



DEPARTMENT OF THE NAVY  
OFFICE OF THE CHIEF OF NAVAL OPERATIONS  
2000 NAVY PENTAGON  
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IN REPLY REFER TO

3140

Ser N00/8U5000076

17 MAR 98

From: Chief of Naval Operations

Subj: U.S. NAVY ELECTRONIC CHART DISPLAY AND INFORMATION  
SYSTEM POLICY

Ref: (a) CNO/CMC ltr Ser 09/1U500942 of 1 Aug 91 "U.S.  
Navy/U.S. Marine Corps Positioning/Navigation  
Policy"  
(b) OASD (C3I) memo "Development, Procurement, and  
Employment of DoD Global Positioning System (GPS) User  
Equipment" of 30 Apr 92  
(c) IMO Resolution A.817(19) adopted on 23 Nov 95  
(d) IEC 61174 "Maritime navigation and radio communication  
equipment and systems - ECDIS - Operation and  
performance standards, methods of testing and required  
test results" draft of Mar 97.

Encl: (1) Electronic Chart Display and Information Systems- Navy  
(ECDIS-N)

1. Purpose. To transition primary support of navigation and piloting on U.S. Navy vessels from paper charts to an electronic charting environment. This policy provides planning guidance for the Electronic Chart Display and Information System - Navy (ECDIS-N) consistent with reference (a).

2. Applicability. This policy applies to the development and procurement of systems that support ECDIS-N, and all U.S. Navy vessels that will use an ECDIS-N in support of navigation, piloting, and accurate positioning. While the interim use of ECDIS-N systems for enhanced situational awareness is acceptable, U.S. Navy vessels may not use ECDIS-N systems in lieu of the requirement to maintain paper charts until the ECDIS-N systems are tested, certified, and approved for fleet introduction (initial operational capability) by the appropriate authority.

3. Background. Electronic databases, operating systems, and computer technology have advanced, and the widespread deployment of digital display systems to the fleet has now made it possible to employ electronic charts at sea. In addition, the advent of

Subj: U.S. NAVY ELECTRONIC CHART DISPLAY AND INFORMATION  
SYSTEM POLICY

continuous and automated positioning systems, such as the Global Positioning System (GPS) and Inertial Navigation System (INS), has made it possible to take maximum advantage of electronic charting, eliminating many constraining aspects of navigation by paper chart while significantly advancing safety of navigation.

4. Policy. This policy directs a Navy transition from navigation by means of paper charts to navigation by means of digital charts within the ECDIS-N standards. This policy promulgates the minimum ECDIS-N standards (enclosure (1)) and delineates specific responsibilities of OPNAV, Fleet Commanders in Chief, and Commander, Operational Test and Evaluation Force (COMOPTEVFOR). ECDIS-N capability begins limited Fleet introduction in FY98 to enhance situational awareness and initiate the transition to a certified ECDIS-N system. The goal is full fleet implementation by FY07. The Navy requirement for paper charts from the National Imagery and Mapping Agency (NIMA) as the primary means of navigation will continue until all U.S. Navy vessels implement ECDIS-N. The Navy may also retain a limited requirement for paper charts beyond FY07 as one means of satisfying ECDIS-N backup requirements (appendix 6 to enclosure (1)). The Navy must ensure interoperability among various ECDIS-N systems and between ECDIS-N systems and other systems. Navy will achieve interoperability by mandating standards and functional requirements for ECDIS-N and associated electronic charts:

a. Navy standard automated and continuous positioning systems and approved navigation and piloting procedures shall be used for position reference. In addition to accepting continuous position systems for navigation and piloting, EDCIS-N shall accept radar and visual navigation fix information. This policy is consistent with references (a) and (b).

b. Department of Defense (DoD) standard products and datum will be employed as follows:

- Standard products and services are defined as those which are produced by NIMA. NIMA produces all electronic charts on WGS-84, maintains these products, and provides them directly to the fleet.

Subj: U.S. NAVY ELECTRONIC CHART DISPLAY AND INFORMATION  
SYSTEM POLICY

- World Geodetic System-84 (WGS-84) is the standard datum.
- Vector Product Format (VPF) is the standard digital data format that will support ECDIS-N onboard all US Navy vessels.

c. The standard products that support navigation onboard U.S. Navy vessels are defined as follows:

<u>Digital Product</u>	<u>Paper Equivalent</u>	<u>Classification</u>
Digital Nautical Chart (DNC™)	General, Coastal, Harbor, & Approach	Unclassified
Tactical Ocean Data (TOD) 0	OPAREA, Range markings	Distribution Limited
Tactical Ocean Data (TOD) 1	Bottom Contour	Confidential
Tactical Ocean Data (TOD) 2	Bathymetric Navigation Planning Chart (BNPC)	Secret
Tactical Ocean Data (TOD) 3	TBD	As required
Littoral Warfare Data (LWD)	Combat Chart	Confidential
Vector Database Update (VDU)	Notice to Mariners	Depends on product

d. ECDIS-N must incorporate safe navigation and piloting functionality at a minimum. Enclosure (1) defines the performance standards for ECDIS-N, which in conjunction with standard DoD digital navigation products will replace the use of paper charts. ECDIS-N functionality is based on reference (c), which is the International Maritime Organization (IMO) performance standards for the Electronic Chart Display and Information System (ECDIS) as established for civil shipping. U.S. Navy vessels are not required to comply with IMO resolutions. In setting standards in keeping with safe maritime operations, however, Navy will follow DoD mandates to use commercial standards wherever possible. Therefore, deviations from the civil guidance will be limited to those required for unique military applications and approved naval navigation and

