

16th CHRIS MEETING
Ottawa, Canada, 28-31 May 2004

REVIEW OF S-52
to reduce its scope and volume

1. Summary

Submitted by:	Mathias Jonas, Germany
Executive summary:	At the 15 th CHRIS meeting, it was agreed under Item 6.2 that an ad hoc WG would review S-52 to reduce its scope and volume, e.g. by removing “operational” aspects for updating. Review of the main part of S-52 has been completed and the results are provided in the attachment.
Actions to be taken:	See paragraph 9
Related documents:	CHRIS15 Minutes, CHRIS16-5.2B, CHRIS16-5.2C

2. Introduction

At the 15th CHRIS Meeting, following a proposal by the Chairman of C&SMWG (M. Jonas, Germany) to reduce and simplify S-52, a CHRIS ad hoc WG¹ was tasked to review S-52, i.e. the main part, App.1, App.2 and App.3, to reduce its scope and volume, particularly by removing “operational” aspects for updating and by transferring the glossary on ECDIS related terms (App.3) into the Hydrographic Dictionary (S-32). USA-NIMA (Andreasen) and Chair C&SMWG (Jonas) would review specifically App.1 and App.2, respectively.

3. Analysis/Discussion.

From the CHRIS15 minutes:

“Chair C&SMWG (JONAS) explained the proposal to reduce and simplify S-52. USA-NIMA (ANDREASEN) considered that App. 3 “Glossary of ECDIS-related Terms” should be transferred to the IHO dictionary S-32. Meanwhile, App.1 “Guidelines on ENC Updating” could probably be considerably reduced in volume. Germany (HECHT) agreed with the USA-NIMA proposal, indicating that it was inappropriate to expect IMO to take charge of any parts of S-52. Relevant information in the S-52 main document “Specifications for Chart Content and Display Aspects of ECDIS” should be moved to App. 2 “Colours and Symbols Specifications for ECDIS”. Chair C&SMWG (JONAS) agreed with Germany, also pointing out that there are operational aspects in App. 1 that are no longer relevant. More important is to retain the display aspects in S-52 and data in S-57. Germany (HECHT) also pointed out that, if there are operational requirements that are regulatory, they should not be part of S-52 or IHO specifications in any case. UK (DRINKWATER) supported the views that App.1 and App. 3 should not be transferred to IMO.

USA-NIMA (ANDREASEN) offered to work on reducing App. 1 to retain only the relevant portions. Chair C&SMWG (JONAS) will work on re-shaping App. 2 to become the main document.

¹ C. Andreasen, H. Hecht, M. Jonas, C. Drinkwater, M. Poulin, and L. Alexander

UK (DRINKWATER) suggested that there might be a need to establish a small ad hoc WG to deal with this matter. ANDREASEN, HECHT, JONAS, DRINKWATER, POULIN, and ALEXANDER agreed to be part of this ad hoc WG.”

4. Benefits.

TBD

5. Working Groups.

TBD

6. Other relevant information.

TBD

7. Priority.

TBD

8. Target completion date.

TBD

9. Action Required.

The CHRIS committee is invited to consider the attached revised S-52 (Annex A) and approve the proposed changes.

REVISED S-52
with changes emphasized

INTERNATIONAL HYDROGRAPHIC ORGANIZATION



**SPECIFICATIONS FOR CHART CONTENT
AND DISPLAY ASPECTS OF ECDIS**

Draft 6th Edition, **April 2004**

Special Publication No. 52

published by the
International Hydrographic Bureau
MONACO

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International Hydrographic Bureau
4, Quai Antoine 1er
B.P. 445 - MC 98011 MONACO Cedex
Principauté de Monaco
Telex : 479 164 MC - INHORG
Telefax : (377) 93 10 81 40
E-Mail: info@ihb.mc
Web-site: www.iho.shom.fr

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ANNEX ~~A~~**B** — **IMO PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)** — ~~A.1~~**AB.1**

APPENDICES (published as separate IHO documents by the International Hydrographic Bureau)

Appendix 1: Guidance on Updating the Electronic Navigational Chart.
(~~by the IHO/CHRIS Updating Working Group~~)

Appendix 2: Colour and Symbol Specifications for ECDIS
(~~maintained~~ by the IHO/CHRIS Colours and Symbols ~~Maintenance~~ Working Group)

Appendix 3: Glossary of ECDIS - related Terms.
(~~by the IHO/CHRIS Glossary Working Group~~)

4 INTRODUCTION

4.1 Historical Background

- (a) *In 1986 the North Sea Hydrographic Commission completed a study on the consequences of the development of Electronic Chart Display and Information Systems (ECDIS) for Hydrographic Offices.*

Its conclusions were, amongst others:

- (1) *Specifications for standardized data content, format and updating procedures should be arrived at by a new IHO ECDIS Working Group as a matter of high priority.*
 - (2) *To assure the integrity of Electronic Navigational Charts (ENC's), their production should be the responsibility of the Hydrographic Offices; the ENC's will be made available in a standard format and all equipment should be designed to accept it.*
 - (3) *When official ENC's are available, ECDIS users should be required to carry them in full, and ECDIS manufacturers or other intermediaries should not make preliminary selections of data before supplying them to the mariners.*
- (b) *It was then decided to establish an International Hydrographic Organization (IHO) Committee on ECDIS (COE*).*
- (c) *As several manufacturers were now developing these systems, it was of immediate importance to all concerned (Hydrographic Offices, mariners, national shipping authorities, manufacturers) to have at least a first draft of the IHO and International Maritime Organization (IMO) guidance for both the Electronic Navigation Chart (ENC) and its display systems.*
- (d) *For that reason the COE*-chairman asked the Netherlands Hydrographer to prepare a working paper on ECDIS specifications, to be further discussed in the COE*.*
- (e) *The aim of this working paper was to evolve and recommend:*
- (1) *Minimum and supplementary data content of the ENC and required characteristics of that data base such as the cataloguing of sea areas, density of digitization of chart data and reliability and worldwide compatibility of chart data and other nautical information produced.*
 - (2) *Minimum and supplementary content of the ENC Display, standards of symbols, colours and their standardized assignment to features, scale limitations of data presentation, and appropriate compatibility with paper chart symbols as standardized in the Chart Specifications of the IHO.*
 - (3) *Methods for the timely updating of the ENC, and means to ensure worldwide compatibility of the correction system data.*
 - (4) *Criteria for a standard format for exchange of digital data for the ECDIS between Hydrographic Offices and for supply to the data user, and procedures and financial aspects of such an exchange and supply.*

