



MARITIME SAFETY COMMITTEE
80th Session
Agenda item ...

MSC 80/.../..
January 2005
Original: ENGLISH

WORK PROGRAMME

Sub-Committee on Safety of Navigation

Amendments to the Performance Standards for Electronic Chart Display and Information Systems (ECDIS)

Submitted by Greece and the International Hydrographic Organization

SUMMARY

Executive summary: Following 9 years experience with ECDIS, Greece and the International Hydrographic Organization propose some amendments / improvements to the ECDIS performance standards to rectify identified shortcomings. This paper proposes the addition of a new high priority work programme item on the work programme of the Sub-Committee on Safety of Navigation to review these amendments and includes a draft amended text for consideration.

Action to be taken: Paragraph 7.

Related documents : Resolution A.817(19) as amended by Resolutions MSC.64(67) and MSC.86(70)

Scope of the proposal

1. Greece and the IHO propose that the Sub-Committee on Safety of Navigation should consider the proposed amendments to the ECDIS performance standards, as adopted by IMO in November 1995. Experience over the last 9 years has highlighted some necessary amendments to the performance standards. The IHO publishes 3 documents relating to ECDIS: Specifications for Chart Content and Display Aspects of ECDIS (S-52); IHO Transfer Standards for Digital Hydrographic Data (S-57) and The IHO Data Protection Scheme (S-63). It is considered that some of the information, currently included in S-52, should more correctly be included in the performance standards and that the performance standards need to refer

to publication S-63 which has been introduced by the IHO since the adoption of the performance standards.

Need for the measure

2.

- a. Over the past 9 years, as experience has been gained with ECDIS, IHO Special Publication (S-52) - Specifications for Chart Content and Display Aspects of ECDIS, has been amended. On reflection it is considered that certain information currently included in S-52 should more correctly be included in the performance standards for ECDIS.
- b. Experience gained by ECDIS users has revealed that there is a need to reconcile the requirements of the 'Standard Display' and the 'Display Base' categories in order to better implement the IHO specifications for colours and symbols to be used with ECDIS. In particular it is proposed that the display of "buoys and beacons" be moved from the 'Display Base' to the 'Standard Display' thereby allowing the mariner to remove them from the display on those occasions when they would otherwise clutter the screen and impair safety of navigation. It is also proposed that "ferry routes" should be moved from the display "All other information" to "Standard Display" thereby ensuring that they are always shown when a chart is first displayed on ECDIS.
- c. In 2003, at the request of member States, the IHO adopted a Data Protection Scheme for Electronic Navigational Charts as described in IHO Special Publication (S-63). It is proposed that a reference to S-63 be included in the performance standards for ECDIS.
- d. The ECDIS glossary referred to in the performance standards will be moved from IHO Publication S-52 to the IHO Hydrographic Dictionary (S-32).

Issues involved

3. The amendments proposed in paragraph 2a do not change the substance of the standards currently included in the IMO performance standard and the IHO Specifications for Chart Content and Display Aspects of ECDIS, and therefore will not affect IEC test standard 61174. The amendments proposed at 2b and 2c will involve some development work by ECDIS manufacturers and consequent change to the test specifications. The use of encrypted data was not envisaged when the performance standards were prepared initially.

Cost

4. It is proposed that the amended performance standards should only apply to new ECDIS fitted after 1 July 2008. The amendments proposed at paragraphs 2b and 2c will require some development work by ECDIS manufacturers although many already allow the use of encrypted datasets as set out in S-63. It is considered that this will have a minimum cost for the shipping industry.

Benefits

5. The amendments proposed in paragraph 2 will:
 - a. Improve the performance standards in the light of experience gained over the last 9 years and more clearly separate the guidance included in the related publications.
 - b. Reduce screen clutter in critical situations, e.g. in confined waters, by giving the mariner the ability to temporarily remove buoys and beacons from the current display, thereby improving the safety of navigation and
 - c. Allow the use of encrypted datasets and ensure that this functionality is properly tested.

Priority, target completion date and relevant sub-committee

6. Greece and the IHO consider that this is a high priority item that should be considered by the Sub-Committee on Safety of Navigation over two sessions with a target completion date of 2007.