Subj: U.S. NAVY ELECTRONIC CHART DISPLAY AND INFORMATION  
SYSTEM POLICY

piloting procedures. All electronic charting data used for navigation must be maintained using the most current NIMA databases and updates available. Reference (d), IEC 61174, with modifications to bring it into compliance with enclosure (1), is the acceptable standard for testing ECDIS-N. Reference (c), and reference (d) (modified) are available from CNO(N096).

e. This policy letter does not take precedence over any DoD and Navy policy with regard to the Joint Technical Architecture (JTA) and the Defense Information Infrastructure-Common Operating Environment (DII-COE) compliance. At a minimum, ECDIS-N shall be DII-COE Level 5 compliant. Further, ECDIS-N shall be compliant with the DOD JTA.

5. Responsibilities.

a. The Deputy Chief of Naval Operations for Resources, Warfare Requirements and Assessments (N8), shall:

(1) Serve as the resource sponsor for ECDIS-N systems;

(2) Identify programmatic requirements for implementation of ECDIS-N capability;

(3) Certify that ECDIS-N systems comply with the standards set forth in this policy prior to authorizing use of ECDIS-N systems in lieu of paper charts. The certification will be based on Operational Test and Evaluation results and implementation of Integrated Logistics Support. (This does not preclude the use of ECDIS-N systems prior to certification, provided that use is restricted to situational awareness only. Uncertified ECDIS-N systems may not be used in lieu of paper charts);

(4) Ensure that appropriate training is established for officers and enlisted personnel;

(5) Approve Fleet introduction and Initial Operational Capability for ECDIS-N systems under their cognizance; and,

b. The Director, Space, Information Warfare, Command and Control Directorate (N6) shall commit research, development, test

Subj: U.S. NAVY ELECTRONIC CHART DISPLAY AND INFORMATION  
SYSTEM POLICY

and evaluation (RDT&E) funds to an ECDIS-N initiative that is a derivative of any existing N6 navigation program.

c. The Oceanographer of the Navy (N096) shall:

(1) Establish and maintain minimum standards for ECDIS-N and review future IMO resolutions and standards. Incorporate changes to this policy as appropriate;

(2) Support N6, N8, and all developmental activities in matters relating to Navy's use of standard navigation products defined by this policy;

(3) Validate all new Geospatial Information & Services (GI&S) requirements and coordinate the development of new standard DoD products, and;

(4) Support the Judge Advocate General of the Navy (N09J), in coordination with NIMA, in matters concerning international regulations and maritime law as related to navigation matters.

d. The Judge Advocate General of the Navy (N09J) shall ensure that uses of ECDIS-N prescribed by the Navy for its ships comply with applicable international legal obligations related to safe navigation. N09J shall apprise the Chief of Naval Operations and Fleet Commanders of changes to international law and regulations which are relevant to the Navy's use of electronic charts.

e. Fleet Commanders in Chief shall:

(1) Incorporate ECDIS-N into Fleet navigation Instructions;

(2) Develop ship's ECDIS-N certification plans; and,

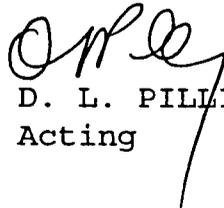
(3) Serve as certifying authority for areas where ECDIS-N can be employed in lieu of paper charts. The policy authorizes Fleet Commanders to approve the use of ECDIS-N within geographical areas covered by GI&S products that meet ECDIS-N standards and updates.

Subj: U.S. NAVY ELECTRONIC CHART DISPLAY AND INFORMATION  
SYSTEM POLICY

f. COMOPTEVFOR shall evaluate the operational effectiveness and operational suitability of ECDIS-N systems and associated products and make recommendations regarding fleet introduction as appropriate.

6. The Assistant Secretary of the Navy for Research, Development, and Acquisition concurs with the policy contained herein.

7. Coordination. This letter has been coordinated with NIMA.

  
D. L. PILLING  
Acting

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ELECTRONIC CHARTING DISPLAY AND INFORMATION SYSTEMS - NAVY  
(ECDIS-N)

ECDIS-N follows the IMO resolution A.817 of November 1995 except as modified to meet DOD unique requirements. These recommended practices will facilitate technical interoperability. These changes to the original document are outlined in bold.

