatic Identification System or a position sensor covered by a manufacturer's declaration of conformity which clearly states that the device's data meets requirements contained in Enclosure (1).
3. Vessel operators should be aware of the significant limitations associated with use of non-type-approved EPFDs. Some devices will not alarm when position data is lost or an updated position has not been calculated within a set reoccurrence. Others will not alarm when the suitability of the constellation in view of the receiver is questionable. Still others will not autonomously monitor the integrity of the position information. These devices will not notify the user when the device fails to provide availability, or acquire and track sufficient satellites.

D. Back-up Arrangement.

1. The Coast Guard recommends vessel owners and operators address procedures for a loss of charts, display systems and/or publications in a Safety Management System (SMS). The Coast Guard further encourages an independent back-up arrangement when using ENC's.
2. Such arrangement could be a secondary system that meets the equivalency or a full folio of currently corrected paper charts. If the back-up arrangement is an additional ENC display, then mariners should consider interfacing it with the same navigation equipment as the primary system. The goal would be to provide a seamless transition of navigation information in the event of a failure.
3. If a vessel chooses to use an SMS, marine inspectors should verify that loss procedures are addressed in it. Further, marine inspectors should check for evidence of successful implementation of those procedures. Marine inspectors should work with Third Party Organizations to address SMS procedures or implementation deficiencies.

E. Training. The Coast Guard considers the principles of marine navigation fundamentally unchanged even when enhancing such practices with electronic tools. However, there are critical navigation and system functions that mariners should understand prior to navigating with ENC's. The International Maritime Organization

¹⁰ Such as a Coast Guard type-approved Global Positioning System (GPS) or Global Orbiting Navigation Satellite Systems (GLONASS), see 33 C.R.F § 164.41.

developed a Model Course that trains mariners in the effective use of these tools.¹¹ Marine inspectors should review documentation as outlined below.

1. Marine inspectors and mariners are reminded that in order to use an ECDIS while in charge of a navigational watch, when serving on a vessel to which the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978, as amended (STCW) applies, they must possess an appropriate STCW endorsement without an ECDIS limitation.
 2. The Coast Guard has reviewed an RTCM class 'A' ECS and considers it to function similarly to an ECDIS. Therefore, those in charge of a navigational watch using an RTCM 'A' ECS are encouraged to possess either a successful completion certificate from a Coast Guard approved ECDIS course or the appropriate STCW endorsement without an ECDIS limitation.
 3. For all other ENC display systems, as an alternative to an approved ECDIS course, several training topics from the Model Course could be applied. The most germane topics include, but are not limited to:
 - a. Display System Performance Standards
 - b. ENC Data
 - c. Sensors
 - d. Basic navigation functions
 - e. Specific functions for route planning and monitoring (as fitted)
 - f. Data updating
 - g. Presentation and display and errors
 - h. Display and function of other navigational information
 - i. Errors in displayed data
 - j. Errors in interpretation
 - k. Status indications, indicators and alarms
 - l. Understanding the risk of over-reliance on ENCs and display systems
 4. Mariners are reminded to complete the required familiarization training with installed equipment prior to use in accordance with 46 C.F.R. § 15.405.
- F. Electronic Publications. Navigation publications required by 33 C.F.R. §§ 161.4, 164.33, and 164.72, Title 46 of the C.F.R. (various sections) and SOLAS Chapter V Regulation 27 may be kept in electronic format provided that it is downloaded directly from an official agency website, currently corrected/up-to-date and readily accessible on the vessel's bridge by the crew while underway. Those publications are: U.S. Coast Pilot®, Sailing Directions, Coast Guard Light List, List of Lights, tide tables, tidal current and river current tables, Notice to Mariners, Local Notice to Mariners, Notices to Navigation Interests, and Vessel Traffic Service Rules. An

¹¹ Model Course 1.27, Operational Use of Electronic Chart Display and Information Systems (ECDIS), series

independent back-up arrangement is required in order to meet the equivalency.

G. Cyber Risk Management Considerations.

1. Cyber dependent technologies have become the backbone of vessel operation and management. Numerous systems, critical to safety and security, depend on these technologies. The increasing level of interconnectivity of electronic navigation equipment brings substantial benefits to the mariner but also introduces new types of risk. Although highly reliable, electronic navigation systems, like other types of electronics, are subject to technical failure and malfunction. As vessels are increasingly networked, and dependent on external inputs including EPFD signals and software updates, they are also subject to cyber related failures or exploitation.
2. Risk management is fundamental to operations in the maritime industry. The increased reliance on cyber dependent systems has created a need for cyber risk management to be implemented in a holistic and widespread manner, much in the same way that mariners assess and mitigate physical risks during all aspects of vessel operations. The Coast Guard recommends that both electronic navigation equipment manufacturers and vessel operators consider their cyber risks and develop cyber risk management processes that are incorporated into the existing operational routine. The International Maritime Organization Maritime Safety Committee Circular 1526 "Interim Guidelines for Maritime Cyber Risk Management" contains recommended actions and procedures for managing cyber related risks.¹² Additionally information is also available on the Coast Guard's Homeport page: <https://homeport.uscg.mil/> under 'Cybersecurity'.

¹² MSC.1 Cir 1526 can be found at:
http://www.imo.org/en/OurWork/Security/Guide_to_Maritime_Security/Guidance/Documents/MS-C.1-Circ.1526.pdf