* Now redefined as "CHRIS", Committee on Hydrographic Requirements for Information Systems

(f) A first draft of the specifications was presented to IHO Member State Hydrographers in May 1987 at the 13th International Hydrographic Conference in Monaco. This draft was also widely distributed to National Shipping Authorities, mariner associations and manufacturers, for comment. Since then, S-52 and its relevant appendices have been updated several times and this is the 6th edition of S-52. The 5th edition was necessary to reflect changes in related standards.

(g) In parallel with the development of the IHO Specifications, the IMO/IHO Harmonizing Group on ECDIS developed Provisional Performance Standards for ECDIS which were first published in May 1989 by the IMO.

An amended version of the Provisional Performance Standards was prepared in the light of experience and was presented in September 1993 to the IMO Sub-Committee on the Safety of Navigation, which endorsed it and submitted the Performance Standards for ECDIS to the IMO Maritime Safety Committee, for approval and submission to the 1995 IMO Assembly for adoption. The current version of the Performance Standards has been promulgated as MSC Circular 637, dated 27 May 1994. The Performance Standard was adopted by IMO resolution A.817(19) dated 23 November 1995. The Performance Standards have incorporated many of the elements of the original IHO Specification. For that reason, S-52 now only provides the details of the hydrographic requirements for ECDIS.

(h) While many of the general elements of S-52 were being incorporated in the IMO Performance Standards, the specifics were being expanded in S52 Appendix 2 "Colour & Symbol Specifications" into a model for presenting all chart and navigational objects on the ECDIS display, according to the developing IMO requirements. IHO published a provisional edition of S52 App.2 in 1991 and the first operational edition, complete with Annex A "Presentation Library", was issued in 1994.

(i) The IHO Committee on Hydrographic Requirements for Information Systems (CHRIS) developed S-57, "IHO Transfer Standard for Digital Hydrographic Data". S-57 describes the standard to be used for the exchange of ENC data. S-57 was adopted as the official IHO standard by the XIVth International Hydrographic Conference, Monaco, 4-15 May 1992.

(k) An important milestone in the development of ECDIS specifications was the introduction of the „ENC Product Specification“. The „ENC Product Specification“ is included in S-57 as Appendix B1 and gives detailed specifications for the ENC structure and content.

(l) In 1997 the IMO Sub-Committee on the Safety of Navigation adopted the so called „dual fuel“ Raster Chart Display System (RCDS) ECDIS mode, accepting official raster data (Raster Navigational Chart or RNC) together with an appropriate folio of paper charts as meeting a vessel's chart carriage requirements in the absence of S57 vector chart data coverage for the operating area. The Performance Standards were amended appropriately and the IHO published S-61 containing the RNC product.

(m) The revision of the 1974 SOLAS Convention in December 2000 accepts ECDIS as legal equipment to fulfil the carriage requirement for nautical publications on board of vessels subject to the SOLAS regulations.

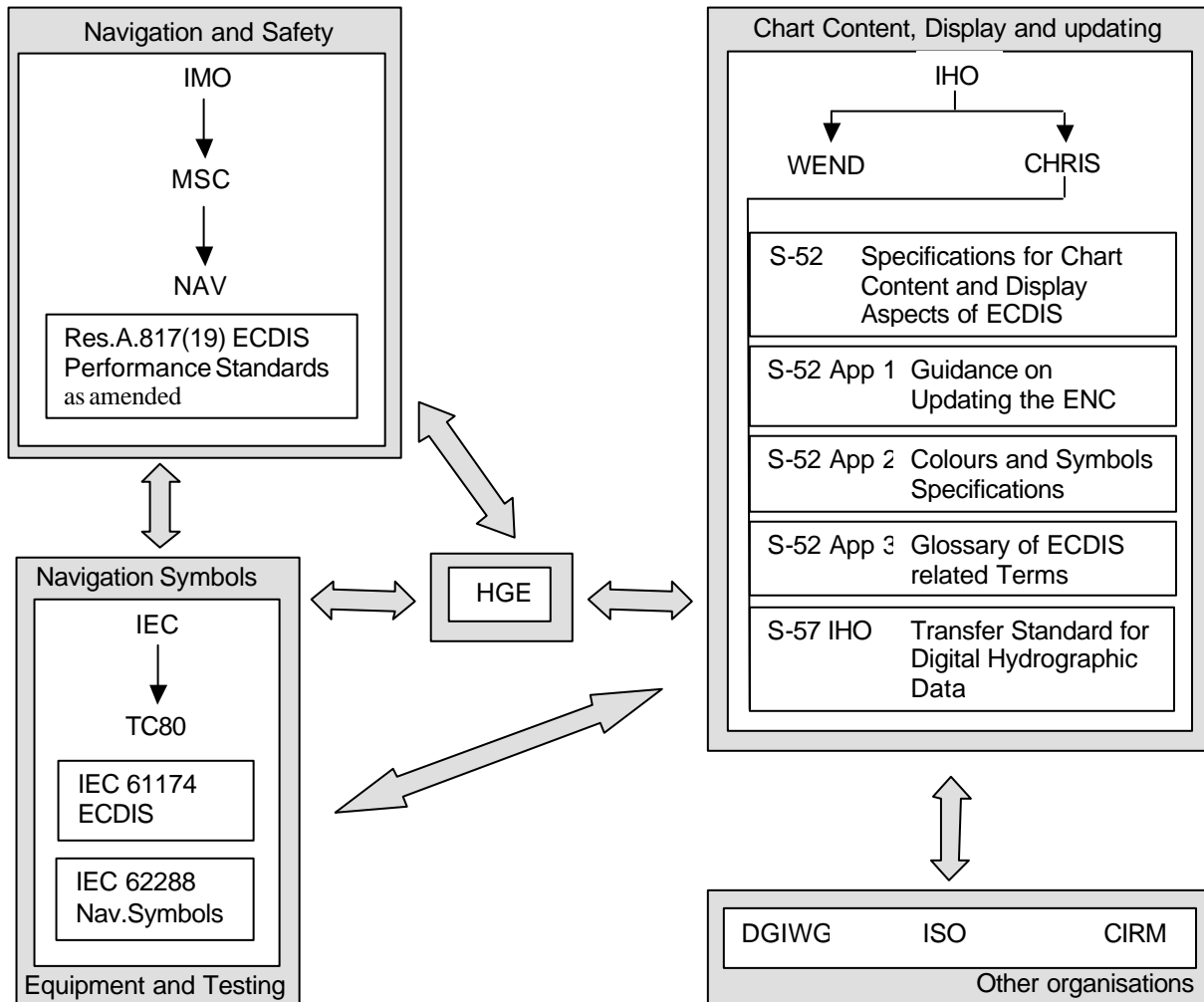
(n) The CHRIS Committee decided on its 15th. Session in May 2003 to remove all operational requirements for ECDIS from this Specification (S-52) as well as the detailed description of "Navigational Symbols" from Appendix 2 of this Specification in order to hand these over to the sole responsibility of IEC TC80. IEC TC80 will incorporate the operational requirements in the upcoming new edition 3 of IEC 61174 „ECDIS Performance Standards, methods of testing and required test results“ and the navigational symbols in the upcoming new standard IEC 60288 „Presentation of navigation related information“. From now on S52 and Appendix 2 in particular is focused on the display aspects and the colour and symbol

definition of chart information on ECDIS. In order to maintain consistent display procedures for charted and operational information S-52, Appendix 2 will continue the provision of appropriate entries in colour tables, viewing groups, look-up tables and conditional procedures for the presentation of navigational symbols.

4.2 International organizations involved in ECDIS standardization

As stated in the Historical Background, the IHO Specifications for ECDIS have been developed in parallel with the IMO Performance Standards. Various other international organizations have also played important parts in the development of the IHO Specifications and the IMO Standard. The International Electrotechnical Commission (IEC), in particular, has developed a series of tests and test results which ~~will~~are ~~be~~ used to ascertain if systems meet the IMO Standards and IHO Specifications. The relationship of the various Working Groups, Organizations and Publications is outlined schematically in Figure 1.

Figure 1. International organizations involved in ECDIS standardization



IMO	:	International Maritime Organization
MSC	:	Maritime Safety Committee
NAV	:	Safety of Navigation Sub-Committee
HGE	:	Harmonization Group on ECDIS
IHO	:	International Hydrographic Organization
WEND	:	World Wide Electronic Navigational Chart Database
CHRIS	:	Committee on Hydrographic Requirements for Information Systems
IEC	:	International Electrotechnical Commission
TC80	:	IEC committee on Maritime Navigation and Radiocommunications Equipment and Systems
WG7	:	IEC working group on ECDIS
DGIWG	:	Digital Geographic Information Working Group
ISO	:	International Organization for Standards
CIRM	:	Comité International Radio-Maritime

1.3 Function and Use of S-52 and its Appendices

- (a) The IHO has produced Specifications for the chart content and display aspects of ECDIS that appear in this publication (S-52) and its appendices, in order to ensure that hydrographic data supplied by its Member States' HO is used in a manner that will enhance the safety and efficiency of navigation by satisfying the requirements set out in the IMO Performance Standards for ECDIS.
- (b) The objective stated in (a) is also met through the publication of the „IHO Transfer Standard for Digital Hydrographic Data“ (S-57) which includes the „ENC Product Specification“.
- (c) S-52 should be read with the IMO Performance Standards and with its own Appendices. It should also be read in conjunction with [the ENC Product Specification in S-57](#).
- (d) Users of these Specifications should also refer to publications of the International Electrotechnical Commission (IEC) when dealing with equipment design and tests. Details of these publications are to be found in paragraph 2.3.
- (e) Not all operational aspects of the updating mechanism of ECDIS contained in Appendix 1 “Guidance on Updating the Electronic Navigational Chart” are mandatory for an ECDIS and should primarily be read as guidance. Since Appendix 1 was drafted, much practical experience with ECDIS and its updating mechanisms have been gained and advanced requirements for operational behaviour of ECDIS updating mechanisms contained in IEC61174 may supersede the guidance given in Appendix 1 of this Specification.

2 CONCEPT, LIMITATIONS AND DEFINITIONS OF ECDIS

2.1 Concept and limitations

It may be noted that the concept of ECDIS is outlined in the introduction section of the IMO Performance Standards. The following contains additional IHO requirements for ECDIS.

- (a) ECDIS, used together with official data, may be accepted as complying with the up to date charts ~~is accepted as fulfilling the carriage requirements for nautical publications~~ required by regulation V/19~~20~~ of the 1974 SOLAS Convention, amended in 2000. It may be noted that electronic chart systems not meeting these ECDIS specifications of IHO and IMO, or ECDIS using non-official data, are named and classified ~~known~~ as ECS (Electronic Chart Systems).
- (b) Chart information may be used in conjunction with radar image on ECDIS. Integration of tracked radar targets provided by for a collision avoidance radar (ARPA) and targets tracked by AIS (Automatic Identification System) into the ECDIS display is another option.
- (c) The colours and symbols defined in Appendix 2 of this Specification are conceptually based on the familiar symbology of conventional paper charts. However, due to the special conditions of the ECDIS chart display as a computer generated image for use as a real-time ship-handling display, as well as with regard to the size of the monitor, its resolution and the limited number of distinguishable colours, the ECDIS presentation of ENC data does not imitate the appearance of a conventional paper chart closely. Instead, there are considerable differences in symbology in shape, colour and size, and ~~the~~ in the placement of text in particular. The display of the ENC data and the conventional paper chart do not necessarily have to be identical in their appearance.
- ~~(d) It is recognized that mariners would benefit from unrestricted choice of an own ship safety contour. This may not be possible with the initial ENC, but may be introduced as more detailed data becomes available~~
- ~~(e) It should be recognized that ECDIS, complying with the up to date charts required by regulation V/20 of the 1974 SOLAS Convention, provides a record for legal purposes.~~
- (d) ECDIS combines chart and navigational positioning information. It should be realized that modern navigation systems (e.g. differential GPS without selected availability) may offer a more accurate positioning than was available to position some of the surveys from which the digital chart data ~~ENC was/were~~ derived.

2.2 Definitions

Terms used in S-52 and its Appendices, as well as those used in the IMO Performance Standards, are defined in Appendix 3 : Glossary of ECDIS - related Terms.

2.3 Useful references (to use with this Specification)

References (in addition to Annex and Appendices) to this Specification are:

- (a) IMO Performance Standards for ECDIS (IMO Resolution A.817 (19) as amended). Always to be referred to when applying these Specifications (see annex B).
- (b) Chart Specifications of the IHO and IHO Regulations for International Charts (INT specs), IHO Publication M-4.

- (c) Technical Resolutions of the IHO (TR's), IHO Publication M-3.
- (d) IHO Transfer Standard for Digital Hydrographic Data, IHO Publication S-57.
- (e) IEC Publication 61174 "Electronic Chart Display and Information System (ECDIS) - Operational and Performance Requirements, Methods of Testing and Required Test Results" .
- (f) IEC Publication 60945 "General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and Marine Navigational Equipment".
- (g) IEC Publication 61162, "Digital Interfaces - Navigational and Radiocommunications Equipment On board Ship".
- (h) [future IEC Publication 62288 "Presentation of navigation related information"](#). |

~~3. ENC CONTENT AND STRUCTURE~~

~~3.1 ENC Content~~

- ~~(a) ENC data should be delivered using the IHO Transfer Standard for Digital Hydrographic Data (IHO publication S-57).~~
- ~~(b) The ENC should include, as a minimum, all information relevant to navigation at present depicted on the paper chart. Certain data infrequently used by the mariner and not affecting safety of navigation need not be included (e.g. cemeteries).~~
- ~~(c) The ENC should be encoded according to the specifications given in the „ENC Product Specification“, S-57 Appendix B.1.~~
- ~~(d) By identifying any object (point, line or area) with a cursor on the chart display, the object description and all available attributes should be displayed in text in common language terms.~~
- ~~(e) Some textual HO information, which is presently contained in separate publications (e.g. Sailing Directions and Light Lists) may also be incorporated in the ENC.~~

~~3.2 Accuracy requirements~~

~~A data quality indicator should be included in the ENC, which allows a quantitative estimate of the accuracy of important chart features, to be used in combination with estimates of position accuracy from satellite navigation in assessing safe distance from hazards, in order that the mariner may be informed of the quality of the information he uses.~~

~~3.3 System ENC (SENC) (Amended December 2001)~~

- ~~(a) The Transfer Standard, is designed for the distribution of digital chart data. It is recognized that it is not the most efficient means of storing, manipulating or preparing data for display. Each manufacturer of ECDIS systems may design his own storage formats or data structure to allow its system to meet the performance requirements stated in this specification. The resulting database is called the System ENC (SENC).~~
- ~~(b) It is mandatory that official HO data (ENC) be available and any ECDIS must be capable of accepting and converting the official HO data (ENC) to the internal storage structure of the individual ECDIS (System ENC or SENC). Such data includes both that in the ENC and that delivered in digital format to update the ENC. This conversion process does not imply real time processing of HO supplied data.~~
- ~~(c) An official copy of the HO data, distributed as an ENC or contained within an externally generated SENC, is to be kept on board. The SENC generated on board, by ENC to SENC conversion, or ashore is used for actually operating the ECDIS. Through the same conversion process, official updates are added to the System ENC.~~

~~The information content of the SENC should include all that of the ENC corrected by official updates (see Appendix 1).~~



3.4 Use and restrictions of data

~~(a) If the area covered by the ECDIS display includes waters for which no HO 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 2).~~

~~(b) The following restrictions also apply:~~

~~(1) The precision of HO supplied data should be maintained, e.g. HO data provided in degrees and decimal degrees, when converted to manufacturer specific formats and structures and used in calculations, should also be maintained to that accuracy.~~

~~(2) It is the responsibility of the Hydrographic Offices to optimize the ENC data in terms of data organization and volume.~~

~~Should the manufacturer use point reduction or smoothing operations in order to compress the 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.~~

~~(3) HO data will be supplied in a cell structure (see para 3.6). If this cell structure is modified, it is the ECDIS manufacturers responsibility to maintain cell dependent characteristics.~~

~~(e) If the mariner does not specify a safety contour, this should default to 30 m. If the safety contour specified by the mariner is not in the SENC, the safety contour shown should default to the next deeper contour.~~

~~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. In each of the above cases, the mariner should be informed.~~

3.5 Navigational purpose

~~ENC data is compiled for a variety of navigational purposes (e.g. approach, berthing). An individual ENC cell should be compiled for a single navigational purpose. The navigational purpose categories are defined in the „ENC Product Specification“, S 57 Appendix B.1.~~

3.6 Cell Structure and coding

~~ENC data should be organized in cells, both for data manipulation in ECDIS, and for chart correction.~~

~~The Cell system is described in the „ENC Product Specification“, S 57 Appendix B.1.~~

3.7 Language

~~In the "International ENC", as opposed to the INT Chart, the exchange language should be English. If other languages and/or alphabets are required this should be a supplementary option.~~

~~Display of non English information should not degrade the chart presentation.~~

~~4. UPDATES~~

- ~~(a) Official HO updates should be distinguished from local ones.~~
- ~~(b) Appendix 1, "Guidance on Updating the Electronic Navigational Chart" describes the model of updating as well as the minimum capability of the ECDIS for the various updating methods.~~

3 DISPLAY OF INFORMATION

5.1 ~~Display categories~~

Display categories for chart information are:

~~Standard display~~

~~"The SENC information that should be shown when a chart is first displayed on the ECDIS and 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."~~

~~Display base~~

~~"The level of SENC information which can not 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."
(the Display base is a subset of the Standard display)~~

~~All other information~~

~~"Chart information not contained in the standard display, displayed only on demand."~~

The detailed allocation of objects to these categories is listed in Appendix 2.

3.4 General arrangements

- (a) Appendix 2: "Colour and Symbol Specifications for ECDIS" and the "Presentation Library", specifies the colours, symbols, linestyles and text for ECDIS as well as the rules for presentation on ECDIS. Appendix 2 also outlines considerations in designing the ECDIS display.

The authoritative "official" version of the Presentation Library is published in human-readable form in pdf-format on a CD-ROM. The machine-readable digital version may also be available [depending on a volunteering industry partner who keeps it up to date.](#)

The ECDIS Chart 1 is issued together with the Presentation Library as a graphic file in TIFF-format and may also be available [as collection of the varying objects contained in a special cell in pseudo-S-57 format containing additional cartographic objects.](#)

A digital version of the Colours and Symbols Library is available for use in conjunction with S-57.

- ~~(b) Some additional symbols and colours have been provided by the International Electrotechnical Commission (IEC) for features not printed on paper charts but necessary for navigation, such as chartwork (tracks, waypoints, time tags etc.).~~
- (b) [Additional navigational symbols necessary for navigation, such as the own ship symbol, tracks, waypoints, time tags etc. are provided by the IEC 61174 Standard for ECDIS. Navigational Symbols are not part of Appendix 2 of this Specification.](#)

5.23 ~~Priority layers~~

- (c) [The display categories specified in the IMO Performance Standards and the IHO priorities of the various types of chart information \(alarms, updates, mariners and non-HO chart data, etc.\)](#)

are applied to every object by the display category and draw priority assignments of the look-up tables and symbolisation procedures of Appendix 2 of this Specification.

- ~~(a) Layers are required to establish the priority of data on the display. The general rule for the priority between different categories of information is given below:~~
- ~~(1) ECDIS visual alarms/indications (e.g. caution, overscale)~~
 - ~~(2) HO data: points/lines and areas + official updates~~
 - ~~(3) N.t.M.'s, manual input and Radio Navigational Warnings~~
 - ~~(4) HO caution (ENC cautions)~~
 - ~~(5) HO colour fill area data~~
 - ~~(6) HO's on demand data~~
 - ~~(7) Radar information~~
 - ~~(8) Mariners data: points/lines and areas~~
 - ~~(9) Manufacturer's data: points/lines and areas~~
 - ~~(10) Mariners colour fill area data~~
- ~~(b) Notes:~~
- ~~(1) This list is not intended to indicate a drawing sequence, but to specify that the information content of category n+1 must not obscure the information content of category n, or any higher category (i.e. n-1, etc).~~
 - ~~(2) category (7) should have a radar off switch to facilitate its removal.~~

5.3 Display categories

- ~~(d) Display categories for chart information are defined in the IMO Performance Standards as follows:~~
- Standard display
"The SENC information that should be shown when a chart is first displayed on the ECDIS and 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."
 - Display base
*"The level of SENC information which can not 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. "
(the Display base is a subset of the Standard display)*
 - All other information
"Chart information not contained in the standard display, displayed only on demand."

The detailed allocation of objects to these categories is listed in Appendix 2 of this Specification.

Display requirements and basic information to be displayed ~~functions~~

(a) Graphic Display requirements

Size: minimum effective size of the area for chart display 270 x 270 mm.

Resolution: Minimum lines per mm (L) given by $L = 864/s$, where s is the smaller dimension of the chart display area (e.g. for the minimum chart area, $s = 270$ mm and the resolution is $L = 3.20$ lines per mm, giving a "picture unit" size of 0.312 mm).

Colours: 64

~~(b)~~ Information should be displayed in the ECDIS on one or more physical screens, which may be divided into more than one chart display. Information may be displayed automatically, on demand or as a result of ~~hand-entry~~ mariners selection.

~~(c)~~ Redraw during route monitoring to follow the ship's progress, including scale changes due to change in the scale of the chart information, should take less than 5 seconds. Demands by the mariner that cannot be predicted by the ECDIS, such as draw at a different scale or in a different area may take more than 5 seconds. In the latter case:

- the mariner should be informed;
- the display should continue route monitoring until the new information is ready to draw within 5 seconds.

~~In addition to the IMO Performance Standards the following basic display functions~~ rules apply:

~~(a)~~ The units for depth should always be on the same screen as the chart display.

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

- Positional data and time;
- legend;
- object description and associated attributes (result of "cursor query") in human readable language, including the meaning given in the Presentation Library for any symbol selected by cursor-pick;
- textual information from SENC, e.g. cell name, compilation date, date of issue;
- record of ENC-updates;
- list of abbreviations (from INT 1) digital chart 1 symbol collection; ECDIS Chart 1 (see Appendix 2 of this Specification)
- colour differentiation diagram (see Appendix 2 of this Specification)
- black adjust symbol for contrast adjustment (see Appendix 2 of this Specification)
- result from navigational computations;
- list of categories which are removed from Standard Display;
- Edition number of symbol library in use (see Appendix 2 of this Specification),
~~should be shown on demand on the same screen as the chart display or on an additional graphic or text display.~~

~~(e)~~ Navigators notes should be shown as a result of a hand-entry on the same screen as the chart display or on an additional graphic or text display.

~~(d)~~ Alarms and indications

~~Under certain conditions ECDIS should inform the mariner (by means of an alarm or indication) of specific dangers or faults and changes in operation that could affect the safety of navigation.~~

~~The conditions are listed in the appendices 4 and 5 of the IMO Performance Standards for ECDIS.~~

~~(e) North up/Course up~~

~~In course up display, the orientation should be altered in steps large enough to avoid unstable display of the chart information.~~

Use and restrictions of data

- (a) If the area covered by the ECDIS display includes waters for which no HO 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 2 [of this Specification](#)).
- (b) The following restrictions also apply:
 - (1) The precision of HO supplied data should be maintained, e.g. HO data provided in degrees and decimal degrees, when converted to manufacturer specific formats and structures and used in calculations, should also be maintained to that accuracy.
 - (2) It is the responsibility of the Hydrographic Offices to optimize the ENC data in terms of data organization and volume.

Should the manufacturer use point reduction or smoothing operations in order to compress the 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.
- (c) In the "International ENC", as opposed to the INT Chart, the exchange language should be English. If other languages and/or alphabets are required this should be a supplementary option. Display of non-English information should not degrade the chart presentation.
- (d) Supplementary Information

Additional information from non-HO sources, may be displayed providing this does not degrade the display of ENC data. This additional information should be distinguished from the ENC data (see Appendix 2).
- (e) Tidal adjustment

Depth information should only be displayed as it has been provided in the ENC and not adjusted by tidal height.

3.3 Calculations

- (a) The accuracy of these calculations should be such that there should be no visible distortion on the display between the following:
 - (1) rhumb line and chart data
 - (2) great circle and chart data

- (b) ~~All calculations should be based on data for the most detailed navigational purpose, available for the area in the ENC.~~ All calculations should be based on data from the ENC of the most detailed navigational purpose available for the area.

4 CARTOGRAPHIC FRAMEWORK

6.1 Horizontal Datum

- (a) ~~In order to combine positional information from many different sources in one (regional) data base, only one horizontal datum should be used.~~
- (b) ~~In accordance with IHO Technical Resolution B1.1, this datum should be WGS 84. This is also the appropriate datum for using Global Positioning Systems (GPS).~~
- (c) ~~HO's should use the official IHO guidance^{*} or equivalent for conversion of local datums to WGS 84.~~

6.2 Vertical datum

~~Depth data acquired from digitizing different charts or otherwise collected may be referenced to different vertical datums.~~

~~The ENC should define each area for which a particular vertical datum applies.~~

4.4 Navigational purpose and scale

- (a) The ENC will may often contain data that is ~~at present normally~~ obtained by digitizing paper charts and other documents. If data derived from different scales appears on the display, the boundary between different scales should be clearly indicated ([see Appendix 2 of this Specification](#)).
- The ENC ~~should~~ defines each area for which a particular compilation scale applies. It is this scale which should be used when deciding if data is being displayed „overscaled”.
- (b) When the display can not be completely covered with ENC data for the selected navigational purpose, the remaining part of the display should be filled with data based on a more general navigational purpose (if available).
 - (c) A graphical index of the navigational purpose of available data should be shown on demand ([see Appendix 2 of this Specification](#), ~~C&S Specifications section 3.1.7~~).
 - (d) Data shown on the display should always be of the same scale. If a scale boundary is shown on the display, the information shown in the overscale area should not be relied upon at the scale of the display. The overscale area should be identified as specified in Appendix 2 of this Specification.
 - (e) The manufacturer should give the navigator the ability to use intermediate scales or ranges, or zoom in between scales or ranges ([Display scale may be specified in terms of range from the ship, e.g. 6 NM, as in radar displays](#)).
 - (f) If the SCAMIN attribute is defined in the ENC it should be used by the ECDIS to avoid cluttering.

* User's Handbook on Datum Transformations involving WGS-84, IHO Publication S-60.

- (g) ~~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 measurement, which should be made by means of the cursor.~~

~~For chart displays at a scale smaller than 1:80 000, a latitude bar should be shown on the border of the standard display.~~

4.2 Units

- (a) Units to be used on ECDIS displays:
- (1) Position: latitude and longitude in degrees, minutes and decimal minutes.
 - (2) Depth: metres and decimetres.
 - (3) Height: metres.
 - (4) Distance: nautical miles and decimal miles, or metres.
 - (5) Speed: knots and decimal knots.
- (b) Units used in (4.2 (a)) above should be indicated in the display legend. There should be no ambiguity about the units in use at a particular time.

4.3 Legend

A standard legend of general information relating to the area displayed, applicable to the ships position, should be shown on a graphic or text display. This legend should contain at minimum:

- ~~(1)~~ ~~units for depth~~
- ~~(2)~~ ~~units for height~~
- ~~(3)~~ scale or range of display, in addition overscale indication where appropriate
- ~~(4)~~ data quality indicator
- ~~(5)~~ sounding/vertical datum
- ~~(6)~~ horizontal datum
- ~~(7)~~ the value of the safety depth if used
- ~~(8)~~ the value of the safety contour selected by the mariner, as well as the value of the safety contour displayed (which may be different from that selected by the mariner)
- ~~(9)~~ magnetic variation
- ~~(10)~~ date and number of last update affecting the chart cells currently in use
- ~~(11)~~ edition number and date of issue of the ENC
- ~~(12)~~ chart projection

7. MINIMUM PERFORMANCE REQUIREMENTS IN RELATION TO THE ENC

~~In addition to the requirements in the IMO Performance Standards, the following apply:~~

~~7.1 Calculations~~

- ~~(a) The system should be capable of performing at least the following calculations:~~
- ~~(1) geographical co-ordinates to display co ordinates and vice versa.~~
 - ~~(2) transformation between local datum and WGS 84 (see 6.1e)~~
 - ~~(3) true distance and azimuth between two geographical positions.~~
 - ~~(4) geographic position from known position and distance/azimuth.~~
 - ~~(5) projection calculations such as true distance, rhumb line, convergence and great circle.~~
- ~~(b) The accuracy of these calculations should be such that there should be no visible distortion on the display between the following:~~
- ~~(1) rhumb line and chart data~~
 - ~~(2) great circle and chart data~~
- ~~(c) All calculations should be based on data for the most detailed navigational purpose, available for the area in the ENC.~~