Version 1.0  
**30 October, 1997**

ENCLOSURE (1)

ASSEMBLY  
19th session  
Agenda item 10

RESOLUTION A.817(19)  
adopted on 23 November 1995

PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND  
INFORMATION SYSTEMS (ECDIS)

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO regulation V/20 of the International Convention for the Safety of Life at Sea (SOLAS), 1974 which requires all ships to carry adequate and up-to-date charts, sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications necessary for the intended voyage,

NOTING that the up-to-date charts required by SOLAS regulation V/20 can be provided and displayed electronically on board ships by electronic chart display and information systems (ECDIS), and that the other nautical publications required by regulation V/20 may also be so provided and displayed,

RECOGNIZING the need to prepare performance standards for ECDIS in order to ensure the operational reliability of such equipment, and to ensure that the information provided and displayed electronically is at least equivalent to that of up-to-date charts and, when also provided and displayed, other nautical publications, and to avoid, as far as practicable, adverse interaction between ECDIS and other shipborne navigational and communication equipment,

NOTING FURTHER that the International Hydrographic Organization (IHO) has, in co-operation with IMO, developed complementary recommendations on electronic navigational charts, thereby standardizing the database and the content, structure and format of the information provided and displayed,

HAVING CONSIDERED the recommendation made by the Marine Safety Committee at its sixty-third session,

1. ADOPTS the Recommendations on Performance Standards for Electronic Chart Display and Information Systems (ECDIS) set out in the Annex to the present resolution;
2. RECOMMENDS Government to ensure that ECDIS used on ships entitled to fly their flag conform to performance standards not inferior to those set out in the Annex to the present resolution;
3. REQUESTS the Maritime Safety Committee to keep Performance Standards under review and to adopt amendments thereto, as necessary;

4. ALSO REQUESTS the Maritime Safety Committee to ensure that any proposed amendments to this resolution are agreed with IHO prior to adoption

## ANNEX

### PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS - NAVY (ECDIS-N)

#### 1 INTRODUCTION

- 1.1. The primary function of the **ECDIS-N** is to contribute to safe navigation.
- 1.2. **ECDIS-N** with adequate back-up arrangements may be accepted, as complying with up-to-date charts required by regulation V/20 of the 1974 SOLAS Convention.
- 1.3. In addition to the general requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and the requirements for electronic navigational aids contained in IMO resolution A.694(17)\*, **ECDIS-N** should meet the requirements of this performance standard.
- 1.4. **ECDIS-N** should be capable of displaying all chart information necessary for safe and efficient navigation originated by, and distributed on the authority of, government-authorized hydrographic offices. **The government-authorized hydrographic office is defined as the National Imagery and Mapping Agency (NIMA).**
- 1.5. **ECDIS-N** should facilitate simple and reliable updating of the electronic navigational chart. **The updates will be provided by NIMA as defined by VDU.**
- 1.6. Use of **ECDIS-N** should reduce the navigational workload as compared to use of a paper chart. It should enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It should be capable of continuously plotting the ship's position.
- 1.7. **ECDIS-N** should have at least the same reliability and availability of presentation as the paper chart published by **NIMA**.
- 1.8. **ECDIS-N** should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment (see Appendix 5).

#### 2 DEFINITIONS

For the purpose of these performance standards:

- 2.1. Electronic Chart Display and Information System-Navy (ECDIS-N) means a navigation information system which, with adequate back-up arrangements, can be accepted as complying with the up-to-date chart required by **Navy Instructions**, by displaying selected information from a system electronic navigational chart (**SDNC**) **in VPF** with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and by displaying additional navigational-related information if required.
- 2.2. Electronic navigational chart (ENC) means the database, standardized as to content, structure and format, issued for use with **ECDIS-N** by **NIMA**. The ENC contains all the chart information necessary for safe navigation, and may

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\*IEC Publication 6945 (see Appendix 1)

contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation. ENC defined for the US Navy is DNC™. For submerged safe navigation ENC is defined as DNC™ and TOD.

2.3. System Digital Nautical Chart (SDNC) means a database resulting from the direct read of the VPF products by ECDIS-N for appropriate use, updates to DNC™ via VDU, and other data added by the operator. It is the database that is actually accessed by ECDIS-N for the display generation and other navigational functions, and is the equivalent to an up-to-date paper chart. The SDNC may also contain information from other sources. The term SDNC is identical to the term SENC as defined for civil ECDIS, except that the data format is specified for the SDNC.

2.4. Standard display means the SDNC information that should be shown when a chart is first displayed on ECDIS-N. The level of the information it provides for route planning or route monitoring may be modified by the mariner according to the mariner's needs.

2.5. Display base means the level of SDNC information which cannot be removed from the display, consisting of information which is required at all times in all geographical areas and all circumstances. It is not intended to be sufficient for safe navigation.

2.6. Further information on ECDIS definitions may be found in IHO Special Publication S-52, Appendix 3 (see Appendix 1).

2.7. National Imagery and Mapping Agency (NIMA) means the official Hydrographic office that provides all charting products to the Department of Defense

2.8. Digital Nautical Chart DNC™ means the Digital Nautical Charts produced by NIMA in VPF. DNC™ is controlled by MIL-PRF-89023, May 1996.

2.9. Littoral Warfare Data (LWD) means the standard DOD product controlled by MIL-PRF-89046, draft dated 1995.

2.10. Vector Product Format (VPF) means the DOD standard data format for vector products which is controlled by MIL-STND-2407, dated 27 Apr 96.

2.11. Tactical Ocean Data (TOD) means the product produced by NIMA in VPF under MIL-PRF-89049/10 (still in draft). TOD contains OPAREA information found on nautical charts, bottom contour charts and bathymetric navigation planning charts.

2.12. Vector Database Update (VDU) means the DOD format to update vector products electronically.

2.13. Vector Product Format Symbology (GEOSYM) means the DOD symbol set which is controlled by MIL-STND-2412 and VPF MIL-V-89045, and incorporates the object classes, colors, symbols, and fonts from IHO S-57 and S-52.

### 3 DISPLAY OF SDNC INFORMATION

3.1. ECDIS-N should be capable of displaying all SDNC information.

3.2. **SDNC** information available for display during route planning and route monitoring should be subdivided into three categories: display base, standard display, and all other information (see Appendix 2).

3.3. **ECDIS-N** should present the standard display at any time by a single operator action.

3.4. When a chart is first displayed on **ECDIS-N**, it should provide the standard display at the largest scale available in the **SDNC** for the displayed area.

3.5. It should be easy to add or remove information from the **ECDIS-N** display. It should not be possible to remove information contained in the display base.

3.6. It should be possible for the mariner to select a safety contour from the depth contours provided by the **SDNC**. **ECDIS-N** should give the safety contour more emphasis than other contours on the display.

3.7. It should be possible for the mariner to select a safety depth. **ECDIS-N** should emphasize soundings equal to or less than the safety depth whenever spot soundings are selected for display.

3.8. The **DNC AND TOD** and all updates to them should be displayed without any degradation of their information content.

3.9. **ECDIS-N** should provide a means of ensuring that the ENC and all updates to it have been correctly loaded into the **SDNC**.

3.10. The **DNC AND TOD** data and updates to it should be clearly distinguishable from other displayed information, such as, for example, that listed in Appendix 3.

#### 4 PROVISION AND UPDATING\* OF CHART INFORMATION

4.1. The chart information to be used in **ECDIS-N** should be the latest edition of information originated by **NIMA**.

4.2. The contents of the **SDNC** should be adequate and up-to-date for the intended voyage, as required by regulation V/20 of the 1974 SOLAS Convention.

4.3. It should not be possible to alter the contents of the **DNC AND TOD**.

4.4. Updates should be stored separately from the **DNC AND TOD**.

4.5. **ECDIS-N** should be capable of accepting official updates to the **DNC AND TOD** data **provided by NIMA**. These updates should be automatically applied to the **SDNC**. By whatever means updates are received, the implementation procedure should not interfere with the display in use.

4.6. **ECDIS-N** should also be capable of accepting updates to the **DNC AND TOD** data entered manually with simple means for verification prior to the final acceptance of the data. They should be distinguishable on the display from **DNC AND TOD** information and its official updates, and not affect display legibility.

4.7. **ECDIS-N** should keep a record of updates, including time of application to the **SDNC**.

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\* Appendix 1 to IHO Special Publication S-52 (see Annex 1).

4.8. **ECDIS-N** should allow the mariner to display updates so that the mariner may review their contents and ascertain that they have been included in the **SDNC**.

## 5 SCALE

**ECDIS-N** should provide an indication of whether:

- .1 the information is displayed at a larger scale than that contained in the **DNC AND TOD**; or
- .2 own ship's position is covered by an **DNC AND TOD** at a larger scale than that provided by the display.

## 6 DISPLAY OF OTHER NAVIGATIONAL INFORMATION

6.1. Radar information or other navigational information may be added to the **ECDIS-N** display. However, it should not degrade the **SDNC** information, and should be clearly distinguishable from the **SDNC** information.

6.2. **ECDIS-N** and added navigational information should use a common reference system. If this is not the case, an indication should be provided.

### 6.3. Radar

6.3.1. Transferred radar information may contain both the radar image and ARPA information.

6.3.2. If the radar image is added to the **ECDIS-N** display, the chart and the radar image should match in scale and in orientation.

6.3.3. The radar image and the position from the position sensor should both be adjusted automatically for antenna offset from the conning position.

6.3.4. It should be possible to adjust the displayed position of the ship manually so that the radar image matches the **SDNC** display.

6.3.5. It should be possible to remove the radar information by single operator action.

### 6.4. Line of Position (LOP) Fix

6.4.1. **ECDIS-N** should provide the capability to enter bearing and distance LOP's, from ownship to charted aids to navigation and/or conspicuous objects, and process the bearings to resolve LOP's into a fix or running fix in the case where LOP's are not obtained from near simultaneous observations.