Action requested to the Committee

7. The Committee is invited to put this high priority item on the work programme of the Sub-Committee on Safety of Navigation and to forward the draft revised text of the ECDIS performance standards, attached as an Annex to this document, to the Sub-Committee for consideration.

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

[IMO Resolution A.817 (19), as amended by MSC.64 (67) and MSC.86 (70)]

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 for electronic navigational aids contained in IMO resolution A.694 (17)¹ 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 ECDIS should reduce the navigational workload compared to using the 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).
- 1.9 When the relevant chart information is not available in the appropriate form (see section 4), some ECDIS equipment may operate in the Raster Chart Display System (RCDS) mode as defined in appendix 7. Unless otherwise specified in appendix 7, the RCDS mode of operation should conform to performance standards not inferior to those set out in this annex.

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 if required display additional navigation-related information.

* Deleted text is shown with strikethrough e.g. ~~delete~~ and new text is highlighted e.g. insert.

¹ IEC Publication 60945 (see appendix 1).

- 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.
- 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. This conversion process does not imply real-time processing of ENC data. 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. Each manufacturer of ECDIS systems may design its own storage formats or data structure to allow its system to meet the performance requirements stated in these standards.
- 2.4 Standard Display means the SENC information that should be shown when a chart is first displayed on ECDIS. Depending upon the needs of the mariner, 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 geographic 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 Hydrographic Dictionary, 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. An ECDIS must be capable of accepting and converting an ENC and its updates into a SENC. An ENC may be converted into a SENC ashore for subsequent display on an on board ECDIS.
- 3.2 SENC information available for display during route planning and route monitoring should be subdivided into the following 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 emphasize the safety contour over other contours on the display.
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- 3.6.1 If the mariner does not specify a safety contour, this should default to 30m. If the safety contour specified by the mariner is not in the SENC, the safety contour shown should default to the next deeper contour.
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- 3.6.2 If the safety contour in use becomes unavailable due to a change in source data, the safety contour should default to the next deeper contour.
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- 3.6.3 In each of the above cases, the mariner should be informed.

- 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. The precision of the ENC data (e.g. degrees and decimal degrees) should be maintained when converted to the SENC or used in calculations.
- 3.9 ECDIS should provide a means of method to ensure that the ENC and all updates to it have been correctly loaded into the SENC. If the cell structure of the ENC is modified in the conversion to the SENC, the new SENC structure should maintain the cell dependent characteristics.
- 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 ² OF CHART INFORMATION

- 4.1 The chart information to be used in ECDIS should be the latest edition of that originated by a government authorized hydrographic office, as corrected by official updates, and conform to IHO standards.
- 4.2 The contents of the SENC should be adequate and up-to-date for the intended voyage to comply with regulation V/20 of the 1974 SOLAS Convention.
- 4.3 It should not be possible to alter the contents of the ENC. An official copy of the ENC or the externally generated SENC is to be kept on board.
- 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. If the ENC is converted to the SENC ashore, all current updates should be applied prior to delivery on board.
- 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 in order to review their contents and to ascertain that they have been included in the SENC.
- 4.9 ECDIS should be capable of accepting an encrypted ENC and its updates conforming to the IHO Data Protection Scheme³.

5. SCALE

- 5.1 ECDIS should provide an indication if:

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

³ IHO Special Publication S-63 (see appendix 1).

- .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.

5.2 A scale bar should be provided as part of the display base for navigating on a large scale (1:80 000 and larger). This is intended to give an immediate impression of scale and of the proximity of charted objects, rather than for accurate distance measurements, which should be made by means of the cursor.

5.3 For chart displays at a scale smaller than 1:80 000, a latitude bar should be shown on the border of the standard 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 it 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. If other orientations are displayed, the orientation should be altered in steps large enough to avoid unstable display of the chart information.

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 to change manually the chart area and the position of own ship relative to the edge of the display.

7.5 If the area covered by the ECDIS display includes waters for which no ENC at a scale appropriate for navigation exists, the areas representing those waters should carry an indication to the mariner to refer to the paper chart

(see appendix 5).

8. COLOURS AND SYMBOLS

- 8.1 IHO recommended colours and symbols should be used to represent SENC information⁴.
- 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 IEC⁵.
- 8.3 SENC information when displayed at the scale specified in the ENC should use the specified size of symbols, figures and letters^{4,5}.
- 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 x 270 mm.
- 9.3 The display should be capable of meeting colour and resolution recommendations of IHO⁴.
- 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.