~~6.47.2 Display requirements and basic information to be displayed~~

~~Graphic Display requirements:~~

~~Size: minimum effective size of the area for chart display 270 x 270 mm.~~

~~Resolution: Minimum lines per mm (L) given by $L = 864/s$, where s is the smaller dimension of the chart display area (e.g. for the minimum chart area, s = 270 mm and the resolution is L = 3.20 lines per mm, giving a "picture unit" size of 0.312 mm).~~

~~Colours: 64~~

~~Information should be displayed in the ECDIS on one or more physical screens, which may be divided into more than one chart display. Information may be displayed automatically, on demand or as a result of hand entry.~~

~~Redraw during route monitoring to follow the ship's progress, including scale changes due to change in the scale of the chart information, should take less than 5 seconds. Demands by the mariner that cannot be predicted by the ECDIS, such as draw at a different scale or in a different area may take more than 5 seconds. In the latter case:~~

- ~~the mariner should be informed;~~
- ~~the display should continue route monitoring until the new information is ready to draw within 5 seconds.~~

In addition to the IMO Performance Standards the following rules apply:

- ~~(a) The units for depth should always be on the same screen as the chart display.~~
- ~~(b) The following information:~~
- ~~Positional data and time;~~
 - ~~legend;~~
 - ~~object description and associated attributes (result of "cursor query");~~
 - ~~textual information from SENC;~~
 - ~~record of ENC updates;~~
 - ~~list of abbreviations (from INT 1);~~
 - ~~result from navigational computations;~~
 - ~~list of categories which are removed from Standard Display;~~
 - ~~symbol library (see Appendix 2);~~
- ~~should be shown on demand on the same screen as the chart display or on an additional graphic or text display.~~
- ~~(c) Navigators notes should be shown as a result of a hand entry on the same screen as the chart display or on an additional graphic or text display.~~
- ~~(d) Alarms and indications~~
- ~~Under certain conditions ECDIS should inform the mariner (by means of an alarm or indication) of specific dangers or faults and changes in operation that could affect the safety of navigation.~~
- ~~The conditions are listed in the appendices 4 and 5 of the IMO Performance Standards for ECDIS.~~
- ~~(e) North up/Course up~~
- ~~In course up display, the orientation should be altered in steps large enough to avoid unstable display of the chart information.~~
- ~~(f) Supplementary Information~~
- ~~Additional information from non-HO sources, may be displayed providing this does not degrade the display of ENC data. This additional information should be distinguished from the ENC data (see Appendix 2).~~
- ~~(g) Tidal adjustment~~
- ~~Depth information should only be displayed as it has been provided in the ENC and not adjusted by tidal height.~~

~~8. MINIMUM CONFIGURATION~~

~~To fulfil these specifications, the following minimum configuration is required:~~

- ~~(a) 1 CPU, capable of providing a sufficient combination of computer memory and graphics memory to perform the following:~~

~~Redraw during route monitoring to follow the ship's progress, including scale changes due to change in the scale of the chart information, should take less than 5 seconds. Demands by the mariner that cannot be predicted by the ECDIS, such as draw at a different scale or in a different area may take more than 5 seconds. In the latter case:~~

- ~~_____ the mariner should be informed;
_____ the display should continue route monitoring until the new information is ready to draw within 5 seconds.~~

- ~~(b) Data storages for:~~

~~(1) _____ the System ENC, compiled by the ECDIS,~~

~~(2) _____ Updates.~~

- ~~(c) 1 Graphic Display~~

~~Size: _____ minimum effective size of the area for chart display 270 x 270 mm.~~

~~Resolution: _____ Minimum lines per mm (L) given by $L = 864/s$, where s is the smaller dimension of the chart display area (e.g. for the minimum chart area, s = 270 mm and the resolution is L = 3.20 lines per mm, giving a "picture unit" size of 0.312 mm).~~

~~Colours: _____ 64~~

- ~~(d) 1 Text Display.~~

- ~~(e) Data Input Devices, capable of reading the ENC, HO updates and test data sets to certify processing of the ENC. Capability of entering mariner's notes and corrections manually. Dedicated key and cursor function.~~

- ~~(f) A facility, equivalent to display, to certify processing of the ENC.~~

- ~~(g) Interface with clock, electronic equipment and electronic update media and other ships equipment when desired.~~

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ANNEX A

**REFERENCE TABLE BETWEEN S-52 AND
THE IMO PERFORMANCE STANDARDS FOR ECDIS (PS)**

<u>S-52</u>	<u>PS</u>	<u>REMARKS</u>
1		Relates in total to only S-52 and its use.
1.1 (a) (1)	1.5	
(2)	4.1	
1.1 (e) (1)	1.7	
(3)	1.5	
1.3 (a)	1.1, 1.6	
(d)	13.1	
(e)	13.1	
2.1	1, 2.1	<p>PS goes into detail on radar.</p> <p>No direct relationship but PS paragraphs refer.</p> <p>PS describes Voyage Recording but does not state it as a legal requirement.</p> <p>Not discussed in PS.</p> <p>(Two sub-paras. of PS 1.3 and 1.6 are not included in S-52).</p>
(a)	1.2, 2.1, 4.2	
(b)	2.1, 6.1, 6.3.1	
(c)	1.7, 2.2, 3.1	
(d)	2.2, 3.6, 10.4.4, 10.5.8	
(e)	1.2, 2.1, 4.2, 10.6	
(f)	2.1, 10.5.6	
2.2	2.1	
2.3	App.1	
3.1	2.2	<p>Refers to last part of PS 4.1 sentence "and conform to IHO Standards".</p> <p>No direct cross ref. possible, particularly in last sentence.</p> <p>No relationship here, except the requirements of 4.1 of PS.</p> <p>No relationship here.</p> <p>No direct relationship. Possibly 6 of PS applies.</p>
(a)	3.9, 4.1	
(b)	1.1, 1.4, 4.2	
(c)	-	
(d)	-	
(e)	-	
3.2	1.1	<p>No specific reference to data quality.</p> <p>All refer to IHO Standards required by PS 4.1.</p> <p>Stated in different words.</p>
3.3	2.2, 2.3	
(a)	3.1, 4.1	
(b)	4.1, 4.5	
(c)	4.1	
(d)	4.3, 4.4, 4.5	

