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RTCM RECOMMENDED STANDARDS

FOR

ELECTRONIC CHART SYSTEMS (ECS)

Version 3.0

DEVELOPED BