Paper for Consideration by TSMAD and DIPWG

S-52 Content for S-101 Portrayal Survey Discussion

Submitted by:	DIPWG Chair and TSMAD Vice Chair
Executive Summary:	The need for further review of the S-52 to S-101 results are discussed. The original survey is attached in Annex B. There was no clear consensus regarding whether some sections should be brought forward from S-52 into S-101. These sections are listed in Annex A and will be "walked-through" during TSMAD28/DIPWG6.
Related Documents:	S-52 S-101 TSMAD28_DIPWG6_09.1C_S-52_for_S-101_Survey_Results_Matrix provides a complete compilation of survey results
Related Projects:	

Introduction / Background

On 28 January 2014 a survey was sent to S-101 stakeholders to assess and verify which portions of the new editions of S-52 and its Presentation Library would need to be included into S-101. While much of content of the S-52 descriptive text and tables will be stored in a machine readable S-101 Portrayal Catalogue, there are some aspects of portrayal that will need a more detailed explanation on how they should be implemented within ECDIS.

While only six responses were received, there still is enough information to move forward and make some preliminary decisions. The results of the survey have been collected into a spreadsheet for further analysis and posted as TSMAD28/DIPWG6 9.1C.

Analysis/Discussion

The spreadsheet consolidated the survey results and tabulated the responses. The following key was used to determine the final survey disposition:

Colour Key	Survey results
	Majority of responses were to discard this section. It will not be included in S-101.
	Majority of responses were to keep then this section It will be brought forward into S-101
	Responses were evenly split between keep/discard/unsure This section will be discussed at TSMAD28 / DIPWG6

Sections of S-52 that require further discussion for inclusion into S-101 are presented in Annex A

Action Required of TSMAD/DIPWG

The TSMAD/DIPWG is invited to:

a. discuss each of the clauses that did not have a clear consensus and make a discussion on whether to include each of them into S-101 or not.

Number		Clause	Clause Header	Keep	Discard	Unsure	Comments	Comments
9	Main	2.1.2	The diversity and flexibility of ECDIS	3	0	0		There is a need to e1plain why some details in the specifications are as they are. 1.1.1, 2.1.1, 2.12 and 2.1.3 could be combined together as new “background information”, which could be either part of body te1t or an informative Anne1.
10	Main	2.1.3	Colour discrimination on the display: perception effects and display calibration	3	0	0		There is a need to e1plain why some details in the specifications are as they are. 1.1.1, 2.1.1, 2.12 and 2.1.3 could be combined together as new “background information”, which could be either part of body te1t or an informative Anne1.
13	Main	2.2.3	Route Planning / Route Monitoring: Look-ahead	2	0	1	This item is tested by IEC62288.	Include important requirements for viewing distance and look-ahead capability
15	Main	2.2.5	Scale and range indicators	2	0	1	This item is tested by IEC62288.	This makes mapping between IMO requirements and IHO specification for related symbols
18	Main	2.2.8	Displaying text	1	1	1	This item is tested by IEC62288.	Covered by IMO and IEC
31	Main	2.3.3b	Selecting objects for the route monitoring display	2	0	1		Very important as this refers to IMO requirement which is implemented by viewing group layers. The te1t should be rewritten to clarify link between IMO and viewing group layers.

Number		Clause	Clause Header	Keep	Discard	Unsure	Comments	Comments
33	Main	2.3.3d	Linkages in selecting mariner's options	1	0	2		
67	Main	5.2.2	Colour display capability	0	2	1		
71	Main	5.2.5	Colour Differentiation Test Diagram; grey scale	0	2	1		Newer provided by IHO, should be removed
73	Main	5.2.5	TABLE 2: CONDENSED COLOUR TABLES	3	0	0	Part of the Portrayal Catalogue?	=> Keep only as reference to Portrayal catalogue
74	Main	5.2.5	Colour table 2.2: DUSK	3	0	0	Part of the Portrayal Catalogue?	=> Keep only as reference to Portrayal catalogue
75	Main	5.2.5	Colour table 2.3: NIGHT	3	0	0	Part of the Portrayal Catalogue?	Part of the Portrayal Catalogue? Keep only as reference to Portrayal catalogue
78	Main	Annex C	Procedure for maintaining the calibration of displays	0	2	1		
88	PL	6	The elements of the Presentation Library – an overview	1	0	2	This would be covered by the introduction of the portrayal catalogue model for S-101	This would be covered by the introduction of the portrayal catalogue model for S-101
89	PL	6.1	The Colour Coding Scheme	1	0	2	This would be covered by the introduction of the portrayal catalogue model for S-101	This would be covered by the introduction of the portrayal catalogue model for S-101
90	PL	6.2	The Library of Symbols, Fill Styles and Line Styles	1	0	2		See 6.1
91	PL	6.2.1	Symbols	1	0	2		See 6.1
92	PL	6.2.2	Area Fills	1	0	2		See 6.1

Number		Clause	Clause Header	Keep	Discard	Unsure	Comments	Comments
93	PL	6.2.3	Line Styles	1	0	2		See 6.1
94	PL	6.3	Symbology Instructions	1	0	2		See 6.1
98	PL	6.7	Mariners' Navigational Object Classes	0	0	3		A few objects remains in PresLib 4.0 (mariner note, etc.)
109	PL	8	The Vector Symbol Description Language	0	0	3	Replaced by SVG	Replaced by SVG need at least short form description of SVG
110	PL	8.1	Size and Orientation of a Vector-Symbol	0	0	3	Replaced by SVG	Replaced by SVG need at least short form description of SVG
111	PL	8.2	Description of Complex Line Style rendering.	0	0	3	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
112	PL	8.3.1	Sample Definition in Vector Format	0	1	2	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
113	PL	8.3.2	Sample Symbol Library Format for Composite Complex Linestyle Symbols	0	1	2	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
114	PL	8.3.3	Sample Implementation of the Composite Complex Linestyle Symbols	0	1	2	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
115	PL	8.4	Symbology Instruction for Area Objects	0	0	3	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
116	PL	8.4.1	Fill Operations	0	0	3	I think this is defined in S-100?	Replaced by SVG need at least short form description

Number		Clause	Clause Header	Keep	Discard	Unsure	Comments	Comments
								of SVG
117	PL	8.4.2	Transparent Fill	0	0	3	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
118	PL	8.5	Area Symbolization by a centred Symbol	0	0	3	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
119	PL	8.5.1	Positioning centred symbols and text	0	0	3	I think this is defined in S-100?	Replaced by SVG need at least short form description of SVG
120	PL	8.5.5.1	Centred symbol	1	0	2	I think this is defined in S-100?	Replaced by SVG Disagreed, this is unique for IHO
121	PL	8.5.2	Centred symbols on a ship-centred display	1	0	2	I think this is defined in S-100?	Replaced by SVG Disagreed, this is unique for IHO
122	PL	8.5.3	Calculating the representative point of an area	1	0	2	I think this is defined in S-100?	Replaced by SVG Disagreed, this is unique for IHO
123	PL	8.5.4	Patterns Fill & Textures for areas	1	0	2	I think this is defined in S-100?	I think this is defined in S-100? need at least short form description
124	PL	8.4.1	Plain and Symbolized Boundaries	1	0	2	I think this is defined in S-100?	I think this is defined in S-100? need at least short form description
125	PL	8.4.2	Masked Lines	1	0	2	Already in S-101	Already in S-101 doubtful, this masking has traditionally been unique to IHO
126	PL	8.4.3	Area Borders	1	0	2		This is essential to achieve seamless portrayal of cells. Shall be e1plained how.

ANNEX B – Survey Sent to S-101 Stakeholders on 28 January 2014

SURVEY INPUT NEEDED BY 28 FEB 2014

From: DIPWG Chair and TSMAD S-101 Work Item Leader

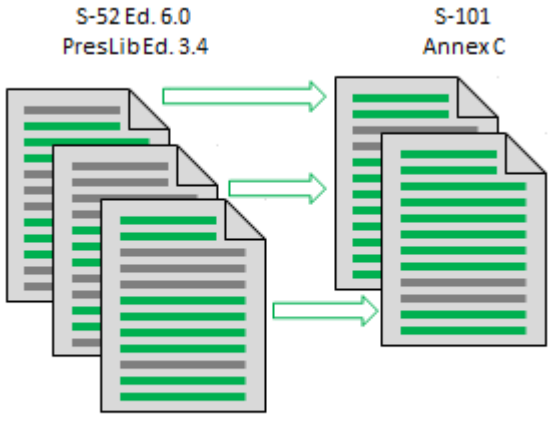
Subject: Assessment of New Editions of S-52 and Presentation Library for use in Portrayal Sections of S-101
Date: 28 Jan 2014
Related Documents: S-52, Editions 6.0 and 6.1
S-52 Presentation Library, Editions 3.4 and 4.0
S-101, Section 9 and Annex C

Purpose:
This survey is to solicit input from TSMAD/DIPWG members to verify the selection of portions of the new editions of S-52 and the Presentation Library to be included in S-101, Annex C "Normative Implementation Guidance," Section C-9 "Portrayal."

Introduction / Background

Section 9 of S-101 specifies how to portray (the next generation) ENC in ECDIS. This section will primarily refer back to the Portrayal Model that is in Section 9 of the S-100 Standard. The S-101 Annex C, "Normative Implementation Guidance", Section C-9, "Portrayal," provides guidance and examples of how ECDIS manufactures are to implement the model to portray ENCs in ECDIS.

In 2010, portions of S-52, Edition 6.0 and its Presentation Library (PresLib), Edition 3.4, were extracted and modified for placement into S-101 Annex C. This can be seen (starting on page 68) at URL: http://www.iho.int/mtg_docs/com_wg/TSMAD/TSMAD26/TSMAD26_DIPWG5-10.2B_S-101_ENC_ProductSpecificationFinalInitialDraft_20130124.pdf.

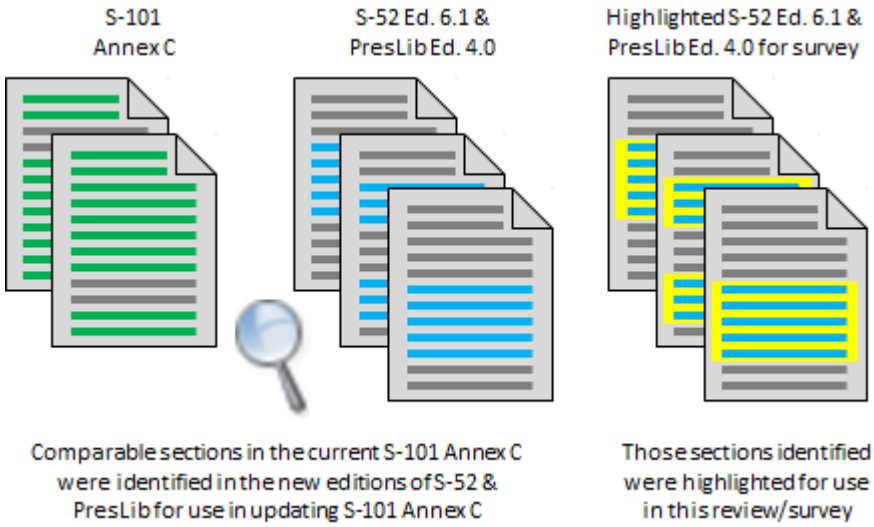


However, the development of new editions of S-52 (Ed. 6.1) and the PresLib (Ed. 4.0) changed and reorganized much of the previous content that had been extracted for use in S-101. Therefore, it is necessary to revisit the portrayal part of S-101 Annex C to ensure that it has the latest improvements and clarifications that were made in the new editions of S-52 and the PresLib.

Analysis/Discussion

To help determine which parts of new S-52 and PresLib need to be put into S-101, the chair of DIPWG and the S-101 Work Item Leader have developed a simple survey to validate what needs to stay as guidance. The results of this survey will be part of the agenda at the upcoming TSMAD28/DIPWG6 meeting in 28 Mar- 6 April 2014. *Your participation will help ensure that the guidance provided to ECDIS manufacturers is as complete and accurate as possible. This will help avoid "ECDIS anomalies" in the portrayal of the next generation of ENC data.*

A single combined document containing all of the text from the new editions of S-52 and the PresLib was created and it was compared to the text that had been extracted from the old (current) editions of S-52 and the PresLib for inclusion in S-101 Annex C. Text that has been identified in the new editions that will be carried forward into S-101 has been highlighted in yellow (Survey Annex 2).



To assist in the future modification of the text for use in S-101, certain words, such as "Presentation Library," "Section," "Annex," "Part I, "Part II," have been changed to red text, as have the words "may," and "should."

A survey form (Survey Annex 1) has also been prepared to enable individual TSMAD/DIPWG members to help validate/correct the list of S-52 and PresLib sections that will be adapted for use in S-101. There is a row in the form for each section heading in the new editions of S-52 and the PresLib (which run consecutively from 1 through 18) and each row is colour coded.

Colour Key	Preliminary Disposition
Yellow	Sections identified for carrying forward into S-101. (Sections for which the corresponding text has been highlighted in Survey Annex 1.)
Red	Sections identified as not appropriate for inclusion in S-101.
White	Sections for which no preliminary disposition has been made.

There are columns in the survey form to "X" each section to "Keep" or "Discard" for inclusion in S-101. If you are not sure if a section should be included, please "X" the "Unsure" column and enter a remark in the "Comment" column describing what you think may or may not lead this section to be carried forward.

It is possible that some of your responses will conflict with the preliminary disposition that has been colour coded into the rows. If this is the case, please explain the rationale for your determination in the "Comment" column.

Action Required of Individual TSMAD/DIPWG Members

a. Review the yellow highlighted version of S-52 Ed. 6.1 and PresLib Ed. 4.0 (Survey Annex 2) noting the sections that will remain applicable within the S-101 ENC product specification.

b. Mark one of the "Keep, Discard or Unsure" columns in the survey form (Survey Annex 1)

c. On or before 28 Feb 2014, e-mail the survey form (Survey Annex 1) to: colby.harmon@noaa.gov and julia.powell@noaa.gov.

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment

This Survey was completed by (Name & Organization) _____

Main	1.1.1	Aims				
Main	1.1.2	Definitions				
Main	1.1.3	Historical Background				
Main	1.1.4	International organizations and their related standards for ECDIS				This is a useful graphic – but should be in a S-101 user guide type of document
Main	1.2	Concept and limitations of ECDIS				
Main	1.3	Function and Use of S-52				
Main	1.4	Structure of the Specifications				This is covered by S-101 maintenance.
Main	2.1.1	Design consideration				
Main	2.1.2	The diversity and flexibility of ECDIS				
Main	2.1.3	Colour discrimination on the display: perception effects and display calibration				
Main	2.2.1	Similarity to the paper chart				
Main	2.2.2	Distinguishing between features and between sources				
Main	2.2.3	Route Planning / Route Monitoring: Look-ahead				
Main	2.2.4	Important features should always be clear and conspicuous				
Main	2.2.5	Scale and range indicators				
Main	2.2.6	Effect of bright sunlight, and the dark night display				
Main	2.2.7	Location for the ECDIS display				
Main	2.2.8	Displaying text				
Main	2.2.9	Flashing to draw attention				
Main	2.2.10	Operator control of information should be effective and simple				
Main	2.3.1a	Distinguishing between chart data and additional data				
Main	2.3.1b	Mariner's Information on the route monitoring display				
Main	2.3.1c	Manufacturer's Information on the route monitoring display				
Main	2.3.1d	Displaying the radar image				
Main	2.3.1e	Displaying pick reports				
Main	2.3.1f	Units				
Main	2.3.1g	Legend				
Main	2.3.2a	Priority layers				

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
Main	2.3.2b	Radar priority				
Main	2.3.3a	IMO categories				
Main	2.3.3b	Selecting objects for the route monitoring display				
Main	2.3.3c	Selecting text for the route monitoring display				
Main	2.3.3d	Linkages in selecting mariner's options				
Main	2.3.4	Displaying ECDIS updates				
Main	3.1.1	Mariner's options in symbols and linestyles				
Main	3.1.2	Areas				
Main	3.1.3	Symbol Specifications: Presentation Library				
Main	3.1.4	Paper chart INT 1 and ECDIS Chart 1				
Main	3.1.5	Size of lines, symbols and text; fonts				
Main	3.1.6	Display Orientation				
Main	3.1.7	ENC scale; Graphical Index of ENCs by Navigational Purpose; Limit of HO data				
Main	3.1.8	Chart data quality indicator				
Main	3.1.9	Cursor enquiry				
Main	3.2.1	Types of new symbols				
Main	3.2.2	Special ECDIS chart symbols to identify unsafe depths				
Main	3.2.3	Other new and simplified ECDIS symbols and their use				
Main	3.3.1	Reproduction of paper chart symbols on ECDIS				
Main	3.4.1	Text as part of the route monitoring display				
Main	3.4.2	Text windows, explanatory diagrams etc. superimposed on the route monitoring display				
Main	3.4.3	Separate text panel on the same screen as the route monitoring display				
Main	3.4.4	Text shown on a separate auxiliary screen				
Main	4.1	Specifications for Colours – General				
Main	4.2	Colour Assignment				
Main	4.2.2	Bright Sunlight or Night viewing - Use of filters, etc.				
Main	4.2.3	Display calibration and verification				
Main	4.2.4	Colour control; contrast and brightness controls				
Main	4.2.4.1	Effect of controls.				

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
Main	4.2.4.2	Use of the controls.				
Main	4.2.4.3	Initial setting of the controls.				
Main	4.2.4.4	Re-adjustment of the controls.				
Main	4.2.4.5	Setting the controls for route monitoring.				
Main	4.2.5	The colour tables				
Main	4.2.6	The colour scheme - colour tokens				
Main	4.2.7	Transparency				
Main	5.1	Physical display requirements				
Main	5.2.1	Reproducing small features and symbols				
Main	5.2.2	Colour display capability				
Main	5.2.3.1	Colour conversion tolerances and tests - Tolerances				
Main	5.2.3.2	Instrumental calibration verification test.				
Main	5.2.3.3	Test using Colour Differentiation Test Diagram				
Main	5.2.5	Colour Differentiation Test Diagram; grey scale				
Main	5.2.5	TABLE 1: GENERAL COLOUR ASSIGNMENT FOR ECDIS FEATURES				
Main	5.2.5	TABLE 2: CONDENSED COLOUR TABLES				Part of the Portrayal Catalogue?
Main	5.2.5	Colour table 2.2: DUSK				Part of the Portrayal Catalogue?
Main	5.2.5	Colour table 2.3: NIGHT				Part of the Portrayal Catalogue?
Main	5.2.5	TABLE 3: ALPHABETICAL LIST OF COLOUR TOKENS				
Main	5.2.5	TABLE 4: 'CAUTIONARY' AND 'INFORMATION' AREAS				
Main	Annex C	Procedure for maintaining the calibration of displays				
PL	1	Scope				
PL	1.1	Use of Language				
PL	2	Terms and Definitions				
PL	3	References				
PL	4	Structure of the Presentation Library				
PL	4.1	S-57 and the Presentation Model for ECDIS				
PL	4.2	Structure of the Presentation Model for ECDIS				

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
PL	4.3	Supple and amendment of the Presentation Library				
PL	5	Basic Concept of ECDIS Display				
PL	6	The elements of the Presentation Library – an overview				This would be covered by the introduction of the portrayal catalogue model for S-101
PL	6.1	The Colour Coding Scheme				This would be covered by the introduction of the portrayal catalogue model for S-101
PL	6.2	The Library of Symbols, Fill Styles and Line Styles				
PL	6.2.1	Symbols				
PL	6.2.2	Area Fills				
PL	6.2.3	Line Styles				
PL	6.3	Symbology Instructions				
PL	6.4	Conditional Symbology Procedures				These are expected to go away in S-101
PL	6.5	The Look-Up Tables and other symbolizing instructions				This is replaced by the Portrayal Catalogue
PL	6.6	Mariners' ECDIS Chart 1 and Colour Differentiation Test diagrams				
PL	6.7	Mariners' Navigational Object Classes				
PL	6.8	Test Edition of the Presentation Library				
PL	7	Description of the Colour Coding System				
PL	7.1	The Sections of the Colour Scheme				
PL	7.1.1	General Colours				
PL	7.1.2	Chart Colours				
PL	7.1.3	Radar Image Overlay Colours				
PL	7.1.4	Mariners' & Navigation Information Colours				
PL	7.1.5	Other Colours				
PL	7.1.6	Colour Section V / Ship Symbol & Planned Route				
PL	7.1.7	User Interface Colours				
PL	8	The Vector Symbol Description Language				Replaced by SVG
PL	8.1	Size and Orientation of a Vector-Symbol				Replaced by SVG
PL	8.2	Description of Complex Line Style rendering.				I think this is defined in S-100?
PL	8.3.1	Sample Definition in Vector Format				I think this is defined in S-100?
PL	8.3.2	Sample Symbol Library Format for Composite Complex Linestyle Symbols				I think this is defined in S-100?

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
PL	8.3.3	Sample Implementation of the Composite Complex Linestyle Symbols				I think this is defined in S-100?
PL	8.4	Symbology Instruction for Area Objects				I think this is defined in S-100?
PL	8.4.1	Fill Operations				I think this is defined in S-100?
PL	8.4.2	Transparent Fill				I think this is defined in S-100?
PL	8.5	Area Symbolization by a centred Symbol				I think this is defined in S-100?
PL	8.5.1	Positioning centred symbols and text				I think this is defined in S-100?
PL	8.5.5.1	Centred symbol				I think this is defined in S-100?
PL	8.5.2	Centred symbols on a ship-centred display				I think this is defined in S-100?
PL	8.5.3	Calculating the representative point of an area				I think this is defined in S-100?
PL	8.5.4	Patterns Fill & Textures for areas				I think this is defined in S-100?
PL	8.4.1	Plain and Symbolized Boundaries				I think this is defined in S-100?
PL	8.4.2	Masked Lines				Already in S-101
PL	8.4.3	Area Borders				
PL	8.5	Colours and Descriptions for Symbols				Part of the Portrayal Catalogue
PL	9	Description of the Symbology Commands				
PL	9.1	SHOWTEXT				
PL	9.1.1	Show Text Examples				
PL	9.2	SHOWPOINT				
PL	9.2.1	SHOWPOINT Example				
PL	9.3	SHOWLINE				
PL	9.3.1	SHOWLINE Example				
PL	9.4	SHOWAREA				
PL	9.4.1	SHOWAREA Examples				
PL	9.5	CALLSYMPROC				
PL	10	ECDIS Requirements				
PL	10.1	Data Consistency				Covered elsewhere in S-101
PL	10.1.1	Unknown Objects				Covered elsewhere in S-101
PL	10.1.2	Unknown or Missing Mandatory Attributes				Covered elsewhere in S-101
PL	10.1.3	Data Overlaps				Covered elsewhere in S-101
PL	10.1.4	Gaps				Covered elsewhere in S-101

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
PL	10.1.5	No Data Coverage				
PL	10.1.6	ENC coverage				Covered elsewhere in S-101
PL	10.1.7	Limit of ENC Coverage: Non-HO Data on the Display				
PL	10.1.8	No Data Areas				
PL	10.1.9	Scale Boundaries				Covered elsewhere in S-101
PL	10.1.9.1	Chart Scale Boundaries				
PL	10.1.9.2	Graphical Index of Navigational Purpose				
PL	10.1.10	Overscale				Partially covered by the data loading and unloading section
PL	10.1.10.1	Overscale Indication				Partially covered by the data loading and unloading section
PL	10.1.10.2	Overscale Area at a Chart Scale Boundary				Partially covered by the data loading and unloading section
PL	10.1.10.3	Larger Scale Data Available				Partially covered by the data loading and unloading section
PL	10.2	Queries				
PL	10.3	How to use the Look-Up Tables				Replaced by the Portrayal Catalogue
PL	10.3.1	Layout of the Look-Up tables				Replaced by the Portrayal Catalogue
PL	10.3.2	Lookup Table Entry Example				Replaced by the Portrayal Catalogue
PL	10.3.3	Matching Entries in the Lookup Tables				Replaced by the Portrayal Catalogue
PL	10.3.3.1	Look-Up Table Entry Matching				Replaced by the Portrayal Catalogue
PL	10.3.3.2	Look-Up Table Attribute Matching				Replaced by the Portrayal Catalogue
PL	10.3.3.3	Look-Up Table Conditional Symbology				Replaced by the Portrayal Catalogue
PL	10.3.3.4	Symbolizing a non-ENC object class				Replaced by the Portrayal Catalogue
PL	10.3.3.5	UML Diagram, How to use the Lookup Tables				Replaced by the Portrayal Catalogue
PL	10.3.3.6	Not set attributes				Replaced by the Portrayal Catalogue
PL	10.3.3.7	'No Symbol' - Objects				Replaced by the Portrayal Catalogue
PL	10.3.3.8	Presentation of New Object NEWOBJ				Replaced by the Portrayal Catalogue
PL	10.3.4.1	Display Priority				
PL	10.3.4.2	RADAR Flag				
PL	10.3.4.3	Display Categories				

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
PL	10.3.4.4	Independent Mariner Selections				
PL	10.3.4.5	Mariners' objects				
PL	10.3.4.6	Viewing groups				
PL	10.3.4.7	Display Priority & Display Category in Conditional Symbology Procedures				
PL	10.3.5	Check Symbol SY(CHKSYM 01)				
PL	10.4.1	Date dependent ENC Objects				
PL	10.4.2	Scale-Dependent Objects				
PL	10.5	IMO Presentation Instructions not Handled by Look-up Tables				
PL	10.5.1	Scalebar and Latitude Scale				
PL	10.5.4	North Arrow				
PL	10.5.5	Graticule				
PL	10.5.6	Display Mode				
PL	10.5.7	Shallow Water Pattern				
PL	10.5.8	Black Level Adjustment Symbol				
PL	10.5.9	Detection and Notification of Navigational Hazards				
PL	10.5.10	Detection of Areas, for which Special Conditions Exist.				
PL	10.5.11	Visualization of the Safety Contour				
PL	10.5.12	Detection of Safety Contour				
PL	10.6.1.1	Standard Attributes INFORM, NINFOM, TXTDSC, NTXTDS and PICREP				
PL	10.6.1.2	Display of National Language Attributes and Content				
PL	10.6.2	ECDIS Legend				
PL	10.6.3	Light Description Text Strings				
PL	10.7.1	Manual Updates				
PL	10.7.1.1	Added Feature				
PL	10.7.1.2	Deleted Feature				
PL	10.7.1.3	Moved Feature				
PL	10.7.1.4	Modified Feature				
PL	10.7.2	Identifying Automatic Chart Corrections On Mariners Demand				
PL	10.7.2.1	Added Feature				

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
PL	10.7.2.2	Deleted Feature				
PL	10.7.2.3	Moved Feature				
PL	10.7.2.4	Modified Feature				
PL	10.7.3	Non-HO (Non-ENC) Chart Information				
PL	10.8	Cursor Pick and Interface Panel Display				
PL	10.8.1	Pick Report Descriptions				
PL	10.8.2	Sorting				
PL	10.8.3	User Defined Curser Pick Parameters				
PL	10.8.4	Sorting by Significance				
PL	10.8.5	Hover-over Function				
PL	10.8.6	Unknown Attributes				
PL	10.9	Tidal Stream Panels : S-57 feature TS_PAD				
PL	11	Digital Presentation Library Format Description				Handled by the Portrayal Catalogue
PL	12	Look-Up Table Listings				Handled by the Portrayal Catalogue
PL	13	Conditional Symbology Procedure (CSP) Diagrams				Handled by the Portrayal Catalogue
PL	14.1	Colour Tables				
PL	14.2	Viewing Group Layers				
PL	14.3	ECDIS Viewing Group Implementation				
PL	14.4	Text Groupings				
PL	14.5	ECDIS Text Group Implementation				
PL	14.6	Abbreviations				
PL	14.6.1	'TE' text command abbreviations				
PL	14.6.3	Nature of seabed abbreviations ('TX')				
PL	14.6.4	Light Description abbreviations				
PL	15	Symbol Library for use on ECDIS				Handled by the Portrayal Catalogue
PL	16	ECDIS Chart 1, Symbol Plots & Colour Test Diagrams				
PL	17	Contents of the Digital Presentation Library				Handled by S-101
PL	18	Use of Digital Chart 1, & Colour Test Diagram				
PL	18.3	Displaying the Colour Test Diagram				
PL	18.3.1	Introduction; providing the diagram				
PL	18.3.2	Using the diagram				

S-52 Doc (Main/PL)	Clause	Clause Header	Keep	Discard	Unsure	Comment
PL	18.4	Grey Scale				

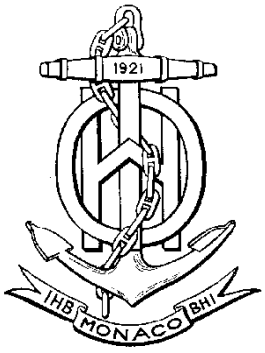
SURVEY ANNEX 2

Highlighted
S-101 Portrayal Content

Mapped from S-52 Edition 6.1.0
&
Presentation Library Edition 4.0.0

S-52 Edition 6.1.0

INTERNATIONAL HYDROGRAPHIC ORGANIZATION



SPECIFICATIONS FOR CHART CONTENT AND DISPLAY ASPECTS OF ECDIS

Edition 6.1, September 2014

Publication S-52

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INTERNATIONAL HYDROGRAPHIC ORGANIZATION

SPECIFICATIONS FOR CHART CONTENT AND DISPLAY ASPECTS OF ECDIS

Edition 6.1, September 2014

Publication S-52

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CHANGE CONTROL HISTORY SINCE 1996

Amendment Abbreviations: MD Maintenance Document
IA Immediate Amendment
DA Deferred Amendment

Specifications for Chart Content and Display Aspects of ECDIS (S-52)

Previous Edition	Amendments Applied	Resulting Edition
Edition 5.0 (Dec 1996)	Mar 1999	"5th Edition, amended Mar 1999"
"5th Edition, amended Mar 1999"	Dec 2001	"5th Edition, amended Mar 1999 & Dec 2001"
"5th Edition, amended Mar 1999 & Dec 2001"	MD7 + Merging with former S-52 App. 2 (C&S specs)	Edition 6.0 (Mar 2010)
Edition 6.0 (Mar 2010)	Deleted Annex B and corrections made to Annex C (not from an amendment)	Edition 6.1 (Sep 2014)

Guidance on Updating the Electronic Navigational Chart (S-52, Appendix 1)

Current Edition	Amendments Applied
Edition 3.0 (Dec 1996)	No revisions since 1996

Colours & Symbols Specifications (Former S-52, Appendix 2)

Previous Edition	Amendments Applied	Resulting Edition
Edition 3.0 (Jul 1996)	July 1997	Edition 4.0 (Jul 1997)
Edition 4.0 (Jul 1997)	MD1 IA i01	Edition 4.1 (Jan 1999)
Edition 4.1 (Jan 1999)	MD2 DA d02 MD4 DA d6	Edition 4.2 (Mar 2004)
Edition 4.2 (Mar 2004)	MD5 DA d7	Edition 4.3 (Jan 2008)

Glossary of ECDIS-Related Terms Specifications (Former S-52, Appendix 3)

Previous Edition	Amendments Applied	Resulting Edition
Edition 3.0 (Dec 1997)	Transferred to S-32	S-32, Appendix 1 (Sep 2007)

Presentation Library (Annex A to former S-52, Appendix 2)

Previous Edition	Amendments Applied	Resulting Edition	Digital PresLib	Addendum to Part I
Edition 3.0 (July 1997)	MD1 IA i01	Edition 3.1 (Jan 1999)	PRSLIB03.dai (Jul 1997) PSLB03_1.dai (Dec 1998)	
Edition 3.1 (Jan 1999)	MD 3 IA i04	Edition 3.2 (May 2000)	PSTY03_0.dai (Jun 1999) PSLB03_2.dai (May 2000)	(2003)
Edition 3.2 (May 2000)	MD2 DA d02 MD3 DA d05 MD4 DA d6	Edition 3.3 (2004)	PSTY3_2b.dai (Oct 2001) PSLB03_3.dai (Mar 2004)	(2007)
Edition 3.3 (2004)	MD5 IA i5 MD5 DA d7 MD6 IA i6	Edition 3.4 (2008)	PSLB03_4.dai (Jan 2008)	(2008)
Edition 3.4 (2008)	MD7 DA d8 MD8 DA d9 and other edits	Edition 4.0 (Sep 2014)	PSLB04_0.dai (Sep 2014)	(2014)

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Notes:

1) Throughout these specifications, *italics* are used to distinguish discussion or recommendations from the specifications. The specifications are in plain type.

2) Quotations from these specifications may be used in the manufacturer's manuals. The source should be acknowledged.

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1 INTRODUCTION

1.1 Aims and Background

1.1.1 Aims

These Specifications for Chart Content and Display Aspects of ECDIS are intended to contribute to the safe operation of ECDIS by:

- ensuring a base and supplementary levels of display for ENC data; 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.

- ensuring the display is clear and unambiguous,

- ensuring that there is no uncertainty over the meaning of colours and symbols on the display,

- establishing an accepted pattern for ECDIS presentation that becomes familiar to mariners and so can be recognized instantly without confusion.

1.1.2 Definitions

ECDIS terminology used in these Specifications is defined in the IHO S-32 “IHO Hydrographic Dictionary”, Appendix 1, “Glossary of ECDIS Related Terms."

1.1.3 Historical Background

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 (HOs). Its conclusions included:

(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.

*It was then decided to establish an International Hydrographic Organization (IHO) Committee on ECDIS (COE *).*

As several manufacturers were now developing these systems, it was of immediate importance to all concerned (Hydrographic Offices, mariners, national shipping authorities, and 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.

* Subsequently renamed the Committee on Hydrographic Requirements for Information Systems (CHRIS) and now known as the Hydrographic Services and Standards Committee (HSSC).

Therefore, the COE asked the Netherlands Hydrographer to prepare a working paper on ECDIS specifications to address the following issues:

(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

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.

In November 1988, the COE established the Colours & Symbols Maintenance Working Group (CSMWG) to develop specifications and guidelines for chart symbol and colour definition for evaluation by hydrographic offices, ECDIS users, and manufacturers.

In January 1989, the Safety of Navigation sub-committee of the IMO Maritime Safety Committee noted the need to define symbols and colours for both chart and navigation purposes, and invited the Comité International Radio-Maritime (CIRM) and the IHO to make detailed technical proposals.

Work on ECDIS display design had already started, exemplified by the Canadian E.C. Testbed on the Norwegian "North Sea Project" in 1988. The CSMWG made its first report in September 1989, based on a study for the Netherlands HO by the TNO Perception Institute, and a review by the DCIEM Perception Institute, Toronto. The initial performance specifications were prepared in June 1990.

Seven Cs GmbH, of Hamburg, developed a digital Provisional Presentation Library, under contract to Canada and the United States, leading to the development of the Presentation Library over the next two years, and culminating in the issue of the first operational editions after a meeting of CSMWG in November 1994. Meanwhile, more research and development in colours and symbols was carried out in Canada. Australia also provided support for completing the Presentation Library and the Mariner's Navigational Object catalogue which implements the IEC Navigational Symbols.

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 it was adopted in 1995 through IMO resolution A.817(19). The Performance Standards have incorporated

many of the elements of the original IHO Specification. Therefore, S-52 now only provides the details of the hydrographic requirements for ECDIS.

Another parallel effort was carried out by the IHO Committee on Hydrographic Requirements for Information Systems (CHRIS), which developed the S-57, "IHO Transfer Standard for Digital Hydrographic Data." S-57 describes the standard to be used for the exchange of ENC data. It was adopted by the 14th International Hydrographic Conference, Monaco, May 1992. The IHO Transfer Standard Maintenance and Application Development Working Group (TSMAD) currently maintains S-57.

While many of the general elements of S-52 were being incorporated into the IMO Performance Standards, the specifics were being expanded in the S-52, 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 the S-52, Appendix 2 in 1991 and the first operational edition, complete with Annex A, "Presentation Library", was issued in 1994.

After 1994, considerable maintenance to adapt the colours and symbols Specifications and Presentation Library to sea experience and to changes in S-57 was carried out in Canada, first by USL/CARIS of Fredericton and later by NDI of St. Johns, funded by the Canadian Hydrographic Service and the Canadian Coast Guard.

In 2001, the Federal Maritime and Hydrographic Agency of Germany (BSH), relieved the Canadian Hydrographic Service as the HO responsible for ECDIS Colours and Symbols. In 2004, a new edition bringing all accumulated deferred amendments into effect was issued. It included a detailed 'hard-copy' version of the symbol library developed at Hochschule Wismar, Fachbereich Seefahrt Warnemunde; in addition Furuno, Helsinki, provided the updated digital version for those who use it.

The version of S-52 published in 2008 focused on adapting Appendix 2, Annex A to the revised IMO ECDIS Performance Standards and the introduction of new symbology for Particular Sensitive Sea Areas, Archipelagic Sea Lanes and generic objects which may be used for future cartographic requirements initiated by the IMO.

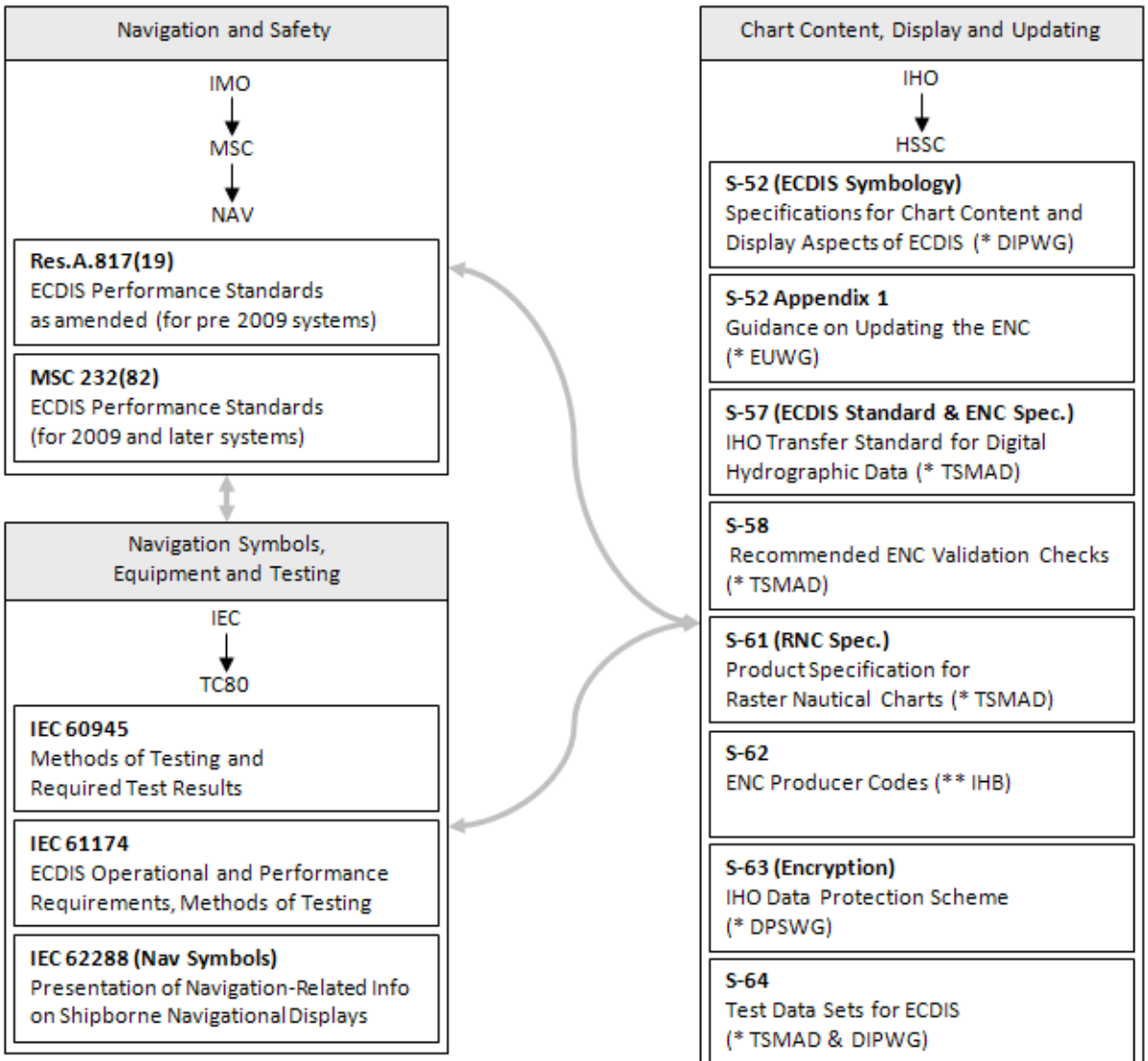
In 2008, the 20th meeting of CHRIS endorsed the recommendation of the CSMWG to revise and restructure S-52 to accommodate the revised IMO ECDIS Performance Standards, MSC.232(82) and the associated new IEC 61174 Specification for ECDIS type approval testing. This has resulted in the creation of Edition 6 of S-52. All references to the previous IMO Performance Standards have been replaced with the appropriate references to MSC.232(82). The structure of S-52 has also been simplified; the S-52, Appendix 2 has been incorporated into the main portion of S-52 and the three annexes of the former Appendix 2 have become annexes to the main document. All of the Appendix 2 paragraph numbers have been retained in the newly integrated S-52 main document so that references to the former S-52, Appendix 2 may be mapped directly to the revised main portion of S-52.

CHRIS, which changed its name to the Hydrographic Services and Standards Committee (HSSC) in 2009, also changed the name of the CSMWG to the Digital Information Portrayal Working Group (DIPWG). The scope of the DIPWG was also redefined to include maintenance of all components of S-52, except for Appendix 1, "Guidance on Updating the Electronic Navigational Chart," which was delegated to the new ENC Updating Working Group (EUWG) to "review and revise."

1.1.4 International organizations and their related standards for ECDIS

The relationships among the international organizations and working groups that have made important contributions to the development of ECDIS are shown schematically in Figure 1.

Figure 1. International Organizations involved in ECDIS Standardization



CIRM	Comité International Radio-Maritime
DGIWG	Defence Geospatial Information Working Group
DIPWG	Digital Information Portrayal Working Group
DPSWG	Data Protection Scheme Working Group
EUWG	ENC Update Working Group
HSSC	Hydrographic Services and Standards Committee
IEC	International Electrotechnical Commission
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IMO	International Maritime Organization
ISO	International Organization for Standards
MSC	Maritime Safety Committee
NAV	Safety of Navigation Sub-Committee
TC80	Maritime Navigation and Radiocommunication Equipment and Systems Technical Committee
TSMAD	Transfer Standard Maintenance and Applications Development Working Group

* These documents are maintained by the IHO, HSSC working group indicated.
** The list of ENC Producer Codes in S-62 is kept by the IHB.

The following have been used as references within these Specifications:

(1) IMO Performance Standards for ECDIS, 1995 edition (Resolution A.817(19) refers) and current edition (Resolution MSC.232(82) refers));

(2) IHO S-57 "IHO Transfer Standard for Digital Hydrographic Data", current edition, IHB, Monaco;

(3) IHO INT 1 "Symbols, Abbreviations, Terms used on Charts". BSH, Hamburg, current edition;

(4) IEC 62288 “Presentation of navigation related information - General requirements, methods of test and required test results”, current edition;

(5) IEC 61174 "ECDIS - Operational and performance requirements, methods of testing and required test results", current edition;

(6) IEC 60945 "Maritime Navigation and Radio Communication Equipment and Systems – General Requirements – Methods of Testing and Required Test Results", current edition;

(7) IHO S-32 Appendix 1: "Hydrographic Dictionary - Glossary of ECDIS-related terms", current edition.

(8) IHO S-60 "User´s Handbook on Datum Transformations involving WGS-84", current edition

Excerpts from the above references are quoted where they form a necessary part of these specifications.

1.2 Concept and limitations of ECDIS

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

(a) ECDIS, used together with official data, [is] accepted as complying with the up-to-date charts carriage requirements for nautical publications required by regulation V/19 of the 1974 SOLAS Convention amended in 2009. It may be noted that electronic chart systems not meeting these ECDIS specifications of IHO and IMO, or ECDIS using non-official data, are known as ECS (Electronic Chart Systems).

(b) Chart information may be used in conjunction with a radar overlay on ECDIS. Integration of tracked radar targets provided for 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 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, the ECDIS presentation of ENC data does not match the appearance of a conventional paper chart closely. Instead, there are considerable differences in symbology in shape, colour and size, and 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) ECDIS combines chart and navigational positioning information. It should be noted that modern navigation systems (e.g. differential GPS) may offer a more accurate positioning than was available to position some of the surveys from which the digital chart data ENC was derived.

(e) 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 Annex A of this Specification.

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

1.3 Function and Use of S-52

(a) The IHO has produced Specifications for the Chart Content and Display Aspects of ECDIS that appear in this publication (S-52), 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" (S-57, Appendix B.1).

(c) S-52 should be read with the IMO Performance Standards. 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.

(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 may supersede the guidance given in Appendix 1 of this Specification.

1.4 Structure of the Specifications

1.4.1 S-52 components

These Specifications consist of the following components (see Figure 2):

.1 The **Specifications for Chart Content and Display Aspects of ECDIS**, which describes the requirements and methods in relatively general terms.

.2 Annex A, the **Presentation Library** as a separate document, which gives full details of colours, symbols, symbolization instructions, etc. together with guidance on how an ENC should be displayed. A digital version is also available with Edition 3.4. Annex A itself consists of three components:

- Part I contains chart objects
- Part II contains Mariner´s Navigational Objects, such as the own ship symbol, tracks, waypoints, time tags, etc.
- The third component is the addendum to Part I which is a paper based description of the symbol library as graphics.

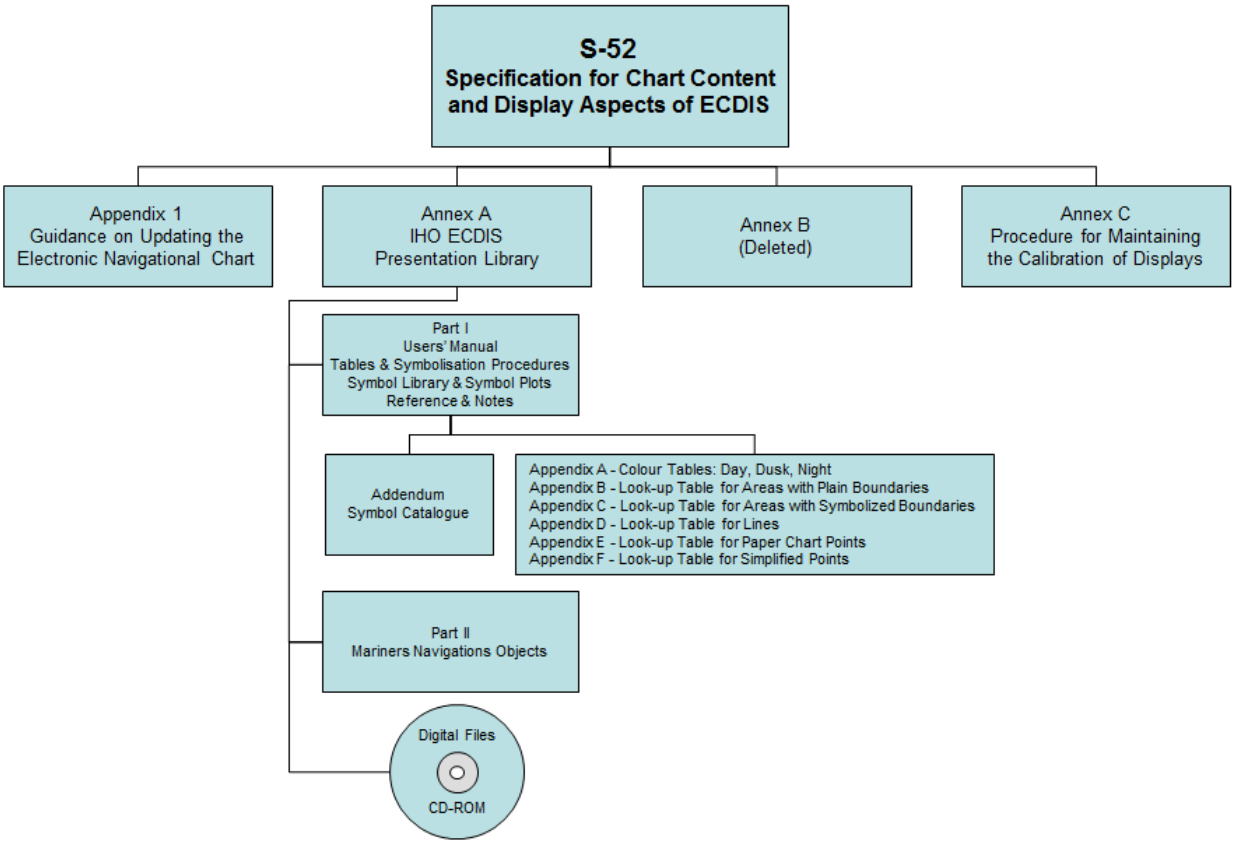
The ECDIS Chart 1 is issued together with the Presentation Library as a graphic file and is also available as a collection of the varying objects contained in a special cell in S-57 format containing generic feature objects.

.3 Annex B, which specifies procedures for initial colour calibration of displays and the verification of that calibration.

.4 Annex C, which specifies a procedure for maintaining the calibration of displays.

.5 Appendix 1, Guidance on Updating the Electronic Navigational Chart.

Figure 2 - S-52 Document Structure



1.4.2 Presentation Library and its status

The Presentation Library links every object class and attribute of the SENC, including the IEC Mariner's Navigational Objects, to the appropriate presentation on the ECDIS display. It carries all the details of these specifications, organised as shown on figure 2.

A digital version in .dai format containing the Symbol Library, Colour Tables and Look-up Tables is provided as a manufacturer's option for edition 3.4, but may not be provided for succeeding editions.

Note that the Presentation Library contains some features and procedures which are not required in the IMO standards or IEC specifications, such as four depth shades, etc. These are identified, and their use is optional.

References to the Presentation Library in this document refer to its Part I unless otherwise stated.

1.4.3 Amending the Colour & Symbol Specifications and the Presentation Library

1.4.3.1 In the life of each edition of S-52, amendments to the structure of the Presentation Library which might affect the ECDIS software (for example changing the number of fields in the look-up tables, or changing the logic of a conditional symbology procedure) will be avoided as far as possible. However incremental changes to detail in these Specifications and the Presentation Library will be required.

In a major revision**,** changes in structure will be made if necessary. Details of the amendment process are given in 1.4.4 below.

1.4.3.2 The current editions of S-52 remain in force until the issue of either:

(a) an immediate correction which is essential for reasons of safety of navigation, or
(b) a new edition which is identified as bringing outstanding deferred amendments into force.

Either of these will result in a new edition of these Specifications and/or the Presentation Library, whichever is affected.

1.4.3.3 Amendments will be distributed as described in section 1.4.4 for information or for implementation. As noted above, immediate correction amendments may have to be issued under certain circumstances.

The manufacturer should implement any immediate corrections in all his ECDIS systems fitted onboard ship, as soon as possible.

When an amendment is implemented in a type-approved ECDIS, the manufacturer should inform the type approval authority in case re-testing may be required.

1.4.4 Amendment Procedures

1.4.4.1 Definitions of three classes of amendments.

(i) "Clarification": an improvement to the wording of S-52 which does not result in any substantive change to the specifications. A substantive change is one which would result in a change in symbolization.

(ii) "Correction": a relatively specific change to S-52 to correct errors of commission or omission; or to improve the ECDIS presentation in the light of practical experience; or to take into account changes in another specification; etc.

(iii) "Extension": an extension has no immediate effect. It is a more general change to S-52 intended to improve the ECDIS presentation.

1.4.4.2 Amendments. An amendment may consist of more than one item, as follows:

- an immediate amendment will contain only immediate correction items,
- a deferred amendment may contain either:
  (a) clarifications and deferred correction items, or
  (b) extension items, which are distributed separately.

1.4.4.3 Immediate and deferred amendments. In exceptional cases, applying only to corrections and only where a correction affects safety of navigation, an immediate amendment will be made.

Normally, the implementation of amendments will be deferred until the next edition which is identified as bringing outstanding deferred amendments into force.

1.4.4.4 Edition number of these Specifications and the PresLib. The respective edition numbers of these Specifications and of the PresLib are of the form “mm.n” where “mm” is the edition number which changes for a major change in the specification, and “n” is an incremental change number which increases by one for every immediate amendment applied. The edition number does not change for a deferred amendment.

Major revisions of these Specifications and the PresLib will be identified by an increment in the "mm" number, followed by a zero, i.e. 04.0, 05.0, etc. Smaller revisions involving immediate amendments, and also revisions which are not major but bring outstanding deferred amendments into force, will be identified by an increment in the "n" number, e.g. 04.1, 04.2, etc.

It should be possible to identify the edition number in use on the ECDIS.

Edition numbers refer only to these Specifications and to the Presentation Library. Edition numbers are used in the numbering of amendment items in order to point to the particular edition of these Specifications or PresLib to which that item should be applied. For example amendment item no. “PL03.4.d7.co.2” should be applied to the Presentation Library Edition 3.4.

1.4.4.5 Amendment item identifiers. Each item within an amendment is assigned a unique identifier, with the following form "ssmm.n.aa.dd.nnn", where:

ss	=	Specifications for Chart Content and Display Aspects of ECDIS (CS) or Presentation Library (PL), depending on which the amendment applies to,
mm.n	=	the edition number to which the amendment applies,
aa.	=	deferred (d) or immediate (i) amendment followed by the sequential number of the amendment,
dd.	=	clarification (cl), correction (co) or extension (ex),

n = sequential number of the item within the amendment.

For example, look at item no: "PL03.4.d7.co.2", reading from the last number group back to the first:

"2" this is item 2 of the amendment,
"co" this item is a correction,
"d7" it is a part of deferred amendment 7,
"PL03.4" it applies to PresLib edition 3.4

(Note that:

i) the edition number of the PresLib would not advance after applying this deferred amendment.
ii) If this example had been an immediate amendment the item number would have been PL03.4.i7.co.2". In the case of an immediate amendment the edition number of the PresLib would have automatically advanced to 3.5 once the amendment was applied.
iii) The next amendment would have been numbered "amendment 8" whether it was an immediate amendment or a deferred amendment.)

1.4.4.6 Distribution

1.4.4.6.1 Immediate corrections to both these Specifications and the Presentation Library are posted on the IHO website www.iho.int. They will need to be applied to the current edition of S-52.

1.4.4.6.2 Clarifications and deferred corrections. These deferred amendments will be posted on the IHO website www.iho.int.

All existing deferred amendments will be implemented in the next edition of S-52 which is identified as bringing them into force. However an ECDIS manufacturer may implement a deferred amendment earlier if he wishes to do so, except when it is specifically stated that a particular amendment should not be implemented before the edition bringing deferred amendments into force is issued (in order to preserve uniformity in symbolising the ENC).

When an amendment is implemented in a type-approved ECDIS, the manufacturer should inform the type approval authority in case re-testing may be required.

1.4.4.6.3 Extensions are working documents, available from the IHB for test purposes on request. A description of the extension will be put on the IHO website www.iho.int.

1.4.4.6.4 Before and after plots. Where appropriate, before and after plots will, whenever possible, accompany amendments that make a change in symbolization.

1.4.4.6.5 Change control history. Amendments will include a change control history and a reference to the current editions. The history of the previous changes to these specifications and the Presentation Library is provided at the beginning of this document.

1.4.4.7 Application and entry in to force.

The grace periods from the issuing date of a new edition after which changes are required to be included in an ECDIS are:

- for new development one year
- for new selling (already type-approved before date of issue) one year

1.4.5 Note on the Specifications as a whole

The effective use of chart colours and symbols on the ECDIS display requires consideration of a variety of factors: purpose (e.g. route planning/route monitoring); bridge lighting conditions (e.g. day/night lighting); human factors (e.g. colour perception, stress); interaction with "non-chart" information on the display (e.g. ship's tracks, navigator's notes, radar); interaction with other displays on the bridge (e.g. ARPA); ECDIS interactions (e.g. relation between ENC structure and display capability); technology (e.g. display calibration); and so on.

The working group has used good advice from ergonomic professionals and ECDIS manufacturers, and has taken advantage of the limited opportunities to test the standards at sea. However the group is conscious that operational sea experience, adaptations in the mode of use of ECDIS and technology developments will probably bring about the need for considerable modifications to the standards in the future.

Reports of experience with these specifications will be welcomed. They should be sent to: The Chairman, IHO DIPWG, International Hydrographic Bureau, BP 445, MC 98011, Principality of Monaco. E-mail: info@ihb.mc.

1.4.6 Type Approval - Minor Deviations to the Presentation Library

It is acknowledged that the manufacturers of navigational equipment and software are in constant contact with ECDIS users. To allow for fast response to suggestions for improvement to the chart display, the IHO Presentation Library for ECDIS is designed to provide a framework and guideline for chart symbolization from which the ECDIS manufacturer can derive a customized Presentation Library. The following criteria shall serve as a guide for judging whether any symbolization on an ECDIS which is visibly different from the symbolization provided by the IHO Presentation Library and as demonstrated by the IHO Test Data Set print-outs is still compliant. The symbolization used:

1.) should be the same in general shape and size as the IHO version;
2.) should be clear and sharp so that there is no uncertainty over meaning;
3.) should be close enough to the IHO version to avoid ambiguity in meaning between that model and any other model of ECDIS;
4.) should use only the colours as specified in S-52;
5.) should comply with the various considerations of scientific design described in S-52;
6.) should comply with the priority of prominence on the display in proportion to importance to safety of navigation which is built into the Presentation Library, and
7.) should avoid any increase in clutter.

Any symbolization which does not meet these criteria is not compliant.

The type-approval authority is strongly encouraged to contact the chairman of the IHO DIPWG in any case of uncertainty over differences in symbolization, ideally attaching graphics to illustrate the situation. The chairman of the WG will give the reason for the particular symbolization on the Test Data Plots, and will comment on any perceived advantages or disadvantages of the manufacturer's version, with reasons.

Manufacturers, type-approval authorities, and above all mariners, are always encouraged to contact the IHO over any improvements, criticisms, questions or comments that they

may have about the ECDIS display, in order that the specifications can be kept effective and up to date. Send informal notes to the address in paragraph 1.4.5.

2 CONSIDERATIONS; ORGANISING THE DISPLAY

2.1 General Considerations

2.1.1 Design considerations

The aim is to ensure that the ECDIS display is always clear and unambiguous. As an operational navigation display, there must be no doubt what the features shown are and what they mean. The basic principle of good display design is to keep the display simple and un-cluttered, and to use well-designed symbols and colours.

A number of guidelines have been used for designing this operational ship-handling display:

- *Contrast is needed to carry information; this may be colour contrast or luminance contrast, or contrast from differing linestyles or symbol shapes. All these inter-relate with each other,*

- *When planning colours, begin with the background colours, the area fills for depth zones and land. Then work on the foreground lines and symbols, making sure they have good contrast with all their backgrounds,*

- *Use redundant coding for important features. For example the ship's planned route is a prominent dark red, which shows well against both the white deep water of the daytime colour table and the black deep water at night, and it is also a thick dotted line, the only such line on the display,*

- *Design for the worst case; fit the rest in afterwards. For the ECDIS this means setting up the display for bright sunlight, when all but the starkest contrast will disappear, and for night when so little luminance is tolerated that area colours are reduced to shades of dark grey (maximum luminance of an area colour is 1.3 cd/sq.m compared with 80 cd/sq.m. for bright sun) and only fine lines can be bright,*

- *Keep the software simple. For example, line weights are not changed for different colour tables as this would require a conditional symbology procedure.*

2.1.2 The diversity and flexibility of ECDIS

The challenge presented by the versatility of ECDIS is illustrated below:

The diversity of information may include:
- *physical chart information, (e.g. coastline, depth contours, buoys),*
- *traffic routeing; specified areas; cautions; etc.,*
- *supplementary HO information from light list, etc.,*
- *mariner's notes; additional local chart information; manufacturer's information,*
- *chartwork such as planned route; electronic bearing lines and range rings; etc.,*
- *own ship's position and velocity vector; ship's head and rate of turn; past track,*
- *fix accuracy, or position check from secondary positioning system,*
- *possibly, shiphandling options, based on ship's characteristics, alphanumeric navigation information (ship's latitude, longitude, heading, course, etc.),*
- *information from radar and other sensors,*
- *information from AIS,*
- *navigational indications and alarms generated by ECDIS,*
- *possibly, telemetered information from shore authorities, (traffic, real-time tides etc.),*

- *possibly, ice information,*
- *reminders, (e.g. time to contact pilot station),*
- *possibly, messages from other displays (e.g. alarm on engine room display).*

The flexibility of presentation may include:
- *displaying/removing various types of chart and non-chart information,*
- *selecting standard chart display or a thinned out display, and full or simplified symbols,*
- *using cursor interrogation for further detail,*
- *overlaying/removing radar video or radar target information (in order to: confirm ship's positioning; aid radar interpretation; show the entire navigation situation on one screen),*
- *overlaying/removing various other sensor information, or information telemetered from shore,*
- *changing the scale or orientation of the display,*
- *selecting true motion or relative motion,*
- *changing screen layout with windowed displays, text information in the margins, etc.,*
- *possibility of pull-down menus and other operator interaction devices being alongside the operational navigation display and so interacting with it,*
- *giving navigation and chart warnings such as "too close approach to safety contour"; "about to enter prohibited area"; "overscale display"; "more detailed (larger scale) data available"; etc.,*
- *possibly, a diagrammatic representation of a computer evaluation of grounding danger,*
- *possibly, a diagrammatic representation of the immediate vicinity of the ship to aid in close quarters manoeuvring,*
- *other future developments. (Further presentation requirements and techniques appropriate to ECDIS are likely to be developed in future).*

2.1.3 Colour discrimination on the display: perception effects and display calibration

Since colour is a prime means of distinguishing features, the maximum range of colours should be available. However the colours selected must be such that they can be clearly discriminated by a mariner with normal colour vision, and colour induction effects must be avoided (for example a small green object on a saturated blue background will tend to appear yellow).

Absolute accuracy in colour reproduction is not required but relative colour fidelity is important. To ensure clear contrast between colour-coded features the display screen should be calibrated before use, and this calibration should as far as possible be maintained while in service. If this is not done, lines, symbols, and area shades may become indistinct, and information may then be lost or become misleading. This problem is discussed in section 4 and 5 and Annexes B and C.

The ambient lighting on the bridge varies between the extremes of bright sunlight, which washes out information on the display, and night, when the light emitted by the display has to be low enough that it does not affect the mariner's night vision. These specifications have been designed to meet these difficult requirements rather than less demanding normal day conditions.

2.2 Operational Considerations

2.2.1 Similarity to the paper chart

Because much experience is embodied in the paper chart, and to avoid confusion in the extended period while paper charts and ENCs co-exist, the two presentations should be similar wherever possible. While recognising that the application of ECDIS extends beyond that of the paper chart, paper chart practice should be followed unless otherwise specified in these specifications.

However, because the ECDIS display uses emitted light, compared with reflected light for the paper chart, ECDIS must switch to a negative image of the chart at night, using a dark background in place of the white background of the paper chart, in order not to impair night vision.

In addition, studies and early experience indicate that the need for good visual communication between the ECDIS display and the user may require simplification and change of symbols traditionally used on paper charts. Some alternative display methods have been introduced as options in the Presentation Library.

2.2.2 Distinguishing between features and between sources

It should be possible to distinguish clearly on the display between a very large number of features. These are listed as classes in section 2.1, such as different water depths, various types of buoys and beacons, chart lines compared with navigators lines, and so on. It should also be possible to distinguish between sources, such as ENC information; hand-entered N to Ms, local information, and mariner's notes and manufacturer's additional information.

The means available for coding these distinctions are limited. They include:
- coloured areas, lines and symbols,
- coded lines (e.g. dashed) and areas (e.g. patterned),
- symbols,
- text labels (but these cause clutter),
- cursor interrogation,
- switching a class of information on/off either automatically or by hand,
- splitting information into separate windows,
- common sense interpretation (e.g. a red buoy, a red arc indicating a light sector, and a dotted red line indicating planned route, are unlikely to be confused, even though all are coloured red).

Because there are more demands for making distinctions than there are coding methods available, duplicate coding will sometimes be unavoidable, as in the above example.

Distinctions should be made logically and systematically, giving priority to features that have greater operational significance.

2.2.3 Route Planning / Route Monitoring: Look-ahead

The IMO Performance Standards for ECDIS distinguish between the route planning and route monitoring modes of using ECDIS. It is expected that in route planning the display will be viewed, without urgency, from the normal screen viewing distance of about 70 cm, and so the display can contain considerable detail without causing confusion.

Experience up to now of route monitoring indicates that in that mode the display will be used for immediate decision-making, sometimes under stress, and that it may be viewed from a distance of several metres. The route monitoring display should therefore be planned to present only the immediately relevant information, in a manner that ensures it can be taken in quickly, clearly and without ambiguity.

In particular, text is difficult to read and tends to cause clutter. It should be kept to a minimum on the route monitoring display.

If there is a delay in preparing data for the route monitoring display (*e.g. due to a request for scale change, or look-ahead to another area*) the ECDIS should inform the mariner. The previous display should be maintained, and updated, until the new display is ready for draw.

Because the display screen is smaller than the paper chart, the IMO PS specify that the ECDIS display should have the capacity for local as well as distant look-ahead. To provide this will be an important consideration in presentation design. While, for example, manufacturers may provide a smaller scale look-ahead display by windowing, these Specifications must take into account the fact that important features such as lights, future waypoints, etc., may often lie out of sight off the screen.

2.2.4 Important features should always be clear and conspicuous

These specifications are designed to make important features (e.g. own-ship symbol, own-ship safety contour, etc.) more conspicuous than minor features.

Ergonomic specialists point out that, to avoid ambiguity, important features, such as those in the IMO PS Display Base, should be redundantly coded. (Two examples are the own-ship safety contour, which is a thick line and has a sharp change in the colour of the depth shade, and the planned route, which is red and is the only heavy dotted line on the display). This serves to improve the visibility of important features on the route monitoring display, and it also helps to distinguish features in bright sun or at night.

Chart features should normally be written over the radar image. See section 2.3.2b for details.

2.2.5 Scale and range indicators

The "(indication of) scale and range" required as part of the Display Base by IMO PS Appendix 2 is intended to give the mariner an immediate appreciation of (a) how close to his ship are hazards seen on the display, and (b) how much time he has to decide on any necessary avoiding action. Two indicators should be provided:

- a one-mile scale bar for a large scale display and a ten-mile latitude scale for a small scale display (see section 3.2.3(9) for details).
  This indicates roughly how close display features are; the cursor or VRM should be used for exact range measurement,

- an emphasized six-minute marker on the course and speed made good vector (see IEC symbol 3 and Part II of the Presentation Library).

2.2.6 Effect of bright sunlight, and the dark night display

It will not be possible to read the ECDIS display if the sun is shining directly onto it. Even diffused bright sunlight on the bridge tends to wash out the colours of the display so that

they tend to look grey. The "day" colour table has strong contrast to combat this effect. But it helps to shield the face of the screen.

The face of the display screen acts as a mirror to white shirts, sometimes seriously obscuring the chart display. Wearing a black cotton (not synthetic) watch-coat will greatly improve viewing on a sunlit bridge.

At night several factors combine to reduce colour discrimination:

- *the display must be darkened to a level at which it does not impair the mariner's night vision, hence his ability to keep a look-out,*
- *the ability of the human eye to distinguish colour is reduced at low light levels,*
- *the display screen is less capable of discriminating between colours at low levels. A dark colour may drop below the screen cut-off and become black.*

Note that ships tend to arrive in port at 0800 and sail by 1700, to reduce port charges; thus the critical passage through the port approaches often occurs at night.

The night colour tables are designed to overcome night viewing problems as far as possible, and some other measures are taken as well:

- *important features are distinguished by redundant symbol/linestyle coding as well as colour, (e.g. own-ship is a unique double circle , in heavy white at night),*

- *if it happens that the entire night display area consists of only one depth zone, the mariner will not be able to judge by absolute colour discrimination which of these depth zones the ship is in. A clearly visible "depth less than safety contour" pattern is provided to indicate shallow water (section 3.2.3(15)),*

- *the mariner should be advised to adjust the night display of a display screen by contrast control, not by brightness, which may shift dark colours below cut-off.*

Use of a 0.9 ND optical filter over a relatively bright display is a better solution for night viewing than reducing the display brightness.

2.2.7 Location for the ECDIS display

Experience in sea tests has shown that it is important to select an appropriate location for ECDIS. For example:

- the navigator should be able to see the display clearly, and to reach the controls, from his normal conning position,
- it is an advantage to locate radar and ECDIS side by side,
- the face of the display should be shaded from direct sunlight, and the display should not be located where the viewer may find the sun directly behind it.

2.2.8 Displaying text

The power of ECDIS lies in conveying operational information quickly, clearly and comprehensively through a picture, a birds-eye view of the ship and her surroundings. Text should be avoided on this graphical operational display unless it is absolutely necessary, because it conveys limited information and, since it has to be written large to be readable, causes confusing clutter.

However some text may be unavoidable, both on the operational display (e.g. buoy numbers if these are required for VTS reporting) or on a separate text display (e.g. course to steer, heading; alarms; tidal information; user interaction to control the ECDIS, etc.).

(See also sections 2.3.3c, 3.1.5 and 3.4, and section 7.1.3 of the Presentation Library).

2.2.9 Flashing to draw attention

The capability to flash a symbol should be used only rarely in very special cases. It should be used to draw attention rather than to simulate a real flashing object.

2.2.10 Operator control of information should be effective and simple

In order to handle the diversity of information and flexibility of display options provided by ECDIS without confusion, the presentation of information must be designed carefully. In particular, the operator interface should provide clear, simple control of the display such that there is no danger of confusion, or of failure to retrieve important chart information in a stressful situation.

"Viewing Groups", as an optional way of giving the mariner control over the information on the display, are described in section 8.3.4.4 of the Presentation Library.

The mariner should have full control over any automatically linked display changes, including the option to inhibit such changes. Examples of linked display changes include changing the source of data when a larger scale becomes available, or displaying lights automatically when the mariner selects the "Dusk" colour table.

There should be enough commonality between the user interfaces of the various makes of ECDIS that a pilot, or watch officer new to the ship, can use an unfamiliar type of ECDIS. However, over-strict standardisation will hamper development of an effective interface.

2.3 Organising the Information for Display

2.3.1 Display of non-chart information

2.3.1a Distinguishing between chart data and additional data

IMO PS section 1.5 states that ECDIS should enable the mariner to execute the chartwork at present performed on the paper chart and section 3.3 states that the SENC may contain information from other sources than ENCs. This specification requires that ECDIS distinguish between chart data and additional data from users (mariners) and manufacturers. The following colour and symbol usage for mariners and manufacturers data is designed to implement this while ensuring the display remains clear and uncluttered.

Part II of Annex A "Presentation Library" describes "Mariner's Navigational Objects" for route planning and route monitoring chartwork, and for adding mariner's and manufacturer's information to the SENC. The descriptions are in the same format as chart objects, in order to avoid the ECDIS having to deal with two differently coded types of data. The colours, symbols, categories and display procedures that apply to all these objects are included in Part I of the Presentation Library, along with the procedures for chart objects.

Mariners may alter the IMO categories for Mariner's Objects (but not for chart objects). Note, however, that IMO PS 11.4.1 requires that own ship and selected planned route should always appear, and should therefore remain in Display Base.

Note that Mariner's Objects should be kept independent of chart data in the SENC, and that mariners' information does not need to be split into cells.

In referring to Mariner's Objects it is important to distinguish between:

"Add/Enter", "Revise" or "Delete" mariner's or manufacturer's information; this refers to the contents of the SENC, and:

"Display" or "Remove" the information; this refers to the ECDIS display.

2.3.1b Mariner's Information on the route monitoring display

In addition to the ability to enter manual chart corrections and to carry out route planning and route monitoring chartwork, the mariner should be provided with the capability of adding at least the following symbols, lines and areas to the SENC, and should be able to revise or delete them:

.1 the caution “(!)” or information “[i]” symbol section 3.2.3 (6b), (6c), used to call up a note on the text display by cursor picking,
.2 simple lines and areas with or without colour fill, set up for cursor picking to give an explanatory note in the text display,
.3 any of the chart symbols in the Presentation Library,
.4 text notes.

Non-ENC chart information added by the mariner should be in normal chart colours, identified as described in the Presentation Library, Part I, section 8.7.2.

Other information added by the mariner should be distinguished by the colour orange (colour token NINFO) except for colour fill, which should use transparent yellow (colour token ADINF). (*Transparent orange tends to look magenta in colour over blue backgrounds*).

Mariner's information should not overwrite ENC information.

The symbols and instructions for using the IEC "Mariners' Navigational Objects" are given in Part II of the Presentation Library.

2.3.1c Manufacturer’s Information on the route monitoring display

.1 If the manufacturer should add non-chart information to the SENC, he should use the following symbols, lines and areas:

(i) the circled “!” caution symbol SY(CHINFO11), or boxed “i” information symbol SY(CHINFO10), used to call up a note on the alphanumeric display by cursor picking,

(ii) simple lines, or areas without colour fill, set up for cursor picking to give an explanatory note in the alphanumeric display (colour fill should not be used).

(iii) Non-chart information entered by the manufacturer should be distinguished by the colour yellow (colour token ADINF). It should not overwrite HO ENC information.

.2 If the manufacturer should add non-HO (non- ENC) chart information to the SENC it should be symbolised in the same way as HO chart information and distinguished from HO chart information as described for the various cases below:

(i) Limited non-HO data is added to existing HO data to augment the chart information. Each object should be marked by the special identifiers described in the Presentation Library, section 8.7.2.

(ii) An area of non-HO data is located in waters for which HO chart data exists; it is superimposed on the HO data. In some cases the non-HO data may be more appropriate for the intended purpose, for example it may be more detailed.

In this situation it is at the mariner's discretion whether to use the HO or the non-HO data.

If the mariner selects the non-HO data, the boundary of this data should be identified on the ECDIS display by the line LC(NONHODAT) and the warning "Unofficial data displayed; refer to official RNC or paper chart" should be displayed.

Note that the LC(NONHODAT) is a "one-sided line", and the boundary of the area of non-HO data must be drawn according to S-57 rules to ensure that the diagonal stroke of the line is on the non-HO data side of the line. More details are given in Presentation Library, section 12 conditional symbology procedure DATCVR section 2.1.

(iii) An area of non-HO data is located wholly outside the area covered by HO data (although it may share a boundary with the HO data) but is shown on the same display as HO data. The non-HO data should be bounded by the line LC(NONHODAT) and the warning "Unofficial data displayed; refer to official RNC or paper chart." should be displayed.

(iv) The entire display contains nothing but non-HO data. The warning "No official data available; refer to official RNC or paper chart." should be displayed. In this case, special identifiers need not be used."

.3 The mariner should be able to remove all manufacturer's information if the need should arise.

2.3.1d Displaying the radar image

The radar image may be displayed by an opaque overlay or a transparent overlay, using colour tokens RADHI and RADLO. Further details are given in section 4.2.7.

2.3.1e Displaying pick reports

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 ENC, e.g. cell name, compilation date, date of issue;
- record of ENC-updates;
- ECDIS Chart 1;
- [colour differentiation diagram];
- [black adjust symbol for contrast adjustment];
- list of categories which are removed from Standard Display;
- Edition number of Presentation Library in use.

2.3.1f Units

There should be no ambiguity about the units in use at a particular time. The units listed below should be indicated in the display legend:

(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.

2.3.1g Legend

A standard legend of general information relating to the area displayed, applicable to the position selected by the mariner, 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 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

2.3.2 Priority of information

2.3.2a Priority layers

The IMO PS divides SENC information into three categories that determine what data is to be on the display: Display Base (always present on the display); Standard Display (the default display); and Other Information (displayed on demand). (IMO PS section 3 and Appendix 2). (See section 2.3.3a).

There are 10 priority layers for the drawing sequence of the data on the display:

(1) ECDIS visual alarms/indications (e.g. caution, overscale)

(2) HO-data: points/lines and areas + official updates

(3) NtMs, 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

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.).

Category (7) should have a radar off switch to facilitate its removal.

The look-up tables and conditional procedures of the Presentation Library assign a category, and a display priority (drawing sequence), to every object (object class-attribute combination) in the ENC.

2.3.2b Radar priority

The priority of HO chart data over radar is carried out by the single action "remove radar" control (IMO PS 7.2). When present, the radar data is always written over the eight opaque area fills (see 3.1.2). Chart line and point features should normally be written over the radar image, with some exceptions, as described in the "over-radar" field of the Presentation Library look-up table. But in order to meet the requirements of IMO PS 11.4.14 to adjust the ship's position, the ECDIS may incorporate the capability of changing the radar priority of the Presentation Library. Operation of this feature should be clearly indicated.

2.3.3 Display categories

2.3.3a IMO categories

The IMO "Standard Display" provides a starting point. It is a list of objects that the mariner may either add further objects to, or remove objects (except Display Base) from, in deciding what is to be displayed. Note that as soon as any object on this list is removed from the display, or any object not on this list is added to the display, the display no longer shows the IMO "Standard Display".

The IMO "Display Base" is that part of the Standard Display that should never be removed. It is a list of basic objects which the IMO consider are required at all times, in all geographic areas and under all circumstances. Note that the IMO do not intend the Display Base to be sufficient for safe navigation on its own; therefore it should not be a display option to "Show Display Base" without any additions.

The IMO category "Other Information" contains every object in the SENC which is not classed as "Standard Display".

The mariner should be able to remove information selectively from "Standard Display", except that he cannot remove any object of the "Display Base". And he should be able to add selectively to the Standard Display any items of the "Other" category.

Field 6 of the look-up table of the Presentation Library assigns the IMO category in detail to every object in the SENC, including Mariner's Navigational Objects. The mariner may override the category for mariner's objects, but not for chart objects.

2.3.3b Selecting objects for the route monitoring display

Section 5.5 of the IMO Performance Standard requires that "It should be easy to add or remove information from the ECDIS display". For example, the mariner might want to retain "caution areas" from the Standard Display (see Table 4 of this document) but remove the remaining thirteen areas, including such as protected areas (e.g. "game preserve"). Another example is that he might want to add soundings from "Other", but omit submarine cables (which cause serious clutter at certain ocean terminals).

As an aid to adding and removing information from the display, field 7 of the look-up table also assigns every feature in the SENC to a viewing set, and these sets are arranged in groups of ten which are related to the lettered groups of INT 1 for the paper chart, a classification which is familiar to the mariner. The details are given in the Presentation Library, Part I, section 8.3.4.4 and Table 13.2.

The manufacturer is responsible for organising SENC features, viewing sets and viewing groups for display in such a way that the mariner has reasonable flexibility in selecting what he sees without the selection process becoming too complex. Note that it is not necessary to provide access to each feature, viewing set or even viewing group individually.

Note that combined groups which include features from different IMO categories should not be linked permanently, since doing so would, in effect, drag additional features into the Display Base or Standard Display. For example, if a combined group includes soundings (which are "Other") and lights (which are "Standard Display"), this link should not cause soundings to be shown with the Standard Display on first switching on the ECDIS.

2.3.3c Selecting text for the route monitoring display

The ECDIS manufacturer should provide the mariner with control over the selection and display of text on the route monitoring display.

Text should not appear automatically whenever the object it is associated with appears on the display. It should always be possible to remove text independently of the object. The IMO Display Category for text is "other".

As a guide to adding and removing text from the display, the Presentation Library distinguishes between "Important text" and "Other text", and provides suggested groupings for text display, in section 7.1 and Table 13.3 of the Presentation Library.

Section 3.4 of this document gives further details on text.

2.3.3d Linkages in selecting mariner's options

Many other options are available to the mariner in addition to those discussed above. Although these may at first be confusing, linkages which reduce these options but which also reduce the performance of the ECDIS should not be used. For example:

- lights should not be automatically displayed when the night colour table is selected. *(Lights cause clutter and under certain circumstances the mariner may not want them on the display.)*

- as stated in section 3.1.1, symbolized area boundaries should not be automatically selected when paper chart point symbols are selected. *(Symbolized area boundaries are needed for large scale displays showing a number of overlapping areas, whereas the selection of paper chart point symbols is a personal preference and is independent of display scale.)*

Because vessels vary widely in their requirements and their operational procedures, linkages between options which reduce the flexibility of the ECDIS should be avoided.

2.3.4 Displaying ECDIS updates

For guidance on updating the ENC, see Appendix 1. This section deals with how updates should be displayed. It is keyed to the relevant sections of the IMO PS.

IMO PS 4.5 Automatic and semi-automatic updates: these should be displayed in the same manner as ENC information, using standard colours and symbols.

IMO PS 4.6 Manual updates: these should be displayed in standard colours and symbols and distinguished as described in the Presentation Library , Part I, section 8.7.

IMO PS 4.8 The mariner should be able to display updates for review as follows:

For automatic updates: the manufacturer should provide a means of distinguishing these. *One method suggested is to identify automatic updates temporarily in the same manner as manual updates. The temporary*

	switch-on/switch-off of the identifiers would distinguish automatic from manual updates.
For manual updates:	display all SENC information. The manual updates should be distinguishable as described in the Presentation Library , Part I, section 8.7.

3 SPECIFICATIONS FOR SYMBOLISING AREAS, LINES & POINTS AND FOR TEXT

3.1 General

3.1.1 Mariner's options in symbols and linestyles

Although buoys and beacons are aids to navigation, they may also become a collision hazard if their presence is not noticed. The Presentation Library therefore provides, as a mariner's option, an alternative set of symbols for buoys and beacons which are more prominent than the paper chart symbols, particularly on the night display. Two look-up tables are provided, to display either simplified or paper-chart type buoy and beacon symbols.

Areas are difficult to symbolise on an ECDIS, for reasons given below. The Presentation Library therefore provides, as a mariner's option, symbolised area boundary linestyles for use on large scale displays. These make the areas easier to figure out than the plain linestyles recommended for small scale displays, where symbolised lines would cause clutter. Two look-up tables are provided, to display either symbolised or plain area boundary linestyles.

The mariner should be given the option of selecting the buoy symbols and area boundary linestyles that best fit the situation, without linkages. For example, boundary linestyle should be selectable independent of the choice of buoy symbol, and independent of the actual display scale.

3.1.2 Areas

The moving display window of ECDIS, coupled with the possibility of the mariner using a large scale (small area) display window that could lie wholly within a given area, so that the border is not visible, give problems in symbolising.

Areas can be identified both by symbolising the area itself and by symbolising its boundary.

The mariner has to be made aware of any important area, and its identity, but the symbolising should not cause clutter.

3.1.2.1 The following methods of symbolising the area are used:

.1 Opaque colour fill: depth areas and land areas. These consist of (with colour token):

deep water, and also user interface - background		*(DEPDW & UIBCK)*
medium deep water	*(DEPMD)*	
medium shallow	*(DEPMS)*	
very shallow		*(DEPVS)*
intertidal area		*(DEPIT)*
land in general		*(LANDA)*
built-up areas		*(CHBRN)*
no chart data		*(NODTA)*

Eight colours are used, which matches 8-bit graphics devices. They form a subdued background giving maximum contrast to foreground information, including the radar image, all of which are drawn on top.

.2 Semi-transparent colour fill: Depth zones should show through this, and all other information is drawn on top, e.g.:
- *traffic separation zone and mariners chartwork area fill.*

.3 Patterns of lines: for important area features in busy waters; the pattern should not be distracting, e.g.:
- *traffic junctions - closely spaced magenta diagonal lines - AP(TSSJCT 02),*
- *grossly overscale part of chart display compiled from two compilation scales - faint grey vertical lines - AP(OVERSC 01)*

.4 Continuous textures: need to show up in small areas; may be used for features in busy waters and so should not be distracting, e.g.:
- *area with no data - AP(NODATA 03),*
- *dredged area - ordered dot pattern, AP(DRGARE 01),*
- *ice area - random short lines, AP(ICEARE 04).*

.5 Patterns of symbols: used in less busy areas, or displayed temporarily and then removed, so can be more distracting, e.g.:
- *aquaculture - AP(MARCUL 02)*
- *quality of bathymetry - AP(DQUAL 11)*

.6 Single centred symbol: used for important features in busy waters, such as traffic lanes, restricted areas. The symbol is large to give it visibility, but faint in colour to reduce clutter, e.g.:
- *traffic lane - SY(TSSLPT 51)*
- *anchorage prohibited or restricted - SY(ACHRES 51)*

These artificial areas are difficult to symbolise because one symbol must apply to all sizes, for example from the case when the display window is wholly inside a traffic lane, to an "area to be avoided" the size of a postage stamp on the display.

In addition, some areas such as traffic routeing systems often have multiple conditions (e.g. “traffic direction” + "deep water route" + "entry restricted"). Many of the symbols in the Presentation Library have deliberate offsets from the pivot point to avoid overwriting.

The Presentation Library provides large transparent symbols for centred symbols and small symbols for pattern coverage:

(a) Centred symbols are used where it is important to avoid clutter, particularly in traffic lanes. The symbol must be placed within the area. See Presentation Library 7.4 for one method of centring a symbol.

(b) (i) For a pattern of small symbols, the spacing between the symbols lies within the limits:
minimum distance apart: 2 cm.
maximum distance apart: 10 cm.

(ii) It would be ideal to space the symbols further apart for a large area and closer together for a smaller area. However reliable symbolising is more important, and a constant fixed-space symbol pattern should be used until "scale dependent spacing" has been developed and proved. See Symbol Library in Addendum.

(iii) While a good-looking solution is desirable, identification without clutter is more important. Pattern symbols need not line up exactly between cells; and they need not stay in the same geographic position on re-draw.

(c) It should always be possible to identify an area by cursor picking on any point within the area.

(d) If the ECDIS offers a ship-centred display mode, the manufacturer should avoid overwriting between the ship symbol and a centred symbol for an area which wholly encloses the display (for example the traffic direction arrow (TSSLPT) in a very large traffic lane such as Dover Strait).

3.1.2.2 Symbolising the area boundary:

.1 *Discussion: on a large scale display of busy waters the boundaries of many areas may appear without the whole of each area being on the display. While the centred symbols will be there, it will often be difficult to know which area they apply to. It may also be difficult to decide which side of a particular boundary line is the inside of the area.*

To help clarify this situation, the Presentation Library includes two area look-up tables: (i) the "symbolised area boundaries" table, using symbolised and "one-sided" versions of the boundary lines of important areas. This is for use at large scale as a mariner-optional alternative to (ii) the "plain area boundaries" table, which uses simple linestyle area boundaries. This will normally be preferred at smaller scales to avoid clutter.

.2 *Symbolised complex linestyles: to identify the area, symbols (or letters acting as symbols) are embedded in the line, e.g.:*
anchoring prohibited or restricted - LC(ACHRES 51)
deep water route - LC(DWRUTE 51)

.3 *One-sided complex linestyles: to identify the side of the boundary line on which the area lies, restricted areas use the traditional "T" linestyle of the paper chart, e.g.:*
entry prohibited or restricted - LC(ENTRES 51).

Other important areas use a boundary linestyle like the cold front on a weather map, e.g.:
waiting area - LC(CTYARE 51)
fairway - LC(NAVARE 51)

.4 *Simple linestyles: dashed lines are generally used for area boundaries. In ECDIS, the dotted line is reserved for the danger line around foul areas, etc.*

.5 *Colours: the colour magenta is used for important areas, grey for less important areas, e.g.:*
traffic areas, caution areas - magenta
harbour limits - grey

3.1.3 Symbol Specifications: Presentation Library

All symbols are specified in the S-52 Symbol Library for ECDIS, which is in the addendum to the Presentation Library.

Some object classes do not have a symbol (e.g. territorial sea). Such "no symbol" objects may be picked up by cursor interrogation of the area.

Should an "unknown object" occur in the SENC which is not adequately defined or for which no symbol exists, its presence should be indicated on the display by a magenta"?" SY(QUESMRK1) with the IMO category "Standard Display".

Some objects are symbolised differently depending on circumstances (for example the symbol for a contour depends on whether it is the safety contour.) The Presentation Library includes conditional symbology procedure diagrams for features whose symbols cannot be supplied by a fixed look-up table. Some of these procedures are unavoidably complex, and they should be evaluated carefully.

3.1.4 Paper chart INT 1 and ECDIS Chart 1

IHO INT 1 for paper charts is both the starting point for the new simplified symbols and the check-list for paper-chart type symbols on the ECDIS. The new symbols simplify the paper chart symbols where operationally proved necessary, to improve readability and drawing speed on the display; they also symbolise new features introduced for ECDIS, such as the Daymark.

Note: the digital version of ECDIS Chart 1 depends on a volunteer to update it, and it may be omitted from editions after 3.4.

Section 14 of the Presentation Library includes an ECDIS Chart 1, a graphical index of ECDIS symbols including both simplified and paper-chart point symbols, and also the symbolized lines and area boundary linestyles. This is intended to familiarize the mariner with the colour and symbol coding used by the ECDIS. The symbols are grouped according to INT1, which is familiar to the mariner, but are numbered with a look-up sheet, not labelled. A digital version of ECDIS Chart 1 is part of the PresLib; the manufacturer should provide linking by cursor interrogation between the symbols and the explanations given in the symbol library.

The ECDIS Chart 1 is intended for use off-line and in route planning. It is not needed during route monitoring, when the mariner can use cursor enquiry to find the meaning of symbols.

Technical details of the digital ECDIS Chart 1 are given in sections 18.8 and 19.3 of the Presentation Library.

3.1.5 Size of lines, symbols and text; fonts

Lines and symbols and text should be large enough that they can be easily interpreted at the operational viewing distance. This will be about 70 cm for route planning, but experience to date indicates that the viewing distance for important features during route monitoring may be several metres.

Human factors experts quote a minimum requirement that symbols and characters subtend 20 arc minutes at the observers eye (for example, a symbol viewed from 70cm for route planning should be about 4mm in size, 1.5 times the size of a normal chart symbol. Two times chart size is a good general rule.). Symbols and characters important for route monitoring may have to be significantly bigger.

For clear representation, symbols require a minimum number of screen units (pixels), depending on their complexity. A simple chart symbol should extend about 12 pixels (that is about 4 mm for an IHO standard screen).

The minimum sizes for all symbols should be as shown in the Presentation Library.

In addition, the symbols should always be drawn with at least the same number of pixels as are required to draw the symbol at the size defined in the Library for the minimum resolution and minimum chart display area (270x270 mm). *That is, the minimum height in pixels of a symbol is: (symbol height in mm) divided by 0.312 mm (where 0.312 mm is the "pixel size" for the minimum size chart display in Section 5.1 – Physical Display Requirements).*

When the display scale is enlarged by zooming in, it should be possible to hold symbol size constant. The same applies to text. Symbol and text size should never be decreased when zooming out.

The text on the ECDIS should be readable from 1 metre.* Sans serif, non-italic fonts should be used. The computer ø should not be used.

Because several appropriate commercial fonts are available, the Presentation Library does not specify alphanumerics, except for soundings. The manufacturer should make his own arrangements for the use of a font. A plain, clearly readable font such as Univers should be used. In most fonts, pica 8 is too small to read.

**IEC 60945 specifies that character size in mm be not less than 3.5 x the viewing distance in metres. Hence "readable from 1 metre" requires that characters be not less than 3.5 mm in size.*

3.1.6 Display Orientation

It should always be possible to display the chart north-up (IMO PS section 8.1), but other orientations are allowed. *(Human factors specialists point out that course-up orientation offers some safety advantages, and operational reports support this)*

Symbols and text should always be drawn screen-up, no matter what the orientation of the screen may be. Symbols which include “rotate” in the symbology instruction (eg light flares) should be rotated with respect to the top of the screen. However symbols that are oriented according to an S-57 attribute such as ORIENT should be oriented with respect to true north. Further details are given in the Presentation Library, Part I, section 7.2.3.

If the display is oriented course-up, the orientation should not be altered too frequently, in order to avoid jitter from frequent rewriting of chart information.

The north arrow is always required on the display, as part of the IMO Performance Standards Display Base.

3.1.7 ENC scale; Graphical Index of ENCs by Navigational Purpose; Limit of HO data

.1 ENC scale. The compilation scale of the ENC is the scale at which the ENC was designed to be displayed. It may not be the same as the scale of the source data. As required by IMO Performance Standards, section 6.1.1, an overscale indication should be shown whenever the mariner selects a display scale that is larger than the compilation scale. See Presentation Library, Part I, section 12.2.2 DATCVR for details.

.2 Automatic overscale at a scale boundary. Where ENCs of different navigational purpose overlap, the ECDIS display of the overlap area should show two “chart compilation scale boundaries”, at the beginning and end of the overlap. Beyond one boundary the part of the display taken from the smaller scale ENC will often be grossly overscale. (See section 3.2.3 8(b))

Only the major changes in compilation scale resulting from a change in “navigational purpose” should be shown as scale boundaries on the display. Small changes in compilation scale within a navigational purpose should not be shown.

The Presentation Library, Part I, section 12.2.2 DATCVR, specifies how the scale boundaries and the overscale area should be symbolised.

When the display cannot 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).

.3 Graphical Index of ENCs by Navigational Purpose. Without cursor enquiry of the chart area it will not always be clear what compilation scale applies to a given part of a mixed source display. S-52 requires a graphical index of the navigational purpose of the data to clarify the situation. This is also needed for route planning.

.4 Limit of HO data. The end of HO chart data on this graphical index defines the limit of HO ENC coverage. Details are given in the Presentation Library, Part 1, section 12.2.2 DATCVR.

3.1.8 Chart data quality indicator

A bathymetric data quality indicator by zones of confidence (M_QUAL CATZOC) will cover the entire area of depth data or bathymetry for the ENC (although not all data will be assessed initially). The table of "CATZOC" values giving the meaning of each zone of confidence should be readily available to the mariner.

3.1.9 Cursor enquiry

It should be possible to call up any of the information associated with an object by cursor enquiry on its symbol. This should extend to areas (restricted area, depth area, etc.) and to "no symbol" areas (territorial seas, etc.) and meta-areas (information about the area such as compilation scale, etc.). The search for area information needs to extend only to the cell boundaries enclosing the position of the cursor.

See Presentation Library, Part I, section 8.8 for further discussion.

3.2 New Symbols for ECDIS

(These are illustrated in the ECDIS Chart 1, provided in the Presentation Library).

3.2.1 Types of new symbols

Four types of new symbols have been introduced for ECDIS:

(1) Special ECDIS chart symbols to identify unsafe depths, such as the safety contour, safety depth, isolated dangers etc.

(2) Optional simplified chart symbols for buoys and beacons, and symbolized area boundary linestyles.

Since buoys and beacons are a potential hazard as well as an aid to navigation, simplified buoy and beacon symbols have been designed which are more compact and more prominent than the paper chart symbols, particularly at night.

On a large scale display, the boundary lines of areas can become confusing; symbolised area boundaries have been designed which identify the type of area involved and also indicate on which side of the boundary line the area lies.

The ECDIS should provide the mariner with the option of using either the traditional paper chart buoy and beacon symbols or the new simplified symbols, and either the symbolized or the plain area boundary linestyles, as best fits his purpose. The symbol tables of the Presentation Library are organised to facilitate these options.

(3) New chart symbols, such as north arrow, scale boundary, depth area less than safety contour, etc., needed to explain the more flexible, electronic display based, presentation of ECDIS.

(4) IEC Mariner's Navigational Elements developed by IEC for IMO, which include the important planned route and own ship symbols. *The authority for these features is IEC Standard 61174 and IEC 62288, and they are included in the Presentation Library for convenient reference by agreement with the IEC. They are described by objects and attributes in the same manner as chart features so that only one symbolising routine is required (see Part II of the Presentation Library).*

3.2.2 Special ECDIS chart symbols to identify unsafe depths

The ECDIS highlights in new ways four features that are important for safe navigation. These are the safety contour, depth shades, the safety depth and isolated dangers:

(1) The own-ship safety contour, selected by the mariner from among the contours in the SENC, is double-coded by a thick line and a prominent change in depth shade.

If the safety contour selected by the mariner is not available in the SENC, the ECDIS should default to next deeper contour and inform the mariner. If, when the ship moves onto a new chart, the safety contour previously in use is no longer available, the ECDIS should again select the next deeper contour, and inform the mariner.

If the mariner does not select a safety contour, the value should default to 30 m.

See Presentation Library, Part I, section 12.2.5 conditional procedure DEPCNTnn for details.

(2) Depth zone shades, defined by the safety contour and selected shallow and deep contours and the drying line.

The safety contour defines two depth zone shades and the drying line a third:

deep water:	deeper than the safety contour (colour token DEPDW),
shallow water:	shallower than the safety contour (colour token DEPVS),
intertidal area:	area exposed at low water (colour token DEPIT).

These are the only three depth shades that can be clearly distinguished on the night display, and they can only be distinguished by contrast, when seen on the display together. If, at night, the entire display consists of shallow water, the mariner will not

be able to recognise this dangerous situation. Therefore, a "depth less than safety contour" pattern is provided in the Presentation Library to reinforce the depth shade. It is optional for the manufacturer to provide this feature, but its inclusion is strongly recommended as a safety feature.

The mariner should be given the option of whether to use this pattern, by night or by day (although it is not strictly necessary by day when the shallow water can be clearly identified by the difference in depth shade). This mariner's option is built into conditional symbology procedure "SEABEDnn". See Presentation Library, sections 8.5.7 and 12.2.18.

It is recommended that the ECDIS should also allow the mariner the option of selecting a deep contour and a shallow contour from among the contours in the SENC, thus establishing the following five depth zones:

deep water:	deeper than the deep contour (colour token DEPDW),
medium-deep water:	depths between the deep contour and the safety contour (DEPMD),
medium-shallow:	depths between the safety contour and the shallow contour (DEPMS),
very shallow water:	depths between the shallow contour and zero metre contour (DEPVS)
drying foreshore:	intertidal area (DEPIT)

The following depth zones may be used as default values:

deep water:	*deeper than 30 m (deep draught vessels)*
medium deep:	*own-ship safety contour to 30 m*
medium shallow:	*2 m to the own-ship safety contour*
very shallow:	*0 to 2 m (defines waters accessible to small craft)*
intertidal:	*exposed at low water*

(3) The own-ship safety depth is intended as an aid when no appropriate safety contour is available in the SENC. Soundings equal to or less than the safety depth selected by the mariner are made more conspicuous than deeper soundings. A separate set of sounding figures is provided in the Presentation Library.

(4) Isolated dangers (small shoals, rocks, wrecks, obstructions) of depth less than the safety contour, and also lying within the 'safe' water defined by the safety contour, are highlighted by a special symbol. Because the mariner may sometimes have to navigate in water shallower than a default safety contour, the mariner may also select to show isolated dangers in the 'unsafe' water between the displayed safety contour and the zero metre contour.

Instructions for these four procedures are given in the Presentation Library, Part I, section 12 'Conditional Symbology Procedures'.

3.2.3 Other new and simplified ECDIS symbols and their use

Other new chart symbols required by the difference in purpose between ECDIS and the paper chart, as well as the difference between paper and electronic presentation, are described below.

Note that all simplified point symbols are centred on the position of the feature.

(1) Simplified buoy symbols.

Sloping topmark symbols are used for lateral, cardinal, isolated danger and safe water buoys. They are coloured in the single most distinctive colour of the buoy (mixed colours in a small buoy symbol look faint on the night display). Special mark buoys are filled yellow circles, and all mooring buoys resemble the paper chart "installation buoy". The default buoy, used when a buoy is not fully described in the ENC or has no specific symbol in the Presentation Library, is a filled grey circle.

All symbols are centred on the position of the buoy.

When the name or number of the buoy is displayed, it is prefixed "By" by the Presentation Library, since otherwise a number can be mistaken for a sounding.

Note 1: this way of displaying buoys is designed primarily to show clearly that a buoy is there, both to avoid collision with the buoy and as an aid to navigation. The details of buoy characteristics, which cause clutter and are difficult to show clearly on an electronic display under all bridge lighting conditions, should be provided by text command or by individual cursor interrogation.

Note 2: green radar on green buoys or light flares does not contrast well, hence buoys and light flares are written over the radar and all light flares are surrounded by a black outline.

(2) Simplified beacon symbols.

Upright topmark symbols are used for cardinal and isolated danger beacons. Lateral beacons, safe water beacons and specials mark beacons are drawn as specific symbols for minor beacons, general beacons, and beacon towers. Beacons are shown in the same colour as buoys, except for the safe water beacon which is black (white at night). The default beacon is a grey general beacon symbol.

All symbols are centred on the position of the beacon.

When the name or number of a beacon is displayed, it is prefixed "Bn".

(3) General symbol for isolated underwater danger.

This conspicuous magenta symbol is applied automatically to rocks, wrecks, small shoals, etc., of depth equal to or less than the own-ship safety contour and which are in deeper water than the safety contour. Optionally, the mariner may extend displaying isolated dangers to shallow waters between the safety contour and the zero metre contour, in case he is forced by circumstances to navigate in such waters.

(4) The dredged area is shown by a grey dotted area fill pattern.

(5) Radar conspicuous coastline.

This includes cliffs and abrupt coastlines that can be expected to return a strong radar echo consistently from the same part of the feature. The magenta highlight line is only used if the coastline is identified as "radar conspicuous" in the ENC.

(6) Prohibitions, cautions and information notes are symbolized with small symbols for point application and with large centred symbols for areas, as illustrated in screens (AB), (JKL) and (MN) of the ECDIS Chart 1. Multiple symbols are used when necessary to convey more than one restriction.

Regulated areas are divided for symbolization into Cautionary Areas (including the existing caution area) and Information Areas, following the distinction established by the IMO/IHO Harmonisation Group on ECDIS in 1992. (See Table 4 of this document).

Point cautions and notes entered by the mariner and the manufacturer are distinguished by the colours orange and yellow respectively.

(7) Unknown object.

A magenta "?" marks the position of an object which cannot be identified or for which there is no entry in the Presentation Library look-up table.

(8a) Scale boundary.

This shows where the compilation scale of the chart data available changes. The ECDIS should warn the mariner of upcoming chart scale change. Only the major changes in compilation scale resulting from a change in "navigational purpose" should be shown. Small changes in compilation scale within a navigational purpose should not be shown. See Presentation Library, Part I, section 12.2.2 DATCVR for details.

(8b) Overscale area at scale boundary.

All the chart data on the display must be shown at the same scale. In order to avoid leaving part of the display blank, the chart display may extend beyond the edge of a relatively large scale ENC to include information from an adjoining smaller scale ENC, which may be from a different "navigational purpose". The smaller scale data will normally be enlarged to match the larger scale ENC, and in this case the "overscale area" symbol should be used to identify any part of the chart display shown at two or more times the compilation scale. See Presentation Library, Part I, section 10.1.10.2 for details.

Note that this symbol applies only to the automatic overscaling performed by the ECDIS in matching ENCs at different compilation scales. It should not be applied to an overscale display deliberately requested by the mariner, which should trigger the overscale indication required by IMO Performance Standard section 6.1.1.