6.4.2. It should be possible to display concurrently both the assumed ships position and the LOP's drawn from objects shot.

6.4.3. **ECDIS-N** should provide the option to compare the LOP's with the position derived from a continuous positioning system, (e.g. GPS, INS) by continuously updating an estimated position calculated by applying set and drift to a dead reckoning position calculated from the LOP.

### 6.5. Dead Reckoning

6.5.1 **ECDIS-N** should provide the capability to construct a dead reckoning plot.

## 6.5.2 ECDIS-N shall have the capability to calculate set and drift

### 7 DISPLAY MODE AND GENERATION OF THE NEIGHBORING AREA

7.1. It should always be possible to display the SDNC in a "north-up" orientation. Other orientations are permitted.

7.2. ECDIS-N should provide for true motion mode. Other modes are permitted.

7.3. When true motions mode is in use, reset and generation of the neighboring area should take place automatically at a distance from the border of the display determined by the mariner.

7.4. It should be possible manually to change the chart area and the position of own ship relative to the edge of the display.

### 8 COLORS AND SYMBOLS

8.1. IHO recommended colors and symbols, which will be provided by NIMA GEOSYM, should be used to represent SDNC information.

8.2. The colours and symbols other than those mentioned in 8.1 should be those used to describe the navigational elements and parameters listed in Appendix 3 and published by IEC\*\*. Where colours and patterns are required to display military tactical or operational overlays on the navigational SDNC, overlay colours and patterns selected must not degrade the SDNC information.

8.3. SDNC information, when displayed at the scale specified in the DNC AND TOD, should use the specified size of symbols, figures and letters\* \*\*.

8.4. ECDIS-N should allow the mariner to select whether own ship is displayed in true scale or as a symbols.

### 9 DISPLAY REQUIREMENTS

9.1. EDCIS-N should be capable of displaying information for:

- .1 route planning and supplementary navigation tasks;
- .2 route monitoring.

9.2. The effective size of the chart presentation for route monitoring should be at least 270 mm by 270 mm.

9.3. The display should be capable of complying with the colour and resolution recommendations of IHO\*. This will be accomplished by using GEOSYM.

9.4. The method of presentation should ensure that the displayed information is clearly visible to more than one observer in the conditions of light normally experienced on the bridge of the ship by day and by night.

### 10 ROUTE PLANNING MONITORING AND VOYAGE RECORDING

10.1. It should be possible to carry out route planning and route monitoring in a simple and reliable manner.

\*Appendix 2 to IHO Special Publication S-52(see Appendix 10)

\*\* IEC Publication 61174

10.2. **ECDIS-N** should be designed following ergonomic principles for user-friendly operation.

10.3. The largest scale data available in the **SDNC** for the area given should always be used by the **ECDIS-N** for all alarms or indications of crossing the ship's safety contour and of entering a prohibited area, and for alarms and indications according to Appendix 5.

#### 10.4. Route planning

10.4.1. It should be possible to carry out route planning including both straight and curved segments.

10.4.2. It should be possible to adjust a planned route by, for example:

- .1 adding waypoint to a route;
- .2 deleting waypoints from a route;
- .3 changing the position of a waypoint;
- .4 changing the order of the waypoints in the route

10.4.3. It should be possible to plan an alternative route in addition to the selected route. The selected route should be clearly distinguishable from the other routes.

10.4.4. An indication is required if the mariner plans a route across an own ship's safety contour.

10.4.5. An indication is required if the mariner plans a route across the boundary of a prohibited area or of a geographical area for which special conditions exist (see Appendix 4).

10.4.6. It should be possible for the mariner to specify a limit of deviation from the planned route at which activation of an automatic offtrack alarm should occur.

#### 10.5. Route Monitoring

10.5.1. For route monitoring the selected route and own ship's position should appear whenever the display covers that area.

10.5.2. It should be possible to display a sea area that does not have the ship on the display (e.g., for look ahead, route planning), while route monitoring. If this is done on the display used for the route monitoring, the automatic route monitoring functions (e.g., updating ship's position, and providing alarms and indications) should be continuous. It should be possible to return to the route monitoring display covering own ship's position immediately by single operator action.

10.5.3. **ECDIS-N** should give an alarm if the ship, within a specified time set by the mariner, is going to cross the safety contour.

10.5.4. **ECDIS-N** should give an alarm or indication, as selected by the mariner, if the ship, within a specified time set by the mariner, is going to cross the boundary of a prohibited area or of a geographical area for which special conditions exist (see appendix 4).

10.5.5. An alarm should be given when the specified limit for deviation from the planned route is exceeded.

10.5.6. The ship's position should be derived from a continuous system of accuracy consistent with the requirements of safe navigation. When possible, a second independent positioning method of a different type should be provided; **ECDIS-N** should be capable of identifying discrepancies between the two systems.

10.5.7. **ECDIS-N** should provide an indication when the input from the position-fixing system is lost. **ECDIS-N** should also repeat, but only as an indication, any alarm or indication passed to it from a position-fixing system.

10.5.8. An alarm should be given by **ECDIS-N** if the ship, within a specified time or distance set by the mariner, is going to reach a critical point on the planned route.

10.5.9. The positing system and the **SDNC** should be on the same geodetic datum. **ECDIS-N** should give an alarm if this is not the case.

10.5.10. It should be possible to display an alternative route in addition to the selected route. The selected route should be clearly distinguishable from the other routes. During the voyage, it should be possible for the mariner to modify the selected sailing route or change to an alternative route.

10.5.11. It should be possible to display:

.1 time-labels along ship's track, manually on demand and automatically at intervals selected between 1 and 120 m; and

.2 an adequate number of: points, free movable electronic bearing, variable and fixed-range markers and other symbols required for navigation purposes and specified in Appendix 3.

10.5.12. It should be possible to enter the geographical co-ordinates of any position and then display that position on demand. It should also be possible to select any point (features, symbol or position) on the display and to read its geographical co-ordinates on demand.

10.5.13. It should be possible to adjust the ship's geographical position manually. These manual adjustments should be noted alpha-numerically on the screen, maintained until altered by the mariner, and automatically recorded.

## 10.6. Voyage recording

10.6.1. **ECDIS-N** should store and be able to reproduce certain minimum elements required to reconstruct the navigation and verify the official database used during the previous 12 hours. The following data should be recorded at one-minute intervals.

.1 to ensure a record of own ship's past track: time, position, heading, and speed; and

.2 to ensure a record of official data used: **DNC AND TOD** source, edition, date, cell and update history.

.3 **ECDIS-N** desires to have the capability to record time, position and depth from the sounder for download to removable media.

10.6.2. In addition, **ECDIS-N** should record the complete track for the entire voyage, with time marks at intervals not exceeding 4 hours.

10.6.3. It should not be possible to manipulate or change the recorded information.

10.6.4. **ECDIS-N** should have the capability to preserve the record of the voyage track.

## 11 ACCURACY

11.1. The accuracy of all calculation performed by **ECDIS-N** should be independent of the characteristic of the output device and should be consistent with the **SDNC** accuracy.

11.2. Bearing and distance drawn on the display, or those measured between features already drawn on the display, should have an accuracy no less than that afforded by the resolution of the display.

## 12 CONNECTION WITH OTHER EQUIPMENT\*

12.1. **ECDIS-N** should not degrade the performance of any equipment providing sensor inputs. Nor should the connection of optional equipment degrade the performance of **ECDIS-N** below this standard.

12.2. **ECDIS-N** should be connected to systems providing continuous position-fixing, heading and speed information.

## 13 PERFORMANCE TESTS, MALFUNCTION ALARMS AND INDICATIONS

13.1. **ECDIS-N** should be provided with means for carrying out on-board tests of major functions either automatically or manually. In case of a failure, the test should display information to indicate which module is at fault.

13.2. **ECDIS-N** should provide a suitable alarm or indication of system malfunction.

## 14 BACK-UP ARRANGEMENTS

Adequate back-up arrangements should be provided to ensure safe navigation in case of an **ECDIS-N** failure. **Amplifying information regarding acceptability of backup arrangements is contained in Appendix 6.**

.1 Facilities enabling a safe take-over of the **ECDIS-N** functions should be provided in order to ensure that an **ECDIS-N** failure does not result in a critical situation.

.2 A back-up arrangement should be provided facilitating means for safe navigation of the remaining part of the voyage in case of an **ECDIS-N** failure.

## 15 POWER SUPPLY

15.1. It should be possible to operate **ECDIS-N** and all equipment necessary for its normal functioning when supplied by an emergency source of electrical power in accordance with the appropriate requirements of chapter II-1 of the SOLAS Convention.

15.2. Changing from one source of power supply to another, or any interruption of the supply for a period of up to 45 seconds, should not require the equipment to be re-initialized manually.

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\*IEC Publication 61162

APPENDIX 1

REFERENCE DOCUMENTS

The following international organizations have developed technical standards and specifications, as listed below, for use in conjunction with this standard. The latest edition of these documents should be obtained from the organization concerned.

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

Address: Directing Committee  
International Hydrographic Bureau  
BP 445  
MC 98011 Monaco CEDEX Phone: +377 9310 8100  
Principality of Monaco Fax: +377 9310 8140

Publications

Special Publication No.S-52 "Provisional Specifications for a Chart Content and Display of ECDIS."

S-52 Appendix 1 "Report of the IHO (COE) Working Group on Updating the Electronic Chart."

S-52 Appendix 2 "Provisional Colour and Symbol Specifications for ECDIS."

S-52 Appendix 3 "Glossary of ECDIS-related Terms."

Special Publication No.S-57 "IHO Transfer Standard for Digital Hydrographic Data"

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

Address: IEC Central Office  
3 rue de Varembe'  
PO Box 131  
CH-1211 Geneva 20 Phone: +41 22 734 01 50  
Switzerland Fax: +41 22 733 38 43

Publications

IEC Publication 61174 "Electronic Chart Display and Information System (ECDIS)"

IEC Publication 6945 "General Require for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and Marine Navigational Equipment"

IEC Publication 61162 "Digital Interfaces - Navigation and Radio communication Equipment On Board Ship"

APPENDIX 2

SDNC INFORMATION AVAILABLE FOR DISPLAY DURING  
ROUTE PLANNING AND ROUTE MONITORING

- 1 Display base, permanently retained on the **ECDIS-N** display, consisting of:
  - .1 coastline (high water);
  - .2 own ship's safety contour, to be selected by the mariner;
  - .3 indication of isolated underwater dangers at depths of less than the safety contour which lie within the safe waters defined by the safety contour;
  - .4 indication of isolated dangers which lie within the safe water defined by the safety contour such as bridges, overhead wire, etc., including buoys and beacons, whether or not these are being used as aids to navigation;
  - .5 traffic routing systems;
  - .6 scale, range, orientation, and display mode;
  - .7 units of depth and height.
  
- 2 Standard display, to be displayed when the chart is first displayed by **ECDIS-N**, consisting of:
  - .1 display base
  - .2 drying line
  - .3 indication of fixed and floating aids to navigation
  - .4 boundaries of fairways, channels, etc.
  - .5 visual and radar conspicuous features
  - .6 prohibited and restricted areas
  - .7 chart scale boundaries
  - .8 indication of cautionary notes
  
- 3 All other information, displayed individually on demand, for example:
  - .1 spot soundings
  - .2 submarine cables and pipelines
  - .3 ferry routes
  - .4 details of all isolated dangers
  - .5 details of aids to navigation
  - .6 contents of cautionary notes
  - .7 **DNC AND TOD** edition date
  - .8 geodetic datum
  - .9 magnetic variation
  - .10 graticule
  - .11 place names

APPENDIX 3

NAVIGATIONAL ELEMENTS AND PARAMETERS\*

- 1 Own ship
  - .1 Past track with time marks for primary track
  - .2 Past track with time marks for secondary track
- 2 Vector for course and speed made good
- 3 Variable range marker and/or electronic bearing line
- 4 Cursor
- 5 Event
  - .1 Dead reckoning position and time (DR)
  - .2 Estimated position and time (EP)
- 6 Fix and time
- 7 Position line time
- 8 Transferred position line and time
  - .1 Predicted tidal stream or current vector with effective time and strength (in box)
  - .2 Actual tidal stream or current vector with effective time and strength (in box)
- 9 Danger highlight
- 10 Clearing line
- 11 Planned course and speed to make good. Speed is shown in box
- 12 Waypoint
- 13 Distance to run
- 14 Planned position with date and time
- 15 Visual limits of lights arc to show rising/dipping
- 16 Position and time of "wheelover"

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\*See IEC Publication 61171

APPENDIX 4

AREAS FOR WHICH SPECIAL CONDITIONS EXIST

The following are the areas which **ECDIS-N** should detect and for which it should provide an alarm or indication under 10.4.5 and 10.5.4:

- Traffic separation zone
- Traffic routing scheme crossing or roundabout
- Traffic routing scheme precautionary area
- Two-way traffic route
- Deepwater route
- Recommended traffic lane
- Inshore traffic zone
- Fairway
- Restricted area
- Caution area
- Offshore production area
- Areas to be avoided
- Military practice area
- Seaplane landing area
- Submarine transit lane
- Ice area
- Channel
- Fishing ground
- Fishing prohibited
- Pipeline area
- Cable area
- Anchorage area
- Anchorage prohibited
- Dumping ground
- Spoil ground
- Dredged area
- Cargo transshipment area
- Incineration area
- Specially protected areas

APPENDIX 5

ALARMS AND INDICATIONS

Section	Requirements	Information
10.3	Alarm or Indication	Largest scale for alarm
10.4.6	Alarm	Exceeding off-track limits
10.5.3	Alarm	Crossing safety contour
10.5.4	Alarm or Indication	Area with special conditions
10.5.5	Alarm	Deviation from route
10.5.8	Alarm	Approach to critical point
10.5.9	Alarm	Different geodetic datum
13.2	Alarm or Indication	Malfunction of <b>ECDIS-N</b>
5.1	Indication	Information overscale
5.2	Indication	Larger scale <b>DNC AND TOD</b> available
6.2	Indication	Different reference system
10.4.4	Indication	Route planning across safety contour
10.4.5	Indication	Route planning across specified area
10.5.7	<b>Alarm and</b> Indication	Positioning system failure
13.1	Indication	System test failure

In this performance standard the definitions of indicators and alarms provided in the IMO publication "Code on Alarms and Indicators" (IMO-867E) apply.

Alarm: An alarm or alarm system which announces by audible means, or audible and visual means, a condition requiring attention.

Indicator: Visual indication giving information about the condition of a system or equipment.