<u>S-52</u>	<u>PS</u>	<u>REMARKS</u>
3.4 (a) (b) (1) (2) (3) (c)	3.1, 5.2, 13.1 3.1 3.8, 4.3, 11.1 1.4, 2.3, 3.8 4.5 2.3, 3.6, 10.5.5, 10.5.8	PS 4.3 Refers primarily to last sentence of S-52 paragraph. No direct reference. The requirements stated in PS do not exist in S-52. The paras. of PS noted are those requiring alarm/indication.
3.5 3.6 3.7	3.1, 5 5 5	These details of the ENC Structure are not addressed by the PS.
4. (a) (b)	4 3.10, 4.4 App.1	
5.1 5.2 5.2 (a) (b) 5.3 (a) (1) (2) (3) (7) (b) (2)	1.1, 1.6, 2.4, 2.5 3.1, 3.2, 3.5, 6.1, 9.1, 9.2, 10.3, App.2 3.1 8.1, 8.2, 8.3, 9.3, 9.4 9.4, 10.5.10, 10.5.11 3.1 5.1 4.5 4.6 6.1 6.1, 6.3.5	
6.1 (a) (b) 6.2 6.3 (a) (c) 6.4 (a) (1) (2) (3) (4) (5) (b)	10.5.9 10.5.9 - 3.1, 5 5.1 2.5, 3.2 3.1 10.5.6, 10.5.12 - - - - -	Not a direct reference. Not in PS. These details of the ENC Structure are not addressed by the PS. Not in PS. Not in PS. Not in PS. Not in PS. Not in PS.

<u>S-52</u>	<u>PS</u>	<u>REMARKS</u>
6.5	3.1	
(7)	3.7	
(8)	3.6	
7.1 (a) (1)	10.4.1, 10.5.12	<p>The calculations specified in S-52 are only stated as a general requirements in 1.6 of the PS.</p>
(2)	-	
(3)	11.2	
(4)	11.2	
(5)	11	
(b)	3.1, 11.1, 11.2	
(c)	11.2	
7.2	3.1, 3.5	
(a)	-	
(b)	2.4, 3.2, 3.3, 4.7, 8.3	The concept of more than one screen is not addressed in the PS.
(c)	-	
(d)	1.1, 1.8, 10.4.5, 10.5.3, 10.5.4, 10.5.7, 10.5.8, 13.2, App-5	Through PS Section 10, numerous indications and alarms are required and specified in App-5 of PS.
(e)	7.1	
(f)	3.8, 3.10, 6.2	PS does not really cover.
(g)	-	Not in PS.
8		Not specified in PS, inferred by PS 1.7.
(a)	1.6, 9.2, 10.3	
(b)	-	Inferred by PS 3.2, 3.4, 3.8, Appendix 2.
(c)	9.2, 9.3, 9.4, 11.2	
(d)	-	The PS does not require two displays.
(e)	13.1	
(f)	3.8	
(g)	12.1	

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ANNEX B

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

[IMO Resolutions A.817 (19), MSC.64 (67) and MSC.86 (70)]

(amended March 1999)

Note: The IMO Performance Standards for ECDIS are reproduced in this publication for convenience, with the kind permission of the International Maritime Organization, London.

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)², 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).
- 1.9³ 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 IEC Publication 945 (see Appendix 1).

³ Additional paragraph authorized by resolution MSC.86(70).

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.
- 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. 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. 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.
- 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 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 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.
- 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 method to ensure 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 that originated by a government authorized hydrographic office, 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.
- 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 would 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 in order to review their contents and to ascertain that they have been included in the SENC.

5. SCALE

ECDIS should provide an indication if:

- .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 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.
- 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.

8. **COLOURS AND SYMBOLS**

- 8.1 IHO recommend 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.

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

⁵ IEC Publication 61174.

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 by 270 mm.
- 9.3 The display should be capable of meeting colour and resolution recommendations of IHO⁶.
- 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 shall 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.
 - 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.

⁶ Appendix 2 to IHO Special Publication S-52.

- 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 within a specified time set by the mariner, own ship will 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 alarm⁷ 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.

⁷ Amendment authorized by resolution MSC.86(70).

- 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. **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 ⁸

- 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

- 14.1 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 to avoid that an ECDIS failure develops into 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 seconds should not require the equipment to be manually re-initialized.

⁸ 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 (IHO)

Address:	Directing Committee	Phone: +377 93 10 81 00
	International Hydrographic Bureau	Fax: +377 93 10 81 40
	BP 445	E-mail: info@ihb.mc
	MC 98011 Monaco Cedex	Web-site: www.iho.shom.fr
	Principality of Monaco	

Publications

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

S-52 Appendix 1: "Guidance on Updating the Electronic Navigational Chart" .

S-52 Appendix 2: "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	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".

[IEC Publication 62288](#) " "Presentation of navigation related information" "

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 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 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. 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 PARAMETERS⁹

- 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".

⁹ 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 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 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 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
10.5.7	Alarm ¹⁰	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
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
13.1	Indication	System test failure

In this Performance Standard the definitions of Indicators and Alarms provided in the IMO publications "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.

¹⁰ Amendment authorized by resolution MSC.86(70).

APPENDIX 6 ¹¹

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;

¹¹ Additional Appendix authorized by resolution MSC.64(67).

- .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 7¹²**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.
- 3.2 SRNC information available for display during route planning and route monitoring should be subdivided into two categories:

¹² Additional Appendix authorized by resolution MSC.86(70).

- .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.
- 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.
- 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.
- 7.2-7.4 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 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. ACCURACY**
- 11.1-11.2 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 INDICATIONS 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.