(8c) Change of units of depth. (*This section is deleted)*

(8d) Change of horizontal (geodetic) datum.

The use of non-WGS 84 ENC data does not comply with IHO S-57, and the boundary at which the local geodetic datum changes is not symbolized by the Presentation Library.

The ENC may include information on the relation between the local geodetic datum and WGS 84 (M_HDAT, HORDAT), but this is intended for use in converting local data to WGS 84 for use in the SENC, should the need arise.

(9) Scale bar or latitude scale.

The IMO PS require an indication of scale and range as part of the Display Base. The display scale decides which should be used:

(a) for display scales larger than 1/80,000: always display the 1 mile scale bar provided in the Presentation Library

(b) for display scales at 1/80,000 or smaller: always display the 10 mile latitude scale provided in the Presentation Library.

The scale bar or latitude scale should always be drawn vertically at the left side of the chart display, just clear of the border of the display.

The mariner should be able to remove any labels on the scales to avoid clutter.

"Display Scale" is defined as: [distance between two features on the display] / [distance between the same two features on the earth's surface]. This means that 1/75,000 is a larger scale than 1/80,000.

(10) North arrow.

The IMO PS requires a north arrow as part of the Display Base. The north arrow should always be shown at the top left corner of the chart display, just clear of the scale bar or latitude scale.

(11) Manual chart correction.

Small orange identifiers are used to distinguish hand-entered chart corrections, which are subject to human error, from corrections entered automatically by electronic means. The original chart object should not be removed or altered. (See 2.3.4 for details).

(12) Ramark, Racon.

This is introduced to distinguish beacons that will appear on the radar display from other radio-beacons.

(13) Data from non-HO sources

The non-HO data boundary LC(NONHODAT) serves to separate ENC data from non-HO chart information. See section 2.3.1c for further details on identifying non-HO data.

(14) No data areas.

The first action of the ECDIS display re-draw should be to cover the entire screen with the NODTA area colour fill and the AP(NODATA03) area pattern. These will remain to identify any area not subsequently covered by chart information as a no data area.

(15) Identifying pattern for depth areas less than the safety contour.

(this section is covered by section 3.2.2 (2))

(16a) Identifying pattern for traffic junctions, crossings and roundabouts.

A pattern of diagonal magenta lines is used to identify the areas of a traffic separation scheme which are traffic junctions, crossings or roundabouts, or precautionary areas.

(16b) Traffic routeing and regulated areas in general.

New centred symbols are provided in the Presentation Library, to avoid the clutter caused by a pattern of symbols in these often critical waters. Details are given on screens (JKL). (M) and (N) of the ECDIS Chart 1.

(17) Glacier or ice shelf.

A random pattern of short lines symbolising "candled" ice is provided to indicate a glacier or area of shore-fast ice.

(18) Daymark.

The daymark symbols are designed so that they can be over-written on a beacon which is highlighted by a daymark.

(19) Paper chart symbols for an opening bridge and a radar reflector on an overhead cable have been revised to fit any orientation of the bridge or cable - see ECDIS Chart 1.

(20) A one-sided linestyle is provided for use on large-scale displays to indicate the side of an area boundary on which the area lies, when only a part of the boundary can be seen on the display.

(21) Meta-data (information about the chart data), such as chart data confidence areas.

The "zones of confidence " in the chart data (section 3.1.8) are symbolised by a system of stars. Other meta-data items, including compilation scale, IALA "A" or "B" buoyage, etc, are left to cursor picking.

(22) Special identifiers.

In addition to the manual chart correction identifier of para. (11) above, identifiers are provided for low accuracy chart data and for ENC objects which have additional information for cursor picking under the "INFORM" attribute. The latter may cause clutter, and should only be displayed temporarily. Identifiers are shown on screen (AB) of the ECDIS Chart 1.

(23) IEC symbols.

By agreement with the IEC, symbols for the "Navigational Elements and Parameters" of the IMO PS Appendix 3, and also symbols being developed by IMO for AIS vessel reports, are included in the Presentation Library. These are on the last diagram of the ECDIS Chart 1.

3.3 Existing Chart Symbols

3.3.1 Reproduction of paper chart symbols on ECDIS

Most of the symbols in IHO INT 1 "Symbols used on (paper) charts" have been translated for use on ECDIS. The ECDIS Chart 1 gives details, and is divided into lettered sections in the same way as INT 1.

The following notes apply to these symbols:

(1) Depth contours are not labelled by the ECDIS. The Safety Contour is highlighted, and the mariner should use cursor picking for other contour values.

(2) Light sectors. It should be possible, on request, for the mariner to be capable of identifying the colour of the sectors affecting the ship, even if the lights involved are off the display.

3.4 Text, Diagrams etc.

3.4.1 Text as part of the route monitoring display

Text information should be used on the route monitoring display only when unavoidable, since it has to be written large to be readable and so causes clutter.

Details of displaying text are given in 3.1.5 and in the Presentation Library.

Soundings are treated by the Presentation Library as symbols to ensure they are legible and correctly located.

3.4.2 Text windows, explanatory diagrams etc. superimposed on the route monitoring display

The 270 mm by 270 mm minimum area of chart presentation for route monitoring should normally be used for chart and navigation information alone.

Any windows containing text, diagrams, etc superimposed on the route monitoring display should be temporary, and should not obscure important chart or navigational information. Such windows should use only the "User Interface" colours from the Presentation Library. It should be possible for the mariner to re-locate a window in a less important part of the display, such as on land, or behind the ship.

3.4.3 Separate text panel on the same screen as the route monitoring display

A Mariner's Information Panel, consisting mainly of text (alphanumerics), might include:

- ECDIS alarms and indications, e.g." crossing safety contour",
- navigation information, e.g. time, position, course to make good, etc.,
- chart information, e.g. contour selected for own-ship safety contour,
- supplementary chart information, e.g. tide tables, sailing directions,
- interface dialogue, e.g. "change to night colour table".
- etc.

Sea experience has shown that the text panel on the route monitoring display may have a prominence out of proportion to its significance to safety of navigation. This is particularly damaging to ECDIS performance at night, when the strictly dimmed chart display, which carries nearly all of the information of importance to navigation, may be overwhelmed by the light emitted from large, bold or bright characters on the text display, some conveying relatively unimportant information.

The text panel should be outside the 270 by 270 mm minimum area designated for the route monitoring chart display by the IMO PS. The colours, symbols and luminance of this user interface panel should not degrade the SENC information on the chart display.

At night it is essential that any interface panel or other information added by the manufacturer to the screen carrying the chart display should never generate more light than the chart display itself. Great care is taken to reduce the light emitted by the chart in order to preserve the mariners night vision, and it is dangerous to ship safety if added non-chart information defeats that purpose.

It is particularly important to limit the information shown using the conspicuous colour token "UINFD", which is reserved for important information. Even a small panel of text in this colour can produce more light on the bridge than the entire route monitoring chart display.

3.4.4 Text shown on a separate auxiliary screen

A separate screen may be provided for text display, either instead of or in addition to a panel on the main screen used for the route monitoring display. The presentation on this auxiliary screen need not follow these specifications in detail, but should conform in general, to avoid confusion, and should meet the same bridge lighting constraints.

All information displays should be designed in accordance with ergonomic principles.

4 SPECIFICATIONS FOR COLOURS

4.1 General

The ECDIS manufacturer can use any technology to build his display as long as his display fulfils the requirements of this specification. It is known that at least displays based on CRT, TFT or LCD can be made to fulfill the requirements of this standard.

The colours are specified in CIE (Commission Internationale de l'Eclairage) xy chromaticity coordinates and luminance L. *CIE colour coordinates are used because any other colour specification, such as RGB, is specific to a particular monitor and so cannot be specified either in relative or in absolute terms.* The ECDIS colour scheme based on specification of colour tokens and color conversion tolerances and tests are described in sections 4.2.6 and 5.2.3.

The Colour Tables are in the Presentation Library, Part I, section 13. The Colour Tables are also included in the .dai file of the digital Presentation Library, however the maintenance of this file depends on a volunteer provider.

Note that these colour specifications apply to both the operational chart display (for route planning and route monitoring), and also to any text on the same screen as the chart display.

The colour tables have been carefully designed by perception specialists to give the maximum clarity and contrast between features on the display under all light conditions on the bridge.

4.2 Colour Assignment

Since chart and navigation lines and symbols must show clearly against the background shades, the colour tables were constructed by first selecting the background area shades and then selecting colours for lines and symbols that contrast with their background. In selecting foreground colours for point and line features, lines and symbols, the aim has been to highlight important information by giving it greater contrast with the background.

In order to accommodate the very large change in bridge lighting between bright sun and dark night , the colours switch from a light background with dark foreground details , which has been found to give the best contrast under bright sun, to a dark background with light foreground details by night. The night display has to be dim enough that it can be viewed without impairing the mariner's night vision. The Dusk table is also a black-background table, for optional use by day as well as at twilight.

The design of both colours and symbols has concentrated on ensuring that important chart and navigation features remain clearly visible under the extremes of bright sun and dark night viewing.

The general assignment of colours is given in Table 1 and condensed Colour Tables are in Table 2.

4.2.2 Bright Sunlight or Night viewing - Use of filters, etc.

The information-carrying capability of the ECDIS display is curtailed at the extremes of bright sunlight and night viewing. The reasons, and some remedies, are described in this section.

Bright sun. *Some of the strong ambient light on the bridge is reflected off the back of the display screen face plate and arrives at the mariner's eye mixed with the light generated by the monitor which carries the image of the ECDIS display. This display image is further diluted by light entering the mariner's eye directly from the brightly-lit bridge. The effect is to make the display look washed out; contrast between features may be severely reduced. In the extreme case of sunlight shining directly on the screen, no information at all will be visible. In addition, reflections on the face of the monitor from objects close to the screen, particularly a mariner's white shirt, may mask parts of the display.*

The ECDIS display should be situated where direct sunlight will not shine onto it, nor into the eyes of the mariner looking at it. A visor around the face of the screen may help. A filter may also help,(*because it attenuates the sunlight twice, both when incident and when reflected, whereas the monitor image is attenuated only once*). Low attenuation neutral density filters may be used, such as a 2 times attenuation filter designated (logarithmically) "0.3 ND". Polarised filters should be an advantage. Ideally, the bridge windows should have glare reducing glass and the inside of the bridge should have non-reflecting paint.

Night. *The need to preserve night vision requires that the illumination from the screen be reduced to a lower level than is desirable from considerations of clear viewing. The light level from night colour tables is below that which provides full contrast capability. Consequently some area-fill colours are indistinguishable on the night display, as noted in section 3.2.2 (2), and colours of lines may be difficult to distinguish.*

An additional problem for CRT type of monitor is that the R,G & B guns of the CRT may drop to the cut-off point at these very low DAC (digital to analog converter) voltages, particularly on an ageing CRT. Because good quality neutral filters reduce illumination without significantly affecting colour, and even tend to enhance contrast their use is recommended for the night display.

4.2.3 Display calibration and verification

The ECDIS display should be calibrated initially in order to transform the CIE colour table coordinates to screen coordinates. The main components of the ECDIS display are the monitor and the image generator. Both the monitor and the image generator used to drive the ECDIS display can be calibrated together as a colour generating unit. Another alternative is to calibrate separately both the monitor and image generator

The following international standards describe methods for calibration of a monitor’s RGB values to produce an output. Other methodologies may be followed, but the same verification test requirements apply regardless of method.

CIE 122-1996
Technical Report: The Relationship between Digital and Colorimetric Data for Computer-Controlled CRT Displays
IEC 61966-3-2000
Multimedia systems and equipment -Colour measurement and management - Part 3:Equipment using cathode ray tubes, Edition 1

IEC 61966 -4-2000 Multimedia systems and equipment-Colour measurement and management -Part4: Equipment using liquid crystal display panels, Edition 1

The ECDIS display calibration should be verified for type approval of all monitors as described in section 5.2.3, using a combination of instrumental testing for the bright sun colour table and subjective visual checking for the dusk and night colour tables.

4.2.4 Colour control; contrast and brightness controls

There are a variety of technologies available for monitors to be used for ECDIS display. Different technologies have different methods to control colour, contrast and brightness, but some basic rules apply for all of them.

4.2.4.1 Effect of controls.

The contrast control of a display generally shortens or extends the range of luminance available, making the display appear darker or brighter.

On the other hand, the brightness control shortens or extends the range of colour saturation available by adding white (which extends the range by making colours other than black less saturated), or subtracting white (colours become darker, more saturated.)

To the viewer, it has much the same apparent effect as contrast, but it achieves this by altering the colour contrast of the colour tables between foreground and background colours, and this may result in some features becoming harder to see, particularly at night. More importantly, making the night display more saturated may drop some dark colours below the cut-off point, into black, thus losing distinctions such as shallow versus deep water.

4.2.4.2. Use of the controls.

Colour tables are provided for day, dusk and night. The mariner should be provided with the control to make fine adjustments between these tables; the calibration position should be marked as a reference for this.

For a CRT type of monitor the brightness control should be preset, i.e. used only when essential, with provision to return to the calibrated setting.

LCD and other monitor technologies have a variety of controls. The general principle is that all available controls should have a provision to return to the calibrated settings and that only appropriate controls should be made available for the mariner.

The ECDIS manual should carry a warning that careless use of the display controls may adversely affect the visibility of information on the display.

4.2.4.3. Initial setting of the controls.

The controls should be set up in preparation for initial calibration, and their positions marked at that time (e.g. by a detent) so that they are recoverable.

4.2.4.4. Re-adjustment of the controls.

In case the controls go out of adjustment in use, they may be re-adjusted onboard ship by means of the Colour Differentiation Test Diagram provided in the Presentation Library, Part I, see section 5.2.5.

4.2.4.5. Setting the controls for route monitoring.

The ECDIS display carries far more detail than a radar display, and requires correspondingly more attention to the correct selection of colour table and the correct adjustment of the controls.

This particularly affects the black-background displays, and is critically important at night, because all colours of the night table, particularly those for large areas, have to be set very dark to avoid loss of night vision, and if the control is turned down too far these colours will disappear into the black background. As a result, chart information will be lost.

The situation will be worse if one of the day tables is improperly dimmed for use at night, instead of switching to the night table.

It is important that the display be adapted to lighting conditions on the bridge by selecting the correct colour table: "Day" for bright sunlight; "Day" or "Dusk" for general daylight viewing; "Dusk" for twilight; and "Night" for the night-darkened bridge.

The controls should only be used for fine adjustment within the appropriate colour table.

To ensure that the controls are always set to a level above that at which information will be lost, the black-adjust symbol BLKADJ should be available to the mariner, treated as "Standard display", to be called up at any convenient point on the screen. The instructions for its use by the mariner should be incorporated in the "Users instructions" for the ECDIS..

Below is an example of instructions for a CRT type of Monitor:

1. First, set contrast to a maximum, brightness to a minimum. Look at the black-adjust symbol. Then either:

2A. If the centre square is not visible, turn up the brightness until it just appears.

or:

2B. If the centre square is clearly visible (with contrast at maximum, brightness at minimum), turn the contrast down until the inner square disappears, then turn contrast back up until the inner square is just visible again.

(If the above adjustment is not successful, select a more appropriate colour table and repeat this procedure).

The "black level" is now correctly set. If a brighter display is required use the contrast control, but it is better not to re-adjust the controls unless lighting conditions on the bridge change.

Note that the black-adjust symbol should be displayed to check that the inner square remains visible on the following occasions:

- every time that the brightness or contrast controls are adjusted,
- every time that the display is switched to the night colour table.

Below is an example of instruction for LCD type of Monitor. The LCD type of monitor used in this example has only one mariner control, which is called brilliance. Internally the

monitor has also other controls available for service engineers. These internal controls include also controls named as contrast and brightness.

1. First, set brilliance to calibration position. Look at the black-adjust symbol. Then either:

2A. If the centre square is not visible, turn up the brilliance until it just appears.

or:

2B. If the centre square is clearly visible, turn down the brilliance until the inner square disappears, then turn brilliance back up until the inner square is just visible again.

(If the above adjustment is not successful, select a more appropriate colour table and repeat this procedure).

The "black level" is now correctly set. If a brighter display is required use the brilliance control, but it is better not to re-adjust the controls unless lighting conditions on the bridge change.

Note that the black-adjust symbol should be displayed to check that the inner square remains visible on the following occasions:

- every time that the brightness or contrast controls are adjusted,
- every time that the display is switched to the night colour table.

It is recommended that the BLKADJ symbol be displayed automatically all the time that the night colour table is selected, with a mariner over-ride to remove it if necessary.

4.2.5 The colour tables

There are three colour tables, all of which shall be made available to the mariner. These are listed in a condensed form in Table 2 and specified in detail in the Presentation Library. They are as follows:

DAY (table 2.1)	The "Day" table uses a white background as a result of a comparative test outdoors in bright sunlight which showed that a display background of maximum luminance gives the best contrast achievable under near-washout conditions. This conclusion has been confirmed by subsequent sea experience.
DUSK (table 2.2)	The "Dusk" colour table is a black background table, which may also be used by day as a mariner's option.
NIGHT (table 2.3)	At night the light emitted by the display must be strictly limited to avoid impairing night vision. In case the luminance needs to be further reduced, the "Night" colour table may be augmented by a luminance-reducing neutral density filter which should have 8 times attenuation, designated (logarithmically) "0.9 ND". (This is a manufacturer's option).

4.2.6 The colour scheme - colour tokens

The colour scheme of the Presentation Library is designed to fit current computer architecture. A digital look-up table assigns all object/attribute combinations of features from the SENC to one of 64 "colour tokens". A few tokens apply to only one feature, but

most include a group of similar features; e.g. traffic lanes, traffic direction arrows, prohibited areas and other such features share the "trfcd" for "traffic control dominant (conspicuous)" colour token. In turn, each token is assigned colour coordinates in the digital colour tables of the Presentation Library. Tables 2 and 3 at the end of this document illustrate how this scheme works.

4.2.7 Transparency

Transparent area colour fill is used at present:

(i) so that the background colours, lines and symbols show through an area shade (e.g. depth shades and contours should show through a traffic separation zone),

(ii) to reduce the prominence of a large symbol (e.g. too prominent a centred anchorage area symbol would cause clutter on the display).

Transparent fill can be achieved in two ways:

1.) with a given percentage of the pixels having the transparent fill colour (see Presentation Library, Part I, section 7.4.2),

2.) by mixing the fill and underlay colour according to the procedure given in the Presentation Library, Part I, section 4.2.3.2. This must be done in such a way that no appearance of change in colour or shape occurs in any SENC feature on the display, at any intermediate transparency value. The underlying SENC information must remain distinguishable, except when the overlay colour approaches 100%, in which case Section 2.3.2 (b) applies, and an indication is required.

5 SPECIFICATIONS FOR THE DISPLAY SCREEN

5.1 Physical display requirements

The requirements of S-52 for the main graphic display are:

"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 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 mariners selection.

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.

5.2 Additional Requirements

5.2.1 Reproducing small features and symbols

The specifications above permit a chart display whose minimum resolution (lines/mm) may vary depending on the size of the display. To maintain a clearly readable chart display under this flexibility requires the following constraints to ensure that enough "picture units" (pixels) are always used to draw small features and symbols clearly:

(1) Chart features: Chart features should never be drawn with fewer "picture units" (ie. lines, pixels, dot-pitch intervals) than when drawn on a 270 x 270 mm chart area at SENC scale.

(2) Symbols: *For clear representation, symbols require a minimum number of picture units, depending on their* complexity. A simple chart symbol should extend about 12 pixels (that is at least 3.5mm for an IHO standard screen.) See section 3.1.5 for details on the size of symbols.

5.2.2 Colour display capability

The colours, as specified in CIE x,y chromaticity co-ordinates and luminance L, are intended for a display capable of at least 256 luminance steps in each of red green and blue

For night performance it is essential that the ECDIS hardware has a graphics card capable of giving "blacker than black", ie complete control of colour, and that the software can control that function.

For CRT type of monitor cathode (beam) current stabilisation is desirable, to prevent dark colours dropping below the cut-off point.

5.2.3 Colour conversion tolerances and tests

5.2.3.1 Tolerances. The tolerances quoted below apply only to the process of converting CIE colour coordinates to RGB values, and so should be evaluated shortly after the ECDIS leaves the manufacturer's plant.

Considerable operational experience will be needed before it will be possible to state colour maintenance tolerances for ECDIS onboard ship.

The colour tables developed have been selected to ensure maximum colour discrimination between features. Colour discrimination depends on both the colour difference and the luminance difference between two colours. Colour science (as represented by the C.I.E. colour convention) has defined colour difference units ΔE . The ΔE* metric is a measure of the overall discrimination (including both colour and luminance differences). As a metric for ECDIS colour accuracy, a measure of the discrimination in colour alone, excluding luminance differences has been defined as a subset of ΔE* referred to as Δ(u*,v*).*

$$\Delta(u^*,v^*) = SQRT\ [\ (u_2^*-u_1^*)^2 + (v_2^*-v_1^*)^2\ ]$$

$$\Delta E^* = SQRT\ [\ (L_2^*-L_1^*) + (u_2^*-u_1^*)^2 + (v_2^*-v_1^*)\ ]$$

Calculations of L, u*, and v* shall be made using as reference the chromaticity and luminance specified for the brightest white colour token in the respective colour table (Y0, u0, y0); where Y0 is the luminance in units of cd/m^2. Note: this is not the brightest white of the monitor.*

Note: "Δ" represents the Greek letter "Delta", although it may appear differently on some computers.

Note: The term ΔC is defined by CIE as the difference in the magnitude of colour saturation. Two colours as different as red and blue could have zero difference in colour saturation.*

The tolerances for the conversion of the colour tables from the CIE colours defined in these specifications to the actual RGB values for the ECDIS CRT are defined in three terms:

1. *Overall discrimination between actual colours within the converted table : ΔE*. This is to ensure that all the colours within the RGB table remain discriminably separate, ie. that the relative colour distinctions have been maintained.*

2. *Colour discrimination differences between the defined and the actual values : Δ(u*,v*). This is to ensure that the actual RGB colours resulting from the conversion remain reasonably close to the CIE colours defined in the specifications, ie. that the blues stay blue and the greens stay green.*

3. *Luminance differences between the defined values and the actual values : L. This is to ensure that the luminance remains the same within acceptable limits.*

Note: The CIE L*u*v* human perception colour model, which is the source of the tolerances described above, has not yet been evaluated at the low luminances of the night colour table, at which the less colour-sensitive rods of the eye take over from the daytime cones. Consequently these tolerances should not be applied to the night table, and for type-approval purposes they are restricted to the bright sun table.

Colour tolerance values:

1. The discrimination difference between any two colours displayed (except those with a tabular ΔE* less than 20 -) should be not less than 10 ΔE* units.

Token	**Colour x, y, L**	**Token**	**Colour x, y, L**	**ΔE***
DEPMD	(.27 .30 65) pale blue	CHWHT DEPDW UIBCK	(.28 .31 80) white	11
CHBRN	(.42 .45 30) brown	ADINF	(.41, .47. 35) yellow	14
DEPMS	(.24 .26, 55) medium blue	DEPVS UIAFD	(.22 .24 45) medium blue	17
DEPMD	(.27 .30 65) pale blue	CHGRF NODTA Ed 3.3 colours have greater ΔE	(.28 .31 45) faint grey	18

2. The difference between the colour displayed and the CIE colour defined in these specifications should be not greater than 16 Δ(u*,v*) units. If a monitor is independently tested then the difference shall be not greater than Δ(u*,v*) units.

3. The luminance of the colour displayed should be within 20% of its specified value. Black is a special case and the luminance of it shall be not greater than 0.52 cd/m² for bright sun colour table.

5.2.3.2 Instrumental calibration verification test. For CRT displays, an instrumental test to check that the results of the colour conversion calibration are within tolerance should be made by displaying the colours of the Day colour table (restricted to colour pairs of tabular ΔE* greater than 20); measuring their CIE coordinates x,y and L; and applying a tolerance test. For LCD displays the instrumental test should be applied to all three colour tables.

Note that since the tolerance test is intended solely to check successful colour calibration, and not to test colour maintenance at sea, this test should be performed on the bench in the manufacturer's or type-approval authority's plant under normal conditions of temperature, humidity and vibration.

Manufacturers of ECDIS can choose between two different methods of colour calibration. The first method is a test of a monitor as part of an integrated system. In this method both the monitor and the image generator parts of ECDIS display are tested together. The second method is an independent test of the monitor. In this method the monitor and the image generator of ECDIS display are separately tested against a reference (i.e. the monitor is tested against a reference image generator and the image generator is tested against a reference monitor). The second method has tighter tolerance for displayed colour than the first method (see section 5.2.3.1).

5.2.3.3 Test using Colour Differentiation Test Diagram. The dusk and night tables should be checked subjectively by means of the colour differentiation test diagram, which is provided as an S-57 file on the Presentation Library CD (.tif file diagrams must not be used for this purpose), as follows:

(1) The person carrying out the test should have passed the Isihara colour blindness test, or other test used to qualify bridge watchkeepers, and should adapt to night viewing for 10 minutes before checking the night display;

(2) The controls should be set to their calibrated settings;

(3) While the display is off, adjust the ambient light reflected from white paper positioned on the display screen to the following values:

Colour table	Light level
Day	200 cd/sq m
Dusk	10 cd/sq m
Night	darkness (the ECDIS display is the predominant light source)

Preferably use natural daylight for the day table.

(4) Under each of the above conditions, display the appropriate colour differentiation test diagram described in section 5.2.5 for the colour tables. Select each table in turn and ensure that:

- each foreground diagonal line is clearly distinguished from its background;

- the foreground lines representing yellow, orange, magenta (purple), green, blue and grey may be clearly identified.

5.2.4 N/A.

5.2.5 Colour Differentiation Test Diagram; grey scale

The use of symbol BLKADJ to adjust the controls every time that the night colour table is selected has been described in section 4.2.4.5. This section describes further checks on the colour performance of the ECDIS display.

A multi-purpose colour differentiation test diagram is illustrated in the Presentation Library, Part I, section 15.4, and is described in the Presentation Library, Part I, sections

19.3 and 19.4. This consists of 20 squares each coloured with one of the 4 main background colour fills (such as shallow water blue), and each having a diagonal line in one of the six important foreground colours (such as mariner's orange). Each diagonal line is 2 pixels wide.

The diagram is in the form of an ENC and so can be displayed using any of the three colour tables.

This diagram is intended:

(1) for use by the mariner to check and if necessary re-adjust the controls, particularly for use at night;

(2) for use by the mariner to satisfy himself that an ageing ECDIS display remains capable of providing the necessary colour differentiation;

(3) for initial colour verification of the day, dusk and night colour tables.

Both the Colour Test Diagram and the instructions for its use (see Presentation Library, Part I, sections 18.8 and 19.4) should be made available to the mariner.

In addition, a grey scale is described in Annex C for use by maintenance technicians in checking colour tracking in an ageing display.

The Colour Differentiation Test diagram is intended for use off-line. It is not needed during route monitoring.

Note that the Colour Differentiation Test Diagram will not be true to colour unless it is projected on a calibrated screen and is generated using the digital format described in the Presentation Library, Part I, section 19.4 which correctly reproduces the colour tokens of the Presentation Library.

TABLE 1: GENERAL COLOUR ASSIGNMENT FOR ECDIS FEATURES

black/white	(black by day / white by night) is used for critical navigation features which need highlighting by contrast against their background to give them adequate prominence. Examples are the own-ship symbol, dangerous soundings less than the safety depth, buoys, conspicuous objects on land etc. It is also used for text, which is less clear in any other colour.
white/black	(white by day / black by night) as a **background area shade** is used for deep, safe, water.
magenta	is used to highlight critically important features such as isolated dangers, traffic routes, anchorages; and for restricted areas, submarine cables, gas pipelines etc. It is also used for aids to navigation and services such as daymarks, racons, and pilot stations.
grey	is used for many features which are black on the paper chart. It is used with thick lines for critical physical objects such as bridges and overhead cables, and with thin lines for important but less critical physical features such as non-dangerous soundings, sandwaves, overfalls, water pipelines and fish farms. It is similarly used for chart features such as fairways, harbour areas, tidal information and for information about the chart such as quality of chart data, overscale areas, etc.
grey	as a **background area shade** is used with a prominent pattern for no-data areas.
blue	as a **background area shade** is used to distinguish depth zones.
blue	as **foreground colour** for AIS and VTS information; also reserved for future requirements.
green	is used for the radar image and synthetics, and for buoy and lights colours.
blue-green	is used for transferred ARPA.
yellow-green	('moss-green') as a **background area shade** is used for the intertidal area between high and low waterlines,
yellow	is used as the manufacturer's colour; for the mariner's transparent colour fill; and for buoy and lights colours.
red	is used for the important planned route, for the mariner's danger highlight, and for buoy and lights colours.
orange	is the mariner's colour, for notes, chartwork, chart corrections. The scale bar, north arrow, and mariner's navigation objects such as EBLs and VRMs are also orange.
brown	as a **background area shade** is used for the land, and dark brown is used for features on land and in the intertidal area that do not have any strong significance for navigation.

TABLE 2: CONDENSED COLOUR TABLES

Note: *These tables are for explanation only. Use the updated tables in the Presentation Library for operational purposes.*

Colour table 2.1: DAY

Colour	X	Y	L	Tokens
black	.28	.31	0.0	sndg2, ships, pstrk, chblk, uinfd, outlw
grey	.28	.31	0.6	bkaj1
"	.28	.31	1.6	bkaj2
grey	.28	.31	10	depsc, cstln, chgrd, uinff, uibdr
"	.28	.31	25	sndg1, depcn, chgrf, sytrk, resgr, res01, res02, res03
"	.28	.31	40	nodta
white	.28	.31	80	depdw, chwht, uibck
blue	.18	.15	22	resbl, uinfb
"	.21	.22	45	depvs, uiafd
"	.23	.25	55	depms
"	.26	.29	65	depmd
magenta	.30	.17	20	isdng, trfcd, chmgd, uinfm
"	.28	.24	48	trfcf, chmgf
green	.31	.56	60	radhi, chgrn, litgn, uinfg
"	.31	.56	20	radlo
blue-green	.26	.42	30	arpat
yellow-green	.26	.36	35	Depit
yellow	.41	49	70	chylw, lityw
"	.41	49	35	adinf
brown	.45	.42	15	landf, outll
"	.39	.43	30	chbrn
"	.35	.39	50	landa, outll, uiaff
orange	.50	.40	32	cursr, ninfo, chcor, aplrt, sclbr, uinfo
red	.58	.35	18	Plrte
"	.48	.30	25	dnghl, chred, litrd, uinfr

Colour table 2.2: DUSK

Colour	X	Y	L	Tokens
white	.28	.31	36	ships, pstrk, sndg2, chwht, uinfd
grey	.28	.31	20	depsc, cstln, chgrd, chblk, uibdr.uinff, resgr
“	.28	.31	10	depcn, chgrf, sndg1, sytrk, res01, res02, res03
“	.28	.31	7.0	nodta
“	.28	.31	0.72	bkaj2
black	.28	.31	00	depdw, uibck, outlw, bkaj1
blue	.18	.15	10	resbl, uinfb
“	.21	.22	5.0	depvs, uiafd
“	.23	.25	3.0	depms
“	.25	.29	1.0	depmd
magenta	.28	.24	18	trfcd, chmgd, isdng, uinfm
“	.30	.17	7.0	trfcf, chmgf
green	.31	.56	20	radhi, chgrn, litgn, uinfg
“	.31	.56	7.0	radlo
blue-green	.26	.42	17	arpat
yellow-green	.26	.36	6.0	Depit
yellow	.41	49	24	chylw, lityw
“	.41	49	12	adinf
brown	.45	.42	12	landf, uiaff
“	.39	.43	8.0	chbrn.
“	.35	.39	5.0	landa, outll
orange	.50	.40	10	cursr, ninfo, chcor, aplrt, sclbr, uinfo
red	.58	.35	8.0	Plrte
“	.48	.30	10	dnghl, chred, litrd, uinfr

Colour table 2.3: NIGHT

Colour	X	Y	L	Tokens
white	.28	.31	5.0	sndg2, chwht, ships, pstrk, uinfd
grey	.28	.31	2.5	chgrd, chblk,cstln, depsc, uibdr, uinff
“	.28	.31	1.25	chgrf, sndg1, depcn, resgr, sytrk, res01, res02, res03
“	.28	.31	1.2	nodta
“	.28	.31	0.1	bkaj2
black	.28	.31	00	depdw, uibck, outlw, bkadj1
blue	.18	.15	1.25	resbl, uinfb
“	.21	.22	0.8	depvs, uiafd
“	.23	.25	0.4	depms
“	.25	.29	0.2	depmd
magenta	.30	.17	2.0	isdng, trfcd, trfcf, chmgd, chmgf, uinfm
green	.31	.56	2.5	radhi, chgrn, litgn, uinfg
“	.31	.56	0.8	radlo
blue-green	.26	.42	1.75	arpat
yellow-green	.26	.36	1.2	Depit
yellow	.41	49	3.0	chylw, lityw
“	.41	49	1.5	adinf
brown	.45	.42	3.2	Uiaff
“	.45	42	1.6	Landf
“	.39	.43	1.3	Chbrn
“	.35	.39	0.8	landa, outll
orange	.50	.40	1.25	cursr, sclbr, ninfo, aplrt, chcor, uinfo
red	.48	.30	1.25	dnghl, chred, litrd, uinfr.
“	.58	.35	0.9	Plrte

TABLE 3: ALPHABETICAL LIST OF COLOUR TOKENS

token	colour (day/night	Use
ADINF	yellow	mariner's and manufacturer's added information
APLRT	orange	alternate planned route.
ARPAT	blue-green	ARPA target and vector.
BKAJ1	black	black colour of black-adjust symbol
BKAJ2	grey	dark grey colour of black-adjust symbol
CHBLK	black/white	general.
CHWHT	white/white	general.
CHGRD	grey, conspic	general.
CHGRF	grey, faint	general.
CHBRN	brown	built-up land areas, etc.
CHGRN	green	general, including buoys.
CHRED	red	general, including buoys.
CHYLW	yellow	general, including buoys.
CHMGD	magenta, conspic	dangers, important magenta chart features.
CHMGF	magenta, faint	less important magenta chart features.
CHCOR	orange	manual chart corrections made by the mariner.
CSTLN	grey, conspic	coastline (high water line), including wharf and dock faces.
CURSR	orange	cursor, also mariner's EBLs and VRMs.
DEPDW	white/black	area fill colour for deep water, depth greater than the deep contour selected by the mariner.
DEPMD	blue	area fill for medium-deep water, deeper than the Safety Contour.
DEPMS	blue	area fill for medium-shallow water, less than the Safety Contour.
DEPVS	blue	area fill for very shallow water, less than the shallow contour.
DEPIT	yellow-green	area fill for the intertidal zone between the drying line and the high water line.
DEPSC	grey, conspic	own-ship's Safety Contour, selected by the mariner.
DEPCN	grey	other depth contours
DNGHL	red	danger highlight symbol, applied by the mariner.
ISDNG	magenta, conspic	isolated danger, selected automatically by ECDIS depending on the Safety Contour selected by the mariner.
LANDA	brown	area fill for land that is not built-over.
LANDF	brown, conspic	contrasting brown for land features (buildings, dykes etc.)
LITRD	red	light flares and sectors.
LITGN	green	light flares and sectors.
LITYW	yellow	light flares and sectors.
NINFO	orange	navigator's information added to the chart by the mariner.
NODTA	grey	area for which there is no chart information.
OUTLW	black	outline colour to clarify overwritten symbols on water areas.
OUTLL	brown	outline colour to clarify overwritten symbols on land areas.
PLRTE	red, conspic	own-ship's planned route.
PSTRK	black/white	own-ship's past track from primary positioning system.

token	colour (day/night	Use
RADHI	green, conspic	high luminance radar colour for high echo intensity.
RADLO	green, faint	low luminance radar colour for low echo intensity.
RESBL	blue	symbol, line or text colour reserved for AIS and VTS
RESGR	grey	symbol, line or text colour reserved for future applications
RES01	grey	symbol, line or text colour reserved for future applications
RES02	grey	symbol, line or text colour reserved for future applications
RES03	grey	symbol, line or text colour reserved for future applications
SCLBR	orange, white	1 mile vertical bar to give general impression of display scale.
SNDG1	grey	soundings deeper than the mariner-selected Safety Depth.
SNDG2	black/white	dangerous soundings, equal to or less than the Safety Depth.
SHIPS	black/white	own-ship symbol or scaled shape, with velocity vectors.
SYTRK	grey	own-ship's past track from secondary positioning system.
TRFCD	magenta, conspic	important traffic routeing features.
TRFCF	magenta	less important routeing features.
TRNSP	transparent	used in "transparent" area fills ,(e.g. traffic separation zones), to let the background colour show through, say, 75% of the pixels.
UIBCK	white/black	user interface background.
UIBDR	grey	border to separate user interface from ECDIS chart display.
UIAFD	blue	area fill for use on user interface, water colour.
UIAFF	brown	area fill for use on user interface, land colour.
UINFD	grey, conspic	conspic colour for limited amount of important text.
UINFF	grey	normal colour for user interface text.
UINFB	blue	colour for symbols, lines and text on the user interface
UINFG	green	colour for symbols, lines and text on the user interface
UINFR	red	colour for symbols, lines and text on the user interface
UINFM	magenta	colour for symbols, lines and text on the user interface
UINFO	orange	colour for symbols, lines and text on the user interface

NOTES

1. There are 63 colours, plus TRNSP (which is not a colour), making 64 colour tokens.

2. Suffix "D" indicates "dominant", important, hence prominent (e.g. "TRFCD");
   Suffix "F" indicates "faint", less important (e.g. "TRFCF").
   Suffix "1" indicates non-dangerous, e.g. "SNDG1" is deeper than the Safety Depth;
   Suffix "2" indicates dangerous, e.g. "SNDG2" is equal to or less than the Safety Depth.

3. The nine opaque area fills are underlined. These are the background colours for all other ECDIS information. These are deliberately made light by day to give maximum contrast for foreground colours in bright sun, and dark by night to avoid a large luminant area which would compromise night vision.

4. Note that the user interface background, UIBCK, and the deep water area fill, DEPDW, are the same colour.

TABLE 4: 'CAUTIONARY' AND 'INFORMATION' AREAS

The cautionary area / information area distinction is reflected in the IMO PS Appendix 4 "Areas for which special conditions exist". It is the basis for symbolising those areas which do not have a specific symbol with either a "(!)" for a cautionary area or a "[i]" for an information area:

Cautionary Areas:

Routeing areas - Standard Display:

Traffic separation zone (TSEZNE)
Traffic routeing scheme crossing or roundabout (TSSCRS, TSSRON)
Traffic routeing scheme precautionary area (PRCARE)
Two-way traffic route (TWRTPT)
Traffic separation scheme lane (TSSLPT)
Deepwater route (DWRTPT)
Recommended traffic lane (RCTLPT)
Inshore traffic zone (ISTZNE)

Other cautionary areas - Standard Display:

fairway (FAIRWY)

area to be avoided (RESTRN 14)
entry prohibited/restricted (RESTRN 7, 8)
anchoring prohibited/restricted (RESTRN 1,2)
fishing/trawling prohibited/restricted (RESTRN 3, 4, 5, 6)

caution area (CTNARE)

waiting area (RESARE CATREA 19)
swinging area (RESARE CATREA 25)
ferry area (FERYRT)

navigation aid safety zone (RESARE CATREA 12)
offshore production area (OFSPRD)
offshore safety zone (RESARE CATREA 1)

minefield (RESARE CATREA 14)
submarine transit lane (SUBTLN)
military practise area (MIPARE)
military area (RESARE CATREA 9)
degaussing area (RESARE CATREA 8)
seaplane landing area (SPLARE)

Information areas - Standard Display:

anchorage area (ACHARE)
anchor berth (ACHBRT)

dumping ground (DMPGRD)

fishing ground (FSHGRD)
pipeline area (PIPARE)
cable area (CBLARE)

cargo transhipment area (CTSARE)
incineration area (ICNARE)

specially protected areas - sanctuaries etc (RESARE CATREA 4, 5, 6, 7,10, 18, 20, 22, 23, 27, 28)
no wake area (RESARE CATREA 24)

For further details, see conditional symbology procedures RESAREnn and RESTRNnn in the Presentation Library, section 12.

ANNEX A

IHO ECDIS PRESENTATION LIBRARY

The Presentation Library is published separately. See Figure 1 for details.

In summary the Presentation Library implements the display specifications in S-52 by decoding and symbolising the SENC. It contains:

1. the ECDIS symbol library, including the IEC navigation symbols,

2. the ECDIS colour tables for day, dusk and night viewing,

3. look-up tables with symbology instructions linking SENC objects to the appropriate colour and symbol and giving their IMO category, draw priority, priority over radar, and suggested viewing group,

4. conditional symbology procedures for:
   - cases where symbolising depends on circumstances such as the mariner's choice of safety contour,
   - cases where symbolising is too complex to be defined in a direct look-up table,

5. symbolising instructions for special cases which are not handled by 3. or 4. above, such as north arrow and scalebar, manual chart corrections, etc.,

6. description of the symbology instructions,

7. mariners' navigational objects, specified in the same format as chart objects for convenience in processing by the ECDIS,

8. supplementary features such as the ECDIS Chart 1, colour differentiation test diagram, colour calibration software.

The IHO Presentation Library is part of the S-52 package. A digital version is also available for edition 4.0.0; updating this digital version will depend on a volunteer provider.

ANNEX B

PROCEDURE FOR INITIAL CALIBRATION OF COLOUR DISPLAYS

(Deleted)

ANNEX C

PROCEDURE FOR MAINTAINING THE CALIBRATION OF DISPLAYS

C.1 Introduction

The application of ECDIS to practical marine use necessitates the development of a greater understanding of monitor limitations as they relate to an accurate colour display and a marine environment.

The factors that effect colour accuracy and the life of the monitor are discussed and an approach for onboard monitor testing and calibration is described in this Annex.

C.2 System Requirements

Monitor calibration is necessary for accurate colour reproduction. Several factors are important to review about the monitor system:

1. When the monitor is initially installed in the system, it should be calibrated and the system matched to the IHO colour tables.

2. In use, the monitor should not let the colours shift beyond a certain perceptible relative limit. Each colour must be perceived as it was intended, and in a relative sense, one colour must not be mistaken for another.

3. When a colour shift occurs that is beyond limits, it should be possible to identify that the shift is beyond limits without the need for special instruments and completely dark environments.

C.2.1 N/A

C.3 Verification of the display performance at sea

C.3.1 Calibration tests for verification of display's performance onboard ship

ECDIS manufacturers shall make available through their user guides how a mariner should carry out verification of the ECDIS display at sea. The Colour Differentiation Test Diagrams with the S-52 Presentation Library have been provided for this task

C.3.1.1 Greyscale test

The Greyscale test shall be used to determine the colour tracking of the monitor. It is general, it is non quantitative and requires judgement on the part of the operator to use. On the other hand, it is quite sensitive, and familiar to video technicians.

This test is simple to use. It consists of putting a greyscale of at least 8 steps from black to white on the screen. The greyscale should be made of rectangles that are at least 2.5 cm by 10 cm. These can be oriented in either a horizontal or vertical direction. The greyscale is critically observed by the viewer from a distance of about 50 cm to 100 cm and any colour shifts in any of the rectangles of grey are noted.

The greyscale should appear to be a neutral shade of white in all rectangles. Each should appear to be the same 'colour' as the others, even though varying in intensity from black to white. Colour shading in any of the rectangles indicates a problem in the adjustment of the display.

Interpretation of results:

The observer will see either a greyscale that is pure and free from colouring, or one which shows varying degrees of shading. If no colouring is seen, then the display is performing properly. If slight shading is seen, then the display is usable. If there is a lot of shading, then the display may be providing false colour information.

This test meets the criteria of simplicity and universality, but fails to be either quantitative or accurate. It should be used as an indication of performance of the display, but not an absolute measure. It should be noted that the identification and the degree of problem will vary according to the operator, so should not be considered as a quantitative test.

C.3.1.2 Colour Differentiation Test Diagram

At the mariner's level, a test is required that reassures him that the display is functioning adequately or alternatively that servicing is required. This is provided in the Presentation Library, Part I, sections 15.4, 19.3 and 19.4. It provides test diagrams that allows the mariner to confirm that his display clearly differentiates the important colours, as well as acting as a test chart for setting the controls for night use.

Note that the Colour Test Diagram must be implemented using the software specifically intended to generate this diagram, which comes with the Colours & Symbol CD, in order to ensure that the colours actually used to generate the chart display are shown on the diagram. Any other form of the Colour Test Diagram (.tif file etc.) will not display the correct colours.

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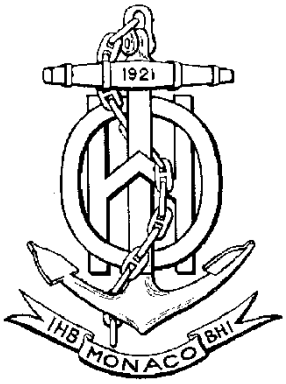
Presentation Library Edition 4.0.0

INTERNATIONAL HYDROGRAPHIC ORGANIZATION



IHO ECDIS
PRESENTATION LIBRARY

Edition 4.0, September 2014

Special Publication No. 52
ANNEX A

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FOREWORD

Edition 4.0 of the Presentation Library brings into effect all the deferred amendments issued since Edition 3.4 and also includes other substantial changes to bring it up to date with the IMO ECDIS Performance Standard requirements, and to provide clearer examples and guidance. This publication provides a clear, concise and comprehensive guide to implementing IHO S-52 symbology in ECDIS.

In keeping with previous versions of the Presentation Library the contents of the symbols, lookups and other ancillary files are published as a set of files which carry a subscription charge for each new edition to help to cover maintenance costs. These files are the authoritative statement of the Presentation Library contents.

The tables below detail the changes made to create S-52 Presentation Library Edition 4.0

New Mandatory ECDIS Requirements

S-52 Ed. 4.0 Clause	Description	Justification
10.3.4.4	Ability to turn Isolated Dangers in Shallow Water on/off	**Existing feature in e3.4 changed from optional to mandatory** This allows the Mariner the flexibility to navigate in shoal areas with or without the isolated danger symbol.
10.4.2	Ability to turn off SCAMIN in ECDIS	SCAMIN is not universally applied by HO's in the same way. Mariners need to be able to view all data and need a function to turn the SCAMIN attribute off.
10.5.7	Display of the shallow water pattern. Optional in e3.4	**Existing feature in e3.4 changed from optional to mandatory** Safety critical feature as it becomes increasingly difficult to detect the changes in the depth shades in ECDIS night pallet.
10.5.9	Detection and Notification of Navigational Hazard. Lists the S-57 features and attributes that will raise an indication.	**IMO PS Requirement** Enables clear and transparent identification of objects that will raise an indication within the ECDIS.

10.5.9	New Mariner Object 'indhlt'	**IMO PS Requirement** Designed for conditions that require a highlight in the ECDIS chart area, to conform to IMO requirements IMO has dictated the colour red shall only be allowed for alarms in ECDIS and that the colour yellow shall be used for warning and cautions. Design of a graphical highlight symbol in colour yellow. The current S-52 traditional graphical highlight symbol dnghlt is red.
10.5.10	Detection of Areas, for which Special Conditions Exist. Lists the S-57 features and attributes that will raise an indication or alert as defined by the Mariner	**IMO PS Requirement** Enables clear and transparent identification of objects that will raise an indication or alert within ECDIS as defined by the Mariner.
10.5.12	Detecting the Safety Contour. Lists the S-57 feature and attribute combinations required to detect the safety contour Rocks, Wrecks and Obstructions have been removed in e4.0 from detection of the safety contour process and moved to Detection and Notification of Navigational Hazards. This change is in line with the IMO PS requirement	**IMO PS Requirement** IMO PS states that rocks, wrecks and obstruction will only be an indication. Removing them from detecting the safety contour will reduce the number of audible alerts in ECDIS.
10.6.1.1	New viewing group created to allow separate display on/off for INFORM01 symbol: "Highlight info" for INFORM and NINFRM. "Highlight document" for TXTDSC, NTXDSC and PICREP.	**IMO PS Requirement** Mariner feedback during IMO Oct 2012 ECDIS meeting expressed irritation at not being able to control the display of features in ECDIS as there were not enough selectors. This was sighted as a major reason for cluttered ECDIS display.
10.7.2	Use of new symbols for identifying automatic ENC updates	**IMO PS Requirement** Previously no standardized symbols available

14.3	Adoption of the IMO PS naming convention for ECDIS viewing groups available in ECDIS	**IMO PS Requirement** Mariner feedback during IMO Oct 2012 ECDIS meeting expressed irritation at not being able to control the display of features in ECDIS as there were not enough selectors. This was sighted as a major reason for cluttered ECDIS display.

Changes and Clarifications

S-52 Ed. 4.0 Clause	Description	Justification
	Inserted Standards Terms and Definitions	
	Inserted new text boxes are used to highlight important text and notes in the new edition of the standard	**Clarification** Highlights critical points in ECDIS presentation for developers
Annex A	FLODOC, PONTON, HULKES display priority changed from 5 to 1	**Error in LUT entries** These objects are part of group 1, skin of the earth objects, they all have a solid area fill and should be lowest in the drawing priority. Before the change for example cranes in a flodoc area were masked by the high priority drawing of solid brown colour.
Annex A App A	The Mariner colours introduced by MD8 have been included in S-52 e4.0 NINFO has been removed from the list of colour tokens that can be substituted.	**MD8**
	Description of the Symbology Instructions**,** removed Backus-Naur diagrams and replaced with POSIX style manual pages	
10.1.3	ECDIS shall only display one ENC chart in an area where ENC cells of the same scale and usage overlap	**Clarification** Unfortunately despite best efforts ENC from different HOs sometimes do overlap. Previously there was no guidance on how overlaps should be handled in ECDIS. Mixing of overlapping charts created cluttered and unusable displays.

10.4	A means to insert a date or date range to display date dependant features. New symbol to indicate where in the chart display the objects with temporal attributes are located	e3.4 provided two options to perform this function, select date or show all. e4.0 has removed the show all option as it was confusing for the Mariner. E4.0 has also introduced a new symbol that will indicate the presence of temporal attributes on features.
10.3.3.8	Use of default symbol NEWOBJ01 if SYMINS instruction cannot be understood	**Clarification** Fail safe procedure
10.6.2	The ECDIS legend will be made available at the position selected by the Mariner	**Change** Ensuring the chart legend is available from the location chosen by the Mariner will remove any confusion about what data should be displayed when the own ships position is not on the ECDIS chart screen.
10.8.5	Guidance on the use of hover over function for a limited number of S-57 features	**Change** Speeds up chart enquiry by the user. Recommendation from IEC 61174 drafting committee.
	CSP name change LIGHTS05 - LIGHTS06	**MD8** New colour added, blue and to allow the display of 360 degree major light sectors with a nominal range of 10nM or greater. MD8
	CSP name change LITDSN01 - LITDSN02	**MD8** New colour added, blue
	CSP name change SYMINS01 - SYMINS02	**Clarification** Default symbolization instruction added
	CSP name change SNDFRM03 - SNDFRM04	**MD7** Introduction of new attribute found by Diver
	CSP name change SOUNDG02 – SOUNDG03	**MD7** No change to CSP, numbering changed as CSP calls sub-procedure SNDFRM
	CSP name change WRECKS04 – WRECKS05	**MD7** No change to CSP, numbering changed as CSP calls sub-procedure SNDFRM

	CSP name change OBSTRN06 – OBSTRN07	**MD7** No change to CSP, numbering changed as CSP calls sub-procedure SNDFRM
	CSP name change RESARE03 – RESARE04	**MD8** To harmonize portrayal of entry prohibited restricted areas with INT 1
	CSP name change DEPARE02 – DEPARE03	**MD5** This change should have been already between Ed 3.3 and Ed 3.4
	CSP name change SLCONS03 – SLCONS04	**Clarification** The expert review team found an error in handling of “low accuracysymbols”
8.5.1	When areas are split by the ECDIS screen the system shall display centred symbols in each part	**Clarification**
10.9	Display of TS_PAD template in ECDIS pick report	**Clarification** Previously no guidance on how the data from the S-57 feature TS_PAD should be presented in the pick report.
S-52 ENC Symbol Catalogue	All conspicuous symbols shall be drawn with a 0.6 line width All non-conspicuous symbols have 0.3 line width	**Clarification** Logical consistency, the more prominent a feature the more distinguishable it should be in the ECDIS chart display
Annex A App B, C, D, E, F	ALL LUT entries with CONRAD 1 or 3 changed to suppressed.	**Clarification**
Annex A App B, C, D, E, F	Found typo style errors have been fixed for CURENT, FERYRT, LNDMRK, RCRTCL, VEGATN	**Clarification** As part of the expert review process the existing printed version of the LUT has been fixed for typo style errors
Annex A App B, C, D, E, F	Selected meta object without visible presentation has been modified to have viewing group, category, priority, etc, but still no visible symbol. This allow Picke report to recognise them: M_ACCY, M_HOPA, M_SDAT, M_SREL, M_VDAT	**Clarification** A technical method to access meta objects by Pick report has been clarified

Annex A App B, C, D, E, F	Selected meta object without visible presentation has been modified to have visible presentation: M_NPUB	**Clarification** Technical possibility for ECDIS and practical graphical indication for mariner to access Nautical publication using Pick report

Deletions

S-52 Ed. 3.4 Clause	Description	Justification
4.1	User Interface Colours	MSC.191(79) and IEC 62288 set rules for user interfaces within ECDIS.
6	The Raster-Symbol Description Format	Presentation Library 3.4 does not contain any raster symbol definitions and has never provided details.
10.5.7	Raster Image Pattern Definition	Presentation Library 3.4 does not contain any raster image pattern definitions
10.6.7	Raster Image Symbol Module Example	Presentation Library 3.4 does not contain any raster symbols
	All Mariners Objects, symbols and LUT entries	IMO and IEC 62288 is the authority for Mariner objects

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CHANGE CONTROL HISTORY SINCE 1996

Amendment Abbreviations: MD Maintenance Document
IA Immediate Amendment
DA Deferred Amendment

Specifications for Chart Content and Display Aspects of ECDIS (S-52)

Previous Edition	Amendments Applied	Resulting Edition
Edition 5.0 (Dec 1996)	Mar 1999	"5th Edition, amended Mar 1999"
"5th Edition, amended Mar 1999"	Dec 2001	"5th Edition, amended Mar 1999 & Dec 2001"
"5th Edition, amended Mar 1999 & Dec 2001"	MD7 + Merging with former S-52 App. 2 (C&S specs)	Edition 6.0 (Mar 2010)
Edition 6.0 (Mar 2010)	Deleted Annex B and corrections made to Annex C (not from an amendment)	Edition 6.1 (Sep 2014)

Guidance on Updating the Electronic Navigational Chart (S-52, Appendix 1)

Current Edition	Amendments Applied
Edition 3.0 (Dec 1996)	No revisions since 1996

Colours & Symbols Specifications (Former S-52, Appendix 2)

Previous Edition	Amendments Applied	Resulting Edition
Edition 3.0 (Jul 1996)	July 1997	Edition 4.0 (Jul 1997)
Edition 4.0 (Jul 1997)	MD1 IA i01	Edition 4.1 (Jan 1999)
Edition 4.1 (Jan 1999)	MD2 DA d02 MD4 DA d6	Edition 4.2 (Mar 2004)
Edition 4.2 (Mar 2004)	MD5 DA d7	Edition 4.3 (Jan 2008)

Glossary of ECDIS-Related Terms Specifications (Former S-52, Appendix 3)

Previous Edition	Amendments Applied	Resulting Edition
Edition 3.0 (Dec 1997)	Transferred to S-32	S-32, Appendix 1 (Sep 2007)

Presentation Library (Annex A to former S-52, Appendix 2)

Previous Edition	Amendments Applied	Resulting Edition	Digital PresLib	Addendum to Part I
Edition 3.0 (July 1997)	MD1 IA i01	Edition 3.1 (Jan 1999)	PRSLIB03.dai (Jul 1997) PSLB03_1.dai (Dec 1998)	
Edition 3.1 (Jan 1999)	MD 3 IA i04	Edition 3.2 (May 2000)	PSTY03_0.dai (Jun 1999) PSLB03_2.dai (May 2000)	2003
Edition 3.2 (May 2000)	MD2 DA d02 MD3 DA d05 MD4 DA d6	Edition 3.3 (2004)	PSTY3_2b.dai (Oct 2001) PSLB03_3.dai (Mar 2004)	2007
Edition 3.3 (2004)	MD5 IA i5 MD5 DA d7 MD6 IA i6	Edition 3.4 (2008)	PSLB03_4.dai (Jan 2008)	2008
Edition 3.4 (2008)	MD7 DA d8 MD8 DA d9 and other edits	Edition 4.0 (Sep 2014)	PSLB04_0.dai (Sep 2014)	2014

The grace periods from the issuing date of a new edition after which changes are required to be included in an ECDIS nominally are:

- for new development one year

- for new selling (already type-approved before date of issue) one year

GENERAL LAYOUT OF THE PRESENTATION LIBRARY

PART I:

USERS' MANUAL

Sections 1-10	Description of symbolisation methods
Sections 11 -12	Description of the Digital Presentation Library

TABLES AND SYMBOLISATION PROCEDURES

Section 13	Conditional Symbology Procedures (UML)
Section 14	Tables
Section 15	Symbol library for use on ECDIS

ECDIS CHART 1, SYMBOL PLOTS & COLOUR TEST DIAGRAM

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- pseudo-S-57 file version of ECDIS Chart 1
- colour test diagram (pseudo S-57 code with look-up table)

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USERS' MANUAL

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1. Scope

This document is intended to explain the mechanisms of the IHO ECDIS Presentation Library to the ECDIS manufacturer, and to help them implement the library correctly. Therefore, it provides the software developer with the information needed to translate abstract descriptions of S-57 [6] objects into effective ECDIS display according to S-52 [3]. The symbols used in the Presentation Library are described by a vector drawing language. There are many components to the ECDIS display and this document presents them in a structured fashion describing how the ENC data is to be rendered on screen and what facilities shall be provided to the Mariner by the display. This document also explains how the various parts of the ECDIS Presentation Library are related to each other, how these parts shall be used to achieve an ECDIS presentation and how the symbol library can be transferred in a machine readable form.

This manual assumes, that the reader has carefully studied in advance the various standards for ECDIS, i.e., IHO S-52/S-57 [4,5,6,7] and IMO Performance Standards for ECDIS [2].

Sections 4, 5 and 6 of this documentation start with an overview of the Presentation Library. They were written for the reader who is interested in the basic concept. Details that address especially the designer of an ECDIS system are explained from section 7 onwards.

Note: The Presentation Library does not cover all aspects of the ECDIS display. The IMO Performance Standards as well as the C&S Specifications and IEC publications 61174 [7] and 62288 shall also be used in conjunction with this document. The IHO Test Data Sets (S-64) [10] shall be used when testing ECDIS software.

1.1 Use of Language

Throughout this document the word shall is used to describe mandatory ECDIS requirements, the word may is used to describe optional requirements.

2. Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

2.1 Alarm

(MSC.302/A) a high-priority alert. Condition requiring immediate attention and action by the bridge team, to maintain the safe navigation of the ship.

2.2 Alert

(MSC.302/A) announcement of abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions. An alert provides information about a defined state change in connection with information about how to announce this event in a defined way to the system and the operator

2.3 Caution

(MSC.302/A) lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information.

2.4 CIE Colours

One of the first mathematically defined colour spaces the CIE XYZ colour space was created by the International Commission on Illumination 1931.

2.5 Colour Token

A five letter, code identifying a colour and its use in ECDIS. The day and night colours which are identified by the token are given in the colour tables (in CIE coordinates). Note that several colour tokens may share the same colour.

2.6 Complex Line Styles

Lines that are themselves symbols, or that have symbols interlaced. Examples of a line as a symbol are a submerged pipeline LC(PIPSOL05), or the T T T lines indicating the inside of an area LC(ENTRES51). A simple or complex line may have a symbol interlaced, such as an anchor for anchorage area LC(ACHARE51).

2.7 Conditional Symbology Procedure

A decision-making procedure used to link an object-class and its attributes to a symbol. Used in cases where the symbol depends on system configuration, Mariner options and the objects spatial relationship to other features (e.g. whether a wreck is symbolized as an "isolated danger" depends on its relationship to the safety contour chosen by the Mariner) or where symbolization is complex (e.g. light sector).

2.8 Display Category

IMO PS [2] establishes three display categories for the presentation of SENC objects Display base: always on the display. Standard display the ECDIS' default display. Other: all other objects in the SENC.

2.9 Display Priority

Hierarchy to decide which object is to be shown when two objects overlap. Priority 2 overwrites 1

2.10 ECDIS

A navigation information system which with adequate back-up arrangements can be accepted as complying with the up-to-date chart required by regulations V/19 and V/27 of the 1974 SOLAS Convention, as amended, 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.

2.11 ECDIS Chart 1

An ECDIS version of chart 1, including all symbols, line styles and colour coding used for chart presentation. Intended for the Mariner to both familiarize himself with ECDIS and to look up specific symbols. The manufacturer shall program the look-up of symbols drawn from the Presentation Library, including certain diagrams which are copied from INT 1 [1].

2.12 Geometric Primitive

A plain point, a plain line, a plain area as defined in geometry (i.e. without any meaning attached).

2.13 Indication

Visual indication giving information about the condition of a system or equipment. [2]

2.14 Look-up Table

A table that links SENC objects to area, point symbol and line representation on ECDIS, and provides display priorities, radar flag, IMO category and viewing groups

2.15 No symbol Object

In some cases, the database contains information that is not intended for display. (An example might be a general area such as 'Great Australian Bight' which would be available for an answer to cursor interrogation of the sea area.)

2.16 Opaque fill

The background is completely filled with the colour fill. (e.g. depth area). The point and line SENC features may be overwritten. The raw RADAR image is a special case of opaque fill which overwrites all other features expect those with "priority over radar" (OVERRADAR).

2.17 Pattern fill

A method of identifying areas by large, faintly coloured symbols well spaced out across the area. A pattern spacing algorithm ensures that the pattern symbols are visible without being so dense as to cause clutter. Used to ensure pattern symbols are always visible at any display scale.

2.18 Pivot Point

The pivot point is the point around which the symbol gets scaled and rotated. When the symbol is placed in the world space, the symbol's pivot point is positioned exactly on the object's position and all elements of the symbol are geometrically related to that position.

2.19 Radar Priority

IMO PS [2] requires that radar can be switched off with a "single action control" in order to see SENC and Mariners info clearly. However certain other info, such as planned route, safety contour, coastline shall always be written over the radar.

2.20 Radar Transparency

A method of varying the transparency of radar in a continuous progression from no radar to a totally opaque radar overlay, by merging the radar colour with the colour of the object it overlays at each pixel

2.21 SCAMIN

The smallest scale at which an object is displayed (e.g. a minor light, SCAMIN of 1:50,000, would not be displayed at a scale of 1:75,000).

2.22 Simple Line Styles
Solid lines, dots and dashes.

2.23 Symbol Size
The size is specified in normalized units of 0.01 mm. The minimum dimension is always more than 4 mm. This size applies to display on a standard minimum screen specified in PC&SS [5] and S-52 [3].

2.24 Symbology Instruction
A machine readable symbolization order used in look-up tables to link object-classes to symbols, in straight forward cases (i.e. where a conditional symbology instruction is not required)

2.25 Text Label
A textual description of an object. Can be formatted to include standard text as well as feature attribute values. For example, light descriptions, place names etc.

2.26 TFT
Thin film transistor (used in LCD display technology).

2.27 Transfer, Exchange
These words are used as verbs or nouns to mean "provide" or "carry information".

2.28 Transparent Fill
A method of identifying areas by covering a given percentage of each 4 pixel square with the fill colour, leaving the remainder "transparent". Used to ensure the information underneath shows through.

2.29 Unknown Object Vector Format Symbol
If an object-class is not listed in the look-up table, the ECDIS shall advice the Mariner that an unknown object exists in the display area, and symbolize all such objects with a question mark.

2.30 Vector Format Symbol
A symbol described in vector coordinates.

2.31 Warning
(MSC.302/A) alert for condition requiring immediate attention, but no immediate action by the bridge team. Warnings are presented for precautionary reasons to make the bridge team aware of changed conditions which are not immediately hazardous, but may become so if no action is taken.

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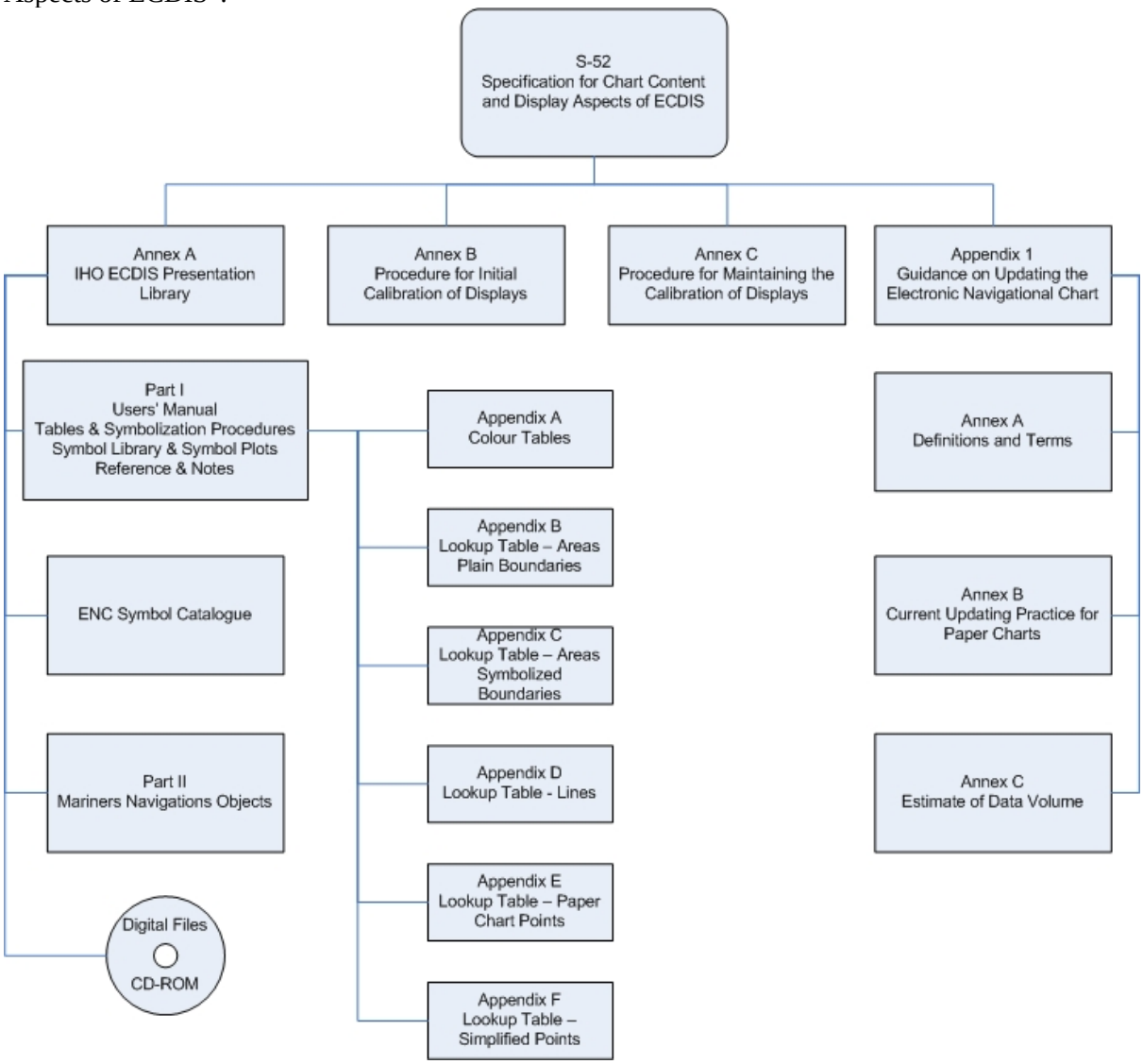
[11] International Hydrographic Organization: Maintenance Section under (www.iho.int > Publications > Download List)

4 Structure of the Presentation Library

The IHO Presentation Library is annex A to IHO S-52 "Specifications for Chart Content and Display Aspects of ECDIS".



4.1 S-57 and the Presentation Model for ECDIS

The Presentation Model for ECDIS refers to the official IHO Transfer Standard for Digital Hydrographic Data (S-57) [6]. The IHO Transfer Standard states in Part 2, section 3;

"The model described in this part of the Standard does not contain any rules for the presentation or display of information. It provides only the means for the factual description of the real world. The presentation of this information may vary to suit a particular use (e.g. it may be presented either graphically, using symbols, or in a textual form). Therefore, the presentation of information is considered to be independent of its storage. Different applications shall provide their own specific "presentation models". A presentation model defines, via a set of presentation rules, the way in which real world information shall be displayed for a specified application. The concept of keeping information storage independent of presentation provides for greater versatility and flexibility. It allows the same data to be used for many purposes without requiring any change to its structure or content. If the presentation style or medium changes, only the presentation model has to be changed."

In contrast to a presentation model suitable for paper chart application, a presentation model to be used by ECDIS systems shall take into account the requirements of the IMO/IHO "Performance Standard for ECDIS" [2] and the IHO "Specifications for Chart Content and Display Aspects of ECDIS", IHO Special Publication No.52 [3]. In particular, this means, that the presentation of charts on an ECDIS screen changes depending on parameters and selections defined by the Mariner, such as safety contour, time of the day, traditional or simplified symbology, etc. Thus the presentation model shall cover not only colour and symbol definitions but also instructions how to handle a dynamically changing presentation as well.

4.2 Structure of the Presentation Model for ECDIS

The **Presentation Model for ECDIS** is built from two major parts:

- A library of colours, line styles, fill styles, point symbols and a set of symbology instructions and look-up tables for the translation of object descriptions into symbology instructions. This part Is called "**Presentation Library for ECDIS**
- A description of the required programmable structure, which serves as a model for the graphic display within an ECDIS system and which explains how to use the elements of the Presentation Library and how to ensure the correct display of data structured according to S-57.

4.3 Supply and amendment of the Presentation Library

From edition 3.3 onwards the word-processed version of the Presentation Library is the "official" version. A digital version in .dai format is provided on the same CD-ROM as a manufacturer's option for edition 4.0. It consists of look-up tables; symbols; and colour tables and is supplied in ASCII format in the .dai file.

The name of the file on this CD which contains the official, word processed Presentation Library is " PSLBmm_n.pdf" where mm_n is the edition number.

IMPORTANT: The edition number of the PresLib installed shall be available to the Mariner on request.

The general layout of the Presentation Library is shown on page 14 of this publication. The various components of the Presentation Library are supplied and amended as follows:

The Presentation Library as a word processed file is issued on a CD-ROM, which carries a subscription charge for each new edition to help to cover maintenance costs. The word-processed Presentation Library includes:

1. the look-up tables, colour tables and symbol library.

2. the narrative and diagram conditional symbology procedures in UML form, together with symbolizing instructions (in section 14) for special IMO and IHO requirements which are needed to complete the symbolizing of an ENC,

3. further information needed for implementing the above in ECDIS given in all sections

On each occasion of an immediate amendment of the Presentation Library:

1. a description of the items in the amendment will be freely available from the IHO web site under the Maintenance Section (www.iho.int > Publications > Download List) [11].

2. the amended word-processed Presentation Library will be posted on the IHO web site (www.iho.int > Catalogue) together with the ECDIS Test Data Set (S-64) [10]. A subscription may be required.

Note: Only immediate amendments and not those of deferred amendments, will be included in the amended Presentation Library of .2 above.

The following digital files are also provided on the CD-ROM containing the word-processed Presentation Library:

1. The .dai file of the Presentation Library, consisting of look-up tables, symbols and colour tables.

Note: The .dai version is provided as a manufacturer's option for edition 4.0, but may not be available for succeeding editions.

The "Test Edition Version" of the .dai file provided with old editions of the Presentation Library is no longer required in IEC 61174 and has been removed permanently from the digital Presentation Library. However symbol SY(CHKSYM01) has been retained for use in checking symbol size.

2. ECDIS Chart 1 & Colour Differentiation Test Diagram, consisting of:

   - S-57 files containing a collection of all symbols coded as NEWOBJ using the SYMINS attribute and similarly arranged as INT1 [1] for paper charts
   - S-57 files containing combinations of foreground and background colours as line and area geometries.

3. UML models of the CSPs in Enterprise Architect format

5 Basic Concept of ECDIS Display

All elements of the Presentation Library are required to be implemented by a manufacturer unless otherwise stated. OEMs developing ECDIS display shall follow this documentation to perform the link between the S57 feature object characteristic and the actual presentation on the ECDIS screen.

Fig 1. is an example of how the various elements of the Presentation Library can be linked together in order to display an S-57 object from the SENC. Only the individual elements (symbol library, look-up tables, etc.) are provided in the Presentation Library. The ECDIS manufacturer writes software linking the elements.

Section 10 gives further details of key functions that shall be taken into consideration by the ECDIS developer.

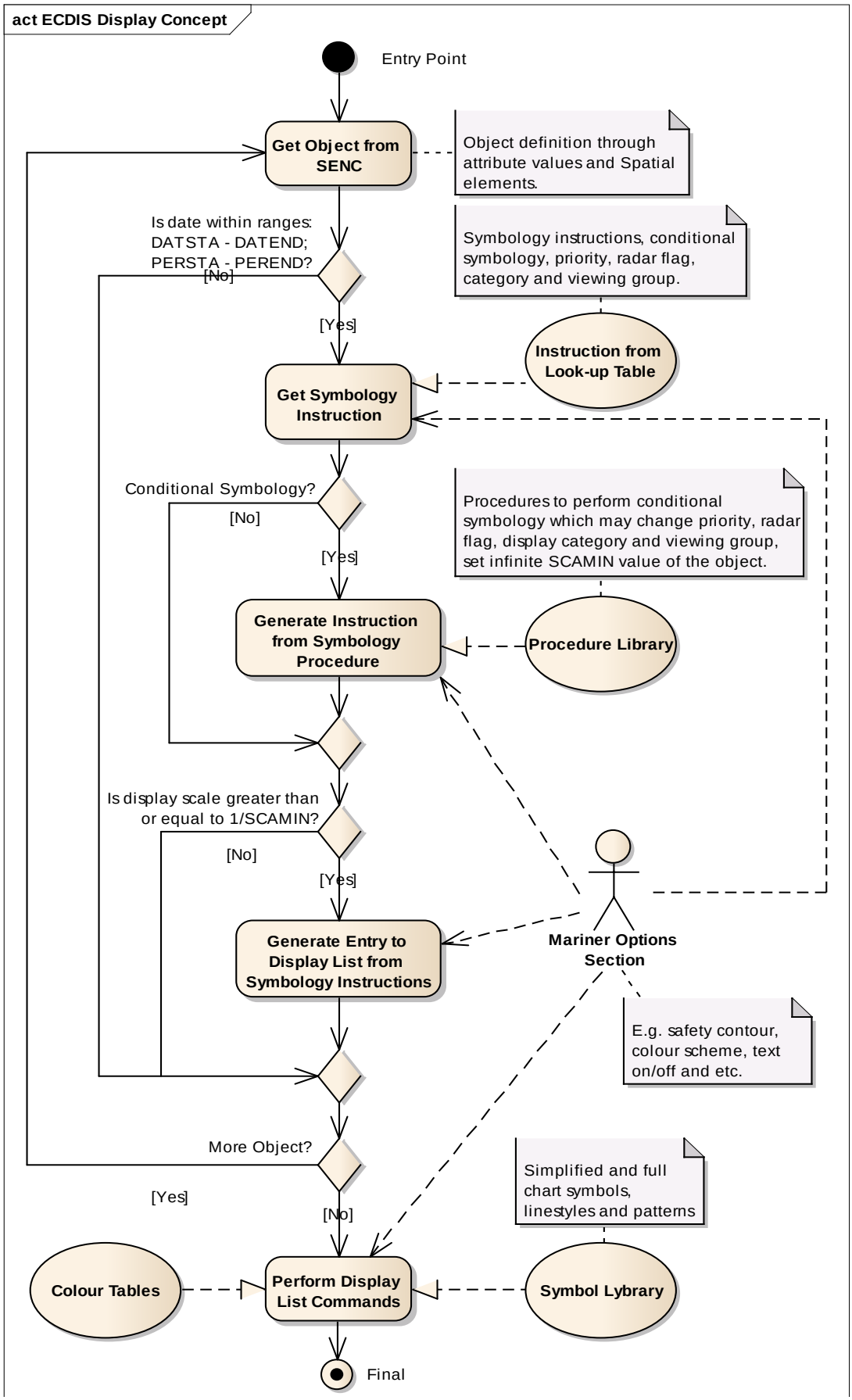

act ECDIS Display Concept
Entry Point
Get Object from SENC
Object definition through attribute values and Spatial elements.
Is date within ranges: DATSTA - DATEND; PERSTA - PEREND?
[No]
[Yes]
Symbology instructions, conditional symbology, priority, radar flag, category and viewing group.
Instruction from Look-up Table
Get Symbology Instruction
Conditional Symbology?
[No]
[Yes]
Procedures to perform conditional symbology which may change priority, radar flag, display category and viewing group, set infinite SCAMIN value of the object.
Generate Instruction from Symbology Procedure
Procedure Library
Is display scale greater than or equal to 1/SCAMIN?
[No]
[Yes]
Generate Entry to Display List from Symbology Instructions
Mariner Options Section
E.g. safety contour, colour scheme, text on/off and etc.
More Object?
[Yes]
[No]
Simplified and full chart symbols, linestyles and patterns
Colour Tables
Perform Display List Commands
Symbol Lybrary
Final

Fig 1. ECDIS display concept

Entry Point	Clipped portion of ENC to be displayed on the ECDIS screen. Perform for each SENC object.
Get Object from SENC	Object definition through attribute values and Spatial elements.
Is date within ranges: DATSTA - DATEND; PERSTA - PEREND?	Is the current date of presentation within the range of existence of the object? I.e. if there are values of the attributes' pairs DATSAT - DATEND or PERSTA - PEREND then the current date is more than Start date and less than End date of the existence period of the object.
Get Symbology Instruction	Get symbology instructions, conditional instructions, priority value, radar flag, display category and viewing group from the appropriate line of the Look-up table file.
Instruction from Look-up Table	Take the Look-up Table file according to geometry type of the object and mariner parameters ('simplify point', 'pattern area boundaries')
Conditional Symbology?	Does a Conditional Symbology Procedure exist?
Generate Instruction from Symbology Procedure	Execute the conditional symbology procedure to get Symbology Instructions with parameters of presentations.
Procedure Library	Procedures to perform conditional symbology which may change priority, radar flag, display category and viewing group, set infinite SCAMIN value of the object.
Is display scale greater than or equal to 1/SCAMIN?	Is the current display scale greater than or equal to 1/SCAMIN value from the object?
Generate Entry to Display List from Symbology Instructions	Add graphical primitives to the display list taking into account Presentation parameters (priority, radar flag, display category and viewing group)
More Object?	Are there more objects in the SENC? If it is, go to the next object.
Perform Display List Commands	
Mariner Options Section	E.g. safety contour, colour scheme, text on/off and etc.
Symbol Lybrary	Simplified and full chart symbols, linestyles and patterns
Colour Tables	Colour tokens with XYL values for different palettes (Day, Dusk and Night palettes)
Final	Final presentation of the SENC

The basic concept of ECDIS display is as follows:

1. The ECDIS determines which feature objects contained within the SENC are required for display.
2. The ECDIS maintains a set of Mariner defined parameters (such as safety contour, safety depth, display category).
3. Each feature object, whether point, line or area geometric primitive are transformed into symbolisation instructions using lookup tables and conditional symbology procedures described in this document.
4. The symbolisation instructions are drawn to the screen using lookup tables to define colour values for the selected pallet and taking into account data-defined parameters which may affect display, such as DATSTA-DATEND and SCAMIN.

If, for example, the Mariner subsequently selects another safety contour, the list of symbolisation instructions are renewed and the depth areas distinguishing shades are changed by a symbology procedure which is called to generate symbology instructions for the object class DEPARE (depth area). There are many display options, some of which are mandatory and which are described in this document. The ECDIS manufacturer is also able to provide Mariner features within their ECDIS which build on the mechanisms described in this document.

Note that the ECDIS shall not initiate any change of state automatically or by linkage, e.g., it shall not automatically select "lights" because the Mariner selects the night colour table. All changes to the composition of the display shall be initiated by the Mariner.

6 The Elements of the Presentation Library - An Overview

The Presentation Library consists of seven elements:

1. A colour coding scheme defining the IHO colour tables for day and night time

2. A library of symbols, line styles and fill styles

3. A set of symbology command words from which symbolisation instructions can be assembled. These are used to symbolize S-57 [6] objects.

4. A set of conditional symbology procedures to decide the appropriate symbolization in cases determined by the Mariner's selection (e.g., safety contour) or in complex symbols (e.g., light sectors).

5. A set of look-up tables that link S57 feature object descriptions and geometric primitives to the appropriate symbology command words using one of two separate mechanisms:

   a) A simple lookup where the link is straight forward, i.e., a direct relationship between an object's description and its presentation such as a buoy or land area. In this case the look-up table provides the symbology instruction to show a symbol, an area fill or a line style.

   b) A more complex lookup where the link between the feature and its symbology is dependent on a parameter or other context, for example a depth area, whose colour fills depends on the choice of the safety contour. In this case the look-up table refers the decision to a conditional symbology procedure which then selects the appropriate symbology instructions.

6. A .tif file (or other medium) set of diagrams that can be displayed or printed on demand and explain the symbology to the Mariner (Mariners' ECDIS Chart 1)

7. A catalogue of navigational object classes that comprise objects that the Mariner may add to the chart. (These are specified in Part II of the Presentation Library [4])

The following section gives a short description of each of the elements of the Presentation Library.

6.1 The Colour Coding Scheme

The Presentation Library uses a colour scheme, which classifies colours by their usage (see section 7). Each colour usage is represented by a five letter colour token. Each colour token corresponds to a colour definition given in CIE coordinates in one of a set of colour tables for different bridge lighting conditions. Each colour table is referred to as a "pallet" such as "Day-Bright", "Dusk" and "Night".

Symbols, fill styles and line styles refer to the colour tables by using the standardized colour tokens as part of the symbol definition. See section 7 and 15 on how to use colour tokens, section 11.4 on how colour tables are transferred in the digital version. Appendix A of this document provides the XYL values for each colour token in Day, Dusk and Night palette.

6.2 The Library of Symbols, Fill Styles and Line Styles

Symbols, area fill patterns and line styles are described in detail in the Symbol Library (section 16 and the Addendum). They are also supplied in a machine readable format on the digital file.

6.2.1 Symbols

The Presentation Library provides two sets of symbols, referred to as "simplified" and "traditional". The symbols for point objects are generally based on the traditional paper chart symbols and, in addition a set of more compact, but more visible, 'simplified' buoy and beacon symbols are provided for use under difficult viewing conditions.

6.2.2 Area Fills

The Presentation Library offers various ways to fill areas. They can be filled with an opaque colour; with a colour shown with some transparency; or with a pattern of symbols (fill pattern) or with a centred symbol. Fill patterns and centred symbols are introduced as a solution for the symbolization of areas in special situations. When using the traditional (paper chart) way, e.g., to symbolize the traffic direction by using an arrow, it might happen that the arrow-symbol moves off the screen because the size and position of the viewing window on the ECDIS chart cannot be predetermined. A fill pattern showing arrows does not have a certain position on the chart like the paper chart arrow-symbol. It shows up as long as any part of the traffic separation lane can be seen on the screen. A centred symbol moves to the centre of the part of the area that remains in the display window.

The Presentation Library provides two options for area boundaries, referred to as “plain” and “symbolised”. There are look-up tables for plain area boundaries (intended for use at small scale to reduce clutter) and symbolized area boundaries (intended for use at larger scales to assist area identification. Note that centred symbols shall still be used with symbolized boundaries to symbolize the case when the entire display window lies within an area. See section 9 for symbology instructions and 11.5 for details of the digital format.

6.2.3 Line Styles

The Presentation Library uses two types of line styles: simple line styles and complex line styles. Simple line styles are solid, dashed or dotted lines with varying colour and thickness. Complex line styles are composed of repeating line patterns. See section 9 for symbology instructions and 11.7 for details of the digital format.

6.3 Symbology Instructions

The ECDIS chart display is generated from symbology instructions. The symbology instructions are in turn assembled from a set of symbology commands which have been designed for the Presentation Library. Symbology commands are intended to be machine readable instructions which can be easily decoded in a straightforward manner to low level graphic actions that are performed by the ECDIS to generate the ECDIS display.

Currently there are five types of symbology instructions:

1. instructions for line objects
2. instructions for area objects
3. instructions for point objects
4. instructions for text labels
5. call to conditional symbology procedures

Symbology instructions are explained in section 15.

6.4 Conditional Symbology Procedures

To handle complex presentation situations conditional symbology is required. Conditional symbology is different from standard symbology in that a procedure is processed rather than a straightforward symbology lookup instruction. Thus decisions are made by the ECDIS at run time which affect symbolization and other display factors such as priority, radar flag, category, viewing groups. The conditional Symbology Procedures are defined in section 13.

6.5 The Look-Up Tables and other symbolizing instructions

Instructions on how to symbolize an instance of an object class can be found in look-up tables that come with the Presentation Library on the distribution CD-ROM.

There are five look-up tables:

1. paper chart point symbols
2. simplified point symbols
3. line symbols
4. plain area boundary symbols

5. symbolized area boundary symbols

IMPORTANT: The manufacturer shall allow the Mariner to select freely between the two point symbol tables and the two area symbol tables. There shall be no linkages, for example linking simplified point symbols to plain area boundaries, etc.

Each line of a look-up table, called a look-up table entry, contains the S57 feature class., a string of attribute-value combinations and symbology instructions or a call to a conditional symbology procedure which in turn creates symbology instructions.

To find the correct symbolization for an instance of an object class the look-up table is entered with the object class code and its presentation-relevant attribute values. The resulting symbology instructions can then be used by the ECDIS to render the symbol on screen.

Every entry to the look-up tables matches either all objects of an object class or a subset. Therefore, the look-up tables are also used to assign the objects to the IMO/IHO display category, display priority, radar flag and optional viewing group. The viewing groups may be used by the Mariner to either reduce or add information shown on the screen.

Look-up table entries are supplied in Annex A and in a machine readable format in the .DAI file.

Some display features cannot be handled by look-up tables, generally because they are not defined S-57 objects and fall between the look-up tables and the conditional symbology procedures. Some examples are the scalebar, the ECDIS chart legend, manual correction identifiers, cursor pick etc. These are described in section 10

6.6 Mariners' ECDIS Chart 1 and Colour Differentiation Test diagrams

To familiarise the Mariner with ECDIS symbology, a printable set of symbol diagrams, following the sequence of the paper chart INT 1 [1], is provided in section 16, along with a numbered list of symbol meanings to explain the use of each symbol.

The digital equivalent, a set of symbol diagrams in the form of S-57 compliant charts, is included on the CD-ROM for edition 4.0. These provide symbol meaning, through cursor picking referring to the symbol descriptions given in the symbol library.

A Colour Differentiation Test diagram is included to enable the Mariner to verify the ability of his ECDIS display screen to distinguish between differently colour-coded areas, lines and point symbols. See 16.3 for the diagram and 18.4 for its use.

6.7 Mariners' Navigational Object Classes

IMO Resolution MSC.191(79) 2004 is the performance standard for the display of navigation-related information on all shipborne navigational systems and equipment. IMO SN/Circ 243 describes symbols used for the display of navigation-related information on all shipborne navigational systems and equipment. IEC 62288 defines the general requirements and the testing methods for navigational related information on shipbourne navigational displays in support of MSC.191(79).

The symbols for which IMO is the authority represent non-chart objects which are not defined in S-57. The IHO has defined three Mariner objects for use in ECDIS the objects are defined in S52- Part 2 and the symbols are contained in the ENC symbol catalogue.

The symbology instruction for Mariner objects detailed in S-52 Part 2 can be found in the look-up tables like the symbology instruction suitable for any S-57 object class.

Please see Part 2 for further details and definitions of the Mariners' navigational object classes.

6.8 Test Edition of the Presentation Library

The Test Edition is no longer required in IEC 61174 [7] and has been removed permanently from the S-52 Presentation Library. However symbol SY(CHKSYM01) has been retained for use in checking correct symbol size.

7 Description of the Colour Coding System

The colours of the Presentation Library for ECDIS are named with a five character code that reflects their usage, e.g., CHMGD for "chart magenta, dominant". These names are called "colour tokens". The colour tokens are referred to by symbology instructions, symbol definitions and line/fill styles. The colour tokens are defined by CIE-coordinates. The standards responsible for describing methods of converting CIE colour coordinates into RGB values are described in S-52 edition 6.1 clause 4.2.3.

The colour tokens are organized in a colour scheme that groups the tokens in colour sections. Each colour section contains a set of colour tokens that serves a special purpose, e.g., to provide colours for the chart content.

7.1 The Sections of the Colour Scheme

The Colour Scheme is split into several sections based on intended usage. The colour values themselves are listed in the colour tables (Part I, Appendix A). This section describes each of the tokens within each section.

7.1.1 General Colours

The colours of this section are used in combination with every section of the whole colour scheme:

Token	Colour	Usage
TRNSP	transparent	invisible pixels
NODTA	grey	areas without chart data
CURSR	orange	cursor colour,VRM,EBL

TRNSP - This means a 100% "transparent" colour. This is not a "real" colour since it is invisible. Every pixel on the screen, which has the colour value 0 shows up as 100% transparent. In case the pixel was already painted with another (visible, e.g., black) colour this colour is not overwritten by the transparent colour. In case the pixel was cleared before or not yet painted the "background" colour shows up (see **NODTA**).

NODTA - This abbreviation stands for "No Data". This colour shows up on every pixel on the screen, which is neither covered by chart features nor covered by other elements of the ECDIS display (e.g., radar overlay, user interface). Thus, it can also be called the "empty background colour" (see **TRNSP**).

CURSR - In most graphic systems the cursor is treated as an item that can be handled completely independent from the graphic of the chart area. Therefore the cursor is given its own colour and it is kept separately from the other sections of the colour scheme. The cursor colour is also used by variable range marker (VRM), electronic bearing line (EBL), parallel indexing lines and other tools to perform absolute and relative measurements in the chart.

7.1.2 Chart Colours

The colours in this section are specifically designed for chart display.

Token	Colour, day/night	Usage
CHBLK	black/grey	general
CHGRD	grey dominant	general
CHGRF	grey, faint	general
CHRED	red	general
CHGRN	green	general
CHYLW	yellow	general
CHMGD	magenta, dominant	general
CHMGF	magenta, faint	general
CHBRN	brown	general
CHWHT	white	general
OUTLW	black	symbol outline on sea area background
OUTLL	pale/dark brown	symbol outline on land area background
LITRD	red	red lights
LITGN	green	green lights
LITYW	yellow	white/yellow/orange/amber lights
ISDNG	magenta	isolated danger
DNGHL	red	danger highlight
TRFCD	magenta, dominant	traffic control features
TRFCF	magenta, faint	traffic control features
LANDA	brown	Land areas
LANDF	brown	Landforms, land features
CSTLN	black/grey	Coastline, shoreline constructions
SNDG1	grey	deep soundings > safety depth
SNDG2	black/white	shallow soundings <= safety depth
DEPSC	grey	safety contour
DEPCN	grey	depth contours
DEPDW	white/black	deeper than selected deep contour
DEPMD	pale/dark blue	safety contour to selected deep contour
DEPMS	light/medium blue	shallow contour to selected safety contour
DEPVS	medium/light blue	zero meter contour to shallow contour
DEPIT	yellow-green	high water line to zero meter contour

CHBLK, CHGRD, CHGRF, CHRED, CHGRN, CHYLW, CHMGD, CHMGF, CHBRN, CHWHT - This selection of colours is used in general to design symbols and chart line features as well as fill styles. They are not used in cases where other colours are available for a special usage.

OUTLW, OUTLL - These colours are used to outline symbols depending on which background they are normally shown (water/land).

LITRD, LITGN, LITYW - Light symbols have their own colours to give the opportunity to influence their colour luminance individually. Yellow (**LITYW**) is used for white, yellow, orange and amber lights because it might be difficult to distinguish these colours from each other on a badly calibrated monitor. It also follows the tradition to show up white lights with a yellow flare or coloured arc.

ISDNG - Since the isolated danger symbol forms one of the most important items on the ECDIS screen, it is given a separate colour.

DNGHL - This colour is used for symbology that highlights Mariner selected dangers. The Mariner decides during route planning which features are highlighted by this colour.

TRFCD, TRFCF - Traffic separation schemes are complex chart features. The navigator is confronted with important elements of the schemes and with less important elements as well.

TRFCD is used to distinguish important traffic routeing features.

LANDA - This colour is used for land areas in general.

LANDF - Landforms and land features are given a contrasting brown.

CSTLN - The coastline is a very important feature of the chart. If a radar image is combined with the chart picture it is required that coastline elements clearly show up on top of the green radar picture (see also **RADHI/RADLO**). To have full control over this combination under all conditions (day/night) a separate colour is reserved for coastline features.

SNDG1 - This colour is used for soundings that are deeper than the selected safety depth ("safe" soundings).

SNDG2 - This colour is used for soundings that are shallower than or equal to the selected safety depth ("unsafe" soundings).

DEPSC - This colour is reserved for the selected safety contour.

DEPCN - All depth contours other than the safety contour shall use this colour.

DEPDW, DEPMD, DEPMS, DEPVS, DEPIT - These are depth shades. The depth zones are:

DEPDW: areas deeper than the Mariner-selected deep contour;

DEPMD: areas between deep contour and the Mariner-selected safety contour;

DEPMS: areas between safety contour and the Mariner-selected shallow water contour;

DEPVS: areas between shallow water contour and the low water line (zero meter contour);

DEPIT: areas between zero meter contour and coastline (intertidal).

For route monitoring it may be desirable to distinguish only two water shades, plus **DEPIT**: deeper than own-ship's safety contour and shallower than safety contour. In that case **DEPDW** and **DEPVS** shall be used. At night it may be difficult to distinguish between **DEPMD** and **DEPDW**.

7.1.3 Radar Image Overlay Colours

Token	Colour	Usage
RADHI	green	high intensity echo or single int. echo
RADLO	green	low intensity echo & target trail
ARPAT	green, dashed	ARPA, target symbols & infos

The radar image overlay can be generated by using either one intensity colour or a range of intensities. The colour for high echo intensity (**RADHI**) shall be used where only one intensity is

used. If you prefer to show more than one echo intensity or fading target trails, the corresponding colour intensities shall be interpolated between the colour for high echo intensity (**RADHI**) and the colour for low echo intensity (**RADLO**). A separate colour token is used for ARPA targets and information tagged on them (**ARPAT**).

Optionally, the manufacturer may vary the radar green overlay by making it transparent. As described in section 8.4.2, there are two ways of doing this:

1) Use "pixel swap" transparency, as described in detail in section 8.4.2.

2) by mixing the fill and underlying colour at each pixel to give a continuous transparency change from 0% to 100%. This shall be done in such a way that no appearance of colour or shape change occurs in any SENC feature on the display, at any intermediate transparency value. The underlying SENC information shall remain distinguishable, except when the overlay colour approaches 100%, in which case Colour & Symbol Specifications 2.3.2 (b) applies and an indication is required.

7.1.4 Mariners' & Navigation Information Colours

Token	Colour	Usage
SCLBR	orange	scalebar
CHCOR	orange	chart corrections
NINFO	orange	Navigators Notes
ADINF	yellow	Mariners' transparent area fill and manufacturers' points and lines

SCLBR Used to generate the scalebar.

CHCOR Hand-entered chart corrections are marked by the colour.

NINFO Mariners' notes of any form (Symbols, Text) are generated using the colour.

7.1.5 Other Colours

Token	Colour	Usage
RESBL	blue	AIS features and symbols
RESGR	grey	reserved for line features & screened areas
BKAJ1	black	black level test symbol background
BKAJ2	grey	black level test symbol foreground

7.1.6 Colour Section V / Ship Symbol & Planned Route

Token	Colour,day/night	Usage
SHIPS	black/white	own ship, Co&SpMG vector
PSTRK	black/white	Past Track
SYTRK	grey	Secondary Track
PLRTE	red	planned route & notations
APLRT	orange	alternate planned route

Own ship symbol, course over ground and the speed over ground vector are shown in the colour **SHIPS**.

The past track of the main position sensor and a secondary position sensor are shown in **PSTRK** and **SYTRK**.

The planned route uses the colour **PLRTE** as well as the symbol set for the planned route elements (waypoints, etc.). Any alternate route is shown in **APLRT.**

7.1.7 User Interface Colours

For ECDIS user interface colours please refer to MSC.191(79) and IEC 62288.

8. The Vector Symbol Description Language

This section describes the format that is used by the Presentation Library to define point symbols, complex line-styles and fill patterns.

The vector format uses an imaginary "pen" to draw on a “canvas” (an area of the screen). Positions on the canvas are referred to by two-dimensional cartesian coordinates (x,y). The coordinates are always within the range of 0 to 32767 units. Each unit represents 0.01 mm on screen. The origin of the coordinates (position 0,0) is on the upper left corner of the two-dimensional canvas. Thus x-coordinates extend to the right and y-coordinates extend downwards.

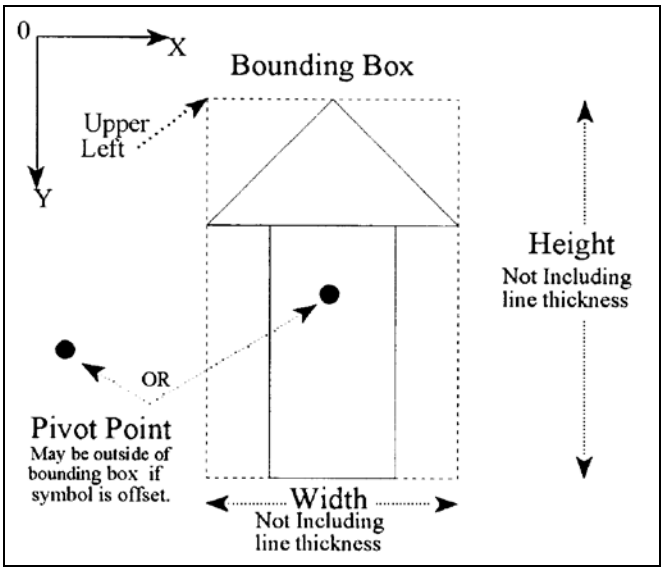


Fig 2. Pivot point, bounding box and symbol coordinates.

The definitions of point symbols, complex line styles and fill patterns are composed of multiple instructions. Vector symbol definitions described by the vector format are defined within the 'PVCT/SVCT/LVCT'-fields (see section 12). The vector format uses the following additional instructions:

; The semicolon separates the instructions from each other. Every instruction shall be terminated by a semicolon.

, The comma separates the parameters of an instruction from each other. If an instruction does not have any parameters no comma is allowed following the instruction.

Vector Instruction	Parameter	Description
SP	**Colour**	The SP instruction selects a pen with a certain colour. The parameter is a single letter which identifies a colour token. The colour tokens used are defined in the "Colour Reference"-fields (see 10.5.4) which map the single letter definition to one of the standard colour tokens. An SP instruction remains in effect until a new pen is selected. Thus, all following instructions are performed using the selected pen colour.

ST	**Transparency**	The ST instruction defines the transparency of the colour that is currently selected. The transparency is given in steps of 25% (0-3, see 8.4.2). The transparency only affects the polygon fill instruction (see FP) while other instructions (AA, CI, EP, PD) produce opaque drawings.
SW	**Width**	The SW instruction parameter defines the physical pen-tip width in units of 0.3 millimetres. If a single point is defined, (a pen down with no movement followed by a pen up) then a dot would be drawn using the current line width as a diameter or a square using the current width. (standard pixel diameter).
PU	**x-coordinate, y-coordinate**	The PU instruction raises the pen and then moves it to the absolute x,y-coordinates. Thus, no line is drawn by the PU instruction.
PD	**x-coordinate, y-coordinate [,x,y, ... x,y]**	The PD instruction lowers the pen at the current position and then moves it to the absolute x,y-coordinates. Thus a line in the current colour (see SP) and width (see SW) is drawn by the PD instruction.
CI	**Radius**	The CI instruction draws a circle of a specified radius. The radius determines the size of the circle. The current pen position is the centre of the circle. The CI instruction includes an implicit pen down feature. When a CI instruction is used the pen lifts, moves from the centre of the circle to the starting point on the circumference, lowers the pen, draws the circle, then returns with the pen up to the centre of the circle. The circle is drawn using the current pen colour (see SP) and pen width (see PW).
PM	**n**	The PM instruction places the command interpreter in polygon definition mode. In this mode you can construct polygons using other instructions (PU, PD and CI). These instructions are stored in the polygon buffer; they are not executed until the polygon is completely defined. In order to draw the polygon it shall be filled with the FP instruction and/or outlined with the EP instruction. To define a polygon move the pen to the desired starting position (see PU or PD). Then execute PM 0 to enter the polygon mode and specify the appropriate instructions to define the shape of the polygon. If you want to define a sub polygon, end the shape with a PM 1 instruction and define the next shape; execute PM 2 to exit the polygon mode. The current pen position before PM 0 is the first point (vertex) of the polygon. The vertices can be defined with the pen up or down (see PU, PD). However, if you intend to outline the polygon with the EP instruction, note that EP will only draw those points that are defined with the pen down. The FP instruction, on the other hand, fills the polygon, regardless of the pen up / down status.
EP		The EP instruction outlines any polygon that has been previously stored in the polygon buffer (see PM). Only vertices that were defined with the pen down are edged. They are edged using the current pen colour (see SP) and pen width (see PW). Upon completion of the EP instruction, the original pen position and status are restored.
FP		The FP instruction fills a polygon that has been previously placed in the polygon buffer (see PM). The polygon is filled using the current pen colour (see SP) and transparency (see ST). Upon

		completion of the FP instruction, the original pen position and status (pen up/down) are restored.
SC	**symbol name, orientation**	*The SC instruction calls another symbol definition. Orientation specifies whether the called symbol is drawn upright (orientation = 0) or rotated to the direction of the last pen moving instruction (orientation = 1), or rotated at 90degrees to the tangent of the symbolized edge at the position of the symbol (orientation = 2). The pivot point of the symbol will be placed on the current pen position. Upon completion of the SC instruction, the original pen position and status (pen up/down) are restored.*

Note: The Vector drawing language defines how symbols shall look on the ECDIS screen when drawn. The ECDIS manufacturer does not have to replicate the drawing mechanism itself within their ECDIS. The choice of SENC storage and symbol drawing procedures are up to the manufacturer. The only requirement is that the colours and symbols are replicated from the specifications contained within this document to the satisfaction of the manufacturers type approval body.

8.1 Size and Orientation of a Vector-Symbol

For each vector symbol the height and width are define in units of 0.01 mm..Symbols in the Presentation Library are already sized to give good readability and appropriate prominence. Only the ship symbol is allowed to be scaled to the actual dimension of the ship.

Every symbol has its own pivot point. The pivot point is the point around which the symbol is rotated. When a point symbol is placed on the display, the symbol's pivot point is positioned exactly on the object's position and all the instructions in the symbol's definition are relative to that position. For further information about position of the pivot point and the symbol definitions please see 11.6.

8.2 Description of Complex Line Style rendering.

A complex linestyle is formed from a repeating symbol. The symbol definition for a line style is very similar to the symbol definition for a point symbol and uses cartesian coordinates as defined in the previous section. The linestyle symbol has its own pivot point around which it is rotated. The orientation is given by the direction between the two vertices of the **segment of the** line being drawn.

To symbolize some lines a composite type of complex linestyle is used, in which the unit is composed of a series of horizontal lines and symbols, strung together along the line object to form the linestyle unit

In order to draw a complex linestyle, first locate the start and end points along the edge to be symbolized. Then draw the complex linestyle along the edge between the start and end positions repeating as necessary. If a symbol needs to be embedded in the line, then the rotation angle relative to the line segment shall be determined. The diagram below shows how the composite symbol is created from the linestyle and its embedded symbols.

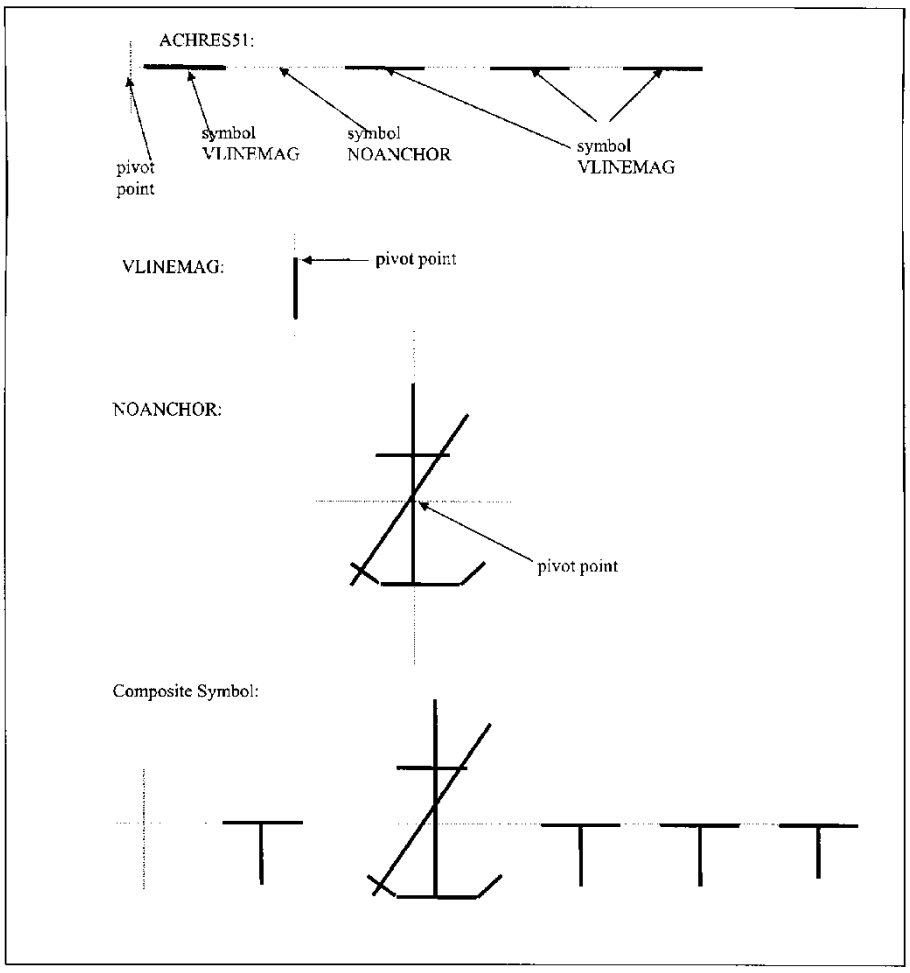


Fig 3. Complex Line Styles.

8.3 Vector Format Examples

8.3.1 Sample Definition in Vector Format

S-57 Feature Object	S52 Symbol	Vector Drawing Instruction (see 11.6.3)	ECDIS Display
Mooring/ Warping Facility	MORFAC03	SYCL = 00747 SYRW = 00746 SYHL = 00253 SYVL = 00253 SBXC = 00603 SBXR = 00617 SCRF ALANDABCHBLK SVCT SPA;SW2;ST0; PU603,617;PM0;PD856,617; PD856,870;PD605,870;PD603,617;PM2 ;FP; SVCT SPB;SW2;PU603,617; PD856,617;PD856,870; PD605,870;PD603,617; SPA;SW2;ST0;PU603,617;PM0;PD856, 617;PD856,870;PD605,870;PD603,617; PM2;FP;	

8.3.2 Sample Symbol Library Format for Composite Complex Linestyle Symbols

The following sample Symbol Library sequence illustrates the step from the “Single Unit" type of complex linestyle to the "Composite" type. The complex linestyle achres51.lin LC(ACHRES51) has been modified as follows (refer to definitions of file formats):

Complex Linestyle achres51.lin:

```
LNST    10LS03354NIL
LIND    38ACHRES5100108008100272900503004460057 2
LXPO    64boundary of an area where anchoring is prohibited or
restricted^_
LCRF    6ACHMGD
LVCT    29SPA;SW1;PU446,810;PD747,810;
LVCT    24PU595,810;SCVLINEMAG,2;
LVCT    25PU1208,810;SCNOANCHOR,2;
LVCT    31SPA;SW1;PU1655,810;PD1957,810;
LVCT    25PU1808,810;SCVLINEMAG,2;
LVCT    31SPA;SW1;PU2248,810;PD2552,810;
LVCT    25PU2404,810;SCVLINEMAG,2;
LVCT    31SPA;SW1;PU2874,810;PD3175,810;
LVCT    25PU3024,810;SCVLINEMAG,2;
```

NOTE: The VLINEMAG and NOANCHOR symbols will be embedded in the linestyle at the position given by the last position of the pen before the inclusion the embedded symbol. The only vectors in this linestyle are the four horizontal dashes that are to be drawn.

Symbol noanchor.sym:

```
SYMB    7SY00000
SYMD    39NOANCHORV012070084800431005030098700572
SXPO    36Anchor symbol with a line through it
SCRF    6ACHMGD
SVCT    32SPA;SW1;PU1208,572;PD1208,1074;
SVCT    31SPA;SW1;PU1052,721;PD1356,721;
SVCT    55SPA;SW1;PU1005,971;PD1111,1075;PD1309,1075;PD1407,974;
SVCT    31SPA;SW1;PU1418,640;PD987,1071;
```

Symbol vlinemag.sym:

```
SYMB    7SY00000
SYMD    39VLINEMAGV005950081000010000100059500810
SXPO    28Vertical Chart-Magenta Line
SCRF    6ACHMGD
SVCT    29SPA;SW1;PU595,810;PD595,970;
```

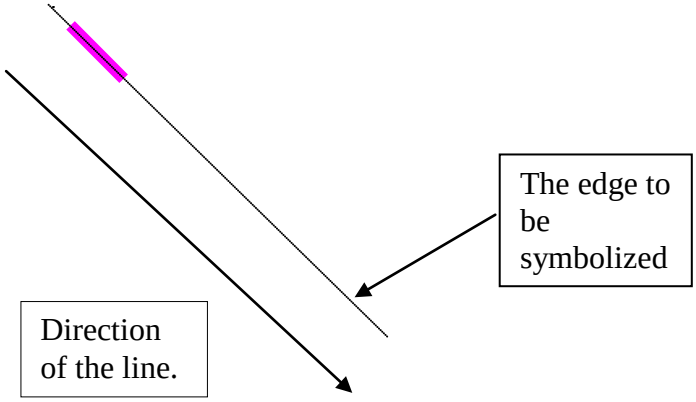
8.3.3 Sample Implementation of the Composite Complex Linestyle Symbols

The following is a simplified example for determining rotation of the symbol that is part of the complex linestyle. This example uses the ACHRES51 complex linestyle described in the documentation.

Each symbolization instruction will be drawn in sequence. The diagrams are as follows:

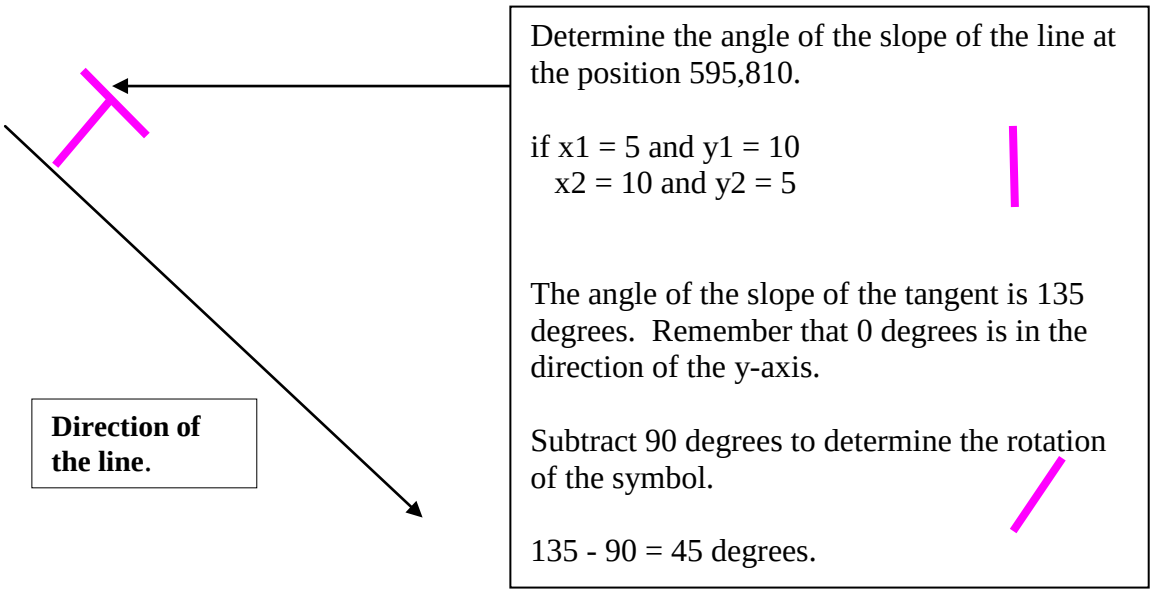
STEP 1: Draw the first straight line segment along the edge of the object.

LVCT 28SPA;SW1;PU446,810;PD747,810;



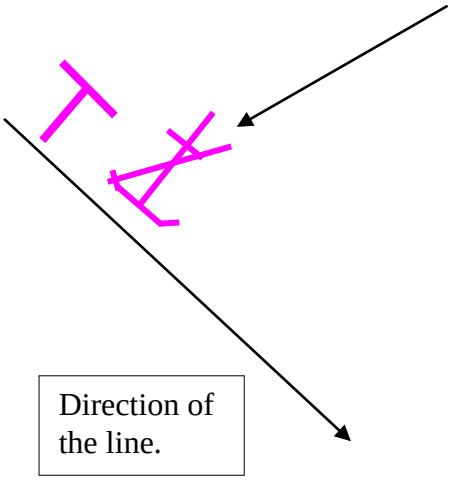
STEP 2: Draw the first LINEMAG symbol at position 595, 810.

LVCT 23PU595,810;SCVLINEMAG,2;



STEP 3: Draw the first NOANCHOR symbol at position 1208, 810.

LVCT 24PU1208,810;SCNOANCHOR,2;



Determine the angle of the slope of the line at the position 1208, 810.

if x1 = 5 and y1 = 10
x2 = 10 and y2 = 5

The angle of the slope of the tangent is 135 degrees. Remember that 0 degrees is in the direction of the y-axis.

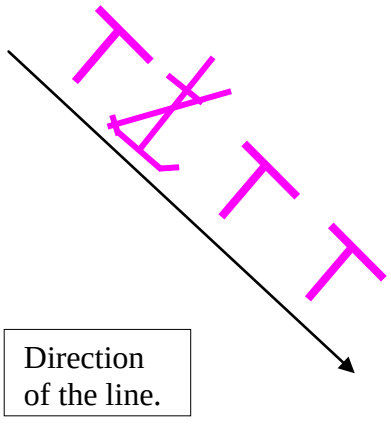
Subtract 90 degrees to determine the rotation of the symbol.

135 - 90 = 45 degrees.

STEP 4: Repeat with the other straight line segments and the VLINEMAG symbols.

LVCT 30SPA;SW1;PU1655,810;PD1957,810;
LVCT 24PU1808,810;SCVLINEMAG,2;
LVCT 30SPA;SW1;PU2248,810;PD2552,810;
LVCT 24PU2404,810;SCVLINEMAG,2;
LVCT 30SPA;SW1;PU2874,810;PD3175,810;
LVCT 24PU3024,810;SCVLINEMAG,2;

The resulting line is ...



8.4 Symbology Instruction for Area Objects

The SHOWAREA instruction was designed to symbolize area objects. It performs a variety of fill operations. The prime requirement is that the area symbolization shall always be clearly visible in the part of the area that lies within the viewing window of the ECDIS. If the area covers a large part of the viewing window, more than one symbol may be required. On the other hand, a secondary requirement is not to show more symbols than necessary, as this will cause distracting clutter. One solution is to centre a symbol in the part of the area exposed by the viewing window.

8.4.1 Fill Operations

An area can be identified in several ways:

- with an opaque colour fill (e.g. depth areas);
- with a transparent colour fill (e.g. traffic separation zone);
- with a pattern of symbols (e.g. traffic arrows) or texture (e.g. pack ice)
- with a symbol or text located on a position inside the area (e.g. traffic arrow)

A transparent colour fill may overlap an opaque fill and a patterned fill may overlap any other fill, including another patterned fill. For overlapping fills the respective area has to be filled more than once in a sequence of several area-fill operations.

8.4.2 Transparent Fill

The Presentation Library supports two methods of transparent fill.

1.) with only a percentage of the pixels having the fill colour (stippled fill, pseudo transparency);

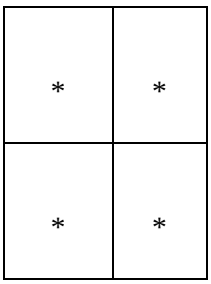
2.) by mixing the fill and underlying colour at each pixel, according to the fill percentage.

When method 1 and a 4 pixel group is used to achieve transparency then only the percentages 25%, 50% and 75% can be used for the transparency. For compatibility with both transparency methods only percentage values 25%, 50% and 75% are used within the Presentation Library.

The following explains the pseudo-transparency that can be achieved by method 1.
If an area of 4 by 4 pixels has to be filled with a transparent colour only 3, 2 or 1 pixel(s) of this area are tinted with the opaque fill colour while the remaining pixel(s) are tinted using the colour 'TRNSP' (= 100% transparent, see 4.2.1), which means the colour fill is not performed for these pixels. Thus the colour of the underlying pixels still can be seen through. On a high resolution screen the result will be very close to a real transparent fill.

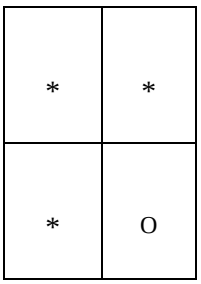
* = pixel tinted in fill colour

O = pixel tinted in TRNSP (transparent)



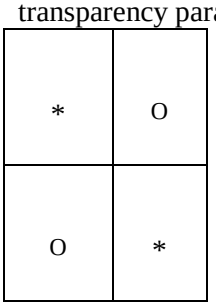
opaque fill with
0% transparency

transparency parameter = 0



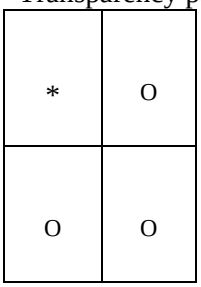
25% transparency

Transparency parameter = 1



50% transparency

transparency parameter = 2



75% transparency

Transparency parameter = 3

Because it is very likely that most of the ECDIS systems do a transparent fill with this technique only the 25%, 50% and 75% percentages for the transparency are used within the Presentation Library.

8.5 Area Symbolization by a centred Symbol

Centred symbols are used to reduce clutter in areas of heavy traffic. Since such areas may be large we use large symbols and since many restrictions may apply to a given area (e.g. traffic lane; precautionary area; no anchoring or fishing) the symbols have built-in offsets to prevent overwriting.

8.5.1 Positioning centred symbols and text

A pivot point for centred symbols and text will be at the centre of the area, or close enough to the centre that it is evident which area the symbol applies to. The offsets for symbols and text are given with respect to the pivot point.

Multiple centred symbols are often used. For example, a traffic lane with restrictions on entry and on fishing will have a centred traffic arrow and an offset “entry restricted” symbol with a subscript “!” to indicate that other restrictions apply.

If the centre of the symbol bounding box falls outside of the area then it shall not be drawn.

There are situations the chart display will split objects into multiple parts appearing in the ECDIS display as separate objects. In this situation the system shall calculate the c of g of each part of the object and display centred symbols for each part.

IHO S-64 contains examples of cases which an ECDIS shall be capable of handling
Text is allowed to extend beyond the boundary of an area. The result will be that the Mariner can clearly identify the area.

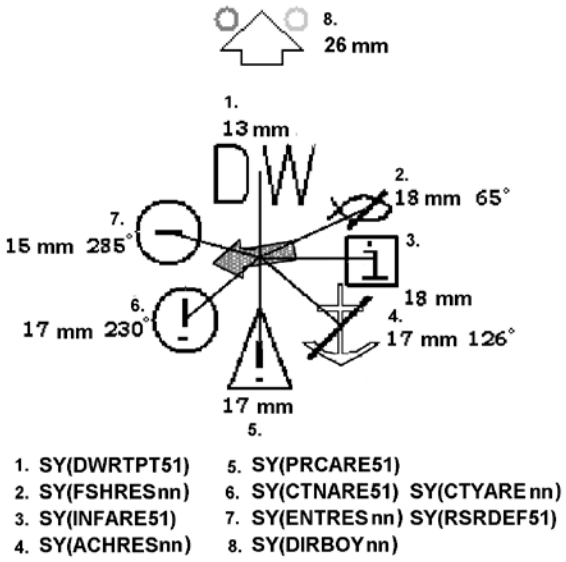


Fig 4. Centred Symbols

8.5.5.1 Centred symbol

A centred symbol shall remain within the area even when the border of the display progressively truncates the area. This can be achieved by repeatedly re-calculating the centre of gravity (c of g) of the area, make sure the symbol remains within the area, this is particularly important if the area is concave (e.g. L shaped, or a disc). One method of doing this if the c of g falls outside the area is to subdivide the area by the x,y coordinates of the calculated c of g then recalculate the component areas recursively until a point within the object is found.

8.5.2 Centred symbols on a ship-centred display

Some ECDIS draw a true-motion display which is updated frequently enough to keep own-ship close to the centre. If, when using this display mode, the situation arises that the display window lies completely within an area which is symbolised by centred symbols, these symbols will draw close to or under the own-ship symbol (having lower display priority) and will cause clutter and confusion.

IMPORTANT: Manufacturers who use a ship-centred display shall keep any centred area symbols a minimum of 20 mm from the own-ship symbol to avoid a potentially dangerous and confusing display.

8.5.3 Calculating the representative point of an area

The default method for identifying the representative point of an area shall be the centre of gravity algorithm.
A method for finding the centre of gravity of an area shall be adopted by the ECDIS manufacturer.

This shall ensure that the correct symbol is viewable on screen even when the area is only partially on screen. It shall also be robust enough to uniquely identify areas which are concave, and where the centre is outside the area (for example, in an L-shaped area the centre is not within the area but the symbol shall be drawn inside).

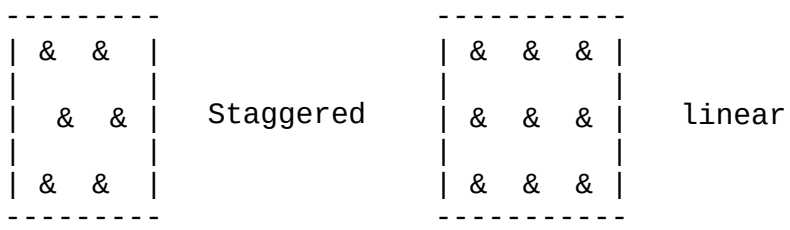
If the c of g algorithum fails to indentify the position within the area the manufacturer shall choose another more suitable calculation.

8.5.4 Patterns Fill & Textures for areas

Fill patterns use widely spaced symbols, for example for a prohibited area. Textures consist of continuous shapes, such as the dots of a dredged area or the diamond pattern that highlights water of depth less than the safety contour at night.

The form of a pattern symbol or texture unit may be described by a pixel array or vector description.

Fill patterns may be either staggered or linear:

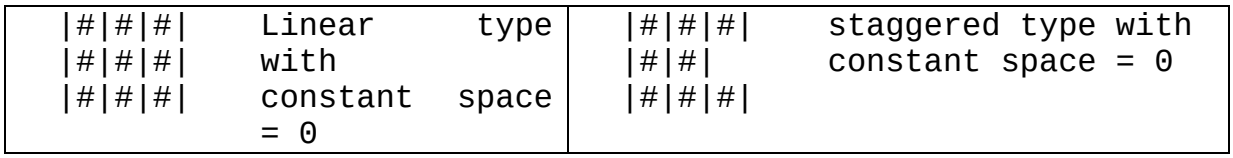


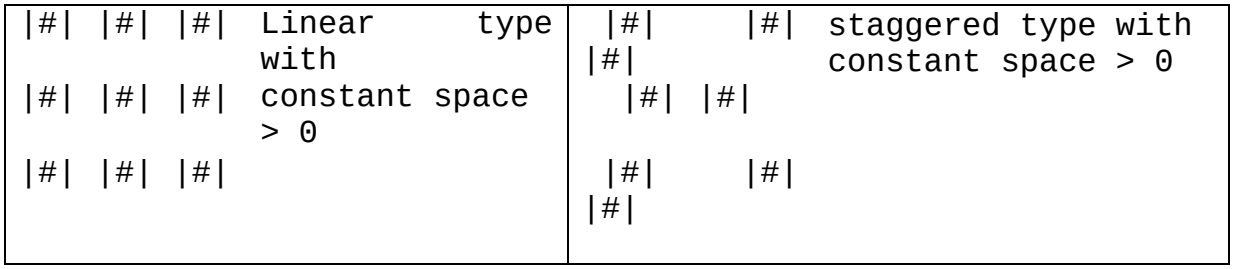
The Presentation Library only uses fixed pattern fill spacing, the pattern shall not move as the Mariner pans the chart display.

The position where an area fill with a pattern symbol is started shall be based on a geographical position and not on an edge of the screen. If the fill pattern was based on an edge of the screen the pattern symbols would not stay on the same position of the chart while the picture was moving underneath in centred mode. Also do not base a fill pattern on the edge of the area to be filled. This will result in a strange looking pattern fill when two adjacent areas are filled by the same pattern.

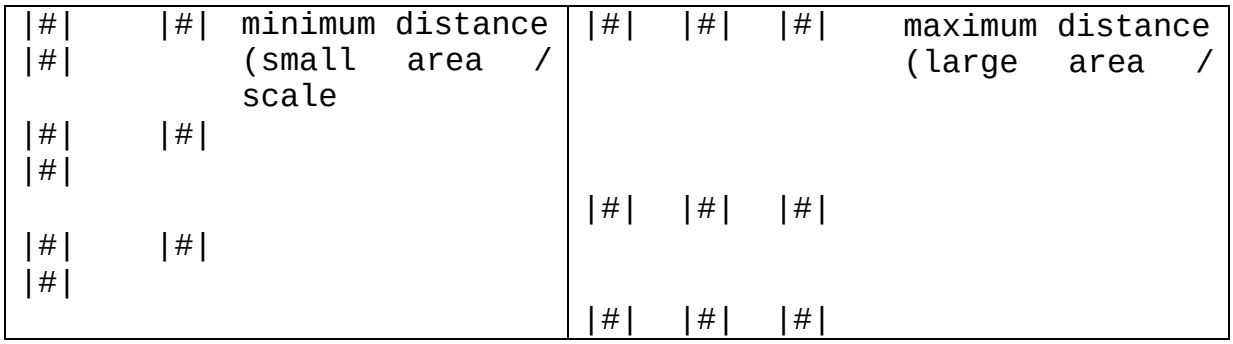
Note: The symbols of a pattern fill shall be closer together for a small or thin area, to ensure enough symbols are seen, and farther apart for a large area, to avoid clutter.

The pattern type and the symbol spacing gives full control over a set of variations (|#| represents the pattern symbol):

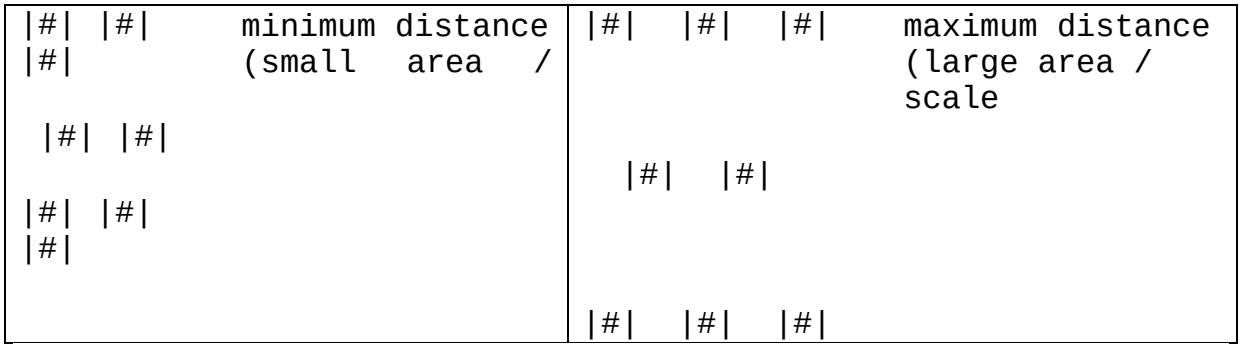




Linear type with variable spacing



Staggered type with variable spacing



The vertical and horizontal distance between pattern symbols is given in the pattern definition (see section 12.5). This distance is the space between symbol covers. The symbol cover is calculated by taking the symbol's bounding box and expanding it to include the pivot point. This mechanism allows the pivot point to be used for fine adjustments to symbol spacing.

Note: An area pattern which is described in the written «Description of Symbols» of the symbol library as a «pattern of symbols» (e.g., FSHHAV02) may be substituted by a single centred symbol. However, this shall never be done with an area texture (pattern of symbols, e.g., NODATA03, RCKLDG01, TSSJCT02, etc.)

8.4 Area Boundaries

8.4.1 Plain and Symbolized Boundaries

The Presentation Library provides look-up tables for plain area boundaries (intended for use at small scale to reduce clutter) and symbolized area boundaries (intended for use at very large scale to show immediately on which side of the boundary the area lies and to identify the area).

Note: Centred area symbols shall be used with symbolized boundaries to symbolize the case when the entire display window lies within an area.

The Mariner shall be given the selection of using plain or symbolized boundaries. See also section 8.2 about the limitations of symbolized linestyles on curved boundaries.

8.4.2 Masked Lines

Masked lines (MASK subfield of FSPT field set to {1}) and cell boundary lines (edges encoded with [USAG] = {3}) shall not be drawn."

8.4.3 Area Borders

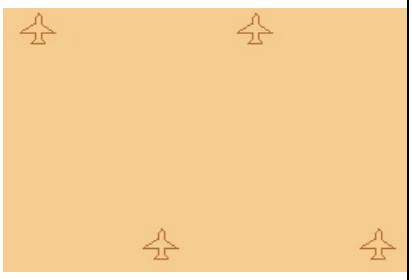
When areas are filled with a colour or a pattern the borders shall be included in the fill as well. This generates an image without gaps between neighbouring areas. It is also important for a perfect fit of adjacent cells. If the borders of the area are to be distinguished from the area's fill, the borders have to be re-drawn on top of the fill. This is forced when a SHOWLINE instruction (see 7.3.4) is called within a SHOWAREA instruction. The SHOWLINE instruction then performs the presentation of the border.

8.5 Colours and Descriptions for Symbols

The colours and descriptions for all symbols in the symbol library are listed in the hard copy addendum containing the "ECDIS Chart 1", which is bound with the Colour & Symbol Specifications. The general naming convention for symbols is described in the following table:

Objects	Drawing Instruction	Description	Example
Symbols	SY(AAAAAAnn)	where A = abbreviated name, n = serial number Anchorage area as a point at sr scale, or anchor points of moor trot at large scale	SY(**ACHARE02**)
	SY(AAAAAA5n)	centred symbol for area Area where anchoring is prohibited or restricted	SY(**ACHRES51**)
	SY(AAAAAA6n)	centred symbol for area with added caution restriction Area where anchoring is prohibited or restricted, with o cautions	SY(**ACHRES61**)
	SY(AAAAAA7n)	centred symbol for area with added information restriction Area where anchoring is prohibited or restricted, with other information	SY(**ACHRES71**)
Lines	LS(type, thickness, colour)	simple line of type solid, dashed or dotted NAVNLE	LS(DASH,1,CHGRD)
	LC(AAAAAAnn)	is a complex line Ferry Route	LC(**FERYRT01**)
	LC(AAAAAA5n)	is a complex linestyle for an area boundary Boundary of a deep water rout	LC(**DWRUTE51**)
Area	AC(CCCCC)	is an area colour fill, where C is the colour token	AC(**CHBRN**)

		Built-Up Area	

	AC(CCCCC,n)	is a transparent area colour fill, w n = transparency Traffic Separation Zone TRFCF = magenta, faint 75% transparency	AC(**TRFCF,3**)
	AP(AAAAAAnn)	is an area pattern fill Airport pattern fill	AP(**AIRARE02**) 

NOTE: All names (A,n) for symbols, complex lines and area patterns (but not colour fills) have 8 characters.

9 Description of the Symbology Commands

Symbology commands are used in the look-up table entries to perform the symbolization of objects. Currently there is a choice of five commands used in the lookup tables.:

- SHOWTEXT (TE and TX) to display text labels
- SHOWPOINT (SY)to symbolize points and place symbols inside areas
- SHOWLINE (LC and LS) to symbolize lines and borders of areas
- SHOWAREA (AP and AC) to symbolize areas
- CALLSYMPROC (CS) to call conditional symbology procedures

The entries in the lookup tables map S57 object/attribute combinations to sequences of command words which describe in precise detail the symbology required to be displayed. This section describes the meaning, syntax and operation of the command words used in the lookup tables.

Entries in the lookup tables may be composed of more than one command word, for example the lookup for ACHARE is:

"SY(ACHARE51);LS(DASH,2,CHMGF);CS(RESTRN01)"

This displays the ACHARE51 symbol in the centre of the area as well as a dashed linestyle in CHMGF colour and then executes the RESTRN01 conditional symbology procedure in case other symbols are required.

Each command is capable of accepting one or more parameters. These parameters affect the way the chosen symbol, line style or pattern fill is displayed. Some parameters can be linked to the value of an S57 attribute of the feature object which is the subject of the lookup table entry. For example,

”SY(TSSLPT51,ORIENT)” translates as the symbol TSSLPT51 oriented in the direction given by the value of attribute ORIENT.

For variable parameters default values can be provided as a fail-safe in case the attribute cannot be found in the feature object description. This can be done by assigning a default value to the parameter e.g. ORIENT='90.0'. The assignment is done within the parameter list of the command word.

IMPORTANT: The symbology command shall be terminated, if a parameter is mandatory (has to be passed) and no value is assigned to it either because a constant is missed from the parameter list or an attribute value cannot be found (attribute is missed from the object definition and no default value was assigned).

This does not mean that the whole symbology instruction is terminated since it may be composed of more than one command word e.g. the first command word in a symbology instruction shows a light flare and the second shows a buoy symbol. If the first command fails the second is still performed and the buoy is shown in the chart.

The full command syntax and parameters are listed in the following sections

9.1 SHOWTEXT

Name:

TX (Display of textual labels) or
TE (Display of numeric or other formatted text strings)

Syntax:

TX (STRING, HJUST, VJUST , SPACE , 'CHARS' , XOFFS , YOFFS , COLOUR , DISPLAY);
TE ('FORMAT' , 'ATTRIB1,ATTRIB2,…', HJUST, VJUST, SPACE, CHARS, XOFFS, YOFFS,COLOUR, DISPLAY);

Description:

Show a text string at a particular position on screen. In order to show text on the display two commands are used.:

1. For purely alphanumeric text, the "TX" Command is used.
2. For numeric text, a prefix is normally used to distinguish between numbers and soundings. For this purpose the "TE" command is used to format the text string shown on the display.

The description of how the FORMAT/ATTRIB lookups and prefixes work is documented in section 16.3. The following text shall be followed when rendering text on the chart display.

1. Text is normally coloured black, to give best readability under all light conditions.
2. Text shall only be displayed when the object it applies to is displayed.
3. Text shall always have display priority 8, to ensure it is readable, independent of the object it applies to.
4. The manufacturer shall provide the capability to select "Important Text" and "Other Text", and he may also provide further text groupings if he so wishes.

The display of text shall be controlled independently of the display of the object it applies to and the Mariner shall have full control over the display of text. All text is in the IMO Category "Other Information". As a guide to organizing the display of text, the last two digits of the SHOWTEXT instruction give a text classification that distinguishes between "Important" and "Other" text, and gives further suggested text groupings. The abbreviations used on the ECDIS display are listed in Section 15.4. All the abbreviations in section 15.4 shall be readily accessible to the Mariner.

Parameters:

STRING: Represents the alphanumeric string to be displayed on the display. The STRING parameter passes a text string in single quotes that shall be written on the ECDIS screen. For example:TX('DR',2,3,2,'15110',-1,1,CHBLK,50);
Note: the six character acronym of a valid S-57 attribute (e.g. ,LITVES, OBJNAM) can also be passed as a parameter to STRING parameter. If the attribute is either of an enumeration type or list type (e.g. COLOUR), then the enumeration value shall be converted into the respective text string from the attribute definition in the object catalogue. If the attribute is of a numerical type, it may just be written as a string. If the attribute is an L-type attribute (e.g. SBDARE, NATSUR) the text equivalent of the listed attribute values shall be written sequentially separated by a space with no punctuation marks. If the attribute or character string named in a text command is not included in the SENC object, the text command shall be disregarded. If the symbology instruction for an object includes more than one text command, only the

text command whose attribute value or character string is missing shall be disregarded; the other text command shall be implemented.

HJUST: Horizontal justification parameter: These can have three distinct values:

1. CENTRE – The pivot point is located at the centre of the overall length of text string
2. RIGHT - The pivot point is located at the right side of the last character of text string)
3. LEFT (default) - This is the default value. The pivot point is located at the left side of the first character of text string

VJUST: Vertical justification parameter. These can have three distinct values:

1. BOTTOM (default) - This is the default value. The pivot point is located at the bottom line of the text string
2. CENTRE - The pivot point is located at the centre line of the text string
3. TOP The pivot point is located at the top line of the text string

SPACE: Character spacing parameter. These can have three distinct values:

1. Fit (not used) - The text string shall be expanded or condensed to fit between the first and last position in a spatial object
2. Standard (default) - The standard spacing in accordance with the typeface given in CHARS shall be used
3. Standard (with word wrap) - the standard spacing in accordance with the typeface given in CHARS shall be used; text longer than 8 characters shall be broken into separate lines by whole words.

CHARS: Font specification parameter. This defines the font to be used for the text display. There are four numeric components to this parameter and they are concatenated together and enclosed in single quotes in order to be passed as a single value, e.g '15110'. The format is therefore 'abcdd' where :

a = 1, a plain serif font.

b = 4, 5 or 6 for light, medium or bold text. The default is medium.

c = 1, meaning upright, non-italic text.

d = Body size given in pica points (1 point = 0.351 mm) that specify the height of an uppercase character. The smallest size to be used is pica 10, and this is also the default size. Larger sizes may be used.

XOFFS X offset parameter: defines the X-offset of the pivot point given in units of BODY SIZE (see CHARS parameter) relative to the position of the spatial object (0 is default if XOFFS is not given or undefined); positive x-offset extends to the right (the "units of BODYSIZE" means that if for example, the body size is 10 pica points each unit of offset is 10 (0.351) = 3.51 mm).

YOFFS Y offset parameter: defines the y-offset of the pivot point given in units of BODY SIZE (see CHARS parameter) relative to the position of the spatial object (0 is default if YOFFS is not given or undefined); positive y-offset extends downwards.

COLOUR Text colour parameter:colour token as described in section 7 and 15.

DISPLAY Text display parameter:defines which text grouping the string belongs to.

9.1.1 Show Text Examples

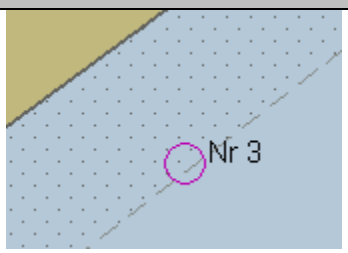
Full LUT entry

"BUAARE","","AC(CHBRN**);TX(OBJNAM,1,2,3,'15110',0,0,CHBLK,26)**;LS(SOLD,1,LANDF)", "3","S","STANDARD","22240"

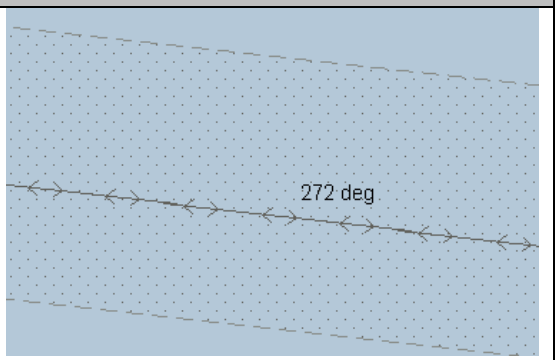
Name	Lookup table value	Description	ECDIS Display
ECDIS Textual Output	OBJNAM	Charmouth	
Horizontal Justification	1	Centre	
Vertical Justification	2	Centre	
Text Spacing	3	Standard with word wrap	
Font Style	1	Sans serif	
Text Weight	5	Medium	
Text Width	1	Upright	
Body Size	10	3.51mm	
X-offset	0	No text offset	
Y-offset	0	No text offset	
Text Colour	CHBLK	Black	
Text Group	26		

Alphanumeric Example

"BERTHS","","SY(BRTHNO01);**TE('Nr %s','OBJNAM',3,1,2,'15110',1,0,CHBLK,29)**",
"3","S","OTHER","32440"

Name	Lookup table value	Description	ECDIS Display
ECDIS Textual Output	Nr (string from attribute OBJNAM)		
Horizontal Justification	3	Left	
Vertical Justification	1	Bottom	
Spacing	2	Standard	
Font Style	1	Plain serif	
Text Weight	5	medium	
Width	1	upright, non-italic text	
Body Size	10	3.51mm	
X-offset	1	3.51mm	
Y-offset	0	No offset	
Colour	CHBLK	Black	
Text Group	29		

"RECTRC","CATTRK1TRAFIC4","LC(RECTRC10);**TE('%03.0lf deg','ORIENT',1,1,2,'15110',0,-1,CHBLK,11)**","6","O","STANDARD","25020"

Name	Lookup table value	Description	ECDIS Display
ECDIS Textual Output		Floating point number from attribute ORIENT followed by deg	
Horizontal Justification	3	Left	
Vertical Justification	1	Bottom	
Spacing	2	Standard	
Font Style	1	Plain serif	
Text Weight	5	medium	
Width	1	upright, non-italic text	
Body Size	10	3.51mm	
X-offset	1	3.51mm	
Y-offset	0	No offset	
Colour	CHBLK	Black	
Text Group	29		

9.2 SHOWPOINT

Name:

SY – Showpoint, Show symbol command.

Syntax:

SY(SYMBOL [, ROT]);

Description:

The SY command displays a symbol at a given point on the display. The command takes a standard symbol name as its first mandatory argument. A second parameter can impose a rotation on the symbol about the pivot point. In the case of an area object the “SY” command is used to display a centred area symbol.

Parameters:

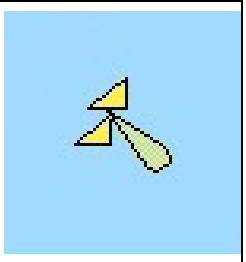
SYMBOL: The name of the symbol to be displayed, e.g ISODGR01. This will be the name as defined in the vector description language SYNM field.

ROT: An optional rotation parameter. The following notes apply to this parameter.

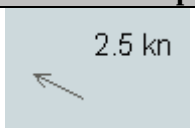
1. Symbols with no rotation shall always be drawn upright with respect to the screen.
2. Symbols with a rotation instruction shall be rotated with respect to the top of the screen (-y axis in figure 2 of section 8.1).
3. Symbols rotated by means of the six-character code of an S-57 attribute such as ORIENT shall be rotated with respect to true north.
4. The symbol shall always be rotated about its pivot point. Rotation angle is in degrees clockwise from 0 to 360. The default value is 0 degrees."

9.2.1 SHOWPOINT Example

SY(BOYCAR01);SY(LIGHTDEF,135) :

S-52 Symbol	Description	ECDIS Example
BOYCAR01	Simplified symbol - North Cardinal Mark	
LIGHTDEF, 135	LIGHTDEF is a symbol selected by a conditional symbology procedure (LIGHTS06). The command string “SY(LIGHTDEF,135)” selects a default light flare rotated by 135 degrees	

SY(EBBSTR01,ORIENT)

S-52 Symbol	Description	ECDIS Example
EBBSTR01	Tidal stream - flood/ebb object, ebb stream symbol rotated by value from the ORIENT attribute. In the example ORIENT = 297.3	

9.3 SHOWLINE

Name:

LS – Showline (complex linestyle) or
LC – Showline (simple linestyle).

Syntax:

LS(PSTYLE, WIDTH, COLOUR);
LC(LINNAM);

Description:

The SHOWLINE instruction is designed to symbolize line objects. It is also used within the SHOWAREA instruction to symbolize area boundaries. The command is used to show simple or complex line-styles (described below) and subsequent commands may add a symbol or text as well.

Parameters:

PSTYLE: Predefined line style parameter: One of three values:

`'SOLD'` (_____)
`'DASH'` (- - - - -) dash: 3.6 mm; space: 1.8 mm
`'DOTT'` (. . . . . .) dot: 0.6 mm; space: 1.2 mm

WIDTH Line width parameter. Units are 0.32 mm (approximately pixel diameter)

COLOUR Line colour parameter. A valid colour token as described in section 7

LINNAM: Name of complex linestyle. This parameter will symbolise the line using the complex linestyle named by the LINNAM parameter.

9.3.1 SHOWLINE Example

LS(DASH,2,CHMGD). Displays a dashed line in "chart magenta, dominant", 0.6 mm (2 x 0.3 mm) width.

LC(ACHARE51). Displays the complex line-style called ACHARE51 defined for borders of anchorage areas. (see below).

9.4 SHOWAREA

Name:

AP – Showarea (area fill) or
AC – Showarea (pattern fill).

Syntax:

AP(PATTERN)
AC(COLOUR [,TRANSP])

Description:

The two showarea commands are used for symbolising area objects (often in conjunction with linestlyes for border rendering). There are two types of colour fill:

1. area fill with a basic colour using one of the standard colour tokens.
2. pattern fill using a pattern to fill areas.

Parameters:

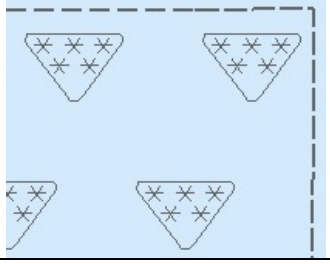
COLOUR: colour fill parameter. A valid colour token as described in section 7

PATTERN: the name of the pattern

TRANSP: Transparency, an optional parameter for colour fills used to make a fill partially transparent. If the transparency parameter is not set then the default value is 0%, i.e an opaque colour fill. There are three permissible values:

1. 25% where 3 out of every 4 pixels use TRNSP
2. 50% where 2 out of every 4 pixels use TRNSP
3. 75% where 3 out of every 4 pixels use TRNSP

9.4.1 SHOWAREA Examples

S-52 Instruction	Description	Example
AC(CHBRN)	area filled with opaque colour 'chart brown'	
AP(DQUALA21);LS(DASH,2,CHGRD)	area filled with pattern for ‘category of zone of confidence; bordered by a dashed line in 'chart grey , dominant', 0.6 mm width	

9.5 CALLSYMPROC

Name:

CS – CALLSYMPROC: Call conditional symbology procedure.

Syntax:

CS(PROCNAME);

Description:

The CALLSSYMPROC command “CS” calls a named conditional symbology procedure. It is used either on its own in order to symbolise a particular class of object/attribute combinations or in conjunction with other commands in order to add symbols to the display dependent on ECDIS Mariner settings, e.g

The lookup for ACHARE is “SY(ACHARE51);LS(DASH,2,CHMGF);CS(RESTRN01)”

Note that the calling of the conditional symbology may affect values in the rest of the lookup table entry, for instance the viewing group or display priority may be affected by the operation of the conditional symbology procedure invoked by the SY command.

Parameters:

PROCNAME: The name of the conditional symbology procedure to invoke, e.g RESTRN01 in the above example. Conditional symbology procedures are normally named by the object class that is interpreted by the procedure. The name is normally an 8 letter code that is composed of the class code (6 letters) and a serial number (2 letters)

10. ECDIS Requirements

This section provides ECDIS developers with other details of ECDIS display that shall be taken into account while designing ECDIS.

10.1 Data Consistency

ENC presentation depends very much on the consistency of the underlying S-57 data. Thus ECDIS manufacturers should be aware of the consistency of the data that will be processed by their ECDIS.

10.1.1 Unknown Objects

Feature objects shall be of an officially adopted object class. If feature objects are of proprietary non-ENC classes (i.e. not included in S-57 Product Specification for ENC) they shall be treated as members of unknown object classes. There will be no appropriate entry in the look-up tables but all objects shall be presented on the ECDIS screen. The occurrence of such an object shall be logged during transformation from ENC to SENC as an anomaly and the unknown objects shall be displayed using the question mark symbol QUESMRK1 as per section 10.3.3.4.

10.1.2 Unknown or Missing Mandatory Attributes

All mandatory attributes required by S-57 Appendix B1, ENC Specification should be populated, except for cases where S-57 Appendix B1 Annex A, Use of the Object Catalogue, deliberately codes by omission (e.g., clauses 5.8.2 and 10.2.1.1). In reality, sometimes the attribute values may not always be available and a producer may encode the attribute value as unknown. S-57 defines how null/unknown and missing attributes are encoded within ENCs. It should be noted that a missing attribute is not "unknown". The Presentation Library provides default symbolization for many cases of attribute value omitted (e.g., in the first line for every object class in the look-up table).

10.1.3 Data Overlaps

The S-57 Product specification for ENC prohibits data overlaps in ENC cells of the same usage band.

"Cells with the same navigational purpose may overlap. However, data within the cells shall not overlap. Therefore, in the area of overlap only one cell may contain data, all other cells shall have a meta object M_COVR with CATCOV = 2 covering the overlap area. This rule applies even if several producers are involved".

Despite the best efforts of the IHO, there are still some areas of the world where ENC overlaps exist.

Where an overlap of two or more cells exists the ECDIS shall only display one cell for the overlap area and provide a permanent and persisting indication "overlap".

10.1.4 Gaps

S-57 Use of the object catalogue edition 3.0.0 states;

"There must be no gaps in data between adjoining cells of the same Navigational Purpose".

Despite the best efforts of the IHO, there are still some areas of the world where gaps in ENC coverage exist.

Where gaps in ENC data of the same navigational usage exist smaller scale data from the SENC may be used to fill the gap. If there is no smaller scale data available the gap shall be filled with the no data area fill pattern.

10.1.5 No Data Coverage

IMO Performance standards states;

> 6.1 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.

IHO Specifications for ECDIS chart content and display S-52:

> An indication "refer to the official chart" is required if the display includes waters for which no ENC at appropriate scale exists.
>
> If a scale boundary is shown on the display, the information in an overscale area should be identified, and should not be relied on.
>
> A graphical index of the navigational purpose of available data should be shown on demand.

10.1.6 ENC Coverage

S 57 app. B1 - "ENC Product Specification", section 2.2, describes the cell system and the use of object class M_COVR to indicate data coverage. Note that a value of M_COVR, CATCVR=2 does not necessarily indicate "no data", since data could be contained in an overlapping cell.

10.1.7 Limit of ENC Coverage: Non-HO Data on the Display

Since the HO will not issue a data coverage diagram, the ECDIS shall compile a graphical index of the HO ENC data available, classified by navigational purpose, and make it available to the mariner.

The end of HO data need not be identified on the display. The appearance of the "No data" colour (NODTA) and fill pattern AP(NODATA03) will indicate the end of data.

If non-HO data is shown on the ECDIS display, its boundary shall be identified by the linestyle LC(NONHODAT). The display priority is 3; over radar; display base; viewing group 11060. Note that the LC(NONHODAT) is a “one-sided” line and the boundary of the non-HO data must be drawn according to S-57 rules to ensure that the diagonal stroke of the line is on the non-HO data side of the line.

10.1.8 No Data Areas

To make sure that the mariner is aware of areas where no data exist, the entire screen shall always be filled with grey NODTA colour fill together with the fill pattern AP(NODATA03) at the start, before any other information is drawn. The display priority is 0 (allowing non-ENC data to be overdrawn); radar flag suppressed by radar; the category is DISPLAYBASE and the viewing group is 11050.

An indication that the mariner must refer to the official chart shall be given whenever line LC(NONHODAT) appears on the display, or whenever the display is comprised of other than ENC data.

10.1.9 Scale Boundaries

"Navigational purpose" is used in S 57 to express the concept of scale (ENC Product Specification 2.1).

10.1.9.1 Chart Scale Boundaries

The "chart scale boundaries", where the navigational purpose of the data changes, shall be symbolised on the ECDIS display by a simple linestyle LS(SOLD,1,CHGRD). Alternatively linestyle LC(SCLBDYnn) may be used, with the double line (indicating better resolution) on the side of the larger scale data. The display priority is 3; over-radar; standard display; viewing group 21030.

Only the significant changes from one navigational purpose to another shall appear as chart scale boundaries; boundaries marking minor changes in compilation scale that lie within the range of a navigational purpose shall not be drawn.

10.1.9.2 Graphical Index of Navigational Purpose

The chart catalogue for official charts may be used as a model for the graphical index of navigational purpose, except that minor changes in compilation scale that lie within the range of a navigational purpose shall not be drawn on this index. Only the significant changes from one navigational purpose to another shall appear.

10.1.10 Overscale

Scale is expressed as a fraction, representing: [length of an object on the chart] / [actual length of that object on the ground]. Thus 1/10,000 is twice as large a scale as 1/20,000, because the length of a given object on the chart is twice as long at 1/10,000 scale as at 1/20,000.

The "Compilation Scale" is the reference for overscale calculation. This is coded in the CSCL subfield of the DSPM field. The object M_CSCL, CSCALE is only used if the compilation scale is different for some part of the data set, and when encoded must also be taken into account. (S 57 App. B1, Ann. A - "Use of the Object Catalogue").

10.1.10.1 Overscale Indication

The overscale indication is intended to remind the mariner that the size of chart errors is magnified when he increases the display scale. A 1 mm error at compilation scale of 1/20,000 becomes a 1.3 mm error at a display scale of 1/15,000 and a 2 mm error at 1/10,000.

The overscale factor shall be calculated as [denominator of the compilation scale] / [denominator of the display scale], expressed as, for example "X1.3", or "X2" (using the figures in the example above.)
This shall be indicated on the same screen as the chart display, and treated as display base. Use colour SCLBR.

This overscale indication is required by IMO PS [3] whenever the display scale exceeds the compilation scale.

Note: If the display is compiled from more than one ENC of the same compilation scale, and if the mariner deliberately chooses to zoom in so that the display scale exceeds the compilation scale, then only the "overscale indication" shall be shown. The "overscale pattern" AP(OVERSC01) shall not be shown.

10.1.10.2 Overscale Area at a Chart Scale Boundary

Section 10.1.10.1 above dealt with overscale deliberately selected by the mariner. A different overscale situation arises when the ship approaches a scale boundary from a larger to a smaller scale ENC, typically when leaving harbour, as illustrated in the data coverage diagram below. In combining data from the large scale and the small scale ENCs to generate a display at the larger scale, the ECDIS will have "grossly enlarged" the small scale data to the left of the scale boundary on this figure.

In addition to drawing the scale boundaries, the "grossly overscale" part of the display shall be identified with pattern AP(OVERSC01), as illustrated. Its display priority is 3; over-radar; standard display; viewing group 21030.

In this context, "grossly enlarged" and "grossly overscale" shall be taken to mean that the display scale is enlarged/overscale by X2 or more with respect to the compilation scale. For example, at the left edge of Fig 5 the display scale of 1/12,500 is X4 the compilation scale of 1/50,000, and so the overscale pattern is required.

Note that in this situation the pattern AP(OVERSC01) shall only be shown on the area compiled from the smaller scale ENC. If the area from the larger scale ENC is also overscale, this shall be indicated

by the "overscale indication". The pattern AP(OVERSC01) shall not be shown on the part of the display taken from the larger scale ENC. For example if the display scale of the situation in the data coverage diagram was 1/3,500 the area of compilation scale 1/12,500 would have an overscale indication of X 3.6 but would have no pattern AP(OVERSC01).

10.1.10.3 Larger Scale Data Available

Visualise the opposite situation from that in the data coverage diagram below. This time, the ship is approaching harbour from the left edge of the figure, displaying an ENC at a compilation scale of 1/50,000. As the display window begins to cover an ENC at a compilation scale of 1/12,500, the ECDIS shall indicate that larger scale data will shortly become available, as required by IMO PS [3].

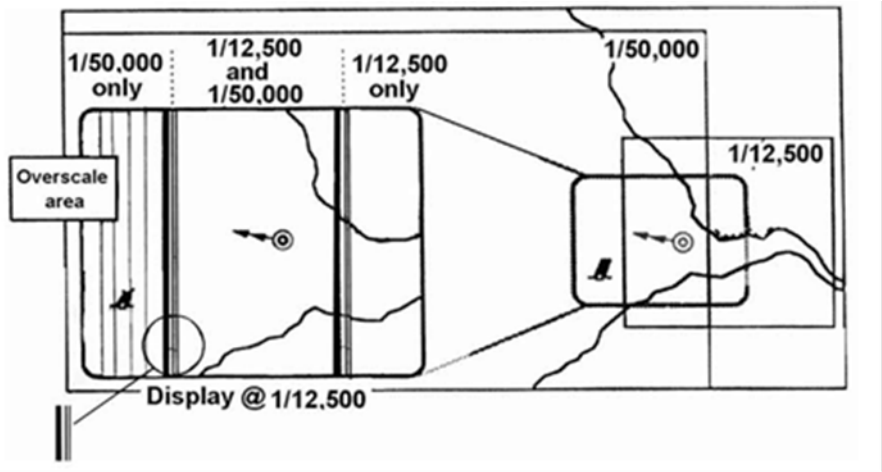


Fig 5. Data Coverage Diagram

(The right hand side of the diagram shows the ENC layout with the screen window overlaid, and the left hand side is enlarged to show the ECDIS display on that screen.)

10.2 Queries

To successfully use the Presentation Library ECDIS shall be capable of performing spatial queries on ENC data during import and symbolisation. Spatial query is understood as possibility to inspect graphical position and numerical value of spatial coordinates associated with a charted object. Spatial query could be available as a part of cursor pick (see 10.8) or as an independent function. Due to the complex nature of these queries it is recommended that the inspector of this requirement tests extensively that all required geometric primitives are accounted for in these tests and that the conditional symbology procedures are thoroughly understood during manufacture. Refer to section 12 for further details of which queries are required.

Note: IHO S-64 contains examples of cases which an ECDIS shall be able to handle.

10.3 How to use the Look-Up Tables

Prior to drawing any chart objects on screen, the first action the ECDIS shall perform as a fail-safe measure, is to cover the screen with grey NODTA colour fill together with fill pattern NODATA03. Display priority is 0, supressed by radar, category “displaybase”, viewing group is 11050. This section describes how S57 features objects are converted to symbols, line and fill styles using the lookup tables. A number of ECDIS display requirements derived from the IMO Performance Standards and the IHO specifications are not handled by look-up tables. These are described in section 10.5.

10.3.1 Layout of the Look-Up tables

The S-52 look-up tables are made up of five separate lists. The look-up tables specify how object classes are presented graphically on the chart display. Each look-up table entry contains six mandatory fields plus one optional field separated by commas “,” and using the double quote “ as a text delimiter for each value. The following lookup tables are defined:

1. Symbolised boundaries for area features.
2. Plain boundaries for area features
3. Line features
4. Simplified point features
5. Traditional point features.

10.3.2 Lookup Table Entry Example

"BOYCAR","BOYSHP2","SY(BOYCAN01);TE('by %s','OBJNAM',2,1,2,'15110',-1,-1,CHBLK,21)","8","O","STANDARD","27010"

Field	Description	Look-Up Table Entry Example
1	feature object acronym	BOYCAR
2	feature attribute	BOYSHP2
3	symbolization instruction	SY(BOYCAN01);TE('by%s','OBJNAM',2,1,2,'15110',-1,-1,CHBLK,21)
4	display priority	8
5	OVERRADAR flag	O
6	display category	STANDARD
7	optional viewing group	27010

The fields are defined as follows:

1. Feature object acronym – This is the S57 acronym for a particular feature class, e.g BOYCAR, LNDARE etc. A default value of “######” is also defined.
2. Feature attribute combination – This field is used to define a set of feature attributes which may be matched. It consists of a concatenated list of valid S57 attribute acronyms together with optional values. A line in the lookup tables matches a given feature object if, and only if, fields 1 and 2 match according to the rules defined in this section.
3. Symbolisation instructions. The instructions to be used to symbolise the feature objects. This may be composed of any of the symbolization commands defined in section XX of this document.
4. Display priority
5. OVERRADAR flag
6. Display category – can be “DISPLAYBASE”, “STANDARD”, “OTHER”, “MARINERS”.

7. Viewing group.

10.3.3 Matching Entries in the Lookup Tables

It is important to note that look-up table lines with the same feature object class in field 1 shall be grouped together and the order defined in the Presentation Library shall be preserved, to provide correct symbolization. The order of the attributes within a given line has no significance, but the order of the attribute values within a given attribute field (2) is significant. When a matching line is found for a feature object the lookup table line used for its symbology instructions shall then also be used for display priority, over radar flag, IMO category and optional viewing group unless modified by a conditional symbology procedure..

10.3.3.1 Look-Up Table Entry Matching

To find the symbology instruction for a specific object, enter the look-up table with the object's class code and gather all lines that contain the class code in field 1. If only a single line is found, field 2 of that line shall be empty and the object is always shown with the same symbology regardless of its description.

If there is more than one line in the look-up table, search for the first line each of whose attribute values in field 2 can also be found in the attribute values of the object. If more than one attribute value is given in the look-up table, the match to the object shall be exact, in order as well as content.

For example, a look-up table attribute value 4,3,4 is not matched by object attribute values 3,4,3 or 4,3. However, the existence of further attribute values does not invalidate the match: in the above example object attribute values 4,3,4,7 would match the look-up table, (because value 7 is not used in symbolizing). Use the symbology instruction given by that line in field 3 to symbolize the object's geometry. As a further example, an object "BCNLAT","COLOUR3,1", for which there is no exact match in the simplified point look-up table, shall be symbolized using the line for "BCNLAT","COLOUR3".

Look- Up Table	**Data Match**	**Result**
attribute value 4,3,4	attribute values 3,4,3	No Match
	attribute values 4,3	No Match
	attribute values 4,3,4,7	Match (value 7 is not used in symbolization)

IMPORTANT: If no look-up table line can be identified where all attribute values in field 2 match the object's attributes, select the symbology instruction from the first line that contains the object class code in field 1. Field 2 of this line shall be empty and field 3 shall contain a fail-safe generic symbolization instruction.

10.3.3.2 Look-Up Table Attribute Matching

The rule in the paragraph above applies in the usual case when the look-up table contains specific values of the attribute in field 2. In this case fields 1 and 2 are of the general form: "OBJCLS", "ATTRBAiATTRBBj", where ATTRBA (attribute A) and ATTRBB (attribute B) are drawn from the SENC. Only values “i”" and “j” of ATTRBA and ATTRBB respectively will match.

Other forms of feature object/attribute matching may be used in certain cases:

(i) No value is given for the attribute value in field 2; the value is missing.
This look-up table line is of the form "OBJCLS", "ATTRBA".
It is used when the same symbolization is to be employed for all values of attribute A.
Any value of the attribute except «unknown» will give a match.

(ii) The placeholder “?” is given for the attribute value.
This look-up table line is of the form "OBJCLS", "ATTRBA?".
Only the attribute value=unknown (i.e., omitted in the data) will give a match in this case. S57 defines how “unknown” is encoded as a value for various attribute types.

Example: "DEPARE","DRVAL1?DRVAL2?","AC(NODTA);AP(PRTSUR01)" etc., is the symbolization for an incompletely surveyed area.

(iii) There is one instance where S-57 uses the «omission» of a mandatory attribute (i.e., the mandatory attribute is not present and the attribute code is omitted) to code a specific object: “TSSLPT”,””, where ORIENT is omitted, codes a traffic junction.

In every other case, the first look-up table line for each object class omits all attributes and is used to give the default symbolization for that feature object..

10.3.3.3 Look-Up Table Conditional Symbology

For some object classes the relation between attribute values and symbology instruction is too complex or the presentation depends on Mariners' selection. Therefore a conditional symbology procedure is defined in the "symbolization instruction" field which in turn produces the symbology instructions for presentation and may modify the priority, the radar flag, the IMO category and/or viewing group.

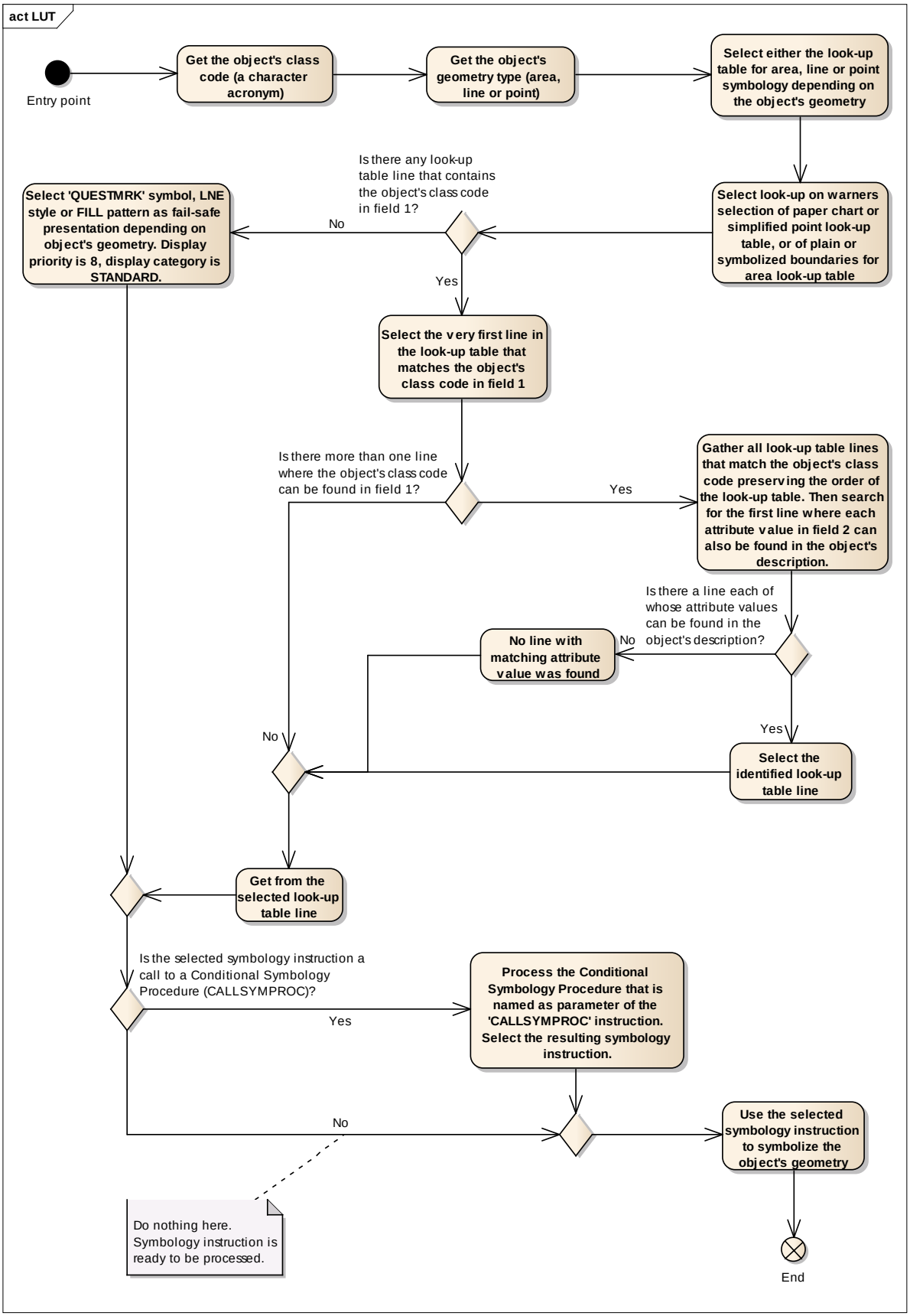
10.3.3.4 Symbolizing a non-ENC object class

When there is no look-up table entry matching the object, the look-up table is incomplete or the object is of an unknown object class, the ECDIS presentation shall use the symbol ('QUESMRK1'). All known S-57 attributes permitted for ENCs that have been populated, shall be available for cursor enquiry. Values of unknown attributes shall also be available via the cursor enquiry.

Symbol	QUESMRK1
Display Priority	**5**
Over Radar	**O**
Display Category	**Standard**
Viewing Group	**21010**

10.3.3.5 UML Diagram, How to use the Lookup Tables

The following flow chart diagram explains in detail how to use the look-up tables.



10.3.3.6 Not set attributes

The symbology instruction may refer to attributes that are not listed in field 2, for example TX(OBJNAM). If these attributes are not set in the feature object, this particular command word shall be ignored and the rest of the symbology instruction shall be completed.

10.3.3.7 'No Symbol' - Objects

In some cases the "symbolization instruction"-fields in a look-up table line are empty. Such an explicitly "empty" instruction means that no actual presentation for the respective object is required by the Presentation Library. Such objects are not symbolized and they are not shown on the screen. For example, there is no symbolisation of a point BRIDGE feature The empty entry into the look-up table is simply for completeness.

10.3.3.8 Presentation of New Object NEWOBJ

The ‘New Object’ feature class has been added to the S-57 Object Catalogue for detail on its use and encoding please see the S-57 Use of the Object Catalogue. NEWOBJ will cater for future requirements specified by the IMO that affect safety of navigation which cannot adequately be encoded by any existing S-57 object class. It will not be used unless approved by the Transfer Standard Maintenance and Application Development Working Group (TSMAD) and the Digital Imaging and Portrayal Working Group (DIPWG).

For the presentation of objects of class NEWOBJ there are two defined presentations to be used depending on whether the SYMINS attribute is defined.

To distinguish a new object symbol from the standard “Non ENC object” symbol (magenta question mark), an exclamation mark shaped in a magenta filled circle has been developed. The new symbol is named ‘NEWOBJ01’. If the SYMINS attribute is defined then it is used to symbolise the feature object using the CS(SYMINS01) conditional symbology procedure.

IMPORTANT: Where the ECDIS fails to indentify the symbol contained in the SYMINS attribute the SY(NEWOBJ01) shall be used as a default

10.3.4 Display Priority, Radar Priority, Display Category, Viewing group

10.3.4.1 Display Priority

Each symbolization instruction except of text drawing from a look-up table line has a display priority given in field 4. Each symbolization instruction from a look-up table line has a display priority given in field 4. The display priority can be of a value between '0' and '9', where '9' identifies the highest priority. The display priority applies irrespective of whether an object is a point, line or area. If the display priority is equal among objects, line objects have to be drawn on top of area objects whereas point objects have to be drawn on top of both. If the display priority is still equal among objects of the same type of geometry (area, line or point) the given sequence in the data structure of the SENC, or some other neutral criterion, shall be used for an arbitrary decision as to which object is drawn on top. Text shall be drawn last (except for own ship etc.), in priority 8.

The display priority shall be used to ensure that objects that overlap each other are drawn in the right sequence. Thus, an object with a higher priority shall be drawn after (on top of) an object with a lower display priority. However, if two line objects, or two area boundaries, or a line and an area boundary, are located at the same position and share the same extent (their coordinates are identical), then the

line symbolization with the higher display priority shall suppress the line symbolization of the other object (line or area). Therefore only the line symbolization of the object (line or area) of the higher display priority is drawn. Where two objects share the same spatial edge and both have the same display priorities each line shall be symbolized.

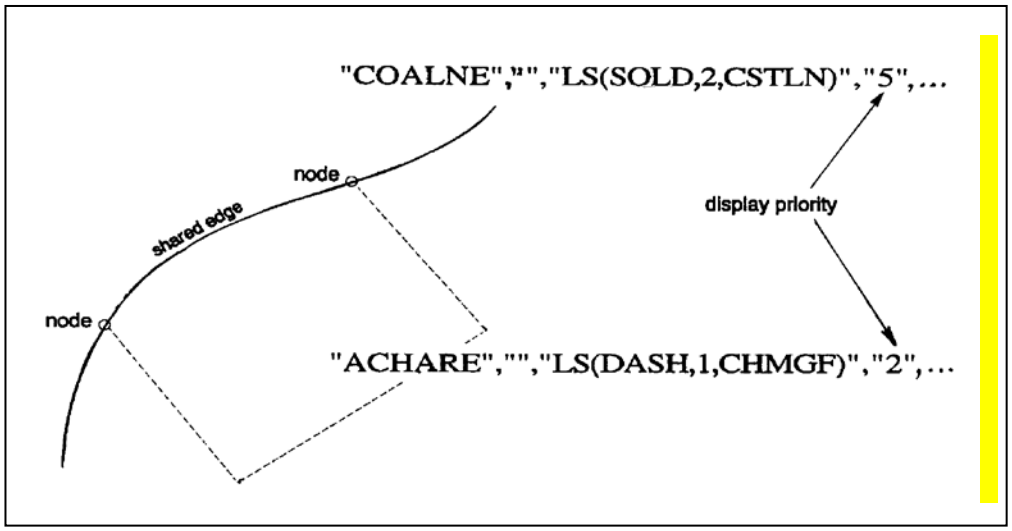


Fig 6. Symbolization of shared edges

The coastline object is symbolized with a solid line while the anchorage area is bordered with a dashed line. Both objects share an edge that is part of the coastline. The symbolization of the coastline object suppresses the border of the anchorage area since the display priority of the coastline symbolization is higher. Note that priorities have to be evaluated again, if the presentation scale changes (see 8.4).

This suppression only applies to line objects and area boundaries. The rule for centred symbols, area patterns and point symbols is that all symbols shall be drawn with the highest priority object being drawn last independent of the geometric primitive (point, line or area).

There is one exception to this rule for suppressing overlapping lines. The manual chart correction lines LC(CHCRIDnn) and LC(CHCRDELn) shall coexist with the underlying line. Both LC(CHCRIDnn) or LC(CHCRDELn) and the underlying line shall be drawn.

Overdrawing may be essential, for example in the case of a buoy, and its name and light flare. These are given offsets in the symbol library to avoid the symbols being drawn over each other.

The following table gives an indication of how priorities are allocated. Within each group priorities are adjusted to meet specific cases:

Data Groupings	Display Priorities
no data filled area pattern	priority 0
S-57 group 1 filled areas	priority 1
superimposed areas	priority 2, 3
restricted area	priority 5
traffic areas	priority 6
land features	priority 4, 5
water features	priority 3, 4, 5, 6
coastline features	priority 5, 6, 7
routeing lines	priority 5, 6, 7
symbols for lines and areas	priority 4, 5, 6
hazards (bridge, safety contour)	priority 8
Mariners VRM & EBL	priority 9
own ship	priority 9

NOTE: To ensure seamless presentation of a single intended usage (navigational purpose) all objects of same display priority from all cells in same intended usage shall be draw together.

10.3.4.2 RADAR Flag

Field 5 of the look-up table lines contain the OVERRADAR flag. It classifies whether objects are shown on top of the raw radar picture. Two different values can occur in this field:

Value	Description
O	puts the object's presentation over radar
S	the presentation is suppressed by radar

Radar Table

OVERRADAR is similar to a display layer that assigns objects to the information shown on top of the raw radar picture. As a fail-safe, objects are automatically assigned ‘O’ OVERRADAR if field 5 of a look-up table line is empty.

When the RADAR overlay is present on the ECDIS chart display the OVERRADAR flag takes presidence over the objects display priority.

10.3.4.3 Display Categories

Every entry to the look-up table matches either all objects of an object class or a subset of objects. Therefore the look-up table can be used to assign the objects to the IMO Display Categories (see IMO Performance Standards for ECDIS [2]).

The IMO "display categories" are as follows:

Display Base is that part of the Standard Display which shall be permanently retained on the display (see IMO Performance Standards [2]).

Standard Display information is that part of the SENC which shall be presented when the ECDIS display is first switched on, and at any time by a single operator action (see IMO Performance Standards [2]).

All Other Information includes all SENC information that is not in the Standard Display, to be displayed on demand by the Mariner.

10.3.4.4 Independent Mariner Selections

There are a number of settings in ECDIS that can be operated by the Mariner that will alter the charted display. Each of these objects has a display category assigned but shall only be shown in that display category if the Mariner has decided to select this option. Listed alphabetically below are the Mariner selectors that shall be available in ECDIS, the name of the selector in the ECDIS GUI and a functional description. There are a number of other optional extra Mariner selectors that can be included in ECDIS at the bottom of the table.

Clause	ECDIS Implementation	Name of Selector in ECDIS	Function Description
14.2	Mandatory	Accuracy	Independent pattern selection of CATZOC, viewing group 31010. Symbol LOWACC01, viewing group 31011
10.4.1	Mandatory	Date dependent	Date Dependent Objects – to turn on and off the display of temporal objects by viewing a date range.
13.2.7	Mandatory	Full light lines	Full Light Sector Lines
10.4.1.1	Mandatory	Highlight date dependent	Indication of date dependent objects – to turn on and off the display of symbol CHDATD01
10.6.1.1	Mandatory	Highlight info Highlight document	Additional Information - viewing group 31030 (INFORM, NINFOM) Additional Documents – viewing group 31031 (TXTDSC, NTXDS, PICREP)
10.3.3.4	Mandatory	Unknown	Unknown Objects - to turn on the display of objects which are not specified in S-52 standard – viewing group 21010
10.7.1.5	Mandatory	Update review	Review of Updates – This function turns on colour

			highlighting for the objects which have undergone modification in the process of the latest accepted correction;
10.4.2	Mandatory	Scale min	Turn SCAMIN Off
10.5.7	Mandatory	Shallow pattern	Shallow Water Pattern
13.2.24	Mandatory	Shallow water dangers	Isolated Dangers in Shallow Water – to turn on the display of isolated danger objects which are located in the unsafe waters - viewing group 24050
14.2	Optional	Contour label	Contour Labels – to turn on the display of contour labels (incl. label of safety contour) – viewing group 33021, 33022
	Optional	Four shades	Four Colour Depth Shades
10.6.1.2	Optional	National language	National Language NOBJNM, text group 31
12	Mandatory	Paper chart / simplified symbols	Point symbol style
12	Mandatory	Plain / Symbolized boundaries	Line symbol style

10.3.4.5 Mariners' objects

All Mariners' navigational objects, which are listed in the look-up table under "Non-standard classes", are assigned in the look-up tables to a "Mariners"category.

The display of Mariners' objects is independent of the ECDIS display category (Display Base, Standard and All Other).

10.3.4.6 Viewing groups

The Mariner shall have effective control over which features appear on the display (subject to the over-riding requirements of IMO category), as required by the IMO ECDIS Performance Standard section 3.5.

The viewing groups in table 14.2 are a framework on which the ECDIS manufacturer can base his own method of providing this capability. The minimum mandatory ECDIS implementation is described in 14.3 and 14.5.

Viewing groups are 'on' or 'off' switches for use by the Mariner to control the information appearing on the display. An item in the viewing group table may be a chart object; a Mariners' or other time-variable object; a special symbol such as the "depth less than safety contour" pattern; or a non-ENC feature such as the shallow water pattern. In edition 3.3 further 'symbol viewing groups' have been added, to allow auxiliary symbols such as contour labels, the 'low accuracy' symbol, etc., to be switched on or off without affecting the primary symbolisation of the object.

Items in the viewing group tables in section 14.2 are arranged in numbered groups (e.g. group 26230 consisting of the items pipeline area and cable area) which in turn are arranged in layers (e.g. layer 26000 consisting of cautionary areas). The groups are arranged by IMO Category, in the sequence of INT 1 [1].

IMPORTANT: Viewing groups from different IMO categories shall not be combined under a single display selector.

Although the viewing groups reflect the IMO category, the authority for category is the classification in field 6 of the look-up table.

The Presentation Library provides a similar classification for text - see section 15.

10.3.4.7 Display Priority & Display Category in Conditional Symbology Procedures

A conditional symbology procedure is called from the look-up tables (see 14). Thus the symbolization that is generated by the procedure has the display priority, OVERRADAR classification and display category which is given in field 4, 5 & 6 of the look-up table entry from which the procedure was called.

A conditional symbology procedure can assign the symbolization to another display category, put it on top of radar or give it a different display priority if necessary. Thus it 'overwrites' the default assignments given in the look-up table e.g. if a depth contour is identical with the safety contour the depth contour is assigned to the DISPLAYBASE category (see symbology procedure diagram 'DEPCNT03', section 14).

In the symbology procedure diagram the new assignment is given explicitly if the conditional symbology procedure overwrites the default look-up table assignments. The default assignments from the look-up tables are valid if there is no explicit assignment for display category, display priority or OVERRADAR.

10.3.5 Check Symbol SY(CHKSYM 01)

The symbol SY(CHKSYM01) has been retained for use in checking symbol size.

10.4 Display of objects - Date Dependent and Display Scale

10.4.1 Date dependent ENC Objects

There are a number of objects within the Marine environment, which are seasonal, such as racing buoys. These objects are only to be displayed over a certain period, S-57 uses the attributes Period Start (PERSTA) and Period End (PEREND) to encode these dates. Other objects, such as traffic separation schemes, use the attributes Date Start (DATSTA) and Date End (DATEND) to indicate their introduction or removal. In order for the Mariner to receive important changes to traffic separation schemes before the event Hydrographic Offices are required to provide updates or new editions containing the alterations at least one month before they come into force. Any S-57 object with one of the above attributes shall not be displayed outside its effective dates unless requested by the Mariner.

To provide the Mariner with effective route planning capabilities and for the look-ahead function during route monitoring ECDIS shall display date dependent chart data based on a Mariner selected date or date range (start viewing date and end viewing date).

During route planning and monitoring the Mariner shall be able to select a date or date range to display all date dependent chart objects. The display of date dependent information is indicated by the symbol SY(CHDAT01) clause 10.4.1.1

Example: A new traffic separation scheme is coming into effect on 01.01.2013, it has been encoded by the ENC producer using the attribute date start (DATSTA). The current date is 12.12.2012 and the Mariner is planning a route that will cross this area over the effective start period.

The ECDIS shall be capable of providing the Mariner the ability to set the date he will be in the area (02.01.2013) and the system shall show the new traffic scheme.

IMPORTANT: When viewing date or date range do not include current date. The Mariner shall be informed by a permanent indication on the chart display that the date has been adjusted. Please use one of the following options below;

Display Not Real Time – Display is based on date dd mmm yyyy

Or

Display Not Real Time – Display is based on viewing date range from dd mmm yyyy to dd mmm yyyy

(Note: dd mmm yyyy = Day, Month, Year, example; 28 Jan 2014)

10.4.1.1 Indication of date dependent objects

All objects for which any of the values for the attributes DATSTA, DATEND, PERSTA PEREND are within the Mariner selected date range shall be indicated using SY(CHDATD01)

10.4.2 Scale-Dependent Objects

To reduce screen clutter most objects within ENC will carry the attribute SCAMIN to specify the smallest display scale at which they shall be drawn. At display scales smaller than SCAMIN the object shall not be drawn. For example, an object with a SCAMIN value of 50,000, indicating a scale of 1/50,000, shall not be drawn on an ECDIS display of 1/60,000.

IMPORTANT: ECDIS shall provide the Mariner a selector to turn off the SCAMIN attribute to display all objects in the chart display.

10.5 IMO Presentation Instructions not Handled by Look-up Tables

In some cases the Presentation Library does not provide a symbology instruction in the look-up tables or flow chart of a conditional symbology procedure that specifies how to present a specific feature on the ECDIS screen. The reason is, that such a feature cannot be clearly identified as an S-57 object class or it appears to be illogical to include it to the Mariners' navigational object classes (see Part II for further details and definitions of the Mariners' navigational object classes).

Therefore, the following presentation instructions are in free text in order to assist the manufacturer to set up a satisfactory and comprehensive ECDIS display.

10.5.1 Scalebar and Latitude Scale

For display scales larger than 1/80,000 (e.g. a scale of 1/50,000) draw symbol 'SCALEB10' on the left side of the chart display, bottom justified and 3mm in from the border of the display. Make sure the symbol is properly sized by your software to represent 1 nautical mile (1852 m) at the scale of the display. For display scales of 1/80,000 or smaller (e.g. 1/250,000) use symbol 'SCALEB11', similarly located, and scaled to represent 10 miles at the scale of the display.

Symbol	**SCALEB10** **SCALEB11**
Display Priority	**9**
Over Radar	**O**
Display Category	**Base**
Viewing Group	**11030**

10.5.4 North Arrow

Use symbol 'NORTHAR1' to indicate true north. Place it in the top left corner of the chart display, inside the scalebar. Rotate the symbol to true north if the display is other than north up, and make sure it is clear of the scalebar even if the latter extends the full height of the display

Symbol	NORTHAR1
Display Priority	**9**
Over Radar	**O**
Display Category	**Base**
Viewing Group	**11040**

10.5.5 Graticule

If the ECDIS shows a graticule (IMO PS [2]) the lines shall be one unit wide, CHBLK.

10.5.6 Display Mode

The ECDIS manufacturer shall provide the indication of display mode required in the display base by IMO PS [2].

10.5.7 Shallow Water Pattern

When the entire water area on the ECDIS display is of less depth than the safety contour, it is not possible for the Mariner to easily detect this problem. The issue is exacerbated when the ECDIS is set to night mode due to the small differences between the depth area shades in the ECDIS chart display. Therefore S-52 provides a faint lattice pattern DIAMOND1 to distinguish shallow water (see conditional symbology procedure SEABEDnn).

IMPORTANT: The Mariner shall be provided with a selection to turn the shallow water pattern on or off from within the ECDIS

Symbol	DIAMOND1
Display Priority	**3**
Over Radar	**S**
Display Category	**Standard**
Viewing Group	**23010**

10.5.8 Black Level Adjustment Symbol

Unless the brightness and contrast controls of the monitor, are properly adjusted there is a danger that information may be lost from the chart display, particularly at night. Symbol BLKADJ is provided for checking correct adjustment and for re-adjusting as necessary. It shall be available for call-up by the Mariner as required. Instructions for its use are given in section 18.4 and Colour & Symbol Specifications, section 4.1.4.5. Display priority is 9; over radar; IMO category is standard display; viewing group does not apply as the black level adjustment symbol is a case of special call-up.

10.5.9 Detection and Notification of Navigational Hazards

The IMO Performance Standard for ECDIS MSC.232(82) clauses, 11.3.5 Route planning states;

"An indication should also be given if the Mariner plans a route closer than a user-specified distance from a point object, such as a fixed or floating aid to navigation or isolated danger".

Clause 11.4.6 Route monitoring states;

"An indication should be given to the Mariner if, continuing on its present course and speed, over a specified time or distance set by the Mariner, own ship will pass closer than a user-specified distance from a danger (e.g. obstruction, wreck, rock) that is shallower than the Mariner's safety contour or an aid to navigation".

The following table lists the S-57 objects and their attributes that satisfy the conditions above and shall precipitate an indication within the ECDIS. The point, line or areas shall be graphically indicated using the instructions contained in the lookup tables named "indhlt". "indhlt" is not an ENC charted object class, but an object that shall be created by the ECDIS. See Fig 7 for example.

NOTE: This is a minimum requirement and does not preclude providing additional functionality allowing Mariner selection to individually alarm on each object class.

S-57 Objects	Condition (if any)	Geometric primitive
BCNCAR		POINT
BCNISD		POINT
BCNLAT		POINT
BCNSAW		POINT
BCNSPP		POINT
BOYCAR		POINT
BOYINB		POINT
BOYISD		POINT
BOYLAT		POINT
BOYSAW		POINT
BOYSPP		POINT
BRIDGE		POINT, LINE, AREA
CBLOHD		LINE
DAYMAR		POINT
PIPOHD		LINE
CONVYR		LINE, AREA
MORFAC		POINT, LINE, AREA
NEWOBJ	CLSNAM = Virtual AtoN, *	POINT
FSHFAC		POINT, LINE, AREA
ICEARE		AREA
LITFLT		POINT
LITVES		POINT
LNDARE		POINT, LINE
LOGPON		POINT, AREA
OFSPLF		POINT, AREA
OILBAR		LINE
PILPNT		POINT
PYLONS		POINT, AREA

OBSTRN	**DEPTH_VALUE < safety contour value	POINT, LINE, AREA
UWTROC	DEPTH_VALUE < safety contour value	POINT
WRECKS	DEPTH_VALUE < safety contour value	POINT, AREA
SOUNDG	EXPSOU=2 and VE3D subfield< safety contour value	POINT

*Denotes that all New Objects with the object class name pre-fix 'Virtual AtoN' shall be indicated.
** DEPTH_VALUE is not an S-57 attribute, it is derived from CSP OBSTRNnn and WRECKSnn. The safety contour value is set by the user.

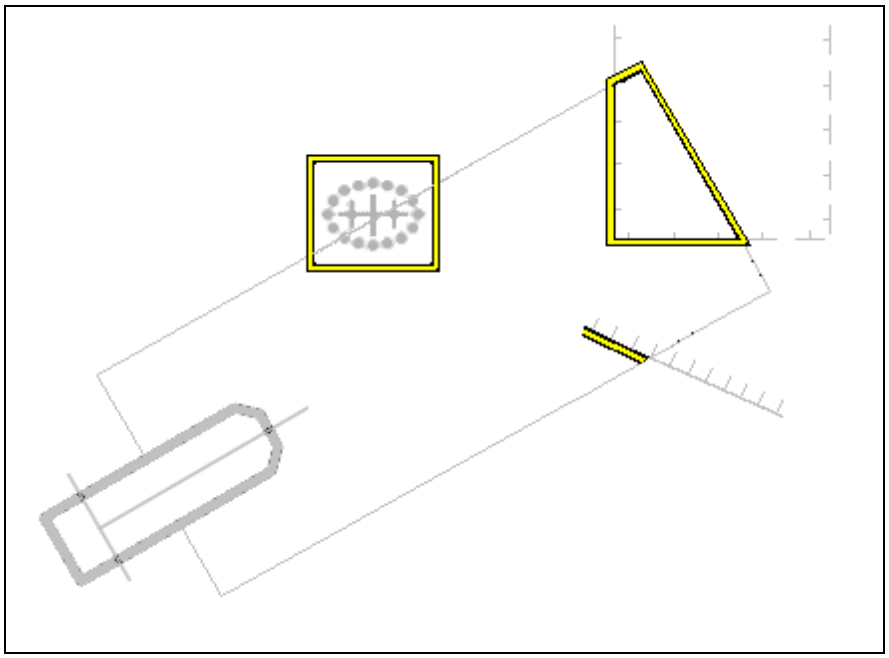


Fig 7. Example of indication highlight in ECDIS 10.5.9 and 10.5.10

10.5.10 Detection of Areas, for which Special Conditions Exist.

The IMO Performance Standard for ECDIS MSC.232(82) clause 11.3.5 Route Planning states;

“An indication should be given if the Mariner plans a route closer than a user-specified distance from the boundary of a prohibited area or a geographic area for which special conditions exist.”

Clause 11.4.4 Route Monitoring states;

"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 area for which special conditions exist".

The IMO Performance Standard Appendix 4 specifies the following areas which ECDIS shall detect and provide an alert or indication.

- Traffic separation zone
- Inshore traffic zone
- Restricted area
- Caution area
- Offshore production area
- Areas to be avoided
- Military practice area
- Seaplane landing area
- Submarine transit lane
- Anchorage area
- Marine farm/aquaculture
- PSSA (Particularly Sensitive Sea Area)

The following table provides an authoritative mapping between the areas identified within the IMO Performance standard for ECDIS and S-57 feature objects, their attributes and geometric primitives. The point, line or area features shall be graphically indicated using the presentation named as “indhlt” in the look-up tables.

IMO Special condition	S-57 Object	Attribute	Geometry
Traffic separation zone	TSEZNE		AREA
Inshore traffic zone	ISTZNE		AREA
Restricted area	RESARE	RESTRN !=14 and CATREA != 28	AREA
Caution area	CTNARE		AREA, POINT
Offshore production area	OSPARE		AREA
Areas to be avoided	RESARE	RESTRN = 14	AREA
Military practice area	MIPARE		AREA, POINT
Seaplane landing area	SPLARE		AREA, POINT
Submarine transit lane	SUBTLN		AREA
Anchorage area	ACHARE		AREA, POINT
Marine farm/aquaculture	MARCUL		AREA, LINE, POINT
PSSA (Particularly Sensitive Sea Area)	RESARE	CATREA = 28	AREA

10.5.11 Visualization of the Safety Contour

The safety contour is defined as an edge between safe and unsafe skin of the earth objects. This edge shall be visualized using the presentation below.

"SAFCON","","LS(SOLD,3,DEPSC)","8","O","DISPLAYBASE","13000"

10.5.12 Detection of Safety Contour

The IMO Performance Standard for ECDIS MSC.232(82) clause 11.3.4 Route Planning states;

"An indication is required if the Mariner plans a route across an own ship's safety contour"

Clause 11.4.3 Route Monitoring states;

"ECDIS should give an alarm if the ship, within a specified time set by the Mariner, is going to cross the safety contour".

The following table specifies the S-57 objects, conditions and geometry that constitute the safety contour and shall therefore be used when raising the safety contour alarm.

The point, line or area shall be graphically indicated using the presentation named as "dnghlt" in the look-up tables.

S-57 Object	Condition	Geometry
DEPARE	*DEPARE03 "UNSAFE=TRUE"	AREA
DRGARE	*DEPARE03 "UNSAFE=TRUE"	AREA
FLODOC	-	LINE, AREA
HULKES	-	POINT, AREA
LNDARE	-	POINT, LINE, AREA
PONTON	-	LINE, AREA
UNSARE	-	AREA
SLCONS	-	POINT, LINE, AREA

* DEPARE03 is not an S-57 attribute, it is a CSP.

Note: Rocks, Wrecks and Obstructions are in Navigational Hazard Detection.

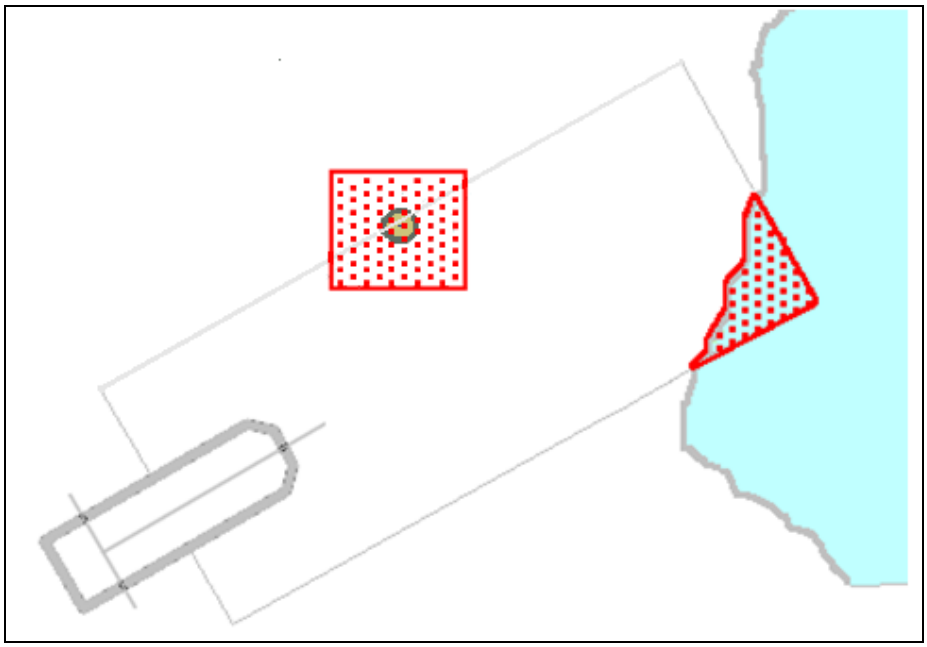


Fig 8. Example Danger Highlight in ECDIS

10.6 HO-Specified Display Features

10.6.1 Additional Chart Information

10.6.1.1 Standard Attributes INFORM, NINFOM, TXTDSC, NTXTDS and PICREP

Additional chart content is encoded using a number of standard attributes. The INFORM attribute is the most common and is used to carry extra information about feature objects. There are a total of five similar universal attributes:

S-57 Acronym	**Description**	**Attribute Type**
INFORM	Information	String, <=300 characters
NINFOM	Information in a national language	String, <=300 characters
TXTDSC	Textual Description	String encodes the file name of an external text file
NTXTDS	Textual Description in a national language	String encodes the file name of an external text file
PICREP	Pictorial Representation	String encodes the file name of an external picture file

NOTE: ECDIS shall provide independent user selection to turn on and off the symbol INFORM01 for two cases;

1.INFORM, NINFOM

2.TXTDSC, NTXTDS and PICREP

This rule applies to all SENC objects whether symbolized by look-up tables or conditional symbology procedures.

The pivot point of SY(INFORM01) shall be placed at the position of a point object, at the midpoint of a line object, or at the centre of an area object. SY(INFORM01) is intended as a temporary overlay. The display priority is 8, overradar, category other, viewing group 31030.

Symbol (SY)	INFORM01
Display Priority	**8**
Over Radar	**O**
Display Category	**Other**
Viewing group	**31030**

IMPORTANT: The ECDIS manufacturers shall provide appropriate solutions that enable PICREP and other ancillary files to be displayed without affecting the night vision of the user.

10.6.1.2 Display of National Language Attributes and Content

Information contained in National language attributes and associated ancillary files (such as NOBJNM and information in NTXTDS files) can be encoded in a number of formats and many IHO member states encode such fields in their data. National language information is not covered by the ECDIS Performance Standard but it is however strongly recommended that OEMs support all text formats contained in the national language attributes and files, see S-57 Appendix B1 «ENC Specification» section 3.11 lexical level 2 for details.

10.6.2 ECDIS Legend

The ECDIS chart legend containing the following elements shall be available for display at the position selected by the Mariner. The following table indicates which ENC data elements shall be used.

ECDIS Legend	Values
Units for depth	DUNI subfield of the DSPM field.
Units for height	HUNI subfield of the DSPM field.
Note: Units for depth and height: although the ENC Product Specification of S-57 does not allow any other than metric depths and heights, these two elements shall be stated for clarity for the Mariner	
Scale of display	Selected by Mariner. (The default display scale is defined by the CSCL).
Data quality indicator	a. CATZOC attribute of the M_QUAL object for bathymetric data. b. POSACC attribute of the M_ACCY object (if available) for non-bathymetric data.
Note: Due to the way quality is encoded in the ENC, both values (a and b) shall be used.	
Sounding/vertical datum	SDAT and VDAT subfields of the DSPM field or the VERDAT attribute of the M_SDAT object and M_VDAT object when available. (VERDAT attributes of individual objects shall not be used for the legend.)
Horizontal datum	HDAT subfield of the DSPM field.
Value of safety depth	Selected by Mariner. Default is 30 metres.
Value of safety contour	Selected by Mariner. Default is 30 metres.
Note: If the Mariner has selected a contour that is not available in the ENC and the ECDIS displays a default contour, both the contour selected and the contour displayed shall be quoted.	
Magnetic variation	VALMAG, RYRMGV and VALACM of the MAGVAR object. Item shall be displayed as; VALMAG RYRMGV (VALACM) e.g., 4°15W 1990 (8'E)
Date and number of latest update affecting chart cells currently in use.	ISDT and UPDN subfields of the DSID field of the last update cell update file (ER data set) applied.
Edition number and date of the ENC.	EDTN and UADT subfields of the DSID field of the last EN data issue of current ENC issue of the ENC set.
Chart projection	Projection used for the ECDIS display (e.g.,

	oblique azimuthal). This shall be appropriate to the scale and latitude of the data in use.

The list above is the minimum that shall be available, but the complete list need not always be shown. Individual items may be picked by the Mariner for display for a period; examples are magnetic variation, data quality for depths (M_QUAL, CATZOC) etc.

10.6.3 Light Description Text Strings

Previous versions of the Presentation Library provided c-code that enabled the building of light description text strings to be displayed on the ECDIS.The c-code has now been removed from the Presentation Library and a textual description of how light descriptions shall be constructed is provided. Control over how the light description is used in the display is still within the conditional symbology LIGHTS06. This section defines the syntax, layout and map of the S-57 attributes to the ECDIS text string.

Note: Care shall be taken when constructing Light descriptions for sectored lights.

To produce textual light descriptions in ECDIS, the ECDIS system shall use an abbreviated form of the S-57 attributes of the Lights feature in a particular order. The number next to the attribute denotes the draw order in which the ECDIS shall output the light description text string. Overall structure:

1 Category of Light (CATLIT)

2 Light Characteristic (LITCHR)

3 Signal Group (SIGGRP)

4 Colour (COLOUR)

5 Signal Period (SIGPER)

6 Height (HEIGHT)

7 Value of Nominal Range (VALNMR)

8 Status (STATUS)

The following tables define a map between the ENC attribute values and the required ECDIS textual output.

S-57 Attribute CATLIT - Category of Light

ENC Input		ECDIS Output
S-57 Attribute Code ID	S-57 Category of Light Attribute Value	Abbreviation
1	directional function	Dir
5	aero light	Aero
7	fog detector light	Fog Det Lt

S-57 Attribute - Status

ENC Input		ECDIS Output
S-57 Attribute Code ID	S-57 Status Attribute Value	Abbreviation
2	occasional	occas
7	Temporary	temp
8	Private	priv
11	extinguished	exting
17	un-watched	U

S-57 Attribute - Light Characteristic

ENC Input		ECDIS Output
S-57 Attribute Code ID	S-57 Light Characteristic Attribute Value	Abbreviation
1	Fixed	F
2	Flashing	Fl
3	long-flashing	LFl
4	quick-flashing	Q
5	very quick-flashing	VQ
6	ultra quick-flashing	UQ
7	Isophased	Iso
8	Occulting	Oc
9	interrupted quick-flashing	IQ
10	interrupted very quick-flashing	IVQ
11	interrupted ultra quick-flashing	IUQ
12	Morse	Mo
13	fixed/flashing	FFl
14	flash/long-flash	Fl+LFl
15	occulting/flashing	OcFl
16	fixed/long-flash	FLFl
17	occulting alternating	AlOc
18	long-flash alternating	AlLFl
19	flash alternating	AlFl
20	group alternating	Al
25	quick-flash plus long-flash	Q+LFl
26	very quick-flash plus long-flash	VQ+LFl

27	ultra quick-flash plus long-flash	UQ+LFl
28	Alternating	Al
29	fixed and alternating flashing	AlF Fl
Wrong	alternating occulting/flashing	AlOc Fl

Units of measure suffixes

S-57 Attribute	Description	Units of Measure
Signal Period	Seconds	s
Height	Metres	m
Value of Nominal Range	Miles	M

When the signal group value is set to or include "()" and/or "(1)" there is no requirement for this to be populated in the light description text. Only when the signal group value differs from the above mentioned values shall the value be output on the ECDIS screen, this follows the paper chart convention Mariners are used to seeing.

The default presentation for each numeric value: signal period, height and value of nominal range is no decimals. If the value of the attribute has non-zero decimal part then the value is displayed to one decimal place.

Example: Given a light with the following attributes;

Feature	LIGHTS
Light Characteristic	Flashing
Signal Group	(1)
Colour	White
Signal Period	30 seconds
Height	7 metres
Value of Nominal Range	10 miles

The ECDIS shall display the lights textual description as follows: **FL W 30s7m10M**

10.7 Displaying Manual and Automatic Updates and Added Chart Information

10.7.1 Manual Updates

Manual updates of ENC information shall be displayed using the same symbology as ENC information and shall be distinguished from ENC information as follows:

10.7.1.1 Added Feature

Point object: superimpose SY(CHCRIDnn)*
Line object: overwrite with line LC(CHCRIDnn)*
Area object: overwrite area boundary with line LC(CHCRIDnn) and superimpose SY(CHCRIDnn) on any centred symbol.

10.7.1.2 Deleted Feature

The object shall remain on the display and shall be marked as follows:

Point object:	Superimpose SY(CHCRDELn)*
Line object:	Overwrite with line LC(CHCRDELn)* (do not remove the original line)
Area object:	Overwrite area boundary with line LC(CHCRDELn) and superimpose SY(CHCRDELn) on any centred symbol.

*SY(CHCRIDnn) means the current version of symbol CHCRID, i.e., CHCRID01 in 1997. CHCRID and CHCRDEL symbols have the category and viewing group of the object they are attached to, display priority «8», radar priority «O».

NOTE: The line symbols LC(CHCRIDnn) and LC(CHCRDELn) shall not suppress the underlying line (see section 10.3.4.1).

10.7.1.3 Moved Feature

As for deleted feature, followed by added feature.

10.7.1.4 Modified Feature

a) If the only modification is an addition(e.g., an existing buoy has a retro-reflector added with no other change): superimpose SY(CHCRIDnn) or LC(CHCRIDnn)

b) If the only modification is a deletion of a part (e.g.,an area has a «fishing prohibited» restriction removed), then this creates both a change and a deletion and both shall be symbolized:

Point:	superimpose SY(CHCRIDnn) and SY(CHCRDELn)
Line:	overwrite with LC(CHCRIDnn) and LC(CHCRDELn)
Area:	overwrite the boundary with LC(CHCRIDnn) and LC(CHCRDELn) and also superimpose SY(CHCRIDnn) and SY(CHCRDELn) on any centred symbol.

c) If the modification is an addition and a deletion then it is handled as in 10.7.1.4 b above.