## "APPENDIX 6"

### BACK-UP REQUIREMENT

#### 1 INTRODUCTION

As prescribed in section 14 of this performance standard, adequate independent back-up arrangements should be provided to ensure safe navigation in case of **ECDIS-N** failure. Such arrangements include:

.1 facilities enabling a safe take-over of the **ECDIS-N** functions in order to ensure that an **ECDIS-N** failure does not result in a critical situation;

.2 a means to provide for safe navigation for the remaining part of the voyage in case of **ECDIS-N** failure.

#### 2 PURPOSE

The purpose of an **ECDIS-N** back-up system is to ensure that safe navigation is not compromised in the event of **ECDIS-N** failure. This should include a timely transfer to the back-up system during critical navigation situations. The back-up system shall allow the vessel to be navigated safely until the termination of the voyage.

#### 3 FUNCTIONAL REQUIREMENTS

##### 3.1. Required functions and their availability

##### 3.1.1. Presentation of chart information

The back-up system should display in graphical (chart) form the relevant information of the hydrographic and geographic environment which are necessary for safe navigation.

##### 3.1.2. Route planning

The back-up system should be capable of performing the route planning functions, including:

.1 taking over of the route plan originally performed on the **ECDIS-N**;

.2 adjusting a planned route manually or by transfer from a route-planning device.

##### 3.1.3. Route monitoring

The back-up system should enable a take-over of the route monitoring originally performed by the **ECDIS-N**, and provide at least the following functions:

.1 plotting own ship's position automatically or manually on a chart;

.2 taking courses, distances and bearing from the chart;

.3 displaying the planned route;

.4 displaying time labels along ship's track;

.5 plotting an adequate number of points, bearing lines, range markers, etc., on the chart.

#### 3.1.4. Display information

If the back up is an electronic device, it should be capable of displaying at least the information equivalent to the standard display as defined in this performance standard.

#### 3.1.5. Provision of chart information

.1 The chart information to be used should be the latest editions of that originated by a government hydrographic office, and based on IHO standards.

.2 It should not be possible to alter the contents of the electronic chart information.

.3 The chart or chart data edition and issuing date should be indicated.

#### 3.1.6. Updating

The information displayed by the **ECDIS-N** back-up arrangements should be up-to-date for the entire voyage.

#### 3.1.7. Scale

If an electronic device is used, it should provide an indication:

.1 if the information is displayed at a larger scale than that contained in the database; and

.2 if own ship's position is covered by a chart at a larger scale than that provided by the system

3.1.8. If radar and other navigational information are added to an electronic back-up display, all the corresponding requirements of this performance standard should be met.

3.1.9. If an electronic device is used, the display mode and generation of the neighboring area should be in accordance with section 7 of this performance standard.

#### 3.1.10. Voyage recording

The back-up arrangements should be able to keep a record of the ship's actual track, including positions and corresponding times.

### 3.2. Reliability and accuracy

#### 3.2.1. Reliability

The back-up arrangements should provide reliable operation under prevailing environmental and normal operating conditions.

#### 3.2.2. Accuracy

Accuracy shall be in accordance with section 11 of this performance standard.

#### 3.2.3. Availability

In order to ensure that safe navigation is not compromised in the event of ECDIS-N failure, overall ECDIS-N system availability shall be equal to the availability of current navigation procedures that use paper charts. The following are acceptable means of achieving this level of availability:

.1 dual, redundant ECDIS-N systems (primary and backup) with a demonstrated availability equal to paper chart availability. (This can include redundancy by multiple servers and LAN configuration)

.2 a primary ECDIS-N system with a NIMA paper chart to provide backup capability; or

.3 a primary ECDIS-N system with the capability to print color charts at an acceptable size and scale. (Note - this presumes that policies are implemented to ensure that required paper backup charts are printed prior to a voyage.

### 3.3. Malfunctions, warnings, alarms, and indications

If an electronic device is used, it should provide a suitable indication of system malfunction.

## 4 OPERATIONAL REQUIREMENTS

### 4.1. Ergonomics

If an electronic device is used, it should be designed in accordance with the ergonomic principles of **ECDIS-N**.

### 4.2. Presentation of Information

4.2.1. Colours and symbols used in the back-up arrangements should be based on **NIMA GEOSYM**.

4.2.2. If an electronic device is used, the effective size of the chart presentation shall be in accordance with section 9.2 of this performance standard.

## 5 POWER SUPPLY

If an electronic device is used;

.1 the back-up power supply should be separate from the **ECDIS-N**; and

.2 conform to the requirements in this **ECDIS-N** performance standard.

## 6 CONNECTIONS WITH OTHER EQUIPMENT

6.1. If an electronic device is used, it should:

.1 be connected to systems providing continuous position-fixing capability; and

.2 not degrade the performance of any equipment providing sensor input.

6.2. If radar with selected parts of the **DNC AND TOD** chart information overlay is used as an element of the back-up, the radar should comply with resolution A.477(XII), as amended.