9.5 The units for depth should always be on the same screen as the chart display.

9.6 The following information should be shown on demand on the same screen as the chart display or on an additional graphic or text display:

.1 result from navigational computations;

.2 list of categories which are removed from Standard Display.

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.

⁴ Appendix 2 to IHO Special Publication S-52 (see appendix 1).

⁵ IEC Publication 61174.

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 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 alternate route in addition to the selected route. The selected route should be clearly distinguishable from the other route.
- 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 a geographic 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, within a specified time set by the mariner, own ship will 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, ~~own ship will 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 alarm 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, will 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 ships track manually on demand and automatically at intervals selected between 1 and 120 minutes; 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. Also, it should be possible to select any point (features, symbol or position) on the display and read it's geographical co-ordinates on demand.
- 10.5.13 It should be possible to adjust the ship's geographic position manually. This manual adjustment 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 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 shall 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 hours.
- 10.6.3 It should not be possible to manipulate or change the recorded information.
- 10.6.4 ECDIS should have a capability to preserve the record of the previous 12 hours and of the voyage track.

11. CALCULATIONS AND 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.

11.3 ~~Should point reduction of~~ smoothing operations ~~using point reduction be~~ employed to compress chart information in the SENC, the resultant image of the chart displayed at ENC scale should not differ from the ENC image by more than the display resolution.

11.4 The system should be capable of performing at least the following calculations:

11.4.1 geographic co-ordinates to display coordinates and vice versa;

11.4.2 transformation between local datum and WGS-84;

11.4.3 true distance and azimuth between two geographical positions;

11.4.4 geographic position from known position and distance/azimuth;

11.4.5 projection calculations such as true distance, rhumb line, convergence and great circle.

11.5 The accuracy of these calculations should be such that there should be no visible distortion on the display between the following:

11.5.1 rhumb line and chart data;

11.5.2 great circle and chart data.

11.6 All calculations should be based on the largest scale data available for the area in the SENC.

12. CONNECTIONS WITH OTHER EQUIPMENT⁶

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.

13. PERFORMANCE TESTS, MALFUNCTIONS ALARMS AND INDICATIONS

13.1 ECDIS should be provided with means for either automatically or manually carrying out on-board tests of major functions. 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 (see [appendix 6](#)).

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

⁶ IEC Publication 61162.

- .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 seconds should not require the equipment to be manually re-initialized.

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	Phone: +377 93 50 65 87 10 81 00
	International Hydrographic Bureau	Fax: +377 93 25 20 03 10 81 40
	BP 445	E-mail: info@ihb.mc
	MC 98011 Monaco Cedex	Web: http://www.iho.shom.fr
	Principality of Monaco	

Publications

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

S-52 appendix 1: "Report of the IHO (COE) Working Group Guidance on Updating the Electronic Navigational 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-32, Hydrographic Dictionary](#)

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

[Special Publication No. S-63, IHO Data Protection Scheme](#)

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

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

Publications

IEC Publication 61174, *Electronic Chart Display and Information Systems (ECDIS) - Operational and Performance Requirements, Method of Testing and Required Test Results*.

IEC Publication 60945, *General Requirements 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 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 **or default safety contour**;
 - .3 indication of isolated underwater dangers of depths 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., ~~and including buoys and beacons whether or not these are being used as aids to navigation~~;
 - .5 **traffic ships** routeing 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
 - .9 **ferry routes**

 3. All other information. 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 PARAMETERS⁷

- 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".

⁷ See IEC Publication 61174.

APPENDIX 4

AREAS FOR WHICH SPECIAL CONDITIONS EXIST

The following are the areas which ECDIS should detect and provide an alarm or indication under sections 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 practise 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 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
10.5.7	Alarm	Positioning system failure
10.5.8	Alarm	Approach to critical point
10.5.9	Alarm	Different geodetic datum
13.2	Alarm or Indication	Malfunction of ECDIS
3.6.3	Indication	Default safety contour
5.1.1	Indication	Information overscale
5.2.1.2	Indication	Larger scale ENC available
6.2	Indication	Different reference system
7.5	Indication	No ENC available
10.4.4	Indication	Route planning across safety contour
10.4.5	Indication	Route planning across specified area
13.1	Indication	System test failure

In this Performance Standard the definitions of Indicators and Alarms provided in the IMO publications "Code of Practice for 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 REQUIREMENTS

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 failure. Such arrangements include:

- .1 facilities enabling a safe take-over of the ECDIS functions in order to ensure that an ECDIS 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 failure.

2. PURPOSE

The purpose of an ECDIS back-up system is to ensure that safe navigation is not compromised in the event of ECDIS 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;
- .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, and provide at least the following functions:

- .1 plotting own ship's position automatically, or manually on a chart;
- .2 taking courses, distances and bearings 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 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 large 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 neighbouring 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.

3.3 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.

4.2 Presentation of information

4.2.1 Colours and symbols used in the back-up arrangements should be based on IHO recommendations.

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; and
- .2 conform to the requirements in this ECDIS 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 ENC chart information overlay is used as an element of the back-up, the radar should comply with Resolution A.477 (XII), as amended

APPENDIX 7

RCDS MODE OF OPERATION

Whenever in this appendix reference is made to provisions of the annex related to ECDIS, ECDIS should be substituted by RCDS, SENC by SRNC and ENC by RNC, as appropriate.

All paragraphs of the annex related to ECDIS are indicated as to whether they apply to RCDS, do not apply to RCDS, or are modified in order to apply to RCDS. These paragraphs are followed by additional requirements for ECDIS equipment in the RCDS mode.

1. INTRODUCTION

1.1 Paragraph applies to RCDS.

1.2 When operating in the RCDS mode, ECDIS equipment should be used together with an appropriate folio of up-to-date paper charts.

1.3 - 1.7 Paragraphs apply to RCDS.

1.8 RCDS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment (see Table 1 of this appendix).

2. DEFINITIONS

2.1 *Raster Chart Display System* (RCDS) means a navigation information system displaying RNCs with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required, display additional navigation-related information.

2.2 *Raster Nautical Chart* (RNC) means a facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized hydrographic office. RNC is used in these standards to mean either a single chart or a collection of charts.

2.3 *System Raster Nautical Chart Database* (SRNC) means a database resulting from the transformation of the RNC by the RCDS to include updates to the RNC by appropriate means.

2.4-2.5 Paragraphs do not apply to RCDS.

2.6 Paragraph applies to RCDS.

3. DISPLAY OF SRNC INFORMATION

3.1 ~~Paragraph applies to RCDS~~ RCDS should be capable of displaying all SRNC information.

3.2 SRNC information available for display during route planning and route monitoring should be subdivided into two categories:

- .1 the RCDS standard display consisting of RNC and its updates, including its scale, the scale at which it is displayed, its horizontal datum, and its units of depths and heights; and
- .2 any other information such as mariner's notes.

- 3.3 Paragraph applies to RCDS.
- 3.4 When a RNC is displayed on the RCDS, it should provide an indication advising the mariner if a more detailed (larger scale) RNC is available for the displayed area.
- 3.5 It should be easy to add to, or remove from, the RCDS display any information additional to the RNC data, such as mariner's notes. It should not be possible to remove any information from the RNC.
- 3.6 - 3.7 Paragraphs do not apply to RCDS.
- ~~3.8-3.10~~ Paragraphs apply to RCDS. The RNC and all updates to it should be displayed without any degradation of their information content.
- ~~3.9~~ RCDS should provide a method to ensure that the RNC and all updates to it have been correctly loaded into the SRNC.
- ~~3.10~~ Paragraph applies to RCDS.
- 3.11 There should always be an indication if the ECDIS equipment is operating in the RCDS mode.

4. PROVISION AND UPDATING OF CHART INFORMATION

- 4.1 The RNC used in RCDS should be the latest edition of that originated by, or distributed on the authority of, a government authorized hydrographic office and conform to IHO standards. RNCs not on WGS-84 or PE-90 should carry meta-data (i.e., additional data) to allow geo-referenced positional data to be displayed in the correct relationship to SRNC data.
- 4.2 The contents of the SRNC should be adequate and up-to-date for that part of the intended voyage not covered by ENC.
- ~~4.3-4.8~~ All paragraphs apply to RCDS. It should not be possible to alter the contents of the RNC.
- ~~4.4~~ Paragraph applies to RCDS.
- ~~4.5~~ RCDS should be capable of accepting official updates to the RNC data provided in conformity with IHO standards. These updates should be automatically applied to the SRNC. By whatever means updates are received, the implementation procedure should not interfere with the display in use.
- ~~4.6-4.8~~ Paragraphs apply to RCDS.