A deleted feature shall appear on the display only when its IMO category and viewing group are displayed.

S-52 Appendix 1 requires that a manually updated feature shall be capable of the same performance in feature selection, response to cursor-picking, etc., as an ENC feature. In addition, it shall provide updating information (identification and source of update, when and by whom entered, etc.) on cursor picking.

10.7.2 Identifying Automatic Chart Corrections On Mariners Demand

The ECDIS manufacturer shall provide a means of identifying chart corrections to the SENC on demand by the Mariner.

The ECDIS manufacturer shall provide a means of identifying chart corrections to the SENC on demand by the Mariner.

On mariners demand automatic chart corrections of ENC information shall be highlighted as follows:

10.7.2.1 Added Feature

When the ENC ISO 8211 record update instruction (RUIN) is set to 1 = Insert

Point object:	superimpose SY(CHRVID01)
Line object:	overwrite with line LC(CHRVID01)
Area object:	overwrite area boundary with line LC(CHRVID01) and superimpose SY(CHRVID01) on any centred symbol.

10.7.2.2 Deleted Feature

When the ENC ISO 8211 record update instruction (RUIN) is set to 2 = Delete

Point object:	Superimpose SY(CHRVDEL1)
Line object:	Overwrite with line LC(CHRVDEL1) (do not remove the original line)
Area object:	Overwrite area boundary with line LC(CHRVDEL1) and superimpose SY(CHRVDEL1) on any centred symbol.

10.7.2.3 Moved Feature

As for deleted feature, followed by added feature.

10.7.2.4 Modified Feature

When the ENC ISO 8211 record update instruction (RUIN) is set to 3 = Modify

Point:	superimpose SY(CHRVID01) and SY(CHRVDEL1)
Line:	overwrite with LC(CHRVID01) and LC(CHRVDEL1)
Area:	overwrite the boundary with LC(CHRVID01) and LC(CHRVDEL1) and also superimpose SY(CHRVID01) and SY(CHRVDEL1) on any centred symbol.

10.7.3 Non-HO (Non-ENC) Chart Information

Limited non-HO data added to existing HO ENC data to augment the chart information shall be distinguished from the HO-ENC information as follows:

Point object:	superimpose SY(CHCRIDnn)
Line object:	overwrite with line LC(CHCRIDnn)
Area object:	overwrite area boundary with line LC(CHCRIDnn) and superimpose SY(CHCRIDnn) on any centred symbol.

Non-HO data shall be distinguished from manually updated chart information, which uses the same identifiers, by cursor picking.

See IHO Colour & Symbols Specifications section 2.3.1c for information on how to symbolize other cases of non-HO data appearing on the ECDIS display.

Non-HO chart information may be updated by any systematic procedure. A record of updates shall be maintained.

The Mariner shall be able to remove all non-HO chart information if the need should arise.

10.8 Cursor Pick and Interface Panel Display

There are a number of rules that shall be applied to all ECDIS cursor pick reports.

No	Cursor Pick Rules
1	Full S-57 Object and Attribute names shall be displayed
2	Enumerate value names shall be displayed
3	There shall not be any padding of attribute values, e.g. a height of 10 metres shall not be padded to 10.000000 metres as this could potentially confuse or mislead the Mariner.
4	Units of measure shall be included after all attribute values which are weights or measures.
5	S-57 category "C" feature attributes shall not be displayed unless requested by the user. Attributes in this subset provide administrative information about an object and the data describing it. In most cases it is of no practical use to the Mariner. This information is only relevant to S-57 data transferred between Hydrographic Offices. An exception to show the value of SORDAT if it is for the following objects: - WRECKS, OBSTRN, UWTROC, and SOUNDG with value QUASOU= 9 and geometry attribute QUAPOS=8 - DRGARE with QUASOU=11 - SWPARE - Any object class with attribute CONDTN=1or 3 or 5
6	Dates shall be given in the form "Day Month Year" DD-MMM-YYYY. JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV,DEC
7	The pick report shall only return information about the visible objects on the ECDIS display. If the viewing group is turned on all objects even no symbol objects without visible presentation within that viewing group are available via the cursor pick report
8	Cursor enquiry shall extend to the spatial object, which carries accuracy attributes QUAPOS and POSACC. It shall include collection objects which carry additional information for example the OBJNAM of traffic separation systems, navigation lines (NAVLNE, RECTRC, DWRTCL, etc.).

10.8.1 Pick Report Descriptions

A plain language explanation of each symbol is included in the Symbol Library and in the Presentation Library section 17. This gives the Mariner quick and understandable information which is not always obvious from the object class and attribute information. The manufacturer shall always provide explanations to the Mariner in response to a cursor pick on the symbol.

Attribute values provided in addition to the above explanation shall be connected to their meaning, and the definitions shall also be available.

10.8.2 Sorting

Effective cursor-pick sorting will be covered in the following deferred amendment. Only a limited number of initial considerations are given below,

10.8.3 User Defined Curser Pick Parameters

The Mariner shall be able to configure the content displayed in the pick report.

10.8.4 Sorting by Significance

A general cursor enquiry shall be sorted by the drawing priority of the object as defined in the look-up table for symbolizing. When the drawing priority of objects is equal the geometric primitive will be used to order the information, points followed by lines and finally areas.

10.8.5 Hover-over Function

OEMs may wish to include hover-over functions for Mariners to access important charted feature details without having to select a pick report. If this function is implemented within an ECDIS the Mariner shall be able to configure the system function on and off.

The hover-over function shall only be used on the following feature objects and for the symbols SYINFORM01 and **(SY - Pol's new date symbol);**

Features	**S-57 Acronym**
Lights	LIGHTS
Beacon, cardinal	BCNCAR
Beacon, isolated danger	BCNISD
Beacon, lateral	BCNLAT
Beacon, safe water	BCNSAW
Beacon, special purpose/general	BCNSPP
Buoy, cardinal	BOYCAR
Buoy, installation	BOYINB
Buoy, isolated danger	BOYISD
Buoy, lateral	BOYLAT
Buoy, safe water	BOYSAW
Buoy, special purpose/general	BOYSPP

Landmarks	LNDMRK

10.8.6 Unknown Attributes

When the ECDIS encounters an unknown attribute not present in the S-57 Attribute catalogue its value shall be available via the ECDIS cursor pick. The existence of unknown attributes must not change the function of the look up table matching see 10.3.3.2

10.9 Tidal Stream Panels : S-57 feature TS_PAD

Tidal Stream Panel

When a tidal stream feature object (TS_PAD) is encoded within ENC, the data from the attribute tidal stream - panel values (TS_TSP) shall be formatted for display in the ECDIS cursor pick report. The following section describes the template that shall be used for displaying the values.

The S-57 attribute catalogue defines the TS_TSP attribute as a coded string. The strings constituent parts are broken down as follows;

1. **Tidal station identifier**
2. **Tidal station name**
3. **Reference Water level (High or Low Water)**
4. **Direction of Stream 13 values given in degrees**
5. **Rate of Stream 13 values given in knots**

Example from S-57 Attribute catalogue Edition 3.1
63230,Darwin,HW,124,2.2,128,2.1,125,2.9,116,2.8,110,2.0,095,0.6,020,0.2,320,1.9,315,2.1,300,2.8,268,2.6,200,2.4,165,2.5

The following tabular template shall be used by ECDIS when displaying the TS_PAD object in the pick report, the fonts, colours and dimensions are all to be defined by the OEM;

Tidal Station:			
Tidal Station Identifier:			
	Hours	Direction of stream (degrees)	Rates at spring tide (knots)
Before	-6		
	-5		
	-4		
	-3		
	-2		
	-1		
	0		
After	+1		
	+2		
	+3		
	+4		
	+5		
	+6		

Populated TS_PAD cursor pick template using the values from the attribute TS_TSP;

Tidal Station: Darwin			
Tidal Station Identifier: 63230			
	Hours	Direction of stream (degrees)	Rates at spring tides (knots)
Before	-6	124	2.2
	-5	128	2.1
	-4	125	2.9
	-3	116	2.8
	-2	110	2.0
	-1	095	0.6
HW	0	020	0.2
After	+1	320	1.9
	+2	315	2.1
	+3	300	2.8
	+4	268	2.6
	+5	200	2.4
	+6	165	2.5

NOTE : The water level shall not be hard coded into the TS_PAD template, this is incorrect as the water level in the TS_PAD values can also refer to 6 hours before/after low water.

11 Digital Presentation Library Format Description

~~~ < SNIP > ~~~
~~~

12 Look-Up Table Listings

~~~ < SNIP > ~~~

13 Conditional Symbology Procedure (CSP) Diagrams

~~~ < SNIP > ~~~

14 Tables

14.1 Colour Tables

The colour tables are designed for different conditions of ambient illumination on the bridge.

The colours are defined in CIE (Commission Internationale de l'Eclairage) values. The ECDIS manufacturer is responsible for computing the correct RGB values for the monitor he uses, from CIE values. A program for the conversion of CIE into RGB values for monitors is provided on the Presentation Library CD (see section 19).

ECDIS manufacturers shall refer to section 7 of the Colour and Symbol Specifications for details for the design and use of the colour tables.

There are 63 colours in these tables. With the addition of the transparent colour (TRNSP) there are 64 colour tokens.

14.2 Viewing Group Layers

Numbering scheme for viewing groups *(Mariners' information in italics)*

DISPLAY BASE	STANDARD DISPLAY	OTHER INFORMATION
00000-09999 reserved for administrative purposes		
10000 reserved *40000 reserved*	20000 reserved *50000 reserved*	30000 reserved *60000 reserved*
11000 A,B information about the chart display *41000 tools*	21000 A,B 51000 tool	31000 A,B *61000 tools*
12000 C, D, E, F land features *42000 own ship, planned route*	22000 C, D, E, F *52000 own ship etc*	32000 C, D, E, F *62000 own ship etc*
13000 H, I depths & currents *43000 Mariners' features*	23000 H,I *53000 Mariners' features*	33000 H,I *63000 Mariners' features*
14000 J,K,L obstructions, pipelines *44000 other vessels*	24000 J,K,L *54000 other vessels*	34000 J,K,L *64000 other vessels*
15000 M traffic,routes *45000 manufacturers' features*	25000 M *55000 manufacturers' features*	35000 M *65000 manufacturers' features*
16000 N special areas *46000 Mariners' assignments*	26000 N *56000 Mariners' assignments*	36000 N *66000 Mariners' assignments*
17000 P,Q,R,S buoys, beacons, lights, radar *47000 reserved for Mariners'*	27000 P,Q,R,S *57000 reserved*	37000 P,Q,R,S *67000 reserved*

information		
18000 T,U services & small craft facilities *48000 reserved for Mariners' information*	28000 T,U *58000 reserved*	38000 T,U *68000 reserved*
19000-19999 reserved *49000-49999 reserved*	29000-29999 reserved *59000-59999 reserved*	39000-39999 reserved *69000-69999 reserved*
70000-99999 reserved for future use.		

Note: These viewing groups reflect the display category, but they do not set it. Display Category is set by field 6 of the look-up table.

Gaps between sets and groups have been left deliberately to allow for future expansion. "na" means that a particular set or group is not yet assigned

CHART INFORMATION - DISPLAY BASE

RESERVED	
10000-10999	Reserved for chart information
A, B	CHART FURNITURE
11000	Information about the Chart Display
11010 11020	cursor [symbol SY(CURSRA01)] na (not assigned)
11030	scalebar, latitude scale [SY(SCALEB10),SY(SCALEB11)]
11040	north arrow [SY(NORTHAR1)]
11050	no data [colour NODTA, AP(NODATA03)], unsurveyed (UNSARE), incompletely surveyed area
11060	Non-HO data boundary LC(NONHODAT)
C, D, E, F	TOPOGRAPHY AND INFRASTRUCTURE
12000	Land area
12010	land area (LANDARE)
12200	Dangers above water
12210	bridge (BRIDGE), pylon (PYLONS), overhead cable (CBLOHD), conveyor (CONVYR), overhead pipeline (PIPOHD), offshore platform (OFSPLF)
12400	Shoreline
12410	coastline (COALNE), ice shelf, glacier (ICEARE), shoreline construction (SLCONS), tie-up wall, dolphin (MORFAC), gate (GATCON, pile (PILPNT), crib, wellhead, ice boom (OBSTRN), floating dock (FLODOC), hulk (HULKES), pontoon (PONTON), oilboom (OILBAR), log boom (LOGPON), flood barrage (DAMCON, CATDAM3)
12420	dock (DOCARE), lock (LOKBSN), canal (CANALS), river (RIVERS)
H, I	HYDROGRAPHY
13000	Safety Contour
13010	safety contour (from conditional symbology procedure DEPCNT03)
13020	na
13030	depth area (DEPARE), dredged area (DRGARE),
J, K, L	SUBSEA FEATURES
14000	Dangers under water
14010	isolated underwater dangers in water deeper than the displayed safety contour (rocks, wrecks, obstructions, mooring cables from conditional symbology procedure)
M	TRACKS AND ROUTES
15000-15999	na (not assigned)
N	SPECIAL AREAS
16000-16999	na (not assigned)
P, Q, R, S	AIDS TO NAVIGATION
17000-17999	na (not assigned)
T, U	SERVICES
18000-18999	na (not assigned)
RESERVED	
19000-19999	Reserved for chart information

The groupings are given to illustrate the contents of the Display Base. All objects of this category shall be permanently retained on the ECDIS display.

CHART INFORMATION - STANDARD DISPLAY

RESERVED	
20000	Reserved for chart information
A, B	INFORMATION ABOUT THE CHART DISPLAY
21000	Information about the Chart Display
21010	Unknown object (magenta question mark)
21020	Generic Object (NEWOBJ01)
21030	Chart scale boundary, overscale data [AP(OVERSCO1)]
21040	na
21050	na
21060	Place-holder for geographic names (LNDRGN, SEAARE)
C, D, E, F	NATURAL & MAN-MADE FEATURES, PORT FEATURES
22000	Major Coastal Features
22010	Lake (LAKARE), sloping ground (SLOGRD), slope top (SLOTOP), dyke (DYKCON), causeway (CAUSWY), dam (DAMCON),
22200	Conspicuous landmarks:
22210	Radar conspicuous object - (any object with attribute CONRAD 1)
22220	Visually conspicuous object (any object with attribute CONVIS 1)
22230	na
22240	Built up area (BUAARE)
H, I	DEPTHS, CURRENTS, etc.
23000	Depths
23010	Area of depth less than the safety contour (DIAMON01 pattern)
23020	na
23030	Swept area (SWPARE)
J, K, L	SEABED, OBSTRUCTIONS, PIPELINES
24000	Seabed dangers
24010	Mooring cables (MORFAC, CATMOR6), (CBLSUB, CATCBL6), tunnel on Seabed (TUNNEL, BURDEP=0), sandwaves (SNDWAV)
M	TRAFFIC ROUTES
25000	Routes and Tracks
25010	Leading line, clearing line (NAVLNE), traffic lane (TSSLPT), deep water route (DWRTPT), traffic separation area (TSEZNE), traffic separation line (TSELNE), traffic roundabout (TSSRON), traffic crossing (TSSCRS), precautionary area (PRCARE), traffic separation scheme boundary (TSSBND), deep water route centre line (DWRTCL), two way route part (TWRTPT), inshore traffic zone (ISTZNE).
25020	Recommended track (RECTRC), recommended traffic lane (RCTLPT), recommended route centreline (RCRTCL)
25030	Ferry route (FERYRT)
25040	Radar line (RADLNE), limit of shore radar (RADRNG)
25060	Radio calling in point (RDOCAL)

N	SPECIAL AREAS
26000	Restricted and Cautionary Areas
26010	Restricted area (RESARE)
26020	na
26030	na
26040	Submarine transit lane (SUBTLN), military practice area (MIPARE), sea plane landing area (SPLARE), offshore production area (OSPARE)
26050	Fairway (FAIRWY)
26150	Caution area (CTNARE)
26200	Information Areas. Protected Areas
26210	Fishing ground (FSHGRD), marine farm (MARCUL), Fishing Facility (FSHFAC)
26220	Anchorage area (ACHARE), anchor berth (ACHBRT),
26230	na
26240	Dumping ground (DMPGRD),
26250	Cargo transhipment (CTSARE), incineration (ICNARE)
26260	Archipelagic sea lane (ASLXIS, ARCSLN)
P, Q, R, S	BUOYS & BEACONS, LIGHTS, FOG SIGNALS, RADAR
27000	Buoys, Beacons, Topmarks, Lights, Fog Signals
27010	Buoy (BOYxxx), light float (LITFLT), mooring buoy (MORFAC, CATMOR7)
27011	Light vessel (LITVES)
27020	Beacon (BCNxxx)
27025	Daymark (DAYMAR)
27030	Distance mark (DISMAR)
27040	Direction of buoyage IALA buoyage regions (M_NSYS)
27050	topmarks (TOPMAR) - for paper chart symbols
27060	gridiron (GRIDRN)
27070	light (LIGHTS)
27080	fog signal (FOGSIG), retro-reflector (RETRFL)
27200	Radar
27210	racon (RTPBCN)
27220	na
27230	radar reflector (RADRFL)
T, U	SERVICES & SMALL CRAFT FACILITIES
28000	Services
28010	pilot boarding point (PILBOP)
28020	signal station, traffic (SISTAT), sig. stn. warning (SISTAW)
RESERVED	
29000	reserved for chart information

OTHER CHART INFORMATION

RESERVED	
30000	reserved for chart information
A, B	INFORMATION ABOUT THE CHART DISPLAY
31000	Information about the Chart Display
31010	accuracy of data (M_ACCY), survey reliability (M_SREL), quality of data

	(M_QUAL)
31011	symbol LOWACC01, identifying low accuracy data, applied to the spatial object of point and area wrecks, rocks and obstructions and to point land areas
31020	nautical publication (M_NPUB)
31030	Additional Information INFORM,NINFOM
31031	Additional Documents NTXTDS, TXTDSC, PICREP
31040	data scale and coverage (M_CSCL, M_COVR)
31050	na
31060	na
31070	na
31080	magnetic variation (MAGVAR), local magnetic anomaly (LOCMAG)
C, D, E, F NATURAL & MAN-MADE FEATURES, PORT FEATURES	
32000	Natural Features
32010	dunes , hills (SLOGRD), ridge, clifftop (SLOTOP), contours and elevation (LNDELV)
32020	na
32030	trees , vegetation, mangrove (VEGATN), marsh (LNDRGN)
32040	na
32050	river (RIVERS) or lake (LAKARE); also rapids (RAPIDS), waterfall (WATFAL)
32060	Na
32070	tideway (TIDWAY)
32080	na
32200	Shore Structures
32210	na
32220	any of the following not classified as CONVIS1 (conspicuous): landmark (LNDMRK), building (BUISGL), tank, silo, water tower (SILTNK), wall (FNCLNE), fort (FORSTC)
32230	na
32240	airport (AIRARE), runway (RUNWAY)
32250	railway (RAILWY), road (ROADWY), tunnel (TUNNEL), control point (CTRPNT)
32260	na
32270	quarry, refinery, power station, tank farm, wind farm, factory, timber yard (PRDARE)
32280	na
32400	Port Features
32410	harbour type (HRBFAC), customs check point (CHKPNT) [note: "small craft facilities" (SMCFAC) is in group 38210]
32420	na
32430	na
32440	berth number (BERTHS), mooring facility (such as bollard) (MORFAC), , gate (such as lock gate) (GATCON) , dry dock (DRYDOC), crane (CRANES)
32450	na
32460	na
H, I DEPTHS, CURRENTS ETC	
33000	Depths, Currents, Tide rips, etc
33010	Soundings (SOUNDG)

33020	depth contours (DEPCNT) other than the safety contour
33021	label for the safety contour
33022	label for contours other than the safety contour
33030	na
33040	water turbulence (WATTUR)
33050	tidal information (T_HMON, T_NHMN, T_TIMS)
33060	current and tidal stream information (CURENT, TS_FEB, TS_PAD, TS_PNH, TS_PRH, TS_TIS)
J, K, L	SEABED, OBSTRUCTIONS, PIPELINES
34000	Seabed Information: rocks, wrecks & obstructions, pipes & cables
34010	nature of seabed (SBDARE)
34020	spring (SPRING), sea weed (WEDKLP)
34030	Pipeline area (PIPARE), cable area (CBLARE)
34040	na
34050	rocks (UWTROC), wrecks (WRECKS), obstructions (OBSTRN), which are not a danger to own-ship's navigation (these are all Display Base if a danger to own-ship)
34051	non-dangerous rocks (UWTROC), wrecks (WRECKS) and obstructions (OBSTRN) which have a VALSOU attribute and are not a danger to own-ship's navigation (these objects are all Display Base if a danger to own-ship)
34060	na
34070	submarine cable (CBLSUB), submarine pipeline (PIPSOL)
M	TRAFFIC ROUTES
35000	Routes
35010	na
N	SPECIAL AREAS
36000	Administrative Areas, (by cursor enquiry)
36010	continental shelf (COSARE),
36020	harbour area (HRBARE) free port area (FRPARE), customs zone (CUSZNE)
36030	na
36040	fishery zone (FSHZNE)
36050	contiguous zone (CONZNE), exclusive economic zone (EXEZNE), national territorial area (NATARE), territorial sea (TESARE), territorial sea baseline (STSLNE), administration area (ADMARE)
P, Q, R, S	BUOYS & BEACONS, LIGHTS, FOG SIGNALS, RADAR
37000-37999	na
T, U	SERVICES & SMALL CRAFT FACILITIES
38000	Services
38010	radar station (RADSTA), radio station (RDOSTA)
38020	na
38030	coastguard station (CGUSTA), rescue station (RSCSTA)
38200	Small craft facilities
38210	small craft facilities (SMCFAC)
RESERVED	
39000	reserved for chart information

MARINERS' INFORMATION - DISPLAY BASE

RESERVED	
40000	Reserved for Mariners’ information
TOOLS	
41000-41999	na
OWN-SHIP, PLANNED ROUTES, PAST TRACKS	
42000	Own ship
42010	Own ship (ownship), symbol or scaled version, together with heading line, beam bearing line and course and speed vector
42200	Selected Planned Route
42210	legline (leglin, select 1), way points (waypnt, select 1)
42220	Course to make good for selected leglines
MARINERS' FEATURES	
43000	na
OTHER VESSELS	
44000	na
MANUFACTURERS' FEATURES	
45000-45999	Manufacturers’ Features
MARINERS' ASSIGNMENTS TO DISPLAY BASE	
46000-46999	Mariners' and manufacturers' objects assigned to Display Base by the Mariner
RESERVED	
47000-49999	reserved for Mariners’ information

MARINERS' INFORMATION - STANDARD DISPLAY

RESERVED	
50000	reserved for Mariners’ information
TOOLS	
51000-51999	na
OWN-SHIP, PLANNED ROUTES, PAST TRACKS	
52000	Notations on Selected Planned Route
52010	wheel-over line (wholin), selected route
52020	course to make good on leglines (leglin, select 1) of selected route
52030	planned position (pinpos), distance to go, and other notations on selected planned route
52200	Alternate Planned Route
52210	leglin (leglin, select 2), waypoint (waypnt, select 2) of alternate planned route
52220	na
52230	wheel-over line (wholin), alternate route
52240	other notations, alternate route
52400	Past Track
52410	event (events)
52420	na
52430	primary past track (pastrk, catpst 1)
52440	notations on primary past track
52450	na
52460	secondary past track (pastrk catpst 2)

MARINERS' FEATURES	
53000	Mariners' features
53010	danger highlight (dnghlt)
53030	Mariners' information note (marnot catnot 1)
53040	Mariners' cautionary note (marnot catnot 2)
53050	Mariners' feature (marfea)
53060	na
53070	na
53080	tidal current observed (tidcur, catcur 2), tidal current predicted (tidcur, catcur 1)
OTHER VESSELS	
54000	Other Ships
54010	other ships (vessels) from radar
54020	notations on other ships (acqsta)
54030	other ships from other sources or undefined sources

MANUFACTURERS' FEATURES	
55000	Manufacturers’ Features
55010	manufacturers' feature (mnufea, catnot 1)
55020	manufacturers' feature (mnufea, catnot 2)
MARINERS' ASSIGNMENTS TO STANDARD DISPLAY	
56000-66999	Mariners' and manufacturers' Objects Assigned to Standard Display by the Mariner
RESERVED	
57000-59999	reserved for Mariners’ information

OTHER MARINERS' INFORMATION

RESERVED	
60000	reserved for Mariners’ information
TOOLS	
61000	Tools
61010	electronic bearing line (ebline), variable range marker (vrmark)
61020	na
61030	range rings (rngrng)
61040	cursor, style B (cursor, cursty2)
61050	cursor reference point (refpnt)
OWN-SHIP, PLANNED ROUTES, PAST TRACKS	
62000	Position fixes
62010	position fix (positn)
62020	position line (poslin)
MARINERS' FEATURES	
63000-63999	na
OTHER VESSELS	
64000-64999	na
MANUFACTURERS' FEATURES	
65000-65999	Manufacturers’ Features
MARINERS' ASSIGNMENTS TO OTHER INFORMATION	
66000-66999	Mariners' and manufacturers' objects assigned to other information by the Mariner

RESERVED	
67000-69999	reserved for Mariners' information

14.3 ECDIS Viewing Group Implementation

For standardization of the ECDIS Human Machine Interface (HMI) and to facilitate generic training of Mariners as a minimum the following viewing group layers shall be implemented to control display of charted objects. An ECDIS may provide more display on/off controls than are available in this table, but OEM shall use the viewing group layer names contained in this table. The viewing group names are derived from the IMO PS.

Viewing Group Layer	**Name of viewing group layer in the ECDIS**	**Viewing groups included**
1	Display Base	10000 - 19999
Standard Display:		
2	Drying line	22010
3	Buoys, beacons, aids to navigation	21020, 22200 – 22240, 27000, 27010, 27011, 27020, 27025, 27040, 27050, 27070, 27080, 27200, 27210, 27230, 27030, 27060
3.1	Buoys, beacons, structures	21010, 21020, 22200 - 22240, 27000-27050, 27080, 27200 – 27230, 27030, 27060
3.2	Lights	27070
4	Boundaries and limits	23030, 26050, 26220, 26240, 26250
5	Prohibited and restricted areas	26000, 26010, 26040
6	Chart scale boundaries	21030
7	Cautionary notes	26150
8	Ships' routeing systems and ferry routes	25010-25060
9	Archipelagic sea lanes	26260
10	Miscellaneous	Switches on and off all not covered objects by viewing group layers 20000-29999
Other		
11	Spot soundings	33010
12	Submarine cables and pipelines	34030, 34070
13	All isolated dangers	34050, 34051
14	Magnetic variation	31080
15	Depth contours	33020
16	Seabed	34010, 34020, 33040
17	Tidal	33050, 33060
18	Miscellaneous	Switches on and off all not covered objects by viewing group layers 30000-39999 or not covered cases by independent mariner selections (see 10.3.4.4)

14.4 Text Groupings

Value of Text Group	Text Group Description	S-57 Object and Attribute Acronyms
00-10	reserved for future assignment by IHO.	
IMPORTANT Text		
10		
11	Vertical Clearance of Bridges	BRIDGE, VERCLR, VERCCL VERCOP, VERCSA
	Vertical Clearance of Overhead Cable	CBLOHD, VERCLR
	Vertical Clearance of Overhead Pipeline	PIPOHD, VERCLR
	Vertical Clearance of Conveyor	CONVYR, VERCLR
	Bearing of Navline	NAVLNE, ORIENT
	Recommended Route	RCRTCL
	Deep Water Route Centreline Line	DWRTCL
	Recommended Track	RECTRC
	Name and Communications Channel of Radio Calling-In Point	RDOCAL, OBJNAM, COMCHA
Other Text		
20		
21	Name or Number of Buoys	BOYxxx, OBJNAM
	Name or Number of Beacons	BCNxxx, OBJNAM
	Name or Number Daymarks	DAYMAR, OBJNAM
	Name or Number Light Vessel	LITVES, OBJNAM
	Name or Number Light Float	LITFLT, OBJNAM
	Name or Number Offshore Platform	OFSPLF, OBJNAM
22	Na (Not Allocated)	
23	Light Description String	
24	Note on chart data (INFORM) or nautical publication (TXTDSC)	See 10.3.4.4
25	Nature of Seabed	SBDARE, NATSUR
26	Geographic Names	ACHARE, OBJNAM
		BRIDGE, OBJNAM
		BUAARE, OBJNAM
		BUISGL, OBJNAM
		DOCARE, OBJNAM
		FAIRWY, OBJNAM
		LNDARE, OBJNAM
		LNDMRK, OBJNAM
		LNDRGN, OBJNAM
		SEAARE, OBJNAM
		TIDEWY, OBJNAM
		PILBOR, OBJNAM
27	Value of Magnetic Variation	MAGVAR, VALMAG
	Value of Swept Depth	SWPARE, DRVAL1
28	Height of Islet Or Land Feature	LNDARE,HEIGHT
29	Berth Number	BERTHS, OBJNAM
		ACHBRT, OBJNAM
30	Na	
*31	National Language Text	NOBJNM
32-49	Reserved For IHO	
50-69	Mariners' Text, Including Planned Speed Etc.	

70-79	Manufacturer's Text	
80-99	Future Requirements	

14.5 ECDIS Text Group Implementation

To enable the Mariner to make selections regarding the text visible in the chart display the ECDIS shall use the individual text groups collected under text group layer.

For standardization of the ECDIS Human Machine Interface (HMI) and to facilitate generic training of Mariners as a minimum the following text group layers shall be implemented to control the display of text. An ECDIS may provide more textual on/off controls than are available in this table, but OEMs shall use the names of text group layer contained in this table.

An example of more detailed selections;

The table has text group layer "Other text". An OEM may wish to subdivide this category into "names", "light description" and "other".

Text Group Layer	Name of Text group layer in the ECDIS	Text groups included
1	Important text	11
2	Other text	20-49, 0-10
2.1	Names	21, 26, 29
2.2	Light description	23
2.3	All other	0-10, 25, 27, 28, 32-49

NOTE: *National text is a supplementary option for ECDIS. If used, the style shall be similar to that of the Presentation Library.

14.6 Abbreviations

The abbreviations listed below (including those referenced in section 10.6.3) are to be used on the ECDIS display. The meanings of the abbreviations shall be available to the Mariner through the pick report.

14.6.1 'TE' text command abbreviations

The following abbreviations are used with the "TE" command word:

Préfixes	Suffixes	'C' Format Command
bn = beacon (INT1) by = buoy clr = overhead clearance clr cl = clearance closed clr op = clearance open sf clr = safe clearance No = number (INT1) Plt = pilot Prod = offshore production (INT1) LtV = light vessel Varn = magnetic variation ch = communication channel	kn = knots (INT1) deg = degrees	% = instruction follows, %s = text string, %d = integer number, %n.mlf = floating point number with n characters (including the deci-mal), m of which come after the deci-mal point.

NMT = not more than “CLEARING BEARING” NLT = not less than “CLEARING BEARING”		

14.6.3 Nature of seabed abbreviations ('TX')

The following abbreviations for values of NATSUR - nature of seabed:

Attribute ID	Description	ECDIS Abbreviation
1	mud	M
2	clay	Cy
3	silt	Si
4	sand	S
5	stones	St
6	gravel	G
7	pebbles	P
8	cobbles	Cb
9	rock	R
11	lava	R
14	coral	Co
17	shells	Sh
18	boulder	R

To reduce undue clutter in the ECDIS chart display, it is recommended that ECDIS manufacturers use the abbreviations of the NATSUR attribute.

14.6.4 Light Description abbreviations

See section 10.6.3 for details.

