Paper for Consideration by TSMAD/ DIPWG

Consolidated Portrayal Documentation: S-100/101 Relevant Portions of S-52

Submitted by:	DIPWG Chair
Executive Summary:	This document provides the starting point from which the portrayal portions of S-100 and S-101 will evolve. It is the consolidation of the parts of S-52 that will be edited, reformatted and brought forward for insertion into the appropriate sections of S-100 and S-101. For the most part the applicable portions of S-52 content will move to S-101, while mostly new content will need to be written for the portrayal sections of S-100. The S-100 portrayal sections will primarily describe the structure and use of the Portrayal register and Portrayal Catalogue, while the S-101 portrayal sections will describe the presentation of the symbology within ECDIS.
Related Documents:	S-52 TSMAD22/DIPWG03-09.3B (Colour Coded S-52 Main) TSMAD22/DIPWG03-09.3C (Colour Coded S-52, Annex A, Part I)
Related Projects:	S-100 & S-101 Development

Introduction / Background

Applicable portions of the S-52 Main Document and Annex A (Part I) have been copied and pasted into this preliminary, rough draft. Parts of S-52 that will not apply have not been copied, such as Annex A (Part II), Annex B, Annex C, as well as several sections of S-52 Main and Annex A (Part I). The Annex A Addendum that shows all of the S-52 graphics will be replaced by the Portrayal Catalogue.

Colour coded versions of the S-52 Main Document and S-52,
Annex A (Part I) are provided in TSMAD22/DIPWG03-09.3B and -09.3 C. Text that has been selected to bring forward has been coloured blue and text that has been deemed not applicable has been coloured red.

Analysis/Discussion

Much of the historical background and general advice that was useful in the nascent days of developing S-52 and S-57 has served its purpose. It provides a quaint reminder of the good-old-days to those who were there at the inception, but only adds bulk for the modern reader. Therefore, most of this commentary (usually shown In Italic in the S-52) has been left behind.

The heritage of the sections extracted into this "Consolidated Portrayal Documentation" has been enclosed in "guillemets" or angle quotes, such as << MAIN 3.1 >>, at the top of each section. Those sections that do not show a reference are part of a larger portion, for which a reference is provided.

S-52 commonly placed information about similar topics in several different sections of the specification. An attempt has been made to consolidate the dispersed specifications and guidance for each topic into a single section as much as possible, although a separate, brief overview of is provided for some topics in the introduction of the document.

Very little editing has been done. The goal of this exercise has been just to assemble the appropriate parts in a logical framework, from which the editing may commence.

Recommendations

1. Establish an ad-hoc correspondence group from within interested DIPWG/TSMAP members to review or compose, edit and finalized the portrayal sections of S-101 and S-100 section by section using this Consolidated Portrayal Documentation as a starting point.

Action Required of TSMAD/DIPWG

1. Endorse the recommendation for the establishment of a Portrayal Documentation Correspondence (DPC) sub-working group.

2. Nominate members for the DPC Sub-working group.

Consolidated Portrayal Documentation: S-100/101 Relevant Portions of S-52

14 March 2011

Contents

1 One

2 Two

3 Three

4 Four

5 Five

6 Six

7 Seven

8 Eight

9 Portrayal

9.1 Introduction << MAIN 1.1.1. >>

[[Not shown here, but may want to incorporate parts of Annex A 1, "Introduction"]]

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.

9.1.1 ECDIS Concept << Likely will consist of a combination of several sections >>

<<ANNEX A 1.2 >>
In contrast to a presentation model suitable for paper chart application, a presentation model to be used by ECDIS systems must take into account the requirements of the IMO/IHO "Performance Standard for ECDIS" [3] and the IHO "Specifications for Chart Content and Display Aspects of ECDIS", IHO Special Publication No.52 [4]. 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 must cover not only colour and symbol definitions but also instructions how to handle a dynamically changing presentation as well.

<<
BASIC CONCEPT OF A 'DISPLAY GENERATOR' FOR AN ECDIS SYSTEM
ANNEX A 2. >>
The elements of the Presentation Library are handled by the ECDIS Display Generator that is designed by each manufacturer, following the guidelines of this documentation and which performs the link between the object characteristic according to S-57 and the actual presentation on the ECDIS screen. Note that the basic concept for a Display Generator that is described in this section is only an example. There are other concepts to realize the ECDIS presentation. NOTE ALSO THAT THE DISPLAY GENERATOR IS NOT PROVIDED IN THE PRESENTATION LIBRARY; THE MANUFACTURER MUST DEVELOP THIS.

Figure 1 shows 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. It is understood, that the ECDIS manufacturer writes software linking these elements. Please note, that section 8 of this manual gives further details that are of interest to the programmer.

Note particularly section 8.4 dealing with the display of objects depending on date (e.g. DATSTA, DATEND, PERSTA, PEREND) or on display scale (SCAMIN). The requirement to display date-dependent information outside the date at which it is active (for route planning etc.) means that the date-filter in the first diamond of figure 1 will be deliberately by-passed on request by the mariner. When this option is in use, the mariner must be reminded that the information on the display may not be correct for the actual, current, date and time.

Each graphic command is assigned to the display priority that was retrieved from the look-up table before. The display priorities are defined according to the requirements of the IMO and IHO (see 8.3.4).

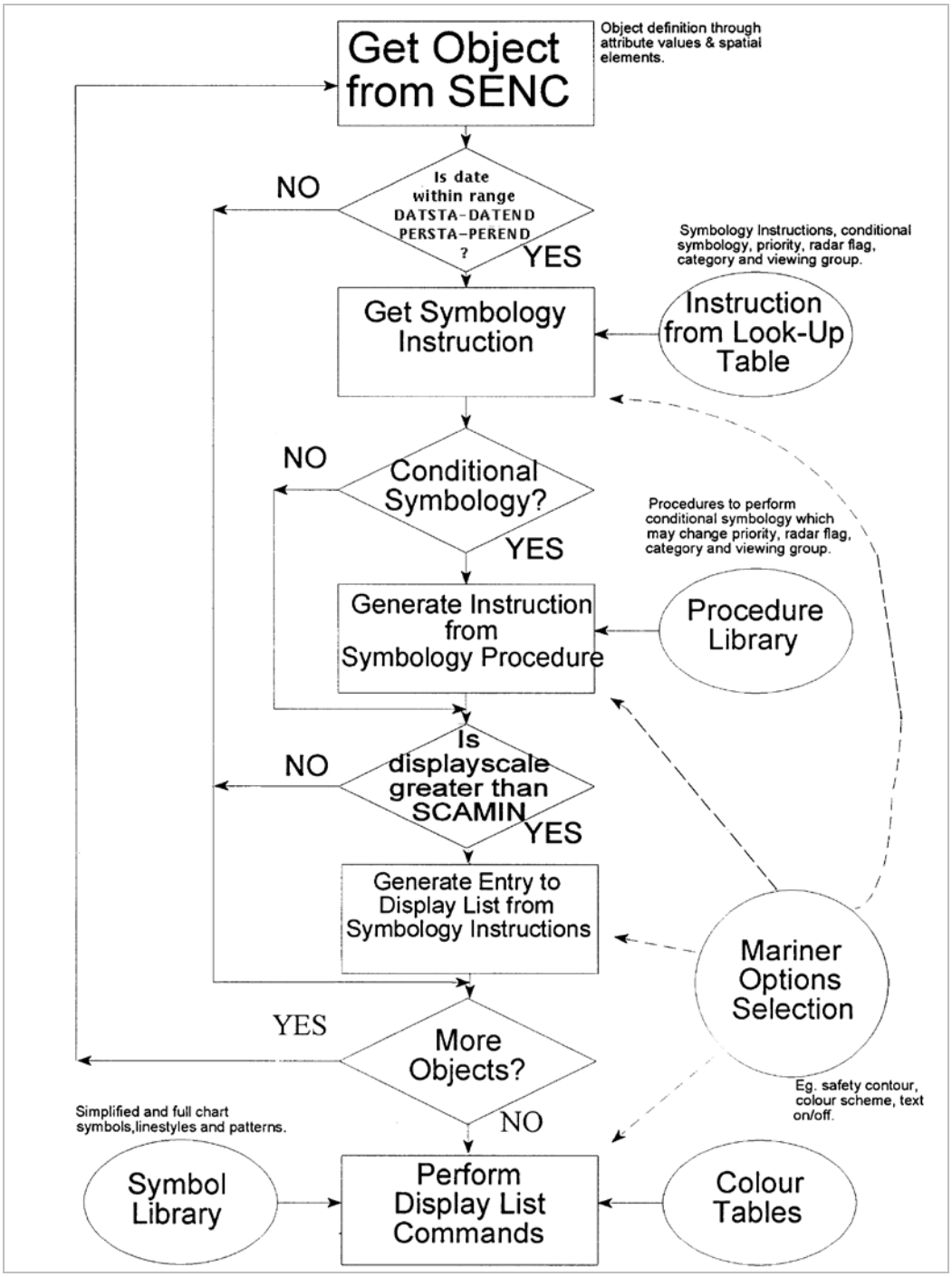


Fig. 1 - Display generator concept

After all objects have been examined by the programmed loop, the display list is filled with graphic commands. The commands are then performed by the ECDIS graphic, which in turn loads symbols from the symbol library and gets the

colour values from the colour tables. This method to generate an ECDIS display gives the mariner control over the contents and the appearance of the presentation:

- If he selects, e.g., another safety contour, the display list is renewed in the programmed loop 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);

- or symbology instructions which refer to the simplified or paper_chart points, plain_boundaries or symbolized boundaries areas, and lines by switching to another look-up table;

- or the generation of the display list is influenced by a filter suppressing text commands;

- or the colour values for the day time are replaced with the values for the night time by selecting another colour table.

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

Design Considerations
<<Adapted from Main 2.1.1 & MAIN 2.1.2>>
The ECDIS display has been designed to be 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.
The diversity and flexibility of ECDIS

The range of information types that need to be portrayed on ECDIS has strongly influenced the manner in which the display has been organized. The different information types 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,
information from radar and other sensors,
information from AIS,
navigational indications and alarms generated by ECDIS,

Other information types, such as the following, may become part of the data portrayed on ECDIS in the future:
information from nautical publications
shiphandling options, based on ship's characteristics, alphanumeric navigation information (ship's latitude, longitude, heading, course, etc.),
telemetered information from shore authorities, (traffic, real-time tides etc.),
ice information,
reminders, (e.g. time to contact pilot station),
messages from other displays (e.g. alarm on engine room display).

The ECDIS display has also been designed with flexibility of presentation in mind, such as accommodating the following:
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 presentation requirements and techniques appropriate to ECDIS are likely to be developed in future.

9.1.2 Structure of Portrayal Specifications << New Content to be placed here >>

9.1.3 Changes to Portrayal Specifications << Adapted from MAIN 1.4.5 >>

Section 9 of this document and Section C-9 of Annex C, "Normative Business Rules of S-101," are maintained by the IHO Digital Information Portrayal Working Group (DIPWG). Recommendations for improving the portrayal specifications are welcomed and should be sent to:

Chairman, IHO DIPWG
International Hydrographic Bureau or emailed to: info@ihb.mc with subject "DIPWG"
BP 445, MC 98011
Principality of Monaco

9.2 General Characteristics

9.2.1 Physical Display << MAIN 5.1 >>

Portrayal requirements 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)

Number of 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.

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:

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.

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.

9.2.2 Units << MAIN 2.3.1f >>

There must be no ambiguity about the units in use at a particular time. The units listed below must 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.

9.2.3 Colours << Adapted from MAIN 4.2 & MAIN 4.1 & MAIN 4.2.6 & ANNEX A 3.1 >>

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

9.2.2.1 Colour Tables and Colour Tokens

Three 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. The ECDIS must enable mariners to switch among all three colour tables specified (day, night and dusk).

DAY – The Day Colour 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 – The Dusk Colour Table is a black background table, which may also be used by day as a mariner's option.

NIGHT – 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).

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 colour tables and other detailed information about the assignment of colours is provided in Appendix C, Section 9.

9.2.2.2 Colour Tokens

A digital look-up table assigns all object/attribute combinations of features from the SENC to one of 64 "colour tokens". Each colour usage is represented by a token that is a five-letter code. 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. 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.

9.2.2.3 Transparency

Transparent area colour fill is used:

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),

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:

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

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.

9.2.4 Abbreviations << ANNEX A, 7.1.3.2 & ANNEX A 13.4 >>

Abbreviations
<< ANNEX A, 7.1.3.2 >>

The abbreviations used on the ECDIS display are listed in Section 13.4. All the abbreviations in section 13.4 must be readily accessible to the mariner.

Note that a few abbreviations, such as «DW» for deep water route and «IT» for inshore traffic zone, are used as symbols; these are explained in the relevant sections of ECDIS Chart1.

Abbreviations
<< ANNEX A, 7.1.3.2 >>

The following abbreviations are used on the ECDIS display:

9.2.4.1 'TE' text command abbreviations

The following abbreviations are used with the “TE” command word:

Prefixes:	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 NMT = not more than “CLEARING BEARING” NLT = not less than “CLEARING BEARING”	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.

The meanings of the above prefixes and suffixes must be available to the mariner.

9.2.4.2 Light description Abbreviations

Dir directional
Aero aeronautical

F fixed
Fl flashing
LFl long-flashing
Q quick-flashing
VQ very quick-flashing
UQ ultra quick-flashing
Iso isophased
Oc occulting
IQ interrupted quick-flashing
IVQ interrupted very quick-flashing
IUQ interrupted ultra quick-flashing

Mo morse
FFl fixed and flashing
Fl+LFl flash/long-flash
AlOc Fl alternating occulting/flashing
FLFl fixed/long-flash
AlOc alternating occulting
AlLFl alternating long-flash
AlFl alternating flash
Al group alternating
Q+LFl quick-flash plus long-flash
VQ+LFl very quick-flash plus long-flash
UQ+LFl ultra quick-flash plus long-flash
Al alternating
AlF Fl alternating fixed and flashing

W White
R Red
G Green
Y Yellow

occas occasional
temp temporary
priv private
exting extinguished

m metres
M nautical miles

9.2.4.3 Nature of seabed abbreviations ('TX')

The following abbreviations may be used for values of NATSUR - nature of seabed:

NATSUR 1, mud	M	NATSUR 8, cobbles	Cb
NATSUR 2, clay	Cy	NATSUR 9, rock	R
NATSUR 3, silt	Si	NATSUR 11, lava	R
NATSUR 4, sand	S	NATSUR 14, coral	Co
NATSUR 5, stones	St	NATSUR 17, shells	Sh
NATSUR 6, gravel	G	NATSUR 18, boulder	R
NATSUR 7, pebbles	P		

To write out on the display "Mud Sand Gravel", for example, causes much more clutter than writing " M S G". ECDIS manufacturers are encouraged to use the abbreviations both on the chart display and when providing cursor-pick information.

The meanings of the abbreviations in 13.4.2 and 13.4.3 must be made available to the mariner.

9.3 Organization of Display << NEW INTRODUCTORY INFORMATION>>

There are several ways that information is organized in ECDIS. Some of these sound similar, such as Display Categories, Display Priority and Viewing Groups, and are often confused. Display Categories and Viewing Groups are used to assist the mariner in selecting features to display or filter out of the ECDIS. Display Priorities are not used for selecting features, but to specify which features may obscure or "overprint" features of less of importance when they are displayed together. These and other means of organizing the data displayed are described below.

9.3.1 IMO Display Categories << MAIN 2.3.3a >>

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.

<<ANNEX A< 8.3.4.3 >>
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 [3]).

The IMO "display categories" are as follows:

The Standard Display information is that part of the SENC which should be presented when the ECDIS display is first switched on, and at any time by a single operator action (see IMO Performance Standards [3]).

The Display Base is that part of the Standard Display which should be permanently retained on the display (see IMO Performance Standards [3]).

Other information includes all SENC information that is not in the Standard Display, to be displayed on demand by the mariner.

9.3.1.1 Mariners objects

The own-ship symbol and planned route are always required on the route monitoring display by IMO PS 10.5.1, and so must be Display base. All other mariners' navigational objects, which are listed in the look-up table under "Non-standard classes", are initially assigned in the look-up tables to a default "Mariners' Standard" or "Mariners' Other" category. However the mariner should have the option of changing the category of any non-standard object class (except for Display base), to suit his operational needs.

The following key words in field 6 are used to assign the look-up table entries to display categories:

DISPLAY BASE	- assigns the object to the Display Base
STANDARD	- assigns the object to the Standard Display
OTHER	- assigns the object to Other Information
MARINERS STANDARD	- assigns the object to Standard Display, or
MARINERS OTHER	whichever category the mariner assigns them to

9.3.1.2 Display Priority & Display Category in Conditional Symbology Procedures << ANNEX A, 8.3.4.5 >>

A conditional symbology procedure is called from the look-up tables (see 7.5). 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 12).

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.

9.3.2 Priority Layers << MAIN 2.3.2 >>

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.

<< ANNEX A 8.3.4.1 >>
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, should be used for an arbitrary decision as to which object is drawn on top. Text should be drawn last (except for ownship etc.), in priority 8.

The display priority should be used to ensure that objects that overlap each other are drawn in the right sequence. Thus, an object with a higher priority should 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 must 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.

Remember, this suppression only applies between line objects, which includes area boundaries. The rule for centred symbols, area patterns and point symbols is that all symbols should be drawn , with the highest priority object being drawn last independent of whether it be 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) should coexist with the underlying line. Both LC(CHCRIDnn) or LC(CHCRDELn) and the underlying line should be drawn.

Overdrawing may be essential, for example in that case of buoy, its name, its light flare. These are given offsets in the symbol library to avoid overwriting.

The following gives a general indication of how priorities are allocated. Within each group priorities are adjusted to meet

specific cases:

no data filled area pattern	priority 0
S-57 group 1 filled areas	priority 1
superimposed areas (e.g. CANALS)	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 that the display priorities for look-up table entries are provisional values that may change in the light of experience.

9.3.3 Radar << MAIN 2.3.1d and MAIN 2.3.2.b >>

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.

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.

<< ANNEX A< 8.3.4.2 >>
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:

'O' which puts the object's presentation over radar; and
'S' which means that presentation is suppressed by radar

Thus, 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 OVERRADAR if field 5 of a look-up table line is empty.

9.3.4 Viewing Groups

The mariner should 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 suggested in table 13.2 are intended as a framework on which the ECDIS manufacturer can base his own method of providing this capability.

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 13.2 are arranged in numbered groups (e.g. group 26230 consisting of the items pipeline area and cable area) which in turn are arranged in sets (e.g. set 26000 consisting of cautionary areas). The groups are arranged by IMO Category, in the sequence of INT 1 [2] for the paper chart. Mariners are generally familiar with INT 1 [2].

The manufacturer may use the viewing group scheme or not, as he prefers. If he does use it, then in some cases a single item, such as soundings (33010) should probably be selectable. In other cases several groups from different sets may be combined. However groups from different IMO categories should not be combined.

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 7.1.3 and 13.3

9.3.5 Text Groupings <<MAIN 2.3.3c >>

<< Blend and shorten the two sections below>>

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.

9.3.5 Display of objects depending on date or display scale <<ANNEX 8.4 >>

9.3.5.1 Date-dependant objects

Some objects, such as seasonal buoys, are only to be displayed over a certain period (PERSTA to PEREND). Other objects, such as a traffic separation scheme, may have a date on which they are introduced (DATSTA) or discontinued (DATEND). Any object with one of the above attributes should not normally be displayed outside its effective dates (see figure 1).

However to provide for effective route planning; for look-ahead during route monitoring; or for other purposes, the ECDIS should allow the mariner to view chart data for any required date and time for the purpose of reviewing pre-planned changes in chart data. The ECDIS manufacturer may provide this either:

By allowing the mariner to select a date for displaying all chart objects active at that date and time, OR

By allowing the mariner to display all objects in the ENC, irrespective of the current date. Information on the date and time window for which objects of interest are in existence should then be available by cursor-pick report through viewing the date-dependent attributes.

When this option is in use, the mariner must be reminded that the information on the display may not be correct for the actual, current, date and time.

9.3.5.2 Scale-dependant objects

Some objects (such as intermediate depth contours) may carry the attribute SCAMIN to specify the smallest display scale at which they should be drawn. At display scales smaller than SCAMIN the object should not be drawn, in order to avoid clutter. For example, an object with a SCAMIN value of 50,000, indicating a scale of 1/50,000, should not be drawn on an ECDIS display of 1/60,000.

9.4 Display Components << Provide short new introductory information here >>

9.4.1 Legend <<ANNEX A 8.6.3 >>

A standard legend containing at least the following elements should be available for display. It may either be on the same screen as the ECDIS chart display, or on a separate screen.

The following table indicates which ENC data elements must be used. Values, other than those defined in the data set record, should reflect the situation at the own ship's position:

1.	units for depth	DUNI subfield of the DSPM field.
2.	units for height	HUNI subfield of the DSPM field.
Note on 1., 2. – 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 may be stated for the information of unfamiliar users.		

3. scale of display	Selected by user. (The default display scale is defined by the CSCL subfield of the DSPM field or CSCALE attribute value of the M_CSCL object.)
4. 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) must be used.	
5. sounding/vertical datum	SDAT and VDAT subfields of the DSPM field or the VERDAT attribute of the M_SDAT object and M_VDAT object. (VERDAT attributes of individual objects must not be used for the legend.)
6. horizontal datum	HDAT subfield of the DSPM field.
7. value of safety depth	Selected by user. Default is 30 metres.
8. value of safety contour	Selected by user. Default is 30 metres.
Note: if the mariner 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 should be quoted.	
9. magnetic variation	VALMAG, RYRMGV and VALACM of the MAGVAR object. Item must be displayed as VALMAG RYRMGV (VALACM) e.g., 4□15W 1990 (8'E).
10. 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.
11. 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.
12. chart projection	Projection used for the ECDIS display (e.g., oblique azimuthal).

The list above is the minimum that should be available, but the complete list need not always be shown. Individual items might be picked by the mariner for display for a period; examples are magnetic variation, data quality for depths (M_QUAL, CATZOC) etc.

9.4.2 ENC Scale & Graphical Index << MAIN 3.17 >>

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.

9.4.3 Display Orientation << MAIN 3.1.6 >>

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.

9.5 Types of ECDIS Symbols << Main, 3.2 & 3.3 >>

9.5.1 Adaption of Traditional Paper Chart Symbols

<< Adapted from Main, 3.3.1 >> << Special Conditions >>

Most of the symbols in IHO INT 1, *Symbols, Abbreviations, Terms used on Charts* have been adapted for use in ECDIS. The ECDIS Chart 1, which is divided into lettered sections in the same way that INT 1 is, provides a quick reference for the symbols.
Two traditional paper chart symbols are treated differently in ECDIS.
Depth contours are not labelled by ECDIS. The Safety Contour is highlighted, and the mariner shall be able to use cursor picking to identify other contour values.

For light sectors, the mariner shall be able, upon request to the ECDIS, be capable of identifying the colour of the sectors affecting the ship, even if the lights involved are off the display.

9.5.2 New Symbols Developed for ECDIS << Adapted from Main, 3.2 >>

There are four types of new symbols have been introduced for ECDIS, which are described below.

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 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).

9.5.3 Special ECDIS Symbols to Identify Unsafe Depths << Adapted from Main, 3.2.2 >>

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 shall 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 shall select the next deeper contour available, 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 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'.

9.5.4 Simplified ECDIS Symbols << Main, 3.1.1 >>

9.5.4.1 Mariner's options in symbols and linestyles << MAIN 3.1.1 >>

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.
<< Adapted from MAIN, 3.2.3 >>
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.

9.5.4.2 Simplified buoy symbols << MAIN 3.2.3(1) >>

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.

9.5.4.3 Simplified beacon symbols<< MAIN 3.2.3(2) >>

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".

9.5.5 Other New ECDIS Symbols << Adapted from Main, 3.2.3(2) – (21) >>

1) 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.

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

3) 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.

4) 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.

5) 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.

6a) 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.

6b) 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 more than twice the compilation scale. See Presentation Library, Part I, section 12.2.2 DATCVR 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.

6c) Change of units of depth. (This section is deleted)

6d) 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.

7) Scale bar or latitude scale.
The IMO PS require an indication of scale and range as part of the Display FBase. 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.

8) 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.

9) 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).

10) Ramark, Racon.
This is introduced to distinguish beacons that will appear on the radar display from other radio-beacons.

(11) 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.

12) 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.

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

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

14a) 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.

14b) 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.

15) 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.

16) Daymark.

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

17) 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.

18) 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.

19) 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.

20) 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.

21) 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.

9.5.6 Mariner's Objects << Adapted from Main, 2.3.1a >>

<< Need more information here, possibly moved from other sections >>

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.

9.6 The Portrayal Specifications

9.6.1 Introduction << MAIN 3.1.3 >>

All symbols are specified in the 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.

9.6.2 Flexibility and Conformance to Specifications << Blend and shorten the 2 separate sections below >>

<< ANNEX 1.1 >>
The symbols of the Presentation Library should be replicated in size and shape, using any convenient format. The colour tables should be reproduced within the tolerances given in C&S Specifications, section 5.2.3. The remaining items may be implemented in any convenient form which produces the same results as the Presentation Library.

Minor Symbol Deviations <<Adapted from Main 1.4.6>>
Minor deviations by ECDIS manufactures in the implementation of the symbols specified in this document and the Portrayal Register are permitted to allow for innovation and responsiveness to ECDIS users. However, only minor changes are allowed and all symbols must be easily recognizable as the respective symbol in the Portrayal Register. The following criteria shall be used to determine whether any symbolization on an ECDIS that is different from the symbolization in Portrayal Register is still compliant. The symbolization used should:

1.) be the same in general shape and size as the IHO version;
2.) be clear and sharp so that there is no uncertainty over meaning;
3.) be close enough to the IHO version to avoid ambiguity in meaning between that model and any other model of ECDIS;
4.) use only the colours as specified in S-101;
5.) comply with the various considerations of scientific design described in S-100;
6.) comply with the priority of prominence on the display in proportion to importance to safety of navigation which as provided in the Portrayal Register, and
7.) avoid any increase in clutter.

9.6.3 Size of Lines, Symbols and Text << MAIN 3.1.5 >>

<< Much of this is commentary and can be deleted >>
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.

9.6.4 Areas << MAIN 3.1.2 >>

<< Can numbering be simplified?? >>
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.

The following methods of symbolising the area are used << MAIN 3.1.21 >>

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:

3.1.2.2 Symbolising the area boundary: <<NEED To Change This Section Number When This Part Is Simplified>>

.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

Patterned Outlines
Patterned Fills
Centred Symbols

9.6.5 Text

9.6.5.1 Text as part of the route monitoring display << MAIN 3.4.1 >>

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.

9.6.5.2 Light description text strings << ANNEX A 8.6.4 >>

The mariner may need to label all lights with a description in order to identify those he can see. A mariner-optional light description text-string is provided for this purpose, as a required sub-procedure of conditional symbology procedure LIGHTS (see ‘C’ program LITDSN on this CD).

9.6.5.3 Text windows, explanatory diagrams etc. superimposed on the route monitoring display << MAIN 3.4.2 >>

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.

9.6.5.4 Separate text panel on the same screen as the route monitoring display <<MAIN 3.4.3 >>

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.

9.6.5.5 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.

9.6.6 Pick Reports <<MAIN 2.3.1e and ANNEX A 8.8.1 >>

<< This section will be augmented with ideas from Richard Coombes' Grand Unified Theory of Pick Reports , otherwise known as TSMAD22/DIPWG3-08.4A, which could entirely replace the text extracted from S-52 >>

<< What is the significance of the [brackets] in the text below? >>

1.) Introduction

The ability to cursor-pick on an object for the additional information that lies behind the symbol is an important part of ECDIS capability. However, an unprocessed cursor pick, which does discriminate or interpret and merely dumps on the interface panel all the information available at that point on the display, will normally result in pages of unsorted and barely intelligible attribute information. This section suggests ways of making the information more useful.

The following information must 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.) Interpretation

A plain language explanation of each symbol is included in the Symbol Library and in the Presentation Library section 15. This gives the mariner quick and understandable information which is not always obvious from the object class and attribute information. The manufacturer should always provide these explanations to the mariner in response to a cursor pick on the symbol.

Attribute values provided in addition to the above explanation should be connected to their meaning, and the definitions should also be available.

3.) Sorting

Unsorted cursor-pick results would be useless for route monitoring, when the mariner needs the information immediately. It would be little use even for route planning, as even then the mariner does not have time to scan through multiple lines of attributes (RECDAT, SCAMIN) that are not relevant to him, perhaps belonging to navigationally insignificant object classes (TESARE, SPRING).

Effective cursor-pick sorting will take much thought and experience. Only initial considerations are given below:

Directed cursor enquiry: e.g., The mariner specifies he only wants information on depths and dangers (INT1 II and IK [2]); or aids (IQ); or only chart corrections.

Sorting by significance: A general cursor enquiry could be sorted;

by importance of the object class, perhaps using the IMO category,

by the significance of the attribute, the most significant attributes being those used in the look-up table for symbolizing plus:

INFORM	QUAPOS	SURSTA
TXTDSC	QUASOU	
POSACC		
SOUACC	(list not complete)	

Sorting by level of detail: The first line might be the symbol description; followed by object and attribute information; with definitions, etc., by further request.

4.) Spatial and meta-objects, collection objects

Cursor enquiry should extend to the spatial object, which carries accuracy attributes QUAPOS and POSACC. It should include collection objects which carry the OBJNAM of traffic separation systems, navigation lines (NAVLNE, RECTRC, DWRTCL, etc.). It should include meta-objects, for example, attribute HORDAT, which identifies the local datum to be used to enter IHB S-60 for the datum shift parameters needed to convert chart information in the local horizontal datum, to the WGS 84 used in the ENC, for example to enter local chart corrections.

9.6.7 Relationships and Collection Objects <<ANNEX A 8.6.2 >>

The manufacturer should endeavour to develop appropriate solutions that minimize clutter for displaying information associated with collection objects.

The following paragraphs from clause 15 “COLLECTION OBJECTS” of S57 Appendix B.1 – Annex A 'Use of the Object Catalogue" (UOC) are quoted here for information:

“If a collection object extends beyond a cell boundary (i.e. the objects that make up the collection are spread over multiple cells), the collection object should be repeated in each cell that contains one or more component objects. However, only the objects that exist in the cell that contains the instance of the collection object can be referenced by that collection object. If this technique is used, each instance of the original collection object must have the same feature object identifier (LNAM). It is up to the application (e.g. the ECDIS) that uses the cells to rebuild the complete collection object based on the unique feature object identifier.

It is highly recommended that no use be made of pointers that reference objects outside the cell in which the pointer is encoded. Use of such pointers cannot be prohibited as no such rule exists in the ENC Product Specification.”

9.6.8 Information and Quality Symbols

1.) Additional information Indicator (INFORM01) << ANNEX A 8.6.1 >>

HOs may apply the INFORM attribute to any object to carry information that cannot be coded in S-57 format, such as a warning for a traffic junction, an abstract from a nautical publication, a pictorial representation of an object, etc. There are a total of five similar universal attributes:

INFORM
NINFOM (INFORM text in national language) *
TXTDSC
NTXTDS (TXTDSC text in national language)
PICREP (Pictorial representation)

To identify objects with such additional information, the ECDIS should, on mariner's command, identify all objects having any such attribute populated by means of SY(INFORM01). The mariner should then be able to access the information by cursor-pick.

The pivot point of SY(INFORM01) should 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. Its display priority is 8, overradar, category other, viewing group 31030.

The ECDIS manufacturers should provide appropriate solutions that enable PICREP and other files to be displayed without affecting night vision. (Note: this applies as of September 2001 – particular technical standards may be applied at a later date if found necessary).

* National language information is an optional supplement for ECDIS, and is not covered by the Presentation Library. See S-57 Appendix B1 «ENC Specification» section 3.11 for details.

<<< Does DIPWG want to make (the optional) display of National Language a mandatory capability of ECDIS? Can DIPWG do this on its own or should IMO be specifying this? >>>

2.) Cautionary' and 'Information' Areas << MAIN Table 4 >>

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:

<u>Information areas</u> - 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.

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)

3.) Chart Data Quality Indicator << MAIN 3.1.8 >>

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.\

9.6.9 Displaying of Manual and Automatic Updates <<Annex 8.7>>

9.6.9.1 Manual Updates <<Annex 8.71>>

Manual updates of ENC information should be displayed using the same symbology as ENC information and should be distinguished from ENC information as follows:

Added feature: <<Annex 8.7.1.1>>

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.

Deleted feature: <<Annex 8.7.1.2>

The object should remain on the display and should 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 that the line symbols LC(CHCRIDnn) and LC(CHCRDELn) should not suppress the underlying line (see section 8.3.4.1).

Moved feature: <<Annex 8.7.1.3>>

As for deleted feature, followed by added feature.

Modified feature: <<Annex 8.7.1.4>>

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 existing buoy has a fog signal removed, or an area has a «fishing prohibited» restriction removed), then this creates both a change and a deletion and both should 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 9.4.4.4 b above.
A deleted feature must appear on the display only when its IMO category and viewing group are displayed.

A manually updated feature must be capable of the same performance in feature selection, response to cursor-picking, etc., as an ENC feature. In addition, it must provide updating information (identification and source of update, when and by whom entered, etc.) on cursor picking.

9.6.9.2 Identifying automatic chart corrections on mariners demand <<Annex 8.7.1.5>>

The ECDIS manufacturer must provide a means of identifying automatic chart corrections to the SENC on demand by the mariner.

9.6.10 Displaying added chart information <<Annex 8.7 & Main 2.3.1>>

9.6.10.1 Non-HO (non-ENC) Chart Information <<Annex 8.7.2>>

Distinguishing between HO and non-HO data <<Annex 8.7.2>>

Non-HO data added to existing HO ENC data by mariners or manufacturers to augment the chart information must be distinguished from the HO-ENC information as follows: <<Annex 8.7.2.1>>

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.

Distinguishing non-HO data from manually updated chart information, which uses the same identifiers, must be enabled through cursor picking.

Manufacturer's Information on the route monitoring display <<Main 2.3.1.c >>

In addition to the requirements of 9.5.2 above, the following is also required for manufacturer added chart and non-chart data.

Updating and removing Non-HO chart information <<Annex 8.7.2.2 & 8.7.2.3>>

Non-HO chart information may be updated by any systematic procedure. A record of updates must be maintained. The mariner must be able to remove all non-HO chart information if the need should arise.

Added non-chart information <Main 2.3.1.c.1 >>

All non-chart information added to the SENC by the manufacturer must use the following symbols, lines and areas:

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,

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

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

Added chart information << Main 2.3.1.c.2>>

All non-HO (non-ENC) chart information added to the SENC by the manufacturer must be symbolised in the same way as HO chart information and distinguished from HO chart information as described for the various cases below:

1.) 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 PresLib section 12 conditional symbology procedure DATCVR section 2.1.**

2.) 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.

3) 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."

9.6.11 Mariner's Navigational Objects << MAIN 2.3.1a >>

<< Text here in 9.6.8 might belong with text in section 9.5.6 >>

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.

Mariner's Information on the route monitoring display << MAIN 2.3.1b >>

In addition to the ability to enter manual chart corrections and to carry out route planning and route monitoring chartwork, the mariner must 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 S-101 Symbol Catalogue,

4 text notes.

Non-ENC chart information added by the mariner should be in normal chart colours, identified as described in section 9.5.1.

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.

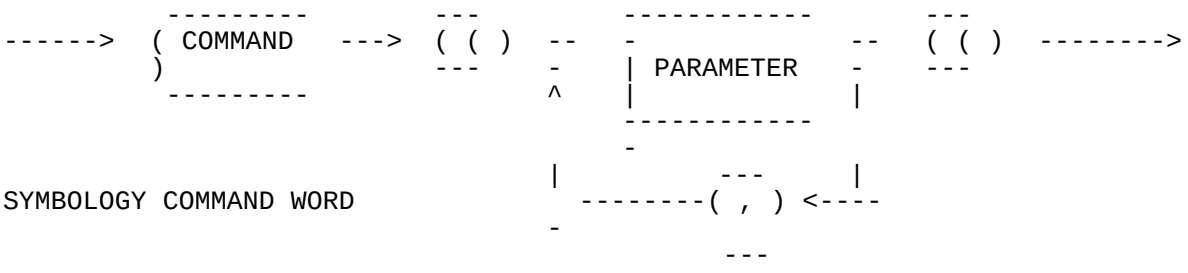
9.7 Symbology Instructions << ANNEX A, 7. Through ANNEX A, 7.1.2.2 >>

Symbology instructions are used in the look-up table entries to perform the symbolization of objects. Currently there is a choice of five symbology instructions:

SHOWTEXT to display text labels
SHOWPOINT to symbolize points and place symbols inside areas
SHOWLINE to symbolize lines and borders of areas
SHOWAREA to symbolize areas
CALLSYMPROC to call conditional symbology procedures

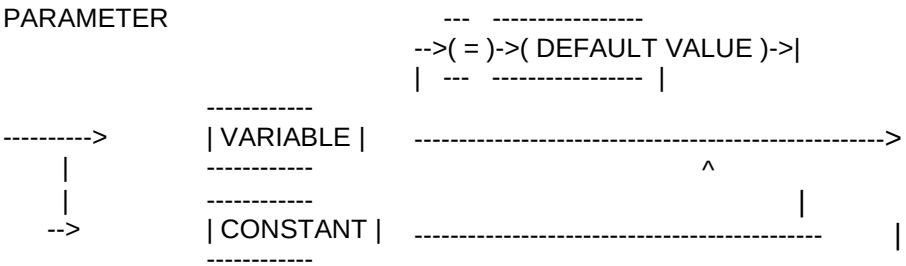
Symbology instructions are composed of symbology command words. Symbology command words are machine readable orders, which can be decoded in a straight forward manner to low level graphic actions e.g. an action like "fill an area" or "draw a line".
These symbology command words and the symbology instructions formed with them are also used in reading and when necessary revising the word-processed version of the Look-up tables.

The general definition of a symbology command word in Backus-Naur form is:



Symbology command words have parameters. The Backus-Naur definition above shows that such a command word can have more than one parameter separated by a comma. There are two types of parameters: constants and variables. Constant parameters pass fixed values like a colour or a line width on to the ECDIS Display Generator which then "knows" e.g. which colour to use to fill an area or which width to use to draw a line. A constant parameter may also be the name of a symbol that the ECDIS Display Generator then can look for in the symbol library.

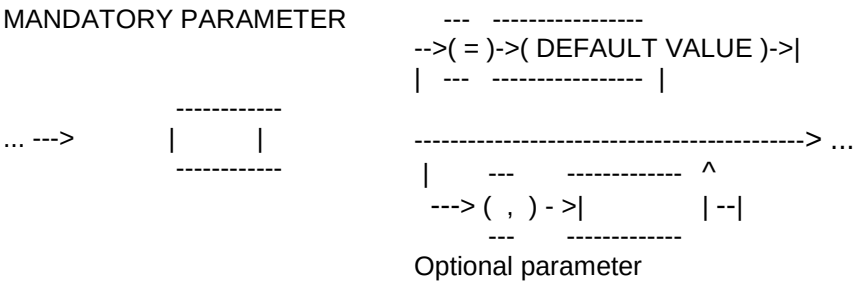
Variable parameters are the six character codes of S-57 attributes. This is a very powerful construction. For example, to rotate a "traffic arrow" symbol the name of the S-57 attribute that contains the traffic direction (ORIENT) is passed as rotation parameter of the "show pattern" command. The ECDIS Display Generator then searches in the SENC for the exact value of the ORIENT attribute of the respective object and rotates the arrow symbol by this value. Thus every time another object is shown by the command, different values from the attribute will be passed to the ECDIS Display Generator.



For example, «TSSLPT», «ORIENT», «SY(TSSLPT51,ORIENT) ...» means «orient symbol TSSLPT51 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.

A default value is assumed by the Display Generator if a parameter is optional (does not have to be passed). Thus the default value is given in the documentation where the command word is described and it must be encoded in the Display Generator. For an example, see the TRANSPARENCY parameter of the SHOWAREA instruction (section 7.4.6).
The symbology command must 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). Note that this does not necessarily 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.
Whether a parameter is optional or mandatory can be seen from the Backus-Naur diagram of the command word:



The following sections explain the symbology instructions.

9.7.1 Symbology Instruction for Text Labels

The text instruction was designed to provide a suitable text placement for ECDIS. It is used to label point, line and area objects.

Text labels are treated as individual symbols, which are not part of the symbol library but part of the S-57 data itself(value of Attribute 'OBJNAM' etc.). Thus text instructions do not call a certain symbol, complex line style or fill pattern but the respective text string within the definition of a feature object or cartographic object.

Note that the Presentation Library does not provide a machine readable version of a font, because there are copyrights on fonts. Manufacturers should purchase a font on their own. For ECDIS presentation, a plain sans serif, non italic font should be used. Other fonts should not be used.

Please also note, that sounding objects are not symbolized as text labels. The Presentation Library provides a set of symbols that were designed to present soundings. See section 12 for the diagram of the conditional symbology procedure "SNDFRMnn". Similarly, some abbreviations such as the "DW" and "IT" used in traffic routing areas are treated as symbols.

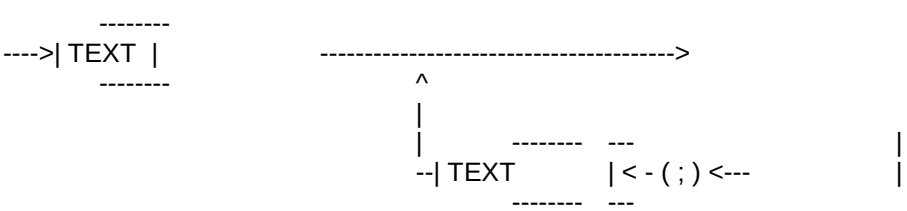
9.7.1.1 Rotation & Positioning of Text Labels

Text is not rotated. The pivot-point for text for an area object is the centre of the area. The pivot-point for text for a line is the centre of a single segment line. For a multi-segment-line the pivot-point is the mid-point of the run-length of the line.

If the text string is truncated by the ECDIS window, it can be left truncated, or alternatively it need not be drawn. If it relates to an object ahead of the ship, the display refresh will eventually permit a full draw.

9.7.1.2 Syntax of the SHOWTEXT Instruction << ANNEX A 7.1.2 >>

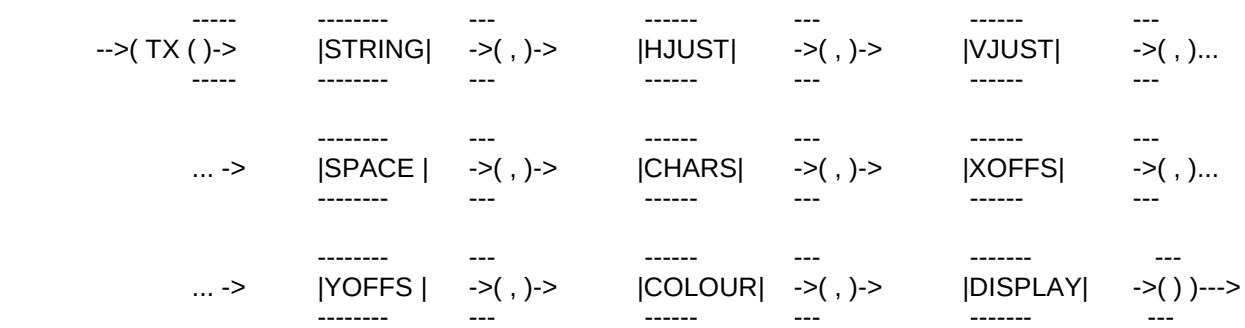
SHOWTEXT instruction (usage: point, line, area objects)



1. **TEXT** "show text" command word: << ANNEX A 7.1.2.1 >>

Two text command words are used:

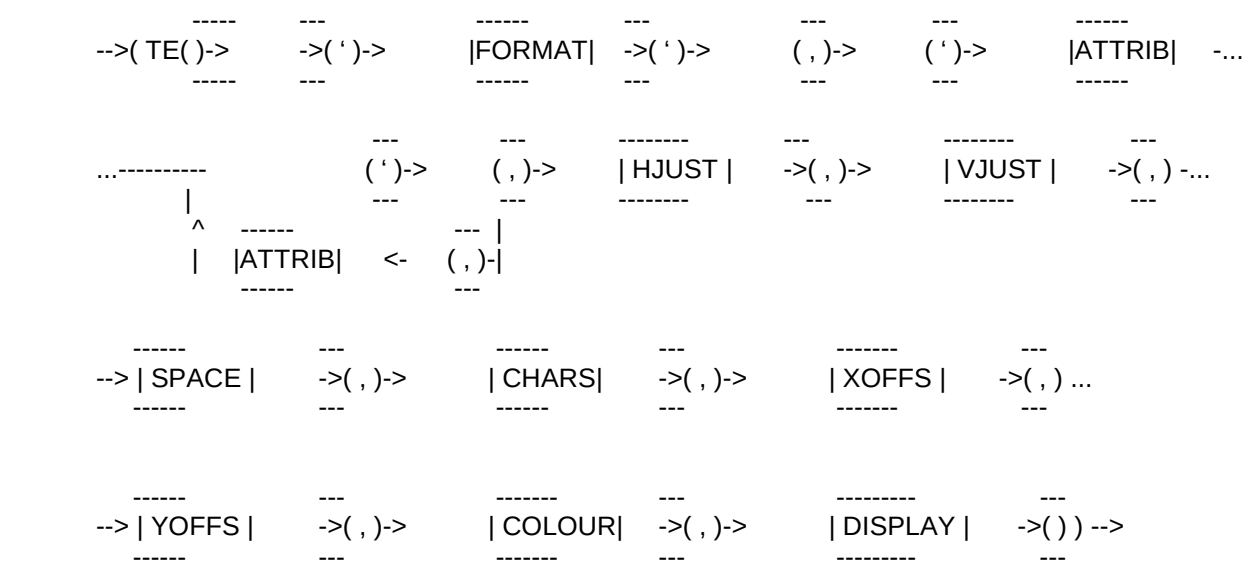
a.) For purely alphanumeric text, the «TX» command:



b.) For numeric text, an alphanumeric prefix or suffix is needed to avoid confusion between the numbers of the text and the numbers representing soundings. For this purpose the »C» format «TE» command is used. This substitutes «format» and «attribute list» parameters for the «string» parameter, but is otherwise the same as the «TX» command word. Other character strings, such as LITDSN, may be used in place of the attribute list in the Bachus-Naur diagram.

Where ‘/n’ is used in a «TE» command, each successive line should have the same justification (HJUST,VJUST) as the first line.

Section 7.1.4 describes how “TE” commands are handled in the look-up table. The alphanumeric prefixes and suffixes used, and the "C" format commands, are listed in section 13.4. The meanings of these prefixes and suffixes must be available to the mariner.



2. Parameters <<ANNEX A 7.1.2.2 >>

STRING "text string" parameter:

The STRING parameter passes a text string that shall appear on the ECDIS screen.

Note: the six character acronym of a S-57 attribute (e.g. ,LITVES, OBJNAM) can be passed as STRING parameter; if the attribute is either of enumeration type or list type (e.g. COLOUR), 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, just convert the attribute value to a string. In the case that the text originates in an L-type attribute (e.g. SBDARE, NATSUR) the text equivalent of the listed attribute values should be written sequentially separated by a space with no punctuation marks.

HJUST "horizontal justification" parameter:

'1' means CENTRE justified
(i.e. pivot point is located at the centre of the overall length of text string)

'2' means RIGHT justified
(i.e. pivot point is located at the right side of the last character of text string)

'3' means LEFT justified. This is the default value.
(i.e. pivot point is located at the left side of the first character of text string)

VJUST "vertical justification" parameter:

'1' means BOTTOM justified. This is the default value.
(i.e. the pivot point is located at the bottom line of the text string)
'2' means CENTRE justified
(i.e. the pivot point is located at the centre line of the text string)

'3' means TOP justified
(i.e. the pivot point is located at the top line of the text string)

SPACE "character spacing" parameter:

'1' means FIT spacing
(i.e. the text string should be expanded or condensed to fit between the first and the last position in a spatial object)

'2' means STANDARD spacing. This is the default value.
(i.e. the standard spacing in accordance with the typeface given in CHARS should be used)

'3' means STANDARD spacing with word wrap
(i.e. the standard spacing in accordance with the typeface given in CHARS should be used; text longer than 8 characters should be broken into separate lines)

CHARS "Character Specification" parameter:

the CHARS parameter defines style (font), weight, width (upright/italic), and size of the text characters:

STYLE
"1" a plain, sans serif font should be used.

WEIGHT
4 means "light"
5 means "medium". This is the default value.
6 means "bold"

WIDTH
"1" means upright i.e. non-italic, ENC $CHARS attributes using "2" for width should be converted to "1".

BODY SIZE
This 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 location 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 location 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 4 and 13.

DISPLAY "Text display" parameter:

define text groupings for selection by the mariner.

9.7.1.3 Display of Text << APPENIX A 7.1.3.1 >>

1. Text Groupings

The display of text should be controlled independently of the display of the object it applies to. The mariner should have full control over the display of text. All text is in the IMO Category "Other Information".

Text is in colour black, to give best readability under all light conditions.
Text should only be displayed when the object it applies to is displayed.
Text should always have display priority 8, to ensure it is readable, independent of the object it applies to.

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 manufacturer should provide at least the capability to select "Important Text" and/or "Other Text", and he may provide further text groupings if he so wishes.

The text groupings are given in section 13.3

2. How text is handled in the Look-up Table << ANNEX A, 7.1.4 >>

The existence of an attribute or other character string in a text command means that the command should be implemented whenever that attribute or character string exists, with a value, in the SENC object being symbolized. (But, remember that text is only written when selected by the mariner.)

If the attribute or character string named in a text command is not included in the SENC object, the text command should 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 should be disregarded; the other text command should be implemented.

9.7.2 Symbology Instruction for Point Objects

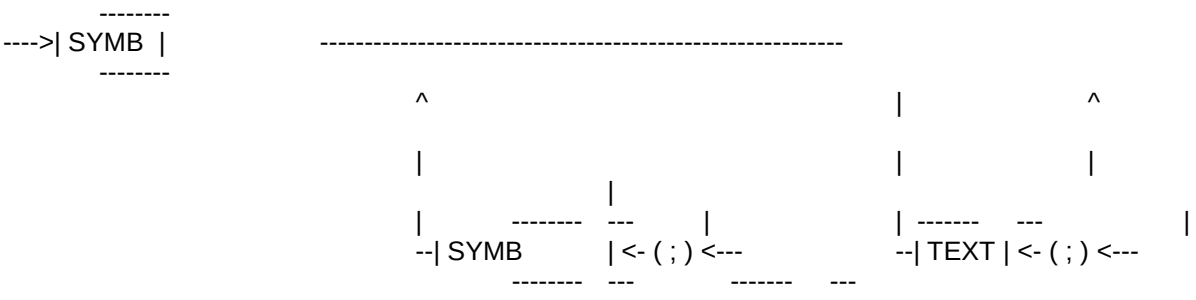
The SHOWPOINT instruction was designed to symbolize point objects. It gets a symbol from the symbol library, places the pivot point of the symbol (see 5.1) or text at the object's position, rotates the symbol if necessary and then displays symbol or text. Note that SHOWPOINT can handle more than one symbol and text at a time.

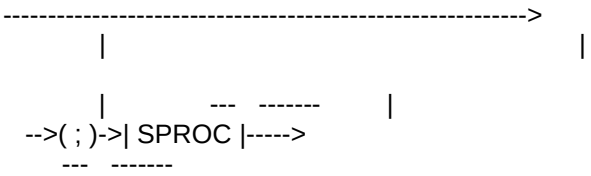
The Presentation Library provides look-up tables for simplified point symbols (intended primarily to provide smaller but more prominent buoy and beacon symbols, symbolized by function - lateral buoy etc.) and paper chart symbols (intended to convey shape).

The mariner should be given the option of choosing paper-chart or simplified symbols.

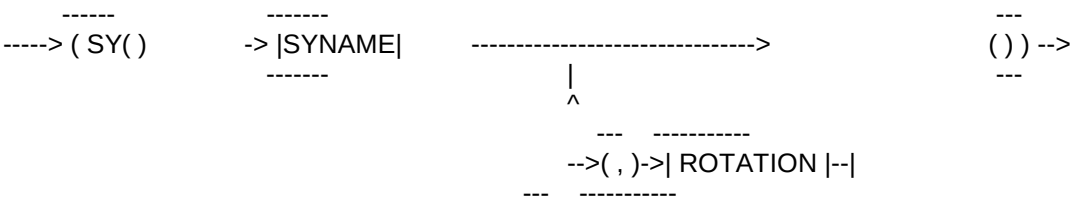
9.7.2.1 Syntax of the SHOWPOINT Instruction

SHOWPOINT instruction (usage: point objects)





9.7.2.2 SYMB ‘show symbol’ command word:



9.7.2.3 Parameters

.1 SYNAME "symbol name" parameter:

The symbol name is an 8 letter-code that is composed of a class code (6 letters) and a serial number (2 letters).

.2 ROTATION "symbol rotation" parameter:

.2.1 Symbols with no rotation should always be drawn upright with respect to the screen.

.2.2 Symbols with a rotation instruction should be rotated with respect to the top of the screen (-y axis in figure 2 of section 5.1). (See example below).

.2.3 Symbols rotated by means of the six-character code of an S-57 attribute such as ORIENT should be rotated with respect to true north.

.2.4 The symbol should be rotated about its pivot point. Rotation angle is in degrees clockwise from 0 to 360. The default value is 0 degrees."

9.7.2.4 Examples:

SY(BOYCAR01);SY(LIGHTS05,135) :

shows symbols 'BOYCAR01' and 'LIGHTS05' at the same location in the given sequence, rotate symbol 'LIGHTS05' by 135 degrees from upright.

9.7.3 Symbology Instruction for Line Objects

The SHOWLINE instruction was designed to symbolize line objects. It is also used within the SHOWAREA instruction to symbolize area boundaries. It uses a simple or complex line-style (see below) and may add a symbol or text. Note that SHOWLINE can handle more than one line-style at a time.

The pivot point of symbols or text should be the midpoint of the visible run-length of the line. If the symbol or text is truncated by the display window, it may be removed or it may remain truncated until screen refresh remedies the problem.

9.7.3.1 Line Styles

There are two types of line styles available: simple line styles and complex line styles. Complex line styles are composed from repeating symbols. A complex line style is transferred in a special line style module (see 10.7).

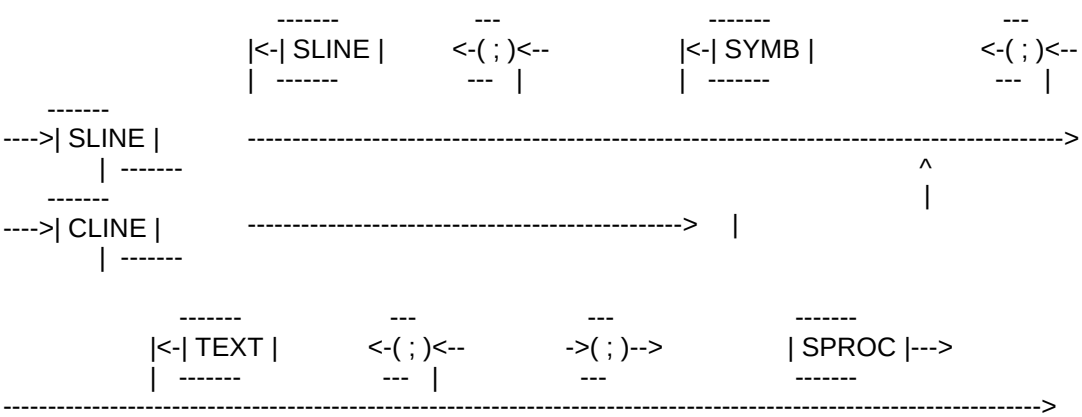
Simple line-styles are used to allow for a variety of basic line-styles without having them defined in the format of complex line-styles. Simple line-styles are based on a solid, dashed or dotted line that can be modified in width and colour. Because of their simplicity they can be 'hard'-coded in the ECDIS software and do not have to be transferred in a machine readable format. See 7.3.3 for simple linestyles.

9.7.3.2 Line Width

The line-width is given in units of the line-spacing (pixel size) specified in section 9 of S-52. This is currently 0.32 mm. If the pixel-diameter or line-spacing is grossly smaller, the line-width should be compensated by drawing the line in an appropriate width. If possible the "Display Generator" should smooth line ends with a width of more than 0.6 mm. Note that the given width of a line should never contain fewer pixels than at the standard display size and resolution specified in the C&S Specifications section 3.1.5.

9.7.3.3 Syntax of the SHOWLINE Instruction

SHOWLINE instruction (usage: line objects)



9.7.3.4 SLINE ‘show simple line style’ command word:

9.7.3.5 Parameters

PSTYLE "predefined line style" parameter:

'SOLD' (_____)
'DASH' (- - - - -) dash: 3.6 mm; space: 1.8 mm
'DOTT' (.....) dot: 0.6 mm; space: 1.2 mm

WIDTH "line spacing" parameter:

'1' x 0.32 mm <= WIDTH <= '8' x 0.32 mm;

line width is given in units of 0.32 mm pixel diameter or whatever size is required in section 8 of S-52.

COLOUR "line colour" parameter:

colour token as described in section 4 and 13.

CLINE "complex line style" command word:

LINNAME "line-style name" parameter:

The line-style name is an 8 letter-code that is composed from an object class code and a serial number (2 letters).

9.7.3.6 Examples:

LS(DASH,2,CHMGD)

dashed line in "chart magenta, dominant", 0.6 mm (2 x 0.3 mm) width.

LC(ACHARE51)

complex line-style defined for borders of anchorage areas.

9.7.4 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 should 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. Eventually, dynamic fill patterns whose density varies according to the size and shape of the area should be developed.

9.7.4.1 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. packice)
- 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.

9.7.4.2 Transparent Fill

A transparent fill can be achieved in two ways:

1.) with only a percentage of the pixels having the fill colour (stippled fill);
2.) by mixing the fill and underlying colour at each pixel, according to the fill percentage.

Since the second method is not easy to achieve and needs a true colour graphic, the simulation of real transparency by the first method is supported by the Presentation Library. That means e.g. 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.

The following explains the pseudo-transparency that can be achieved by this method:

* = pixel tinted in fill colour

O = pixel tinted in TRNSP (transparent)

*	*
*	*

opaque fill with 0% transparancey

transparency parameter = 0

*	*
*	O

25% transparency

Transparency parameter = 1

*	O
O	*

50% transparency

transparency parameter = 2

*	O
O	O

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.

9.7.4.3 Area Symbolization by a centred Symbol

1. Introduction

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 (see figure 4a).

2. Positioning centred symbols and text

A pivot point for centred symbols and text should 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, due to an offset built in by the Presentation Library, the whole of a symbol falls outside the area it applies to, it should not be drawn. If it overlaps the area boundary it should be drawn. Text may be allowed to extend beyond the boundary. The result should be that the mariner can clearly identify the area.

Fig. 4a - Centred symbol

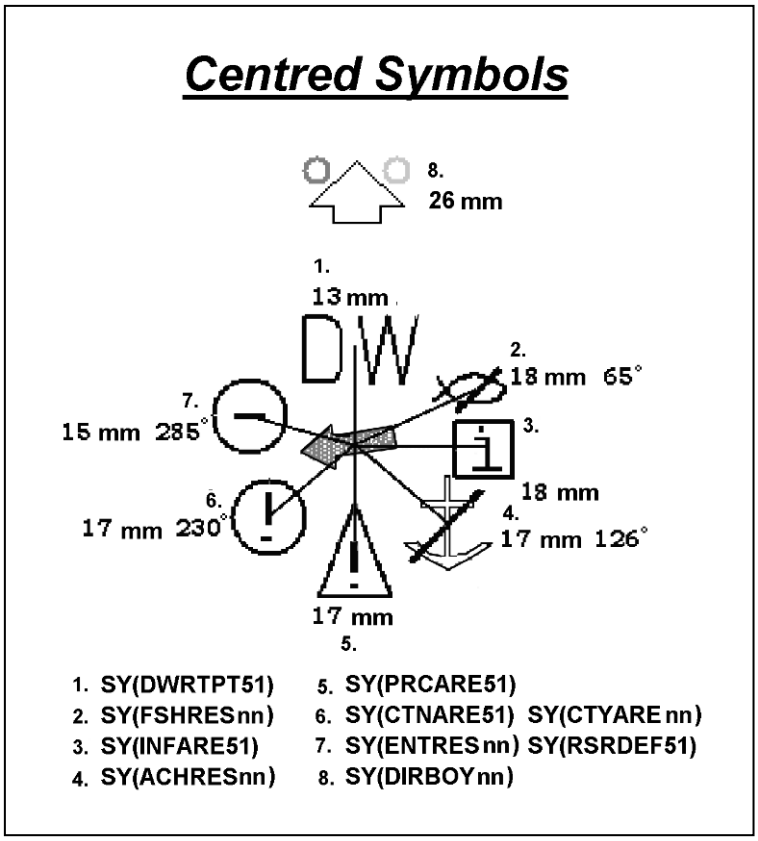
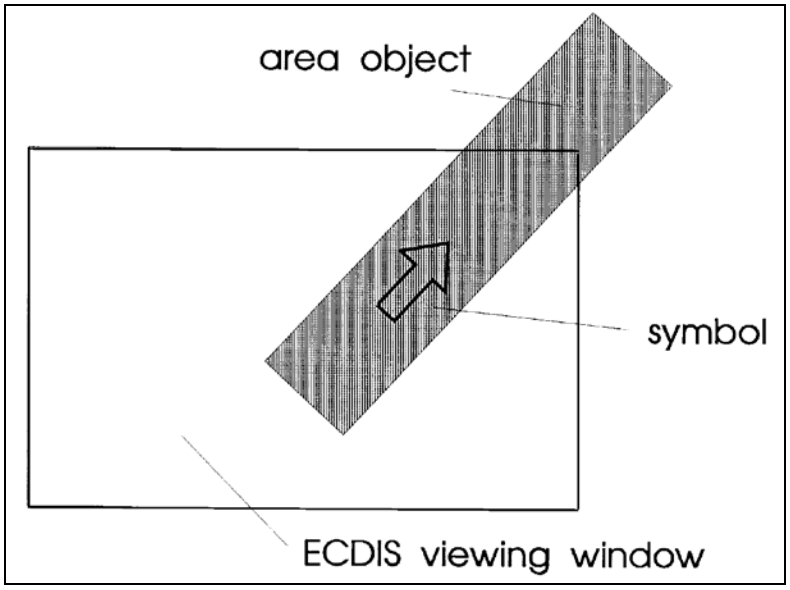


Fig. 4b - Centred symbol



A centred symbol should remain within the area even when the border of the display progressively truncates the area at each chart re-draw. If this is done by repeatedly re-calculating the centre of gravity (c of g) of the area, make sure the symbol remains within the area if this should be 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.

3. Centred symbols on a ship-centred display

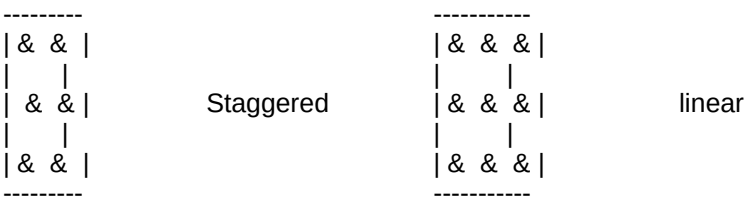
Some ECDIS draw a true-motion display which is updated frequently enough to keep own-ship close to the centre. If, when using this display mode, the situation arises that the display window lies completely within an area which is symbolised by centred symbols, these symbols will draw close to or under the own-ship symbol (having lower display priority) and will cause clutter and confusion. It is the responsibility of a manufacturer who uses a ship-centred display to avoid this potentially dangerous situation by keeping any centred area symbols at least 20 mm from the own-ship symbol.

9.7.4.4 Fill Patterns & Textures for areas

Fill patterns use widely spaced symbols, as 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 (see section 5 for further details).

Fill patterns may be either staggered or linear:



Ideally the symbols of a pattern fill should 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. But until simple, proven algorithms for variable symbol spacing are developed, the Presentation Library will use fixed spacing.

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

	Linear type with constant space = 0	|#|#|#| |#|#| |#|#|#|	staggered type with constant space = 0

|#| |#| |#| |#| |#| |#| |#| |#| |#|	Linear type with constant space > 0	|#| |#| |#| |#| |#| |#| |#| |#|	staggered type with constant space > 0

Linear type with variable spacing

|#| |#| |#| |#| |#| |#| |#| |#| |#|	minimum distance (small area / scale	|#| |#| |#| |#| |#| |#| |#| |#| |#|	maximum distance (large area / scale

Staggered type with variable spacing

|#| |#| |#| |#| |#| |#| |#| |#|	minimum distance (small area / scale	|#| |#| |#| |#| |#|	maximum distance (large area / scale

The vertical and horizontal distance between pattern symbols is given in the pattern definition (see section 10.5). 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.

The position where an area fill with a pattern symbol is started should preferably 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.

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 should never be done with an area texture (pattern of symbols, e.g., NODATA03, RCKLDG01, TSSJCT02, etc.)

9.7.4.5 Area Boundaries

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 that centred area symbols should still be used with symbolized boundaries to symbolize the case when the entire display window lies within an area.

The mariner should be given the option of using plain or symbolized boundaries. See also section 5.2 about the limitations of symbolized linestyles on curved boundaries.

2. Masked Lines

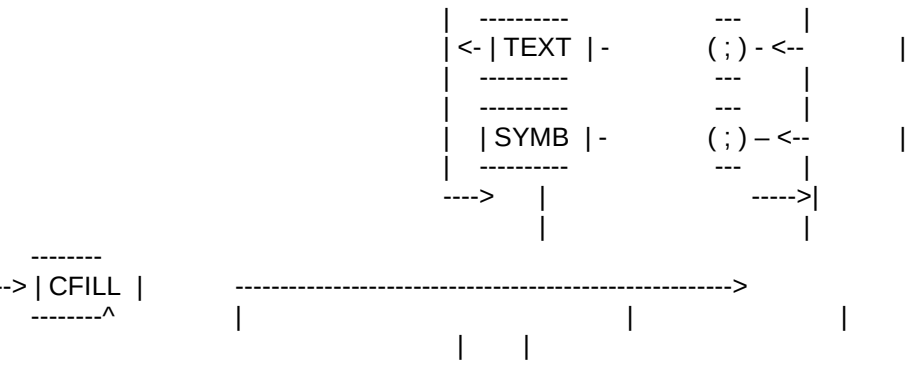
Masked lines (MASK subfield of FSPT field set to {1}) and cell boundary lines (edges encoded with [USAG] = {3}) should not be drawn."

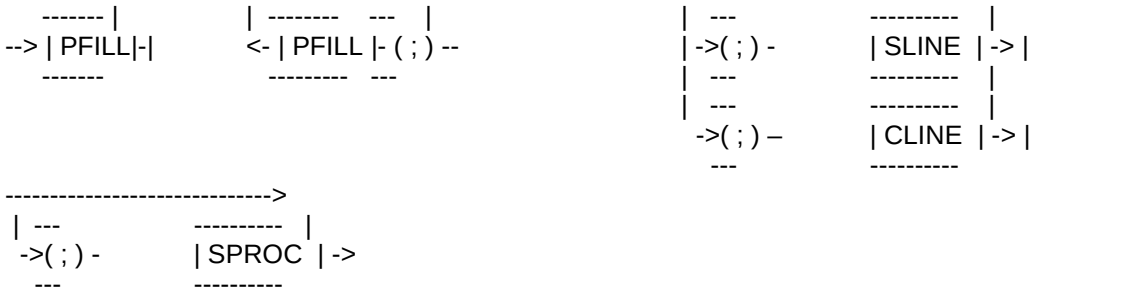
3. (Details of the above)

Note that if an area is filled with a colour or a pattern the borders must 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.

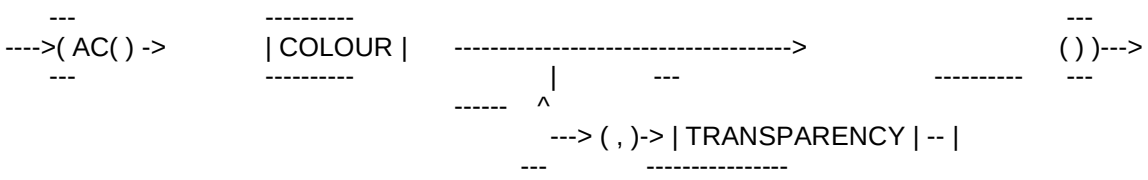
9.7.4.6 Syntax of the SHOWAREA Instruction

SHOWAREA instruction (usage: area objects)





9.7.4.7 CFILL 'colour fill' command word



9.7.4.8 Parameters

COLOUR "area colour" parameter: colour token as described in section 4 and 13.

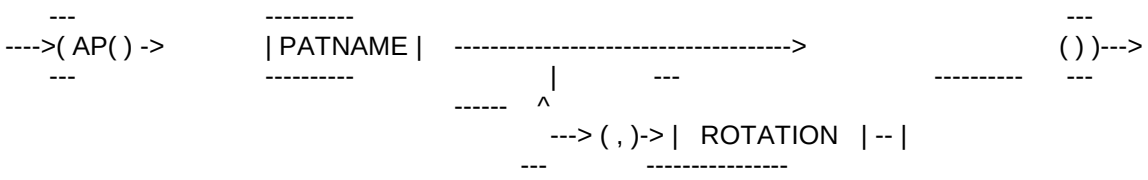
TRANSPARENCY "area transparency" parameter:

0 opaque (= default value)
1 25 % (3 of 4 pixels use COLOUR, 1 uses TRNSP)
2 50 % (2 of 4 pixels use COLOUR, 2 use TRNSP)
3 75 % (1 of 4 pixels use COLOUR, 3 use TRNSP)

Note: the TRANSPARENCY parameter is an optional part of the colour fill command; if it is not included, the command defaults to opaque fill.

Example: AC(CHMGF,3) means 25% magenta, 75% TRNSP

PFILL "pattern fill" command word:



PATNAME "pattern symbol name" parameter:

The pattern symbol name is an 8 letter-code which is composed of a class code (6 letters) and a serial number (2 letters).

ROTATION "pattern symbol rotation" parameter:

0 to 360 nautical degrees (clockwise, starting North);
default: 0 degree;

Note: the ROTATION parameter is optional; if a raster symbol is called the ROTATION parameter is ignored; the six character code of an S-57 attribute can be passed as ROTATION parameter.

The rotation function would operate on individual symbols of the pattern and not on the pattern as a whole. It is not in use at present.

9.7.4.9 Examples:

AC(CHBRN,0) or 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 in bathymetry’, no symbol rotation; bordered by a dashed line in 'chart grey , dominant', 0.6 mm width

SY(TSSLPT51,ORIENT);SY(DWRTPT02);CS(RESTRN01)

area with oriented centred traffic arrow; offset centred symbol «DW» symbol; and with whatever restriction symbol is required by conditional symbology procedure RESTRN01.

9.7.5 Calls to Conditional Symbology Procedures

9.7.5.1 The CALLSYMPROC instruction was designed to call a conditional symbology procedure.

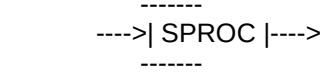
This call is used in two ways:
(1) As the sole instruction in field 3 of the look-up table.
In this case it does the symbolization and may change the values given in the look-up table (for the succeeding fields of that line, e.g., «LIGHTS», «CS(LIGHTS05)», «8», «O», «STANDARD», «27070».

(2) As the last command in a symbolization instruction.
In this case it may change the values in the succeeding fields of that line, as in case 1. In addition, it may add to or amend the symbolization instructions already given in the same field, e.g., «ACHARE», «», «SY(ACHARE51); LC(ACHARE51); CS(RESTRN01); «3», «S», «STANDARD», «26220»

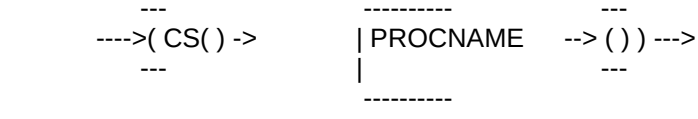
The placing of the CALLSYMPROC is shown in the Backus-Naur diagrams for the SHOWPOINT, SHOWLINE and SHOWAREA instructions.

9.7.5.2 Syntax of a Call to a Conditional Symbology Procedure

CALLSYMPROC instruction (usage: point, line, area objects)



SPROC "symbology procedure call" command word:



PROCNAME "symbology procedure name" parameter:

Conditional symbology procedures are named by the object class that is interpreted by the procedure. The name is an 8

letter-code that is composed of the class code (6 letters) and a serial number (2 letters)

Example:

CS(DEPARE02)

The symbology procedure no. 01 for objects of the class 'DEPARE' (depth area) is called.

9.8 The ECDIS Display Generator << ANNEX A, 8 >>

This section gives program designers some hints which details have to be taken into account while designing an ECDIS Display Generator. It will be amended as feedback from program designers will accumulate. It is recommended that designers study S-57 before reading this section since S-57 terminology and references to S-57 are used to wide extent.

9.8.1 Data Consistency Requirements

The quality of the presentation depends very much on the consistency of the data with respect to S-57. Thus ECDIS manufacturers should be aware of the consistency of the data that will be processed by their ECDIS Display Generator. Some criteria that are important:

Feature objects must be of an officially adopted object class. If feature objects are of proprietary non-ENC classes (i.e. not included in S-57 Product Specifications for ENC) they will be treated as members of unknown object classes. There will be no appropriate entry in the look-up tables but even in that case they must be presented on the ECDIS screen in accordance with 8.3.3.7a below. The occurrence of such an object should be recorded during transformation from ENC to SENC as an anomaly and the unknown objects should be displayed as by means of '?'-symbols.

In the perfect world, all mandatory attributes required by S-57 Appendix B1 «ENC Specification» would 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 the data may not always be available and the producer will code the attribute but omit the value to indicate it is 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). However, it is impossible to foresee all potential problems, and the possibility exists that an omitted mandatory attribute or missing mandatory attribute value may cause processing to hang up,, and/or unpredicted symbolization.

9.8.2 Display Generator Requirements << ANNEX 8.2 >>

To successfully use the Presentation Library make sure that the Display Generator is capable of:

- Detecting whether a point object is located inside or outside of any of the area objects of group 1 (earth's surface). Some conditional symbology procedures are based on this capability.
- Detecting whether two or more feature objects are referring to the same spatial object like an area, line or point. Duplicate spatial objects that are located at the same position and share the same extent (their coordinates are identical) should be treated as one. The relationship of a group of feature objects to one or a group of identical spatial objects is needed to derive the correct symbolization. For example, a depth contour and the two adjacent depth areas are referring to ("use") the same edge (or a set of identical edges) since the edge is part of the depth contour as well as part of the boundaries of the depth areas. Such a relationship should be derived from the data to allow for a decision by a conditional symbology procedure whether the contour is a safety contour.

9.9 IMO Presentation Instructions Not Handled by Look-up Tables <<ANNEX A, 8.5 >>

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. The manufacturer can achieve a correct presentation by handling these cases in his software individually. All symbols, line styles or fill pattern mentioned in the text are on the distribution CD. Note that this section will always be necessary, since nothing is perfect in our world.

9.9.1 Detecting the Safety Contour

IMO Performance Standards for ECDIS [3] requires that "ECDIS should give an alarm if the ship, within a specified time

set by the mariner, is going to cross the safety contour".

Note that the HO may not draw any contours round small isolated dangers. However conditional symbology procedure UDWHAZ identifies all rocks, wrecks and obstructions that require a safety contour, and the output of this procedure through calling procedures OBSTRN and WRECKS may be used in generating alarms. One object, LNDARE as a point (islet) or line (isthmus) is not covered by procedure UDWHAZ; it should be added to the safety contour detection process as a separate item.

9.9.2 Units of depths:

IMO PS [3] requires that units of depth be part of the display base. However S57 does not permit any other unit of depth than metres, and so it is no longer necessary to display the earlier symbols UNITFTH1 and UNITMTR1. These symbols are hereby removed from the PresLib.

9.9.3 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 (so that the mariner knows where to look for it), bottom justified and about 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. For both symbols the display priority is 9, over radar, category display base, viewing group 11030.

9.9.4 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. Display priority is 9; over radar; category display base, viewing group 11040.

9.9.5 Graticule:

If the ECDIS shows a graticule (IMO PS [3]) the lines should be one unit wide, CHBLK.

9.9.6 Display mode:

The ECDIS manufacturer should provide the indication of display mode required in the display base by IMO PS [3].

9.9.7 Night-time shallow water indicator:

If the entire water area on the display is of less depth than the safety contour, it will not be possible to detect this problem at night due to the small differences between the depth area shades. A faint lattice pattern DIAMOND1 is provided to distinguish shallow water at night (see conditional symbology procedure SEABEDnn). Display priority is 3, suppressed by radar, IMO category is standard and viewing group is 23010. This is not a required feature, but it is recommended that it be made available. The mariner should be given the option of whether he wishes to use the pattern (see section 12.2.18 conditional symbology procedure “SEABED”, last question).

9.10 Elements of Portrayal Register Model << ANNEX A 3. (except for 3.6) >>

<< The text below has been inserted as a place holder to show the elements of the PresLib that are discussed in S-52. This will have to be completely reworked to describe the new Portrayal Register and Portrayal Catalogue Concepts >>

THE ELEMENTS OF THE PRESENTATION LIBRARY - AN OVERVIEW

The Presentation Library consists currently of seven elements:

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

2. 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)

3. A colour coding scheme which includes the IHO colour tables for day and night time

4. A set of symbology command words from which machine readable instructions can be assembled. The result is a symbology instruction which in turn is processed to symbolize S-57 [7] objects.

5. A set of look-up tables that link object description from the SENC database to the appropriate symbology

instructions depending on whether:

a) 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) The link is conditional, i.e., depending on circumstances, for example a depth area, whose colour fill depends on the choice of the safety contour. In this case the look-up table refers the decision to a conditional symbology procedure that then selects the appropriate symbology instructions.

6. 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).

7. A catalogue of navigational object classes that comprise objects that the mariner may add to the chart in accordance with IEC 61174 [9], IEC 62288 [10] and that cannot be defined by means of S-57. (These are specified in Part II of the Presentation Library)

The following sections give a short description of the elements of the Presentation Library.

3.1 The Colour Coding Scheme

The Presentation Library uses a colour scheme, which classifies colours by their usage (see section 4). Each colour usage is represented by a token that is a five-letter code. 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. 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 4 on how to use colour tokens, section 10.4 on how colour tables are transferred in the digital version and section 13 for a listing of the colour coordinates. ECDIS manufacturers should also refer to section 4 of the Colour and Symbol Specifications (C&SS) [5] for details of the design and use of colours.

3.2 The Library of Symbols, Fill Styles and Line Styles

ECDIS manufacturers should also refer to section 3 of the C&SS [5] for details of the design and use of symbols, line & fill styles.

Symbols, area fill patterns and line styles are described in detail in the Symbol Library (section 14 and the Addendum). For edition 3.4, they are also supplied in a machine readable format on the digital file.

3.2.1 Symbols

The Presentation Library provides symbols for point objects which are generally based on the traditional paper chart symbols. In addition to buoy and beacon symbols based on the paper chart, it also provides a set of more compact but more visible 'simplified' buoy and beacon symbols for use under difficult viewing conditions.

See section 7.2 for symbology instructions and 10.6 for details of the digital format.

3.2.2 Fill Styles

The Presentation Library offers various ways to fill areas. They can be filled with an opaque colour; or 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 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 that centred symbols should still be used with symbolized boundaries to symbolize the case when the entire display window lies within an area.

See section 7.4 for symbology instructions and 10.5 for details of the digital format.

3.2.3 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 7.3 for symbology instructions and 10.7 for details of the digital format.

3.3 Symbology Instructions

The ECDIS picture is generated from symbology instructions. The symbology instructions are in turn assembled from a set of symbology command words which have been designed for the Presentation Library. Symbology command words are machine readable orders, which can be decoded in a straightforward manner to low level graphic actions that are performed by the ECDIS program to generate the ECDIS picture.

These symbology instructions are also used in the look-up table of the word-processed version.

Currently there are five types of symbology instructions:

- instructions for line objects
- instructions for area objects
- instructions for point objects
- instructions for text labels
- call to conditional symbology procedure

Symbology instructions are explained in section 7.

3.4 Conditional Symbology Procedures

The majority of objects can be presented in a straightforward manner: symbology instructions for lines, areas or symbols are used.

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 instruction. Thus decisions are made by the computer while it is creating the presentation of an object, which affect symbolization and perhaps also priority, radar flag, category, viewing group.
Further conditional symbology procedures will be used as future requirements arise for which conditional symbology gives the simplest or most effective solution.

The conditional Symbology Procedures are given in section 12.

3.5 The Look-Up Tables and other symbolizing instructions

3.5.1 The Look-Up Tables

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.

Due to the need for ECDIS to operate as a real-time navigation display, using an electronic display screen in place of the paper chart, a number of new symbols have been introduced. These identify the safety contour, no data areas, etc. In addition, a simplified and more visible set of buoy and beacon symbols have been developed for bad viewing conditions, such as bright sunlight or at night.

There are five look-up tables:
paper chart point symbols
simplified point symbols
line symbols
plain area boundary symbols
symbolized area boundary symbols

The manufacturer should allow the mariner to select freely between the two point symbol tables and the two area symbol tables. There should 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 code of the addressed object 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 processed by the Display Generator of the ECDIS system.

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 section 11 and in a machine readable format in the .DAI file of edition 3.3. See 8.3, 10.2 and section 11 for further details.

3.5.2 Extended Presentation Instructions which cannot be described by Look-Up Tables

Many display features cannot be handled by look-up tables, generally because they are not discrete 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 sections 8.5 through 8.8.

3.7 Catalogue of Mariners' Navigational Object Classes

IEC 61174 [9] and IEC 62288 [10], describes the Navigational Symbols required by Appendix 3 of the IMO Performance Standards for ECDIS. These symbols for which IEC is the authority represent non-chart objects which are not defined in S-57, e.g., a way point or a line of position. Thus, by agreement with the IEC, and to allow ECDIS manufacturers to handle navigation symbols by the same means as S-57 or chart objects, the Presentation Library includes as Part II a catalogue of navigational objects. As a result, a waypoint can be stored in the SENC and it will be presented on the ECDIS screen using symbols, line styles and fill styles of the Presentation Library. The symbology instruction suitable for a navigational object can be found in the look-up tables like the symbology instruction suitable for any S-57 object class.

Because navigational object classes are non-standard object classes, the class code is a lowercase 6 character acronym according to S-57. Therefore, they do not interfere with
S-57.

Please see Part II for further details and definitions of the mariners' navigational object classes.

9.11 Testing (S-58)

9.11.1 ECDIS Chart 1

<<Blend and shorten the two sections below >>
<<ANNEX A 3.6 >>
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 [2], is provided in section 15, 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 3.3. These provide symbol meaning, through cursor picking referring to the symbol descriptions given in the symbol library.

<< MAIN 3.1.4 >>
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.

9.11.2 Colour Test Diagram

<< Is this test procedure in IEC 61174 or somewhere else? >>
<<ANNEX A 3.6 >>
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 15.4 for the diagram and 19.4 for its use.

<< MAIN 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 a 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

C.9 Portrayal

C.9.1 Design Considerations <<Adapted from Main 2.1.1 & MAIN 2.1.2>>

The ECDIS display has been designed to be 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.
The diversity and flexibility of ECDIS

The range of information types that need to be portrayed on ECDIS has strongly influenced the manner in which the display has been organized. The different information types 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,
information from radar and other sensors,
information from AIS,
navigational indications and alarms generated by ECDIS,

Other information types, such as the following, may become part of the data portrayed on ECDIS in the future:
information from nautical publications
shiphandling options, based on ship's characteristics, alphanumeric navigation information (ship's latitude, longitude, heading, course, etc.),
telemetered information from shore authorities, (traffic, real-time tides etc.),
ice information,
reminders, (e.g. time to contact pilot station),
messages from other displays (e.g. alarm on engine room display).

The ECDIS display has also been designed with flexibility of presentation in mind, such as accommodating the following:
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 presentation requirements and techniques appropriate to ECDIS are likely to be developed in future.

C.9.2 General Colour Assignment for ECDIS Features <<Main 5.2.5 – Tbl 1>>

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.

C.9.3 DESCRIPTION OF THE COLOUR CODING SYSTEM << ANNEX A 4. >>

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 used by symbology instructions, symbols, line & fill styles and to enter the colour tables (see section 13) where the colours are identified by CIE-coordinates. The method of converting CIE colour coordinates into RGB values for a specific CRT is given in Annex B to the C&S Specifications [4]. The software for processing colour calibration observations, converting CIE to RGB colour coordinates, and verifying the results is described in section 19.2 and Annex B. ECDIS manufacturers should also refer to section 4 of the Colour and Symbol Specifications for details of the design and use of colours. The colours are designed to meet different conditions of illumination on the bridge.

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. Note that the number of tokens is currently limited to 64, to fit the architecture of present day computers.

Because user interfaces based on window systems will have a strong influence on the design of ECDIS-Systems, colours for the user interface are included in the colour scheme as well.

Changes to the CIE colour coordinates must be expected as experience accumulates; these should be relatively easy to handle. Changes to the organization of the scheme may also be required, but these will be avoided as far as possible. The colour definitions in CIE-coordinates as well as the usage of the colours are required. To handle changes to the colour values in a flexible way, the tables for the CIE-coordinates are attached to this publication in a separate section (see section 13).

C.9.3.1The Colour Scheme << ANNEX A 4.1 >>

This section explains the structure of the colour scheme and the usage of the colour tokens. Note that the colour values themselves are listed in the colour tables of section 13.

General Uses

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

Colour Section I / Chart Contents (31 uses)

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)

Colour Section II / Radar Image Overlay (3 uses)

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)

Radar Overlay

The radar image overlay can be generated by using either one intensity or a range of intensities of the radar colour. The colour for high echo intensity (RADHI) should be used in case you show only one intensity. If you prefer to show more than one echo intensity or fading target trails, the corresponding colour intensities should 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).

Transparent Radar

Optionally, the manufacturer may vary the radar green overlay by making it transparent. As described in section 7.4.2, there are two ways of doing this:

1) Use "pixel swap" transparency, as described in detail in section 7.4.2.

2) by mixing the fill and underlaying colour at each pixel to give a continuous transparency change from 0% to 100%. This must 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 must 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.

Colour Section III / Mariners' & Navigation Information (3 uses)

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)

This section provides colours for mariners' notes and navigation info. SCLBR is used to generate the scalebar. Hand entered chart corrections are marked by the colour CHCOR. Mariners' notes of any form (Symbols, Text) are generated using the colour NINFO.

Colour Section IV / Reserved for Special Requirements (7 uses)

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)
RES01	grey	(reserved for future use)
RES02	grey	(reserved for future use)
RES03	grey	(reserved for future use)

The colours of this section were originally reserved for future requirements. Some have since been assigned as indicted above.

Colour Section V / Ship symbol & Planned Route (5 uses)

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)

This section groups colours that apply to the ship symbol and objects associated to it. Own ship symbol, course over ground and speed over ground vector are shown in the colour SHIPS. The past track of the main position sensor and a secondary position sensor is 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.). The alternate route is shown in APLRT.

Colour Section VI / User Interface (11 uses)

Token	Colour,day/night	Usage
UIBCK	white/black	(background user interface components)
UIBDR	grey, dominant	(user interface border components)
UIAFD	medium/light blue	(dominant fill colour)
UIAFF	brown	(faint fill colour)
UINFD	black/white	(dominant textual information)
UINFF	grey	(faint textual information)
UINFR	red	(textual information)

UINFG - green (textual information)
UINFO - orange (textual information)
UINFB - blue (textual information)
UINFM - magenta (textual information)
Note: These colours are to be used whenever a user interface is on the same screen as the chart display.
Note: keep the use of UINFD to a minimum!

The following is advisory. The manufacturer is responsible for the design of the user interface panel, subject to the requirement in Colours and Symbols Specifications section 3.4.3 that "The colours, symbols and luminance of this user interface panel should not degrade the SENC information on the chart display".

This section is composed of eleven colour tokens to be used in coding information in the user interface area. The foreground and background colours have been selected with the intent of ensuring the visibility and legibility of information in this area and, at the same time, not distracting the mariner while viewing the chart. Thus, UIBCK is white in the light background colour sets and black in the dark background colour sets. This helps ensure the visibility of information in bright sunlight and helps maintain the mariner's dark adaptation at night. At the same time, it keeps average luminance in the two areas consistent. Large differences in brightness between the chart and the user interface area could be distracting to the mariner when viewing the chart. For the same reason, the amount of information in the user interface area should be keep to a minimum and excessive differences in luminance between the foreground and background should be avoided. Thus, UINFD should be used for limited important text information only.

To ensure legibility, alphanumerics should be between 24 and 30 minutes of arc at the viewer's eye. The use of the UINFR (red) and UINFB (blue) tokens should be avoided for large amounts of text especially under low ambient illumination. The use of colours that vary widely across the spectrum can be fatiguing because of the need to constantly refocus when switching between them. In addition, the eye is less sensitive to red in low ambient illumination. In general, the use of several different colours, several different fonts, and excessive highlighting should be avoided because these practices can interfere with human processing of information.