5. SCALE

This section applies to RCDS.

6. DISPLAY OF OTHER NAVIGATIONAL INFORMATION

- 6.1-6.3 All paragraphs apply to RCDS.

7. DISPLAY MODE AND GENERATION OF THE NEIGHBOURING AREA

7.1 It should always be possible to display the SRNC in "chart-up" orientation. Other orientations are permitted.

7.2-7.4⁵ All paragraphs apply to RCDS.

8. COLOURS AND SYMBOLS

8.1 IHO recommended colours and symbols should be used to represent SRNC information.

8.2 Paragraph applies to RCDS.

8.3 Paragraph does not apply to RCDS.

8.4 Paragraph applies to RCDS.

9. DISPLAY REQUIREMENTS

9.1-9.2 Paragraphs apply to RCDS.

9.3 Paragraph does not apply to RCDS.

9.4 Paragraph applies to RCDS.

9.5-9.6 Paragraphs do not apply to RCDS.

9.5⁷ RCDS should be capable of displaying, simply and quickly, chart notes which are not located on the portion of the chart currently being displayed.

10. ROUTE PLANNING, MONITORING AND VOYAGE RECORDING

10.1-10.2 Paragraphs apply to RCDS.

10.3 Paragraph does not apply to RCDS.

10.4 Route Planning

10.4.1-10.4.3 Paragraphs apply to RCDS.

10.4.4-10.4.5 Paragraphs do not apply to RCDS.

10.4.6 Paragraph applies to RCDS.

10.4.7 It should be possible for the mariner to enter points, lines and areas which activate an automatic alarm. The display of these features should not degrade the SRNC information and it should be clearly distinguishable from the SRNC information.

10.5 Route monitoring

10.5.1 Paragraph applies to RCDS.

- 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 in 10.4.6 and 10.4.7 should be continuous. It should be possible to return to the route monitoring display covering own ship's position immediately by single operator action.
- 10.5.3-10.5.4 Paragraphs do not apply to RCDS.
- 10.5.5-10.5.8 Paragraphs apply to RCDS.
- 10.5.9 The RCDS should only accept data referenced to the WGS-84 or PE-90 geodetic datum. RCDS should give an alarm if the positional data is not referenced to one of these datums.
- 10.5.10-10.5.13 Paragraphs apply to RCDS.
- 10.5.14 RCDS should allow the user to manually align the SRNC with positional data. This can be necessary, for example, to compensate for local charting errors.
- 10.5.15 It should be possible to activate an automatic alarm when the ship crosses a point, line, or is within the boundary of a mariner-entered feature within a specified time or distance.
- 10.6 Voyage recording
- 10.6.1-10.6.4 All paragraphs apply to RCDS.
- 11. CALCULATIONS AND ACCURACY**
- 11.1-11.2⁶ All paragraphs apply to RCDS.
- 12. CONNECTIONS WITH OTHER EQUIPMENT**
- 12.1-12.2 All paragraphs apply to RCDS.
- 13. PERFORMANCE TESTS, MALFUNCTION ALARMS AND INDICATIONS**
- 13.1-13.2 All paragraphs apply to RCDS.
- 14. BACK-UP ARRANGEMENTS**
- All paragraphs apply to RCDS.
- 15. POWER SUPPLY**
- 15.1-15.2 All paragraphs apply to RCDS.

Table 1

ALARMS AND INDICATORS IN THE RCDS MODE OF OPERATION

Para	Requirement	Information
10.4.6, 10.5.5 10.4.7, 10.5.15 10.5.7 10.5.8 10.5.9 13.2	Alarm Alarm Alarm Alarm Alarm Alarm	Deviation from route Approach to critical point, line, area or mariner-entered feature Position system failure Approach to critical point Different geodetic datum Malfunction of RCDS mode
3.11 3.4, 5.1 5.2	Indication Indication Indication	ECDIS operating in the raster mode Information under-scale or overscale Larger scale RNC available for the area of the vessel

The definitions of indicators and alarms are given in appendix 5.