14.6.5

15 Symbol Library for use on ECDIS

~~~ < SNIP > ~~~

16 ECDIS Chart 1, Symbol Plots & Colour Test Diagrams

16.1 Introduction

This section of the Presentation Library contains the following:

16.2 ECDIS Chart 1
16.3 Colour Differentiation Test Diagram
16.4 Plots of Symbols Arranged Alphabetically

The ECDIS Chart 1 and its indexing list of symbol names and meanings arranged numerically, together with the colour differentiation test diagrams, are intended for the Mariner's use. The use of the Colour Differentiation Test Diagrams is described in section 18

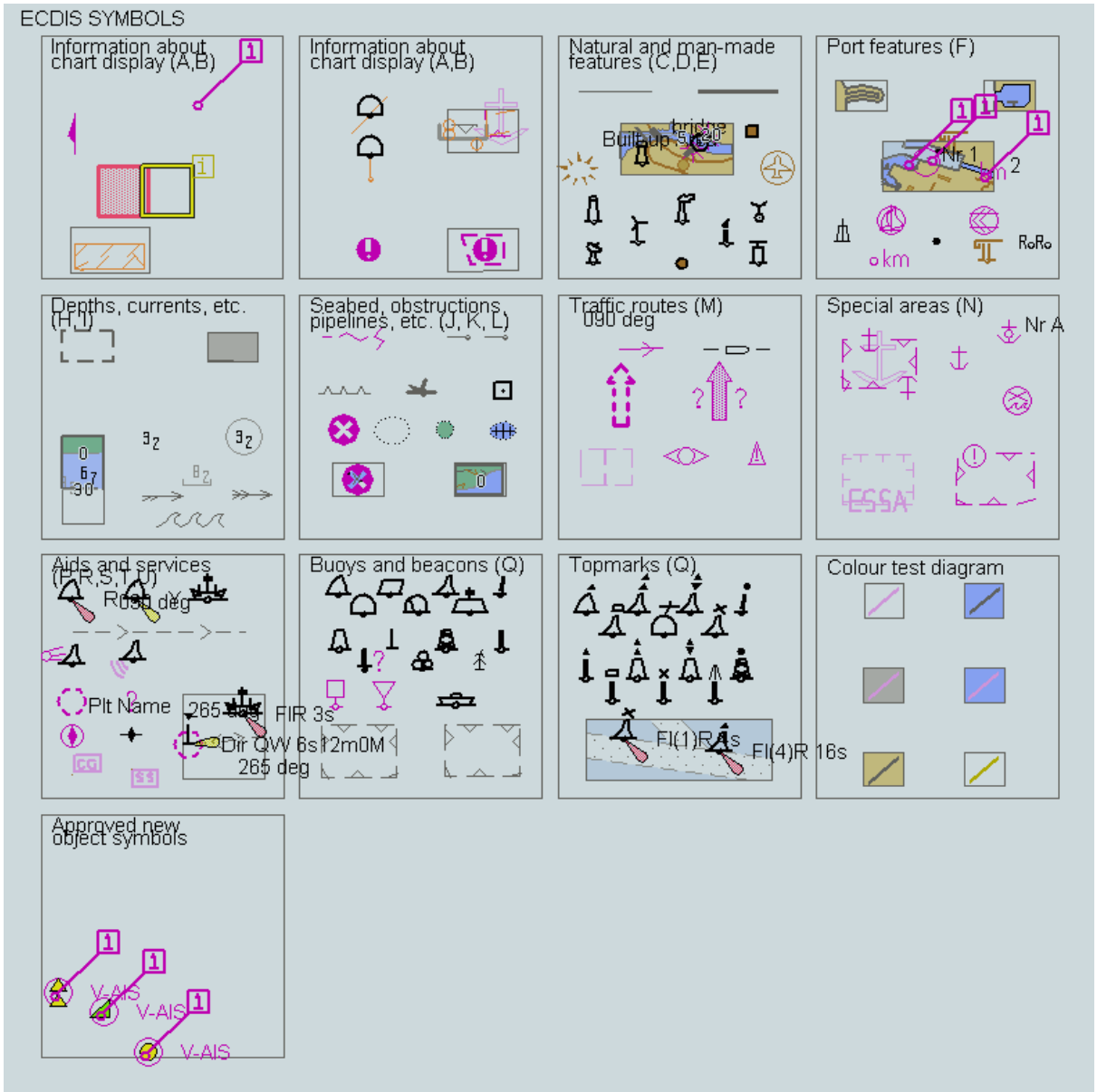
The plot of symbols arranged alphabetically and its indexing list of symbol names and meanings arranged alphabetically are intended for the manufacturer's use.

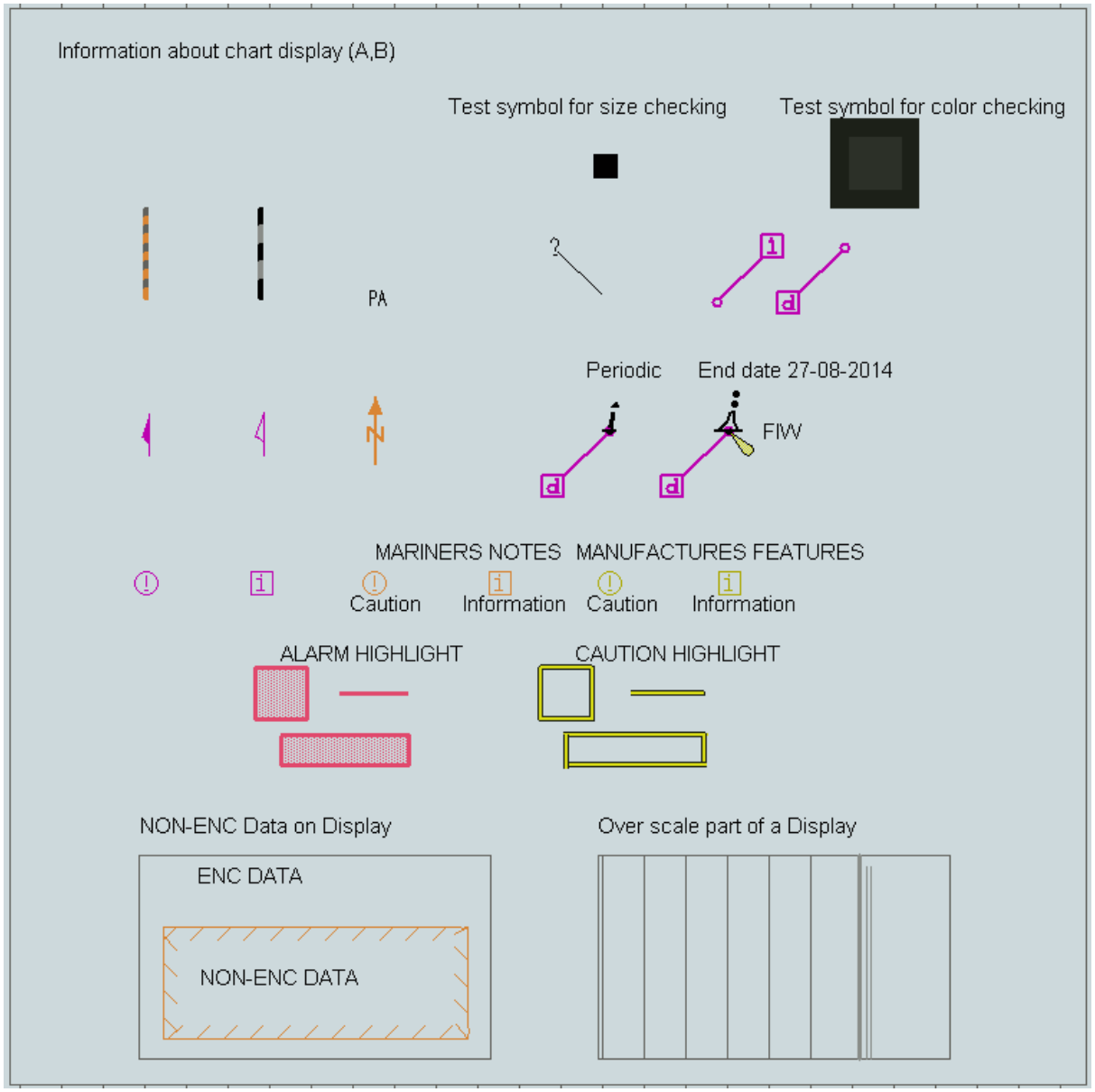
Note that because colour printing and copying is not completely true to the original, this hard-copy version does not accurately represent the colour requirements of the IHO Colour and symbol Specifications.

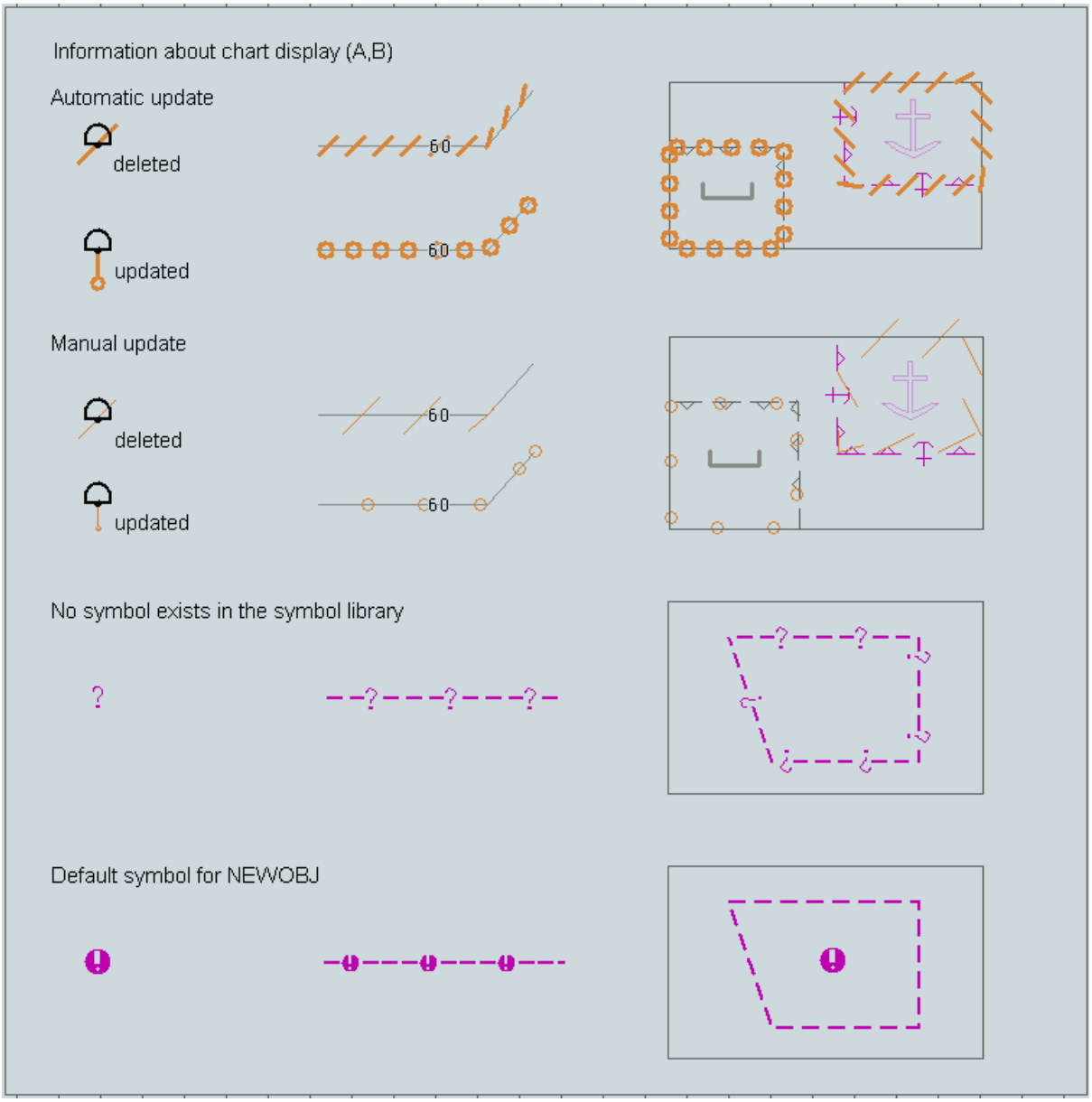
In addition, symbol size may change in copying. To ensure correct size, all symbols illustrated shall be scaled by the factor required to make symbol CHKSYM01 measure 5mm by 5mm.

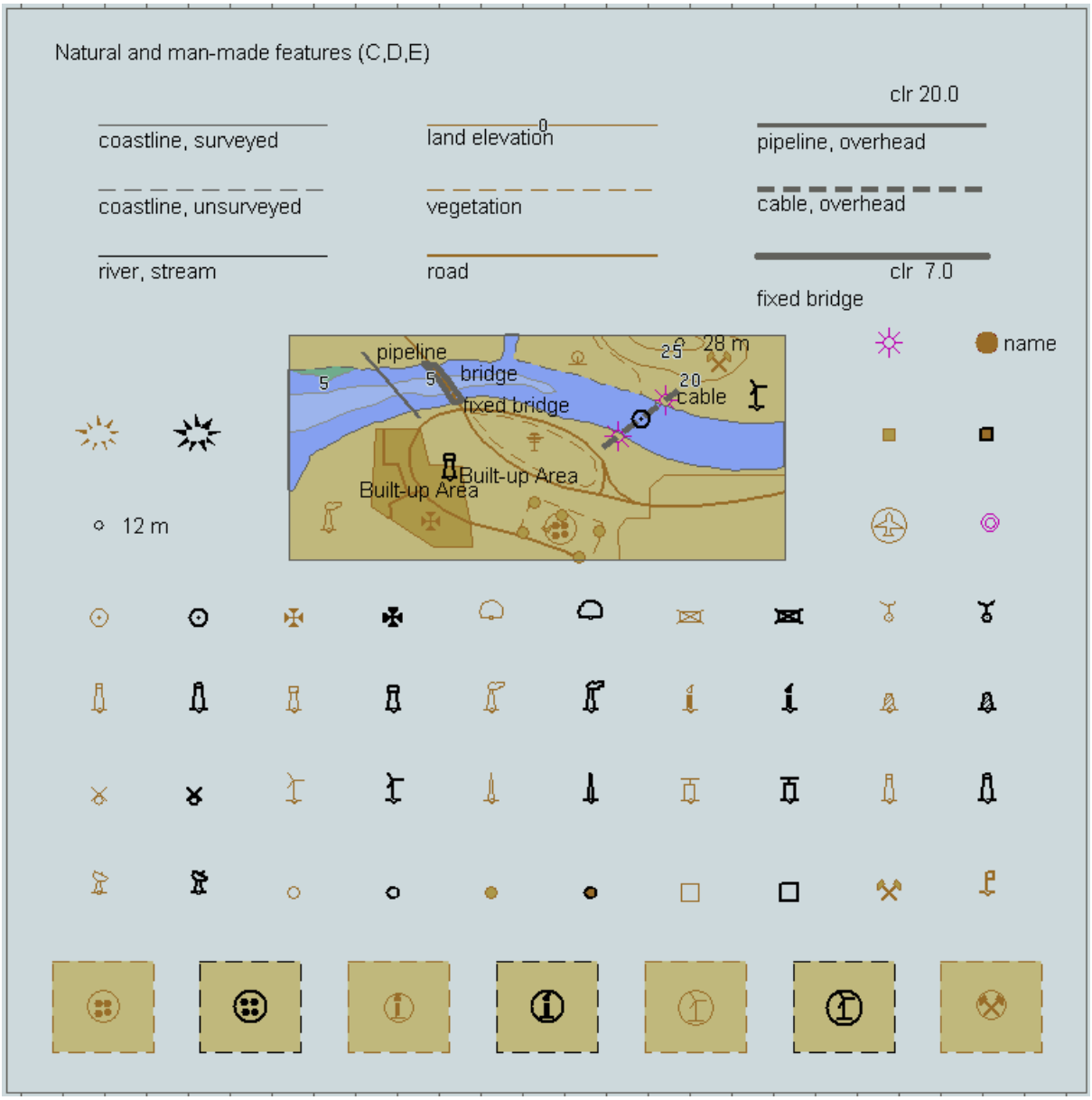
16.2 ECDIS Chart 1

ECDIS Chart 1 symbols




Information about chart display (A,B)
Test symbol for size checking
Test symbol for color checking
PA
Periodic
End date 27-08-2014
FIW
MARINERS NOTES
MANUFACTURES FEATURES
Caution
Information
Caution
Information
ALARM HIGHLIGHT
CAUTION HIGHLIGHT
NON-ENC Data on Display
ENC DATA
NON-ENC DATA
Over scale part of a Display


Information about chart display (A,B)
Automatic update
deleted
updated
60
60
Manual update
deleted
updated
60
60
No symbol exists in the symbol library
?
Default symbol for NEWOBJ

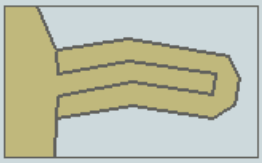

Natural and man-made features (C,D,E)
clr 20.0
coastline, surveyed
land elevation
0
pipeline, overhead
coastline, unsurveyed
vegetation
cable, overhead
river, stream
road
clr 7.0
fixed bridge
pipeline
bridge
fixed bridge
cable
28 m
25
20
5
5
Built-up Area
Built-up Area
name
12 m

Port Features (F)

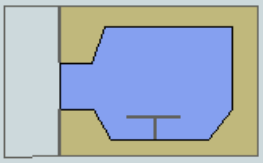
shorline construction

lock gate

dam

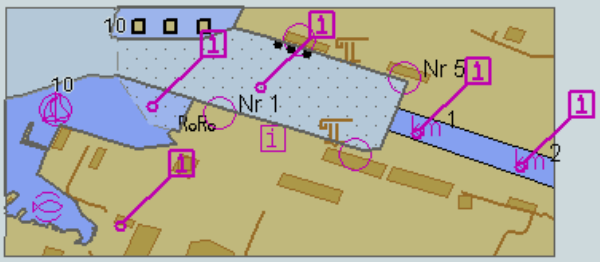


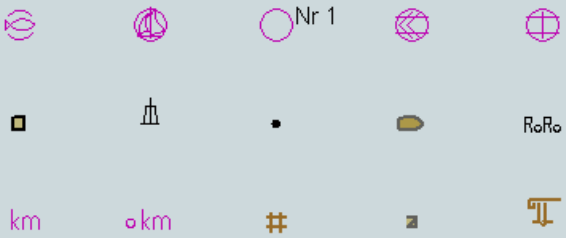
breakwater

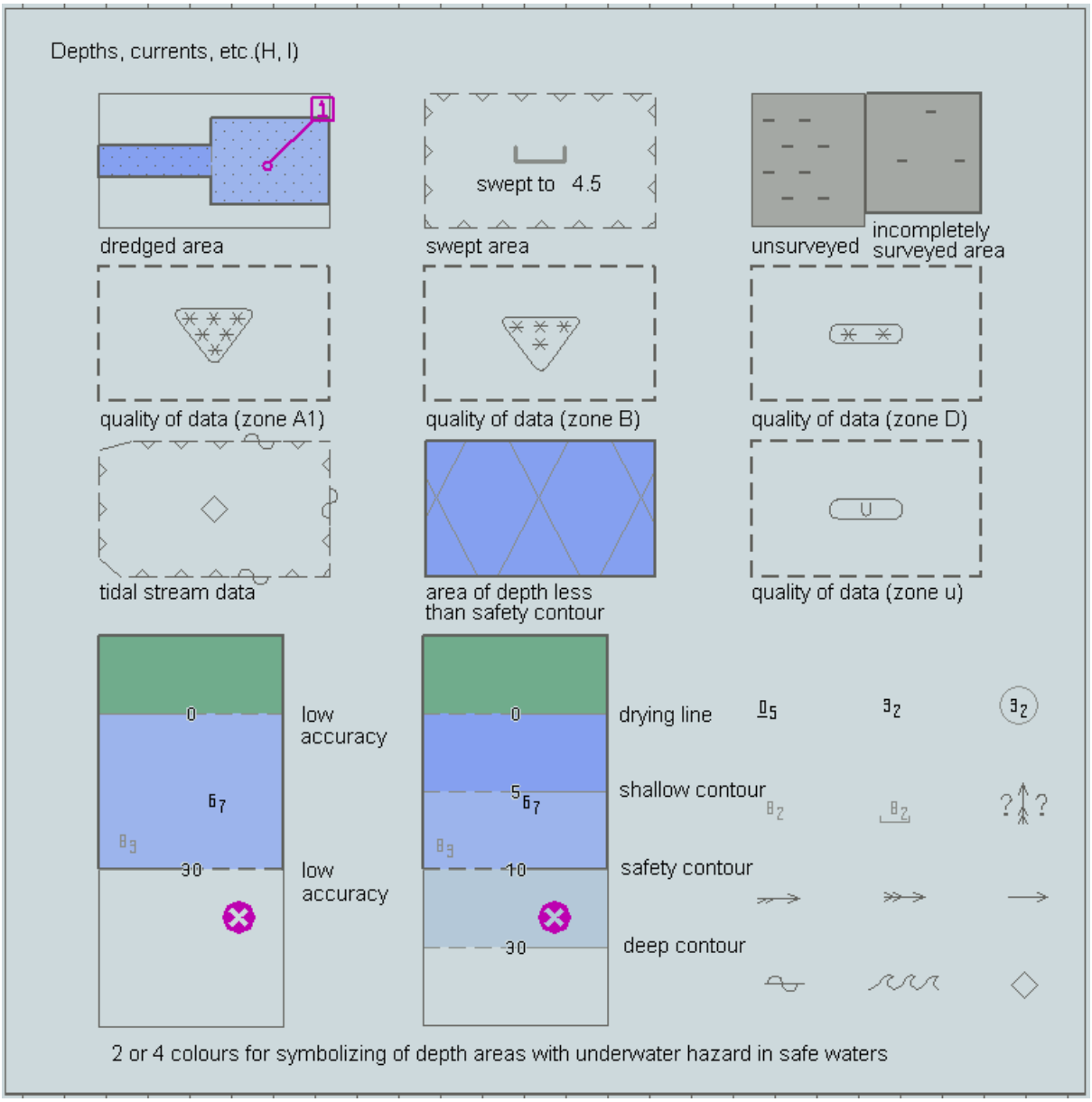


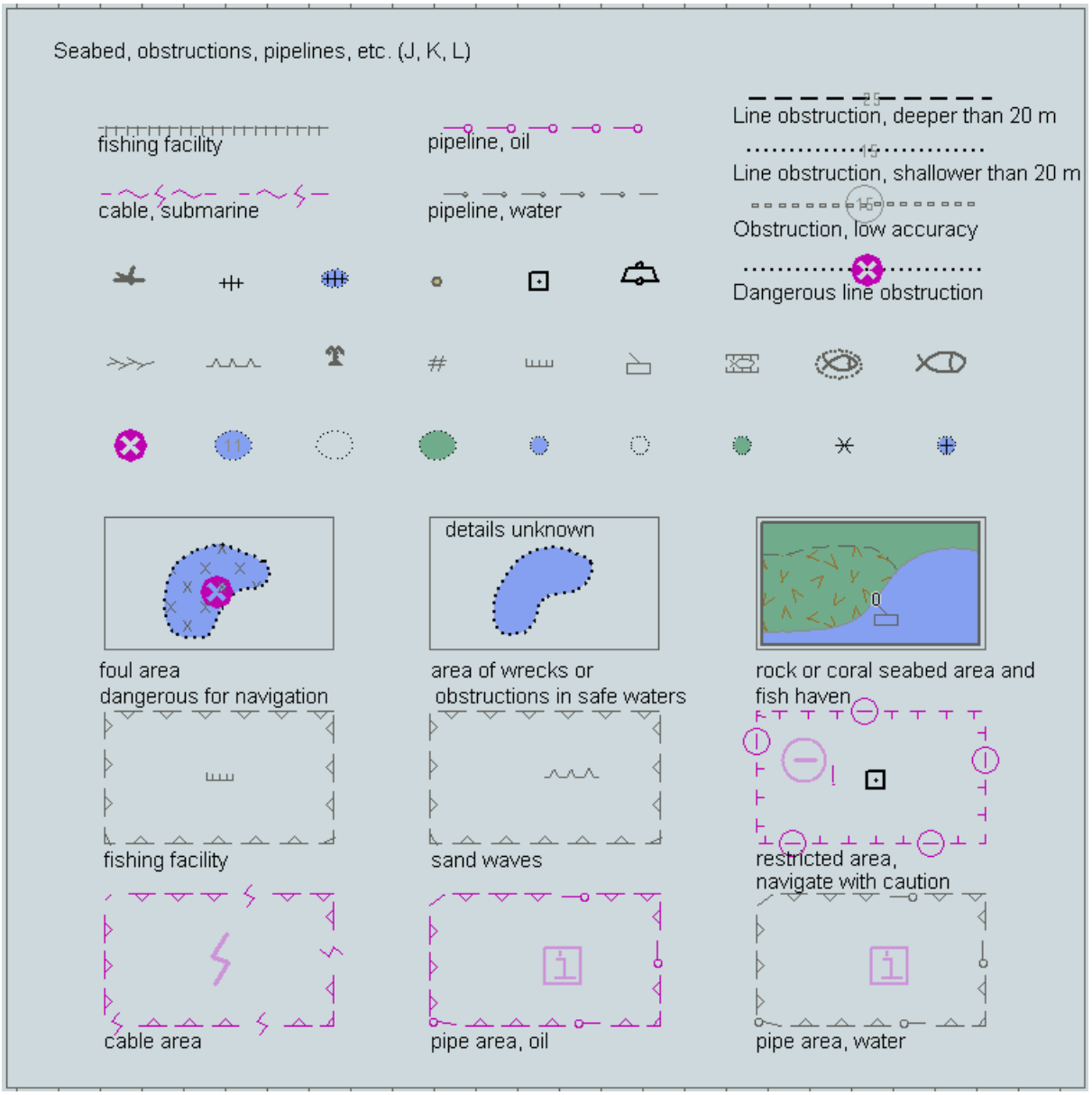
tidal basin

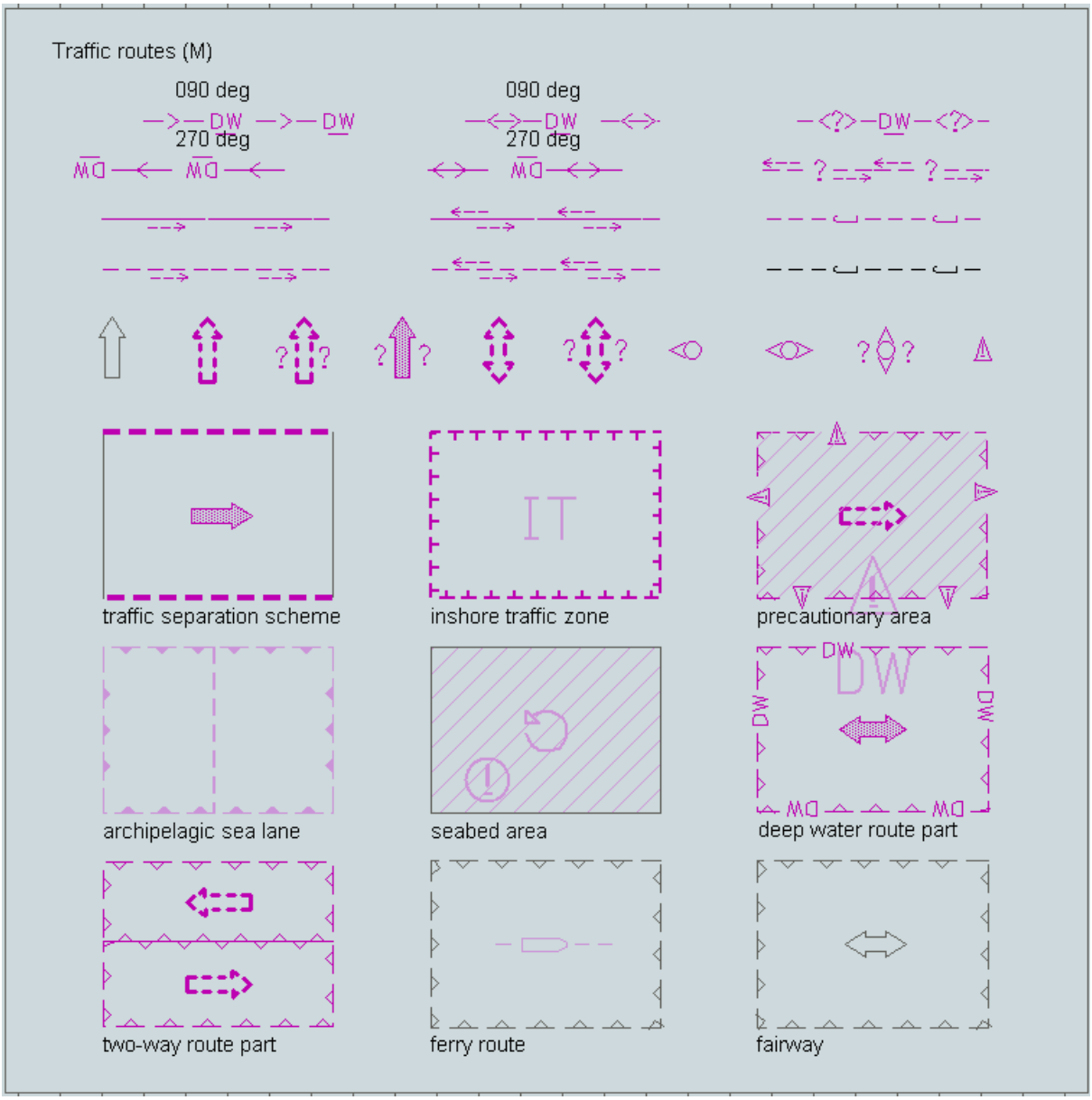
timber yard

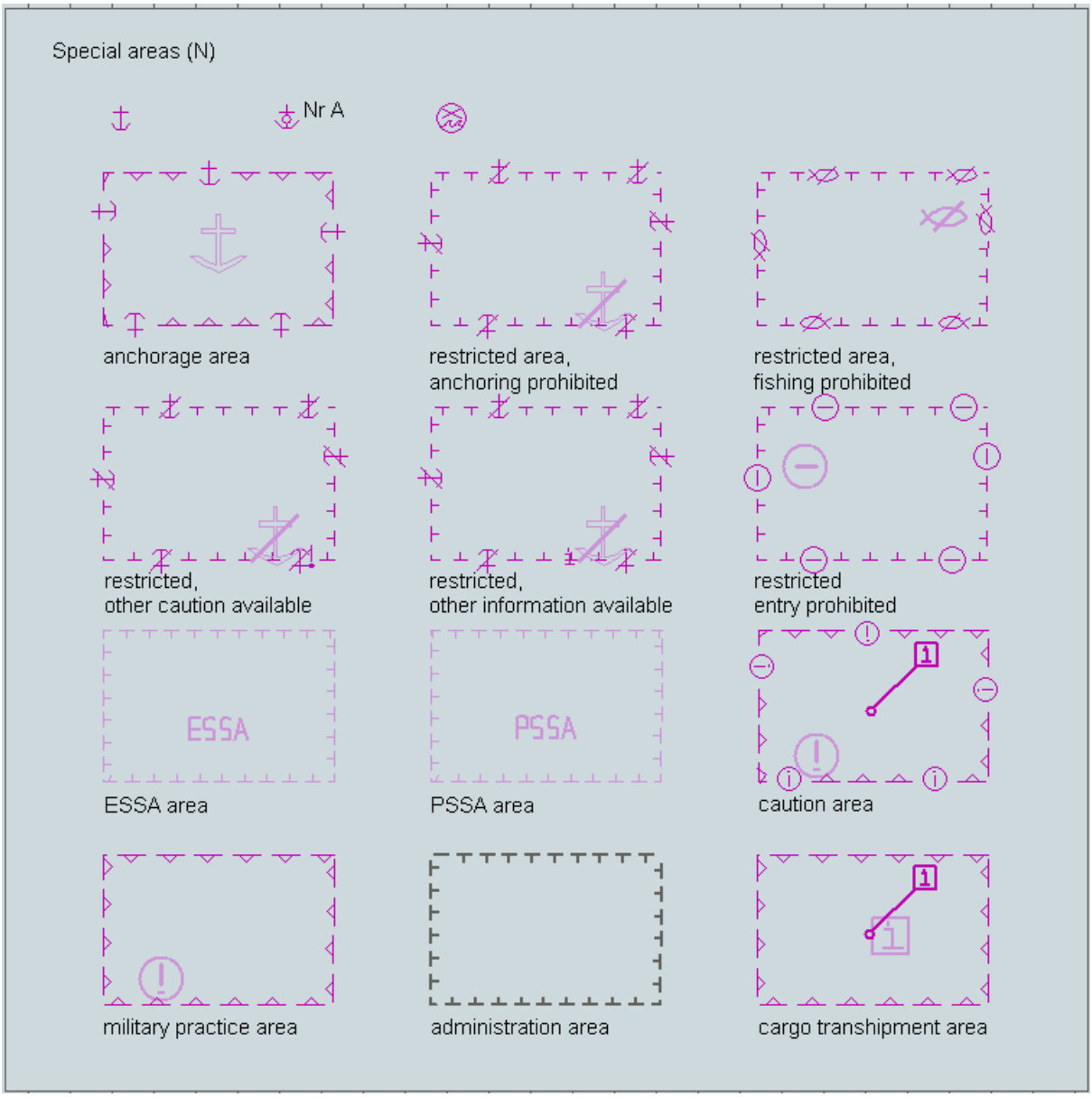


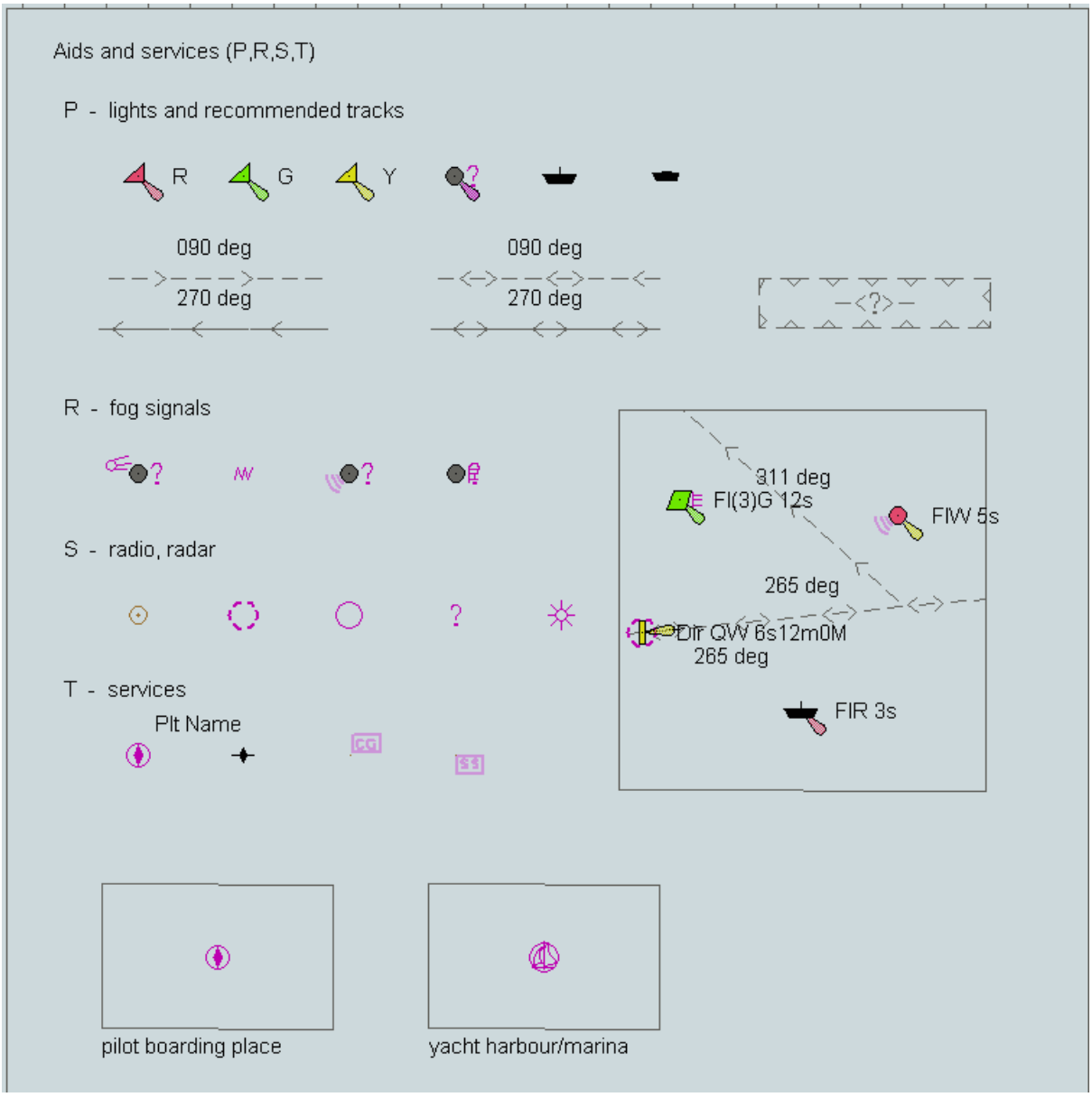



Depths, currents, etc.(H, I)
dredged area
swept to 4.5
swept area
unsurveyed
incompletely surveyed area
quality of data (zone A1)
quality of data (zone B)
quality of data (zone D)
tidal stream data
area of depth less than safety contour
U
quality of data (zone u)
0
low accuracy
30
low accuracy
0
5
10
30
drying line
shallow contour
safety contour
deep contour
2 or 4 colours for symbolizing of depth areas with underwater hazard in safe waters


Seabed, obstructions, pipelines, etc. (J, K, L)
fishing facility
pipeline, oil
Line obstruction, deeper than 20 m
Line obstruction, shallower than 20 m
cable, submarine
pipeline, water
Obstruction, low accuracy
Dangerous line obstruction
details unknown
foul area
dangerous for navigation
area of wrecks or
obstructions in safe waters
rock or coral seabed area and
fish haven
fishing facility
sand waves
restricted area,
navigate with caution
cable area
pipe area, oil
pipe area, water

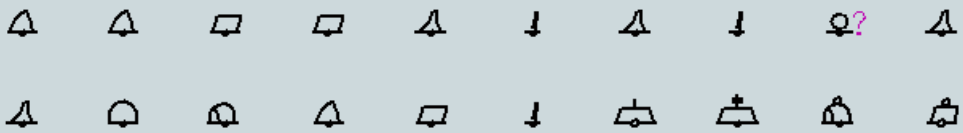

Traffic routes (M)
090 deg
270 deg
DW
traffic separation scheme
IT
inshore traffic zone
precautionary area
archipelagic sea lane
seabed area
deep water route part
two-way route part
ferry route
fairway


Special areas (N)
Nr A
anchorage area
restricted area,
anchoring prohibited
restricted area,
fishing prohibited
restricted,
other caution available
restricted,
other information available
restricted
entry prohibited
ESSA
ESSA area
PSSA
PSSA area
caution area
military practice area
administration area
cargo transhipment area


Aids and services (P,R,S,T)
P - lights and recommended tracks
R
G
Y
090 deg
270 deg
090 deg
270 deg
R - fog signals
S - radio, radar
T - services
Plt Name
311 deg
Fl(3)G 12s
FlW 5s
265 deg
Dir QW 6s12m0M
265 deg
FlR 3s
pilot boarding place
yacht harbour/marina

Buoys and beacons (Q)

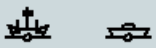
Buoys



Beacons

Daymarks

Light float and light vessel

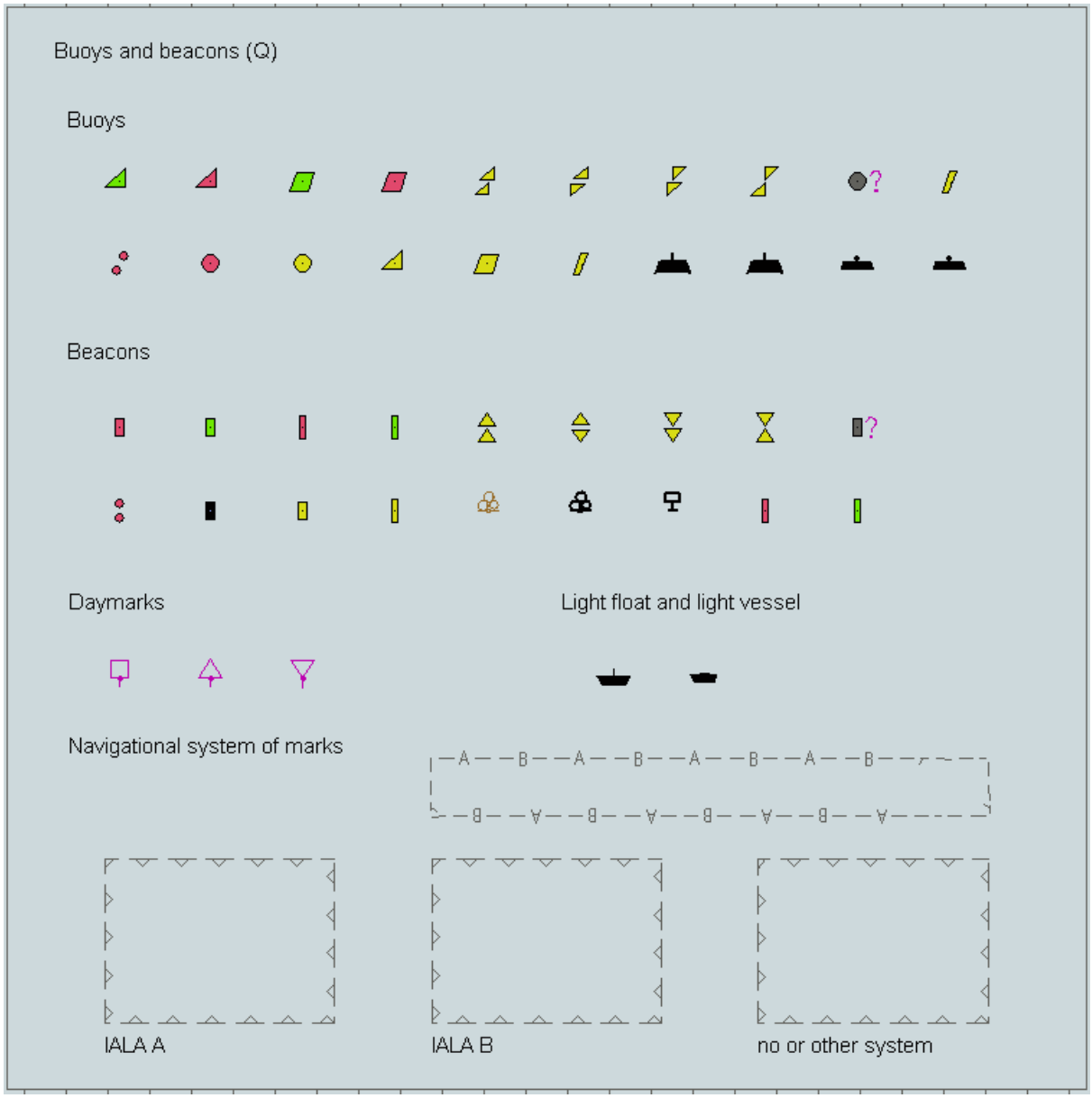


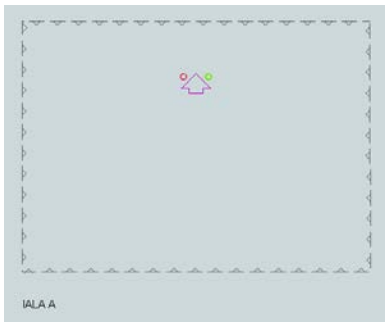
Navigational system of marks

IALA A

IALA B

no or other system





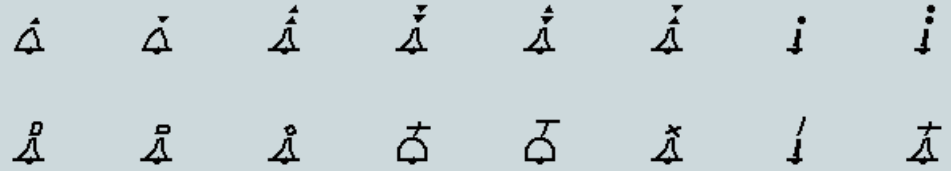
IALA A at 1:5000

IALA B at 1:5000

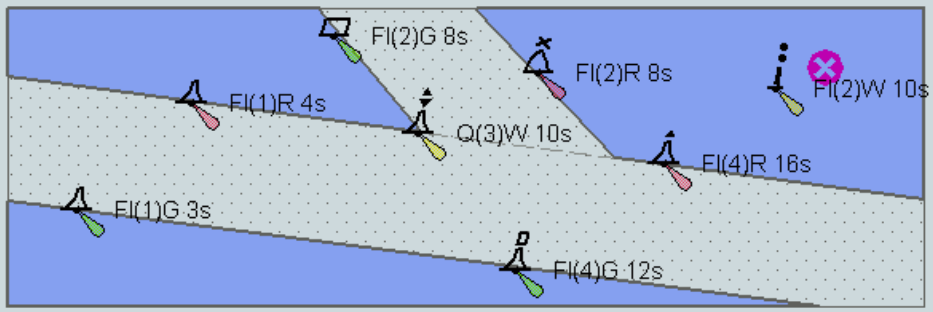
No or other system at 1:5000

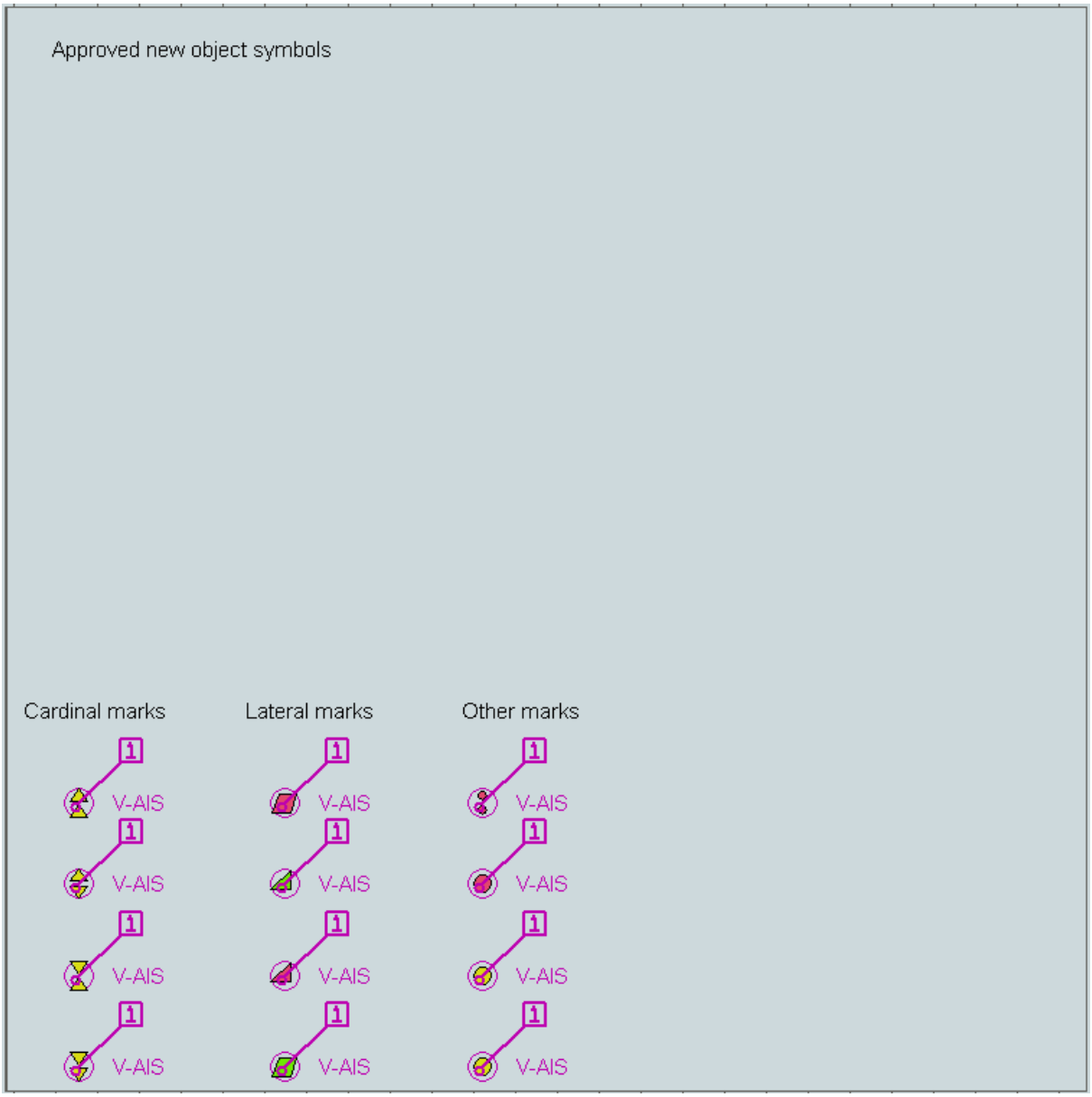
Topmarks (Q)

Buoys Topmarks



Beacon topmarks

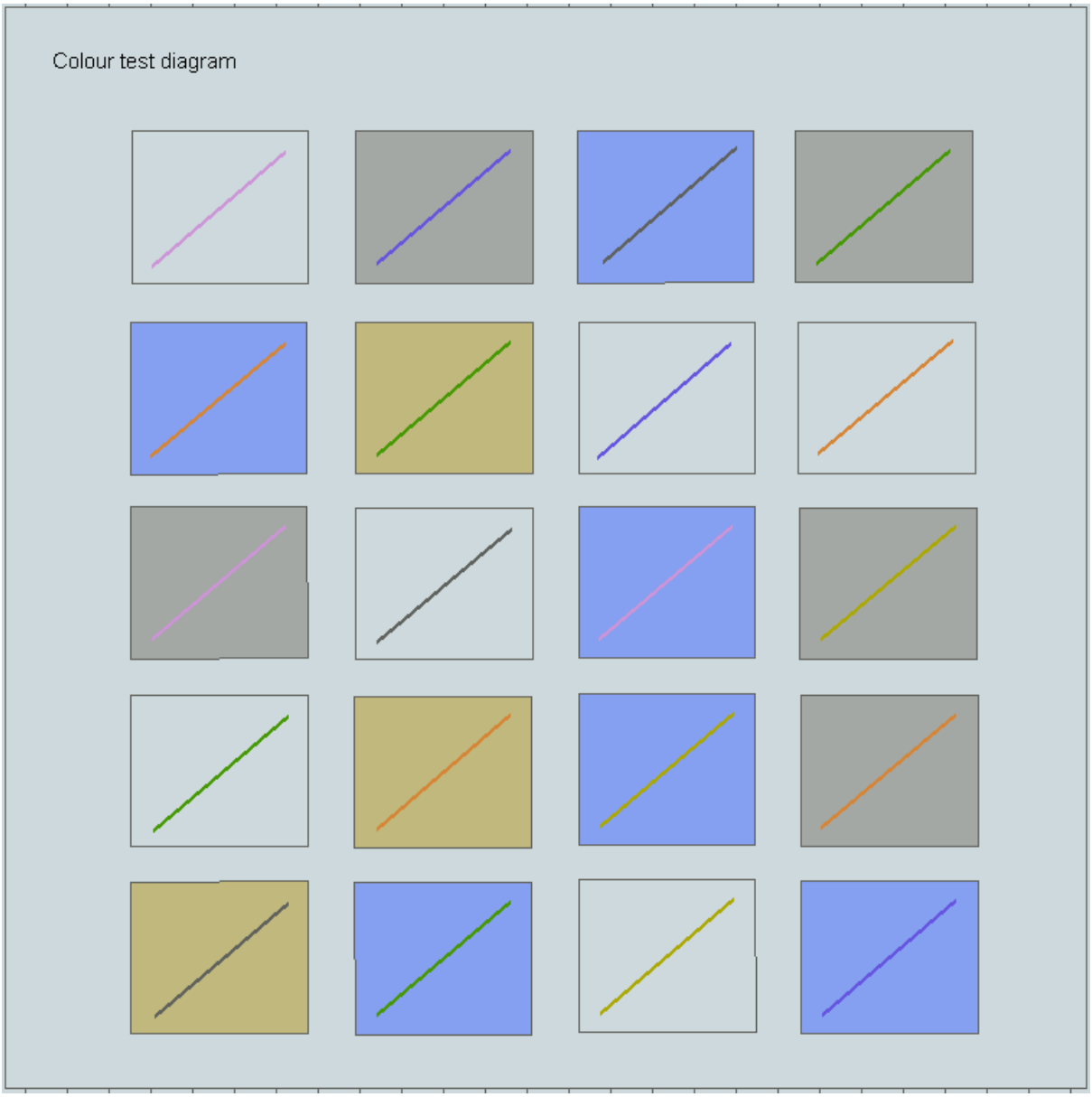



Approved new object symbols
Cardinal marks
Lateral marks
Other marks
1
V-AIS

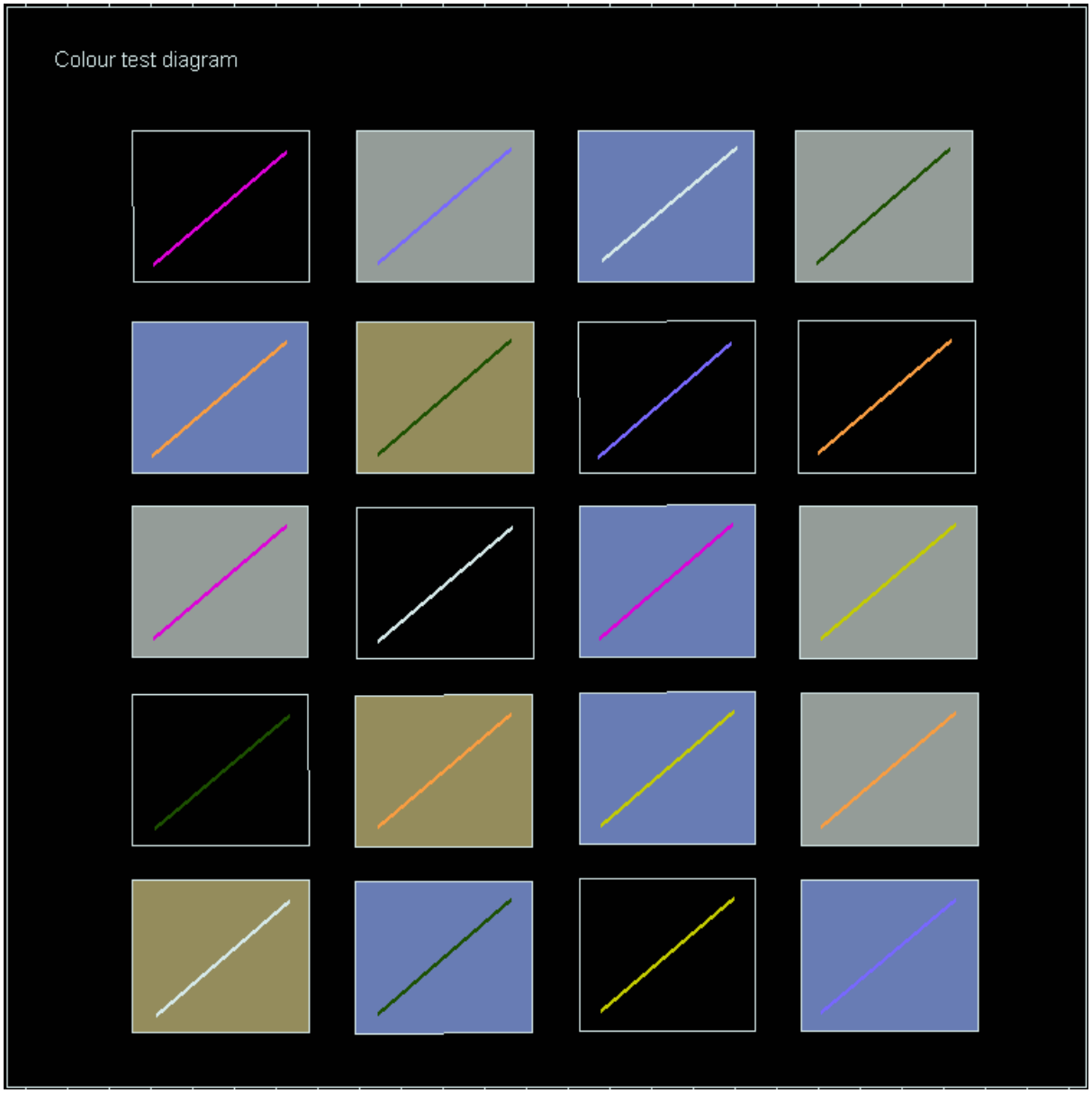
16.3 Colour Differentiation Test Diagram

The following diagram is required in "Day" and "Dusk" colours so that the Mariner can verify that his ECDIS display monitor has the colour differentiation capability needed to distinguish between the various colour-coded areas, lines and point symbols of the ECDIS display. The diagrams will not be true to colour unless they are projected on a calibrated monitor and are generated in a manner which correctly reproduces the colour tokens of the PresLib, as described in section 18.4. Section 18.4 also describes the use of these diagrams.

16.3.1 Day



16.3.2 Dusk



16.4 List of symbol names & meanings

~~~ < SNIP > ~~~

16.5 Plots of Symbols

~~~ < SNIP > ~~~

17 Contents of the Digital Presentation Library

From edition 3.3 onwards the word-processed version is the "official" version of the Presentation Library. The digital version in .dai format described in this section is provided as a manufacturer's option for edition 4.0. However the S-57 format Colour Differentiation Test Diagram file will continue to be provided so that this diagram can be displayed using the ECDIS colour tables, as described in 18.4, in order to test the colour differentiation capability of the display screen.

Please see README file on individual disks for file/data extraction and specific contents.

17.1 Digital Presentation Library

The optional digital Presentation Library is supplied in ".dai" format, the name on the disk being PSLBmm_n.dai, where mm_n is the edition number. This file is formatted in accordance with the description given in section 12 and contains look-up tables, colour tables and symbol descriptions. This file may not be up-dated and may not be available for future editions.

17.2 Test Edition of the Presentation Library

The ECDIS is no longer required to receive amendments to the Presentation Library at sea. Consequently, the Test Edition is no longer required.

17.3 Look-up Table sets

The digital form of the look-up tables are included in the above-described PSLBmm_n.dai file. This file may not be up-dated and may not be available for future editions.

17.4 Colour Tables

The CIE colour tables are included in the above-described PSLBmm_n.dai file. This file may not be up-dated and may not be available for future editions.

17.5 Symbols, Patterns and Linestyles

The official symbols, patterns and linestyles are provided in the PSLBmm_n.dai file. This file may not be up-dated and may not be available for future editions.

17.6 Official Presentation Library

The official Presentation Library, in the form of a word processed file, is contained on the Presentation Library CD. The content of the Presentation Library is given in section 4.

17.7 ECDIS Chart 1

An ECDIS Chart 1 is available for use by the Mariner, off-line, as described in "Colour & Symbol Specifications for ECDIS" section 3.1.4. This is in section 17.2 of the Presentation Library as graphics files on the Presentation Library CD.

In addition to the above, the digital Presentation Library contains a set of 13 pseudo S-57 files named AANC1XXX.000 ("N" is the navigational purpose), with AGEN code 1810. These cells carry the representation of the ECDIS Chart 1 as a collection of all symbols coded as NEWOBJ using the SYMINS attribute and similarly arranged as INT1 [1] for paper charts.

Detailed specifications for these diagrams and their use are given in section 19 of the Presentation Library.

17.8 Colour Differentiation Test Diagram

A Colour Differentiation Test Diagram is provided to enable the Mariner to check the colour performance of his ECDIS screen, off-line, as described in "Colour & Symbol Specifications for ECDIS" section 5.2.5. It is illustrated in section 16 and fully described in sections 18.3 and 18.4.

17.9 CSPs in UML

In addition to the graphical form of the CSPs provided in this document they are also provided for use as a digital set of diagrams in Enterprise Architect form.

18 Use of Digital Chart 1, & Colour Test Diagram

18.1 Introduction

The digital part of the IHO ECDIS Presentation Library carries supplementary features intended to aid the manufacturer in implementing the IHO Colour & Symbol Specifications, and the Mariner in using them. These consist of:

- An ECDIS Chart 1, as pseudo S-57 files, to help familiarise the Mariner with the colour and symbol coding used by ECDIS and to aid in picking the appropriate symbol for manual chart correction. (Note that the digital version of the ECDIS Chart 1 described here will be available in edition 3.3 of the Presentation Library, but may not be updated in the future. The ECDIS Chart 1 is also presented in section 16.2 of the word-processed Presentation Library.)

- A Colour Differentiation Test Diagram, as an S-57 file, to enable the Mariner to test whether his screen is still capable of differentiating the main colours used in ECDIS, and also to assist him in setting the brightness and contrast controls. (This digital version of the colour differentiation test diagram shall be supplied with the ECDIS as the diagrams are intended to test whether an aging ECDIS screen is still capable of showing colour differences clearly.)

18.2 Specification for ECDIS Chart 1 and the Colour Test Diagram

18.2.1 Definition (for this specification only)

A Chart 1 data cell shall be displayed so as to fill all of the standard ECDIS display area. (i.e. the min 270x270 mm chart area).

18.2.2 Description and purpose

The ECDIS Chart 1 and the Colour Differentiation Test are diagrams for use by the Mariner which are provided in the form of ENC-like S-57 files.

The ECDIS chart 1 is intended to familiarise the Mariner with the symbology used on ECDIS. The Mariner shall be able to display each cell, and by cursor-pick get a read-out of the meaning of any symbol shown.

The Colour Differentiation Test diagram is intended for display using the day or dusk colour tables so that the Mariner can check that the ECDIS monitor is providing adequate colour performance. It is also used in type-approval testing. Instructions for its use are given in section 18.4 of the Presentation Library.

The ECDIS chart 1 includes the CHKSYM which is intended for checking the correct size of the symbols during the type approval. The width and height of the CHKSYM is 5.0 mm.

The line width of the diagonal line in the Colour Differentiation Test diagram is specified as 0.6 mm wide (i.e. 2 pixel wide with a monitor with 0.3 mm pixel pitch). The line width shall be checked during the type approval.

18.2.3 Mode of use

These diagrams are supplementary features of the ECDIS, intended for use off-line or during route planning. Because they occupy the entire display they shall not be used during route monitoring. If the Mariner needs to find the meaning of a symbol during route monitoring, he shall use cursor-picking.

The operation of these diagrams is not subject to the draw-speed requirements of route monitoring.

18.2.4 Content and Encoding

The Chart 1 / Colour Test package consists of the thirteen S-57 cell files described below. The S-57 files of the ECDIS Chart 1 consists of eleven detail cells and an the index cell. The detail cells contain all of the symbols used on ECDIS, excluding Mariners' Navigational Objects, plus some explanatory diagrams. They are organised in displays that follow the classification used for INT 1 [1] for the paper chart (e.g. the first display is "AB - Information about the chart display.")

The S-57 file of the Colour Differentiation Test Diagram consists of one display cell (C1WOO) containing twenty squares, each with a different background/foreground colour combination.

The cells are identified as follows:

cell code	INT 1	Name	comp. Scale	"N"
C1AB1	AB	information about the chart display	1/14 000	5
C1AB2	AB	information about the chart display	1/14 000	5
C1CDE	CDE	natural and man-made features	1/14 000	5
C1FOO	F	port features	1/14 000	5
C1HIO	HI	depths, currents etc.	1/14 000	5
C1JKL	JKL	seabed, obstructions, pipelines etc.	1/14 000	5
C1MOO	M	traffic routes	1/14 000	5
C1NOO	N	special areas	1/14 000	5
C1PRS	PQRSTU	aids and services	1/14 000	5
C1QO1	Q	paper chart buoys and beacons	1/14 000	5
C1QO2	Q	topmarks	1/14 000	5
C1WOO	-	colour differentiation test diagram	1/14 000	5
C1XOO	-	index covering all of above detail cells excluding Mariners navigational objects	1/42 000	4

The file name uses the IHO Producer Code (AA), followed by the navigational purpose and the individual cell code given above. Revision will be by new edition (see section 19.3.6 below), and so the update number is always ".000". An example of a full file name is:

"AA5C1AB1.000"

Spatially, the "harbour" scale Chart 1 detail cells ("N"=5) are laid out in a 3 x 3 matrix with the Colour Test display cell below (to the south), and all are covered by the index cell on the "approach" scale ("N"=4). They are located in the West African desert at 15 degrees north, 5 degrees west, where there shall be no danger of their being called up as real chart cells (unless river traffic on the R. Niger above Timbuktu increases drastically.)

The EN Application Profiles of S-57 Appendix B1 are used, with arbitrary values entered for certain items (such as vertical datum) which do not apply to Chart 1. (This is done to minimise the changes to ECDIS software needed in order to process these special purpose Chart 1 files in an ECDIS.)

The IHO agency code (1810) is used in the AGEN sub-field of the DSID field, and the PRSP field is given the value {3} to distinguish it from the values used for the ENC Product Specification.

18.2.6 Revisions

Revisions will be made by whole file replacement, ie by issuing a new edition, as indicated in the EDTN sub-field of the DSID field.

18.2.7 Packaging

The pseudo S-57 data files are part of the Digital Presentation Library.

18.2.8 Presentation

The Chart 1 files are symbolized by the NEWOBJ look up table entries triggered by the SYMINS attribute of the generic object NEWOBJ introduced by the supplement No. 1 of S-57 Edition 3.1.1.

The README files give some specific Mariner settings, such as safety contour, that are required to give the correct display.

The Chart 1 and Colour Test diagram cells shall be displayed full-screen (270 x 270 mm), i.e. at or larger than the compilation scale. Otherwise features such as centred symbols may not be correctly illustrated.

The Mariner shall be able to cursor-pick on any symbol on the Chart 1 display and get a text read-out of the symbol meaning (LXPO field of the symbol library).

18.3 Displaying the Colour Test Diagram

18.3.1 Introduction; providing the diagram

The colour generating capability of any type of display screen will deteriorate with age and the Colour Differentiation Test diagram is provided to enable the Mariner to verify that his display screen still retains the colour differentiation capability needed to distinguish between the various colour-coded areas, lines and point symbols of the ECDIS display.

The diagram will not be true to colour unless it is projected on a calibrated monitor and is generated using the colour tables of section 15.1.

Two methods of providing the diagram are:

a) Use the S-57 format file labelled “C1WOO” containing the Colour Differentiation Test Diagram, which is included on the Presentation Library distribution CD. This file shall be drawn so that the extent of the imaginary chart data covers the entire ECDIS display. Because the file uses pseudo-S-57 cartographic objects it shall be displayed using the special look-up provided for the digital ECDIS Chart 1.

b) Use the graphics file illustrated in section 17.3 as a model. Based on this model reproduce the same pattern of rectangles and lines on the screen, but present them in the correct colours using the colour tokens given immediately below and the colour tables of section 15.1.

The diagram consists of twenty numbered squares extending over the whole of a 270x270 mm screen. Each square is coloured with one of the four main background area shades (such as shallow water blue, DEPVS), and each carries a two-pixel wide diagonal line in one of the important line or symbol foreground colours (such as planned route red, PLRTE). These are arranged as follows:

Four main background colours:

DEPVS	(shallow water blue)	squares 3, 5, 11, 15, 18, 20.
DEPDW	(deep water, white or black)	squares 1, 7, 8, 10, 13, 19.
LANDA	(land colour)	squares 6, 14, 17.
NODTA	(no data shade: radar, navigation safety lines and chartwork shall be visible on the no-data part of a display)	squares 2, 4, 9, 12, 16.

Six important foreground colours:

DEPSC	(safety contour grey)	squares 3, 10, 17.
NINFO	(orange, Mariner's information)	squares 5, 8, 14, 16.
ADINF	(yellow, manufacturer's information)	squares 12, 15, 19.
TRFCD	(magenta, traffic lanes and area boundaries)	squares 1, 9, 11.
RADLO	(the lower luminance radar green)	squares 4, 6, 13, 18.
RESBL	(blue, provisionally reserved for traffic info from transponder, VTS etc.)	squares 2, 7, 20.

Note: Remember that a tif, .pdf or other source will not be true to colour unless it has been specifically modified to access the colour tokens and colour tables used by the ECDIS.

Although originally designed for use on CRTs, this test shall be extended to LCD and other screens.

18.3.2 Using the diagram

The Colour Test shall be applied on the day and dusk colour tables.

Before the Colour Test diagram is used, the black-adjust symbol SY(BLKADJ) shall be brought up on the screen and the contrast and brightness controls (or equivalent controls for an LCD) shall be adjusted as follows:

1. First, set contrast to a maximum, brightness to a minimum. Look at the black-adjust symbol. Then either:

2A. If the centre square is not visible, turn up the brightness until it just appears.

OR:

2B. If the centre square is clearly visible (with contrast at maximum, brightness at minimum), turn the contrast down until the inner square disappears, then turn contrast back up until the inner square is just visible again.

(If the above adjustment is not successful, select a more appropriate colour table and repeat this procedure).

The "black level" is then correctly set. If a brighter display is required use the contrast control, but preferably do not adjust the controls unless lighting conditions on the bridge change.

The test consists of being able to distinguish the background colours and to pick out the like foreground colours, ie to say that squares 3, 5, 11, 15, 18 and 20 all have a shallow water blue background, and that squares 3, 10 and 17 have a grey line.

NOTE: The test above uses the black-adjust symbol for the purpose of a type approval test. The other purpose of the black-adjust symbol SY(BLKADJ) is to allow the mariner to adjust the display for ambient illumination on the bridge of a ship. An ECDIS shall have the black-adjust symbol displayed whenever the mariner is adjusting the display (i.e. depending on the technology of the display brilliance, brightness, contrast, etc.), as required by S-52 e6.1 4.2.4.5.

18.4 Grey Scale

A grey scale may be used by service technicians to detect display ageing or other display performance issues.

Eight grey strips are recommended, spaced between the minimum and the maximum luminance for each of the five mandatory colour tables.

The bit levels or signal levels producing the grey levels are evenly spaced from the level producing white to the level producing black. In order to select the appropriate grey level from a large set of available grey levels, use one of the following models:

1. ***Bit Levels in Software:*** Given n levels of grey that can be displayed on a screen, with 0 for black and $w = n - 1$ for white. We want to select a subset of m levels that are as evenly spaced as possible. The interval between the n levels to create m levels is $\Delta V = w/(m-1)$, which may not be an integer. So, the levels to select are the (integer) values of $V_i = \text{int}[(i-1)\ \Delta V]$ for $i = 1, 2, ..., m$, or $V_i = 0, \text{int}(\Delta V), \text{int}(2\Delta V), \text{int}(3\Delta V), ..., \text{int}[(m-1)\ \Delta V]$, with $\text{int}[(m-1)\ \Delta V] = w$ for white. For example, if there are $n = 256 = 2^8$ levels from which we select $m = 8$ levels, white is $w = 255$; the interval is $\Delta V = 36.4286$, and the chosen levels are: 0, 36, 73,109, 146, 182, 219, 255.

2. ***Analog Signal Levels:*** For analog signals, if V_w is the white level and V_b is the black level, then for m levels the signal step size is $\Delta V = (V_w - V_b)/m$ and $V_j = V_b + j\Delta V$.

19 Supply and Amendment of the Digital Presentation Library

~~~ < SNIP > ~~~