The user interface area should have a border, especially at night to delineate it from the chart area. The use of a solid line, 3 pixels wide, in UIBOR is recommended. Note that the selection of colours for the user interface area and the guidelines given above are likely to change as experience accumulates.

For further information on the design of visual interfaces, the following articles are recommended:

1. HFS (1988). American National Standard for Human Factors Engineering of Visual Display Terminal Workstations. ANSI/HFS 100-1988. Santa Monica, CA: The Human Factors Society Inc.

2. Mullet, K. and Sano, D. (1995). Designing Visual Interfaces. Mountain View, CA: SunSoft Press.

3. Post, D. L. (1992). Applied color vision research. In H. Widdel and D. L. Post (Eds.), Color in Electronic Displays, (pp. 137-174). New York, NY: Plenum Press.

4. Walraven, J. (1992). Color basics for the display designer. In H. Widdel and D. L. Post (Eds.), Color in Electronic Displays. (pp. 3-38). New York, NY: Plenum Press.

4.2.1 General Uses

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

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 was 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.

4.2.2 Colour Section I / Chart Contents

The colours in this section are designed for chart display. The selection of the colours is a compromise between minimum bitplane consumption (5 bits) and flexibility for future changes in the colour composition. Some colours can be used in general, others are reserved for specific types of feature purposes.

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 was 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 should 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** should be used. At night it may be difficult to distinguish between **DEPMD** and **DEPDW**.

C.9.4 Colour Tables << ANNEX A, 13.1 >>

The following colour tables have been designed for different conditions of ambient illumination on the bridge. There are 63 colours in these tables. With the addition of the transparent colour (TRNSP) there are 64 colour tokens.

DAY Colour Table

Token	Colour	X	Y	Luminance	
NODTA	grey	0.2800	0.3100	40.000	
CURSR	orange	0.5000	0.4000	32.000	
CHBLK	black	0.2800	0.3100	0.000	
CHGRD	grey	0.2800	0.3100	10.000	
CHGRF	grey	0.2800	0.3100	25.000	
CHRED	red	0.4800	0.3000	25.000	
CHGRN	green	0.3100	0.5600	60.000	
CHYLW	yellow	0.4100	0.4900	70.000	
CHMGD	magenta		0.3000	0.1700	20.000
CHMGF	magenta		0.2800	0.2400	48.000
CHBRN	brown	0.3900	0.4300	30.000	
CHWHT	white	0.2800	0.3100	80.000	
SCLBR	orange	0.5000	0.4000	32.000	
CHCOR	orange	0.5000	0.4000	32.000	
LITRD	red	0.4800	0.3000	25.000	
LITGN	green	0.3100	0.5600	60.000	
LITYW	yellow	0.4100	0.4900	70.000	
ISDNG	magenta		0.3000	0.1700	20.000
DNGHL	red	0.4800	0.3000	25.000	
TRFCD	magenta		0.3000	0.1700	20.000
TRFCF	magenta		0.2800	0.2400	48.000
LANDA	brown	0.3500	0.3900	50.000	
LANDF	brown	0.4500	0.4200	15.000	
CSTLN	grey	0.2800	0.3100	10.000	
SNDG1	grey	0.2800	0.3100	25.000	
SNDG2	black	0.2800	0.3100	0.000	
DEPSC	grey	0.2800	0.3100	10.000	
DEPCN	grey	0.2800	0.3100	25.000	
DEPDW	white	0.2800	0.3100	80.000	
DEPMD	pale_blue		0.2600	0.2900	65.000
DEPMS	light_blue		0.2300	0.2500	55.000
DEPVS	medium_blue		0.2100	0.2200	45.000
DEPIT	yellow-green		0.2600	0.3600	35.000
RADHI	green	0.3100	0.5600	60.000	
RADLO	green	0.3100	0.5600	20.000	
ARPAT	blue-green		0.2600	0.4200	30.000
NINFO	orange	0.5000	0.4000	32.000	
RESBL	blue	0.1800	0.1500	22.000	
ADINF	yellow	0.4100	0.4900	35.000	
RESGR	grey	0.2800	0.3100	25.000	
SHIPS	black	0.2800	0.3100	0.000	
PSTRK	black	0.2800	0.3100	0.000	
SYTRK	grey	0.2800	0.3100	25.000	
PLRTE	red	0.5800	0.3500	18.000	
APLRT	orange	0.5000	0.4000	32.000	
UINFD	black	0.2800	0.3100	0.000	
UINFF	grey	0.2800	0.3100	10.000	
UIBCK	white	0.2800	0.3100	80.000	
UIAFD	medium_blue		0.2100	0.2200	45.000
UINFR	red	0.4800	0.3000	25.000	
UINFG	green	0.3100	0.5600	60.000	
UINFO	orange	0.5000	0.4000	32.000	
UINFB	blue	0.1800	0.1500	22.000	
UINFM	magenta		0.3000	0.1700	20.000
UIBDR	grey	0.2800	0.3100	10.000	
UIAFF	brown	0.3500	0.3900	50.000	
OUTLW	black	0.2800	0.3100	0.000	
OUTLL	brown	0.4500	0.4200	15.000	
RES01	grey	0.2800	0.3100	25.000	

RES02	grey	0.2800	0.3100	25.000
RES03	grey	0.2800	0.3100	25.000
BKAJ1	grey	0.2800	0.3100	0.600
BKAJ2	grey	0.2800	0.3100	1.600

DUSK Colour Table

Token	Colour	X	Y	Luminance	
NODTA	grey	0.2800	0.3100	7.000	
CURSR	orange	0.5000	0.4000	10.000	
CHBLK	grey	0.2800	0.3100	20.000	
CHGRD	grey	0.2800	0.3100	20.000	
CHGRF	grey	0.2800	0.3100	10.000	
CHRED	red	0.4800	0.3000	10.000	
CHGRN	green	0.3100	0.5600	20.000	
CHYLW	yellow	0.4100	0.4900	24.000	
CHMGD	magenta		0.2800	0.2400	18.000
CHMGF	magenta		0.3000	0.1700	7.000
CHBRN	brown	0.3900	0.4300	8.000	
CHWHT	white	0.2800	0.3100	36.000	
SCLBR	orange	0.5000	0.4000	10.000	
CHCOR	orange	0.5000	0.4000	10.000	
LITRD	red	0.4800	0.3000	10.000	
LITGN	green	0.3100	0.5600	20.000	
LITYW	yellow	0.4100	0.4900	24.000	
ISDNG	magenta		0.2800	0.2400	18.000
DNGHL	red	0.4800	0.3000	10.000	
TRFCD	magenta		0.2800	0.2400	18.000
TRFCF	magenta		0.3000	0.1700	7.000
LANDA	brown	0.3500	0.3900	5.000	
LANDF	brown	0.4500	0.4200	12.000	
CSTLN	grey	0.2800	0.3100	20.000	
SNDG1	grey	0.2800	0.3100	10.000	
SNDG2	white	0.2800	0.3100	36.000	
DEPSC	grey	0.2800	0.3100	20.000	
DEPCN	grey	0.2800	0.3100	10.000	
DEPDW	black	0.2800	0.3100	0.000	
DEPMD	dark_blue		0.2500	0.2900	1.000
DEPMS	medium_blue		0.2300	0.2500	3.000
DEPVS	light_blue		0.2100	0.2200	5.000
DEPIT	yellow-green		0.2600	0.3600	6.000
RADHI	green	0.3100	0.5600	20.000	
RADLO	green	0.3100	0.5600	7.000	
ARPAT	green	0.2600	0.4200	17.000	
NINFO	orange	0.5000	0.4000	10.000	
RESBL	blue	0.1800	0.1500	10.000	
ADINF	yellow	0.4100	0.4900	12.000	
RESGR	grey	0.2800	0.3100	20.000	
SHIPS	white	0.2800	0.3100	36.000	
PSTRK	white	0.2800	0.3100	36.000	
SYTRK	grey	0.2800	0.3100	10.000	
PLRTE	red	0.5800	0.3500	8.000	
APLRT	orange	0.5000	0.4000	10.000	
UINFD	white	0.2800	0.3100	36.000	
UINFF	grey	0.2800	0.3100	20.000	
UIBCK	black	0.2800	0.3100	0.000	
UIAFD	light_blue		0.2100	0.2200	5.000
UINFR	red	0.4800	0.3000	10.000	
UINFG	green	0.3100	0.5600	20.000	
UINFO	orange	0.5000	0.4000	10.000	
UINFB	blue	0.1800	0.1500	10.000	
UINFM	magenta		0.2800	0.2400	18.000

UIBDR	grey	0.2800	0.3100	20.000
UIAFF	brown	0.4500	0.4200	12.000
OUTLW	black	0.2800	0.3100	0.000
OUTLL	brown	0.3500	0.3900	5.000
RES01	grey	0.2800	0.3100	10.000
RES02	grey	0.2800	0.3100	10.000
RES03	grey	0.2800	0.3100	10.000
BKAJ1	black	0.2800	0.3100	0.000
BKAJ2	grey	0.2800	0.3100	0.720

NIGHT Colour Table

Token	Colour	X	Y	Luminance	
NODTA	grey	0.2800	0.3100	1.200	
CURSR	orange	0.5000	0.4000	1.250	
CHBLK	grey	0.2800	0.3100	2.500	
CHGRD	grey	0.2800	0.3100	2.500	
CHGRF	grey	0.2800	0.3100	1.250	
CHRED	red	0.4800	0.3000	1.250	
CHGRN	green	0.3100	0.5600	2.500	
CHYLW	yellow	0.4100	0.4900	3.000	
CHMGD	magenta		0.3000	0.1700	2.000
CHMGF	magenta		0.3000	0.1700	2.000
CHBRN	brown	0.3900	0.4300	1.300	
CHWHT	white	0.2800	0.3100	5.000	
SCLBR	orange	0.5000	0.4000	1.250	
CHCOR	orange	0.5000	0.4000	1.250	
LITRD	red	0.4800	0.3000	1.250	
LITGN	green	0.3100	0.5600	2.500	
LITYW	yellow	0.4100	0.4900	3.000	
ISDNG	magenta		0.3000	0.1700	2.000
DNGHL	red	0.4800	0.3000	1.250	
TRFCD	magenta		0.3000	0.1700	2.000
TRFCF	magenta		0.3000	0.1700	2.000
LANDA	brown	0.3500	0.3900	0.800	
LANDF	brown	0.4500	0.4200	1.600	
CSTLN	grey	0.2800	0.3100	2.500	
SNDG1	grey	0.2800	0.3100	1.250	
SNDG2	white	0.2800	0.3100	5.000	
DEPSC	grey	0.2800	0.3100	2.500	
DEPCN	grey	0.2800	0.3100	1.250	
DEPDW	black	0.2800	0.3100	0.000	
DEPMD	dark_blue		0.2500	0.2900	0.200
DEPMS	medium-blue		0.2300	0.2500	0.400
DEPVS	light-blue		0.2100	0.2200	0.800
DEPIT	yellow-green		0.2600	0.3600	1.200
RADHI	green	0.3100	0.5600	2.500	
RADLO	green	0.3100	0.5600	0.800	
ARPAT	blue-green		0.2600	0.4200	1.750
NINFO	orange	0.5000	0.4000	1.250	
RESBL	blue	0.1800	0.1500	1.250	
ADINF	yellow	0.4100	0.4900	1.500	
RESGR	grey	0.2800	0.3100	1.250	
SHIPS	white	0.2800	0.3100	5.000	
PSTRK	white	0.2800	0.3100	5.000	
SYTRK	grey	0.2800	0.3100	1.250	
PLRTE	red	0.5800	0.3500	0.900	
APLRT	orange	0.5000	0.4000	1.250	
UINFD	white	0.2800	0.3100	5.000	
UINFF	grey	0.2800	0.3100	2.500	
UIBCK	black	0.2800	0.3100	0.000	
UIAFD	light-blue		0.2100	0.2200	0.800

UINFR	red	0.4800	0.3000	1.250	
UINFG	green	0.3100	0.5600	2.500	
UINFO	orange	0.5000	0.4000	1.250	
UINFB	blue	0.1800	0.1500	1.250	
UINFM	magenta		0.3000	0.1700	2.000
UIBDR	grey	0.2800	0.3100	2.500	
UIAFF	brown	0.4500	0.4200	3.200	
OUTLW		black	0.2800	0.3100	0.000
OUTLL	brown	0.3500	0.3900	0.800	
RES01	grey	0.2800	0.3100	1.250	
RES02	grey	0.2800	0.3100	1.250	
RES03	grey	0.2800	0.3100	1.250	
BKAJ1	black	0.2800	0.3100	0.000	
BKAJ2	grey	0.2800	0.3100	0.100	

C.9.5 Alphabetical List of Colour Tokens << MAIN, 5.2.5, Tbl 3 >>

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.
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.