

Resolution A.817(19)
adopted on 23 November 1995
(Agenda item 10)

**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 Maritime Safety Committee at its sixty-third session,

1. ADOPTS the Recommendation on Performance Standards for Electronic Chart Display and Information Systems (ECDIS) set out in the annex to the present resolution;
2. RECOMMENDS Governments 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 these 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.

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

1 INTRODUCTION

1.1 The primary function of the ECDIS is to contribute to safe navigation.

1.2 ECDIS, with adequate back-up arrangements, may be accepted as complying with the 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 should meet the requirements of this performance standard.

1.4 ECDIS 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.

1.5 ECDIS should facilitate simple and reliable updating of the electronic navigational chart.

1.6 Use of ECDIS 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 should have at least the same reliability and availability of presentation as the paper chart published by government-authorized hydrographic offices.

1.8 ECDIS 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 (ECDIS)* means a navigation information system which, with adequate back-up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/20 of the 1974 SOLAS Convention, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and by displaying additional navigation-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 on the authority of government-authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation, and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation.

* IEC Publication 945 (see appendix 1).

2.3 *System electronic navigational chart (SENC)* means a database resulting from the transformation of the ENC by ECDIS for appropriate use, updates to the ENC by appropriate means, and other data added by the mariner. It is this database that is actually accessed by ECDIS for the display generation and other navigational functions, and is the equivalent to an up-to-date paper chart. The SENC may also contain information from other sources.

2.4 *Standard display* means the SENC information that should be shown when a chart is first displayed on ECDIS. 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 SENC 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).

3 DISPLAY OF SENC INFORMATION

3.1 ECDIS should be capable of displaying all SENC information.

3.2 SENC 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 should present the standard display at any time by a single operator action.

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

3.5 It should be easy to add or remove information from the ECDIS 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 SENC. ECDIS 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 should emphasize soundings equal to or less than the safety depth whenever spot soundings are selected for display.

3.8 The ENC and all updates to it should be displayed without any degradation of their information content.

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

3.10 The ENC 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 should be the latest edition of information originated by a government-authorized hydrographic office, and conform to IHO standards.

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

- 4.2** The contents of the SENC 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 ENC.
- 4.4** Updates should be stored separately from the ENC.
- 4.5** ECDIS should be capable of accepting official updates to the ENC data provided in conformity with IHO standards. These updates should be automatically applied to the SENC. By whatever means updates are received, the implementation procedure should not interfere with the display in use.
- 4.6** ECDIS should also be capable of accepting updates to the ENC data entered manually with simple means for verification prior to the final acceptance of the data. They should be distinguishable on the display from ENC information and its official updates, and not affect display legibility.
- 4.7** ECDIS should keep a record of updates, including time of application to the SENC.
- 4.8** ECDIS should allow the mariner to display updates so that the mariner may review their contents and ascertain that they have been included in the SENC.

5 SCALE

ECDIS should provide an indication of whether:

- .1 the information is displayed at a larger scale than that contained in the ENC; or
- .2 own ship's position is covered by an ENC 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 display. However, it should not degrade the SENC information, and should be clearly distinguishable from the SENC information.
- 6.2** ECDIS 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 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 SENC display.
- 6.3.5** It should be possible to remove the radar information by single operator action.

7 DISPLAY MODE AND GENERATION OF THE NEIGHBOURING AREA

- 7.1** It should always be possible to display the SENC in a "north-up" orientation. Other orientations are permitted.
- 7.2** ECDIS should provide for true motion mode. Other modes are permitted.

7.3 When true motion mode is in use, reset and generation of the neighbouring 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 COLOURS AND SYMBOLS

8.1 IHO recommended colours and symbols should be used to represent SENC 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.†

8.3 SENC information, when displayed at the scale specified in the ENC, should use the specified size of symbols, figures and letters.* †

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

9 DISPLAY REQUIREMENTS

9.1 ECDIS 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 × 270 mm.

9.3 The display should be capable of complying with the colour and resolution recommendations of IHO.*

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.

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

10.3 The largest scale data available in the SENC for the area given should always be used by the ECDIS 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.

* Appendix 2 to IHO Special Publication S-52 (see appendix 1).

† IEC Publication 1174.

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

- .1 adding waypoints 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 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 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 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 positioning system of an accuracy consistent with the requirements of safe navigation. Whenever possible, a second independent positioning method of a different type should be provided; ECDIS should be capable of identifying discrepancies between the two systems.

10.5.7 ECDIS should provide an indication when the input from the position-fixing system is lost. ECDIS 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 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 positioning system and the SENC should be on the same geodetic datum. ECDIS 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 lines, 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. This manual adjustment should be noted alphanumerically on the screen, maintained until altered by the mariner, and automatically recorded.

10.6 Voyage recording

10.6.1 ECDIS 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 h. 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: ENC source, edition, date, cell and update history.

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

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

10.6.4 ECDIS should have the capability to preserve the record of the previous 12 h and of the voyage track.

11 ACCURACY

11.1 The accuracy of all calculations performed by ECDIS should be independent of the characteristics of the output device and should be consistent with the SENC accuracy.

11.2 Bearings and distances 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 CONNECTIONS WITH OTHER EQUIPMENT*

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

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

* IEC Publication 1162.

13 PERFORMANCE TESTS, MALFUNCTION ALARMS AND INDICATIONS

13.1 ECDIS 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 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 failure.

- .1** Facilities enabling a safe take-over of the ECDIS functions should be provided in order to ensure that an ECDIS 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 failure.

15 POWER SUPPLY

15.1 It should be possible to operate ECDIS 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 1974 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 s, should not require the equipment to be re-initialized manually.

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 (IHO)

Address: Directing Committee
International Hydrographic Bureau
BP 445
98011 Monaco CEDEX
Principality of Monaco

Phone: + 33 9350 6587
Fax: + 33 9325 2003

Publications

Special Publication No. S-52 "Provisional Specifications for Chart Content and Display of ECDIS", 2nd Edition, September 1992.

S-52 appendix 1 "Report of the IHO (COE) Working Group on Updating the Electronic Chart", 1st Edition, June 1990.

S-52 appendix 2 "Provisional Colour and Symbol Specifications for ECDIS", 1st Edition, February 1991.

S-52 appendix 3 "Glossary of ECDIS-related Terms", 1st Edition, July 1991.

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

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3 rue de Varembe
PO Box 131
1211 Geneva 20
Switzerland

Phone: + 41 22 734 01 50
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Publications

IEC Publication 1174 "Electronic Chart Display and Information System (ECDIS)".

IEC Publication 945 "General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and Marine Navigational Equipment".

IEC Publication 1162 "Digital Interfaces - Navigation and Radiocommunication Equipment On Board Ship".

Appendix 2

SENC information available for display during route planning and route monitoring

- 1 Display base, permanently retained on the ECDIS 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 wires, 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, 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 ENC 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 and 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 range
- 16 Position and time of “wheelover”

* See IEC Publication 1174.

Areas for which special conditions exist

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

- Traffic separation zone
- Traffic routeing scheme crossing or roundabout
- Traffic routeing 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 trans-shipment area
- Incineration area
- Specially protected areas

Alarms and indicators

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 ECDIS
5.1	Indication	Information overscale
5.2	Indication	Larger scale ENC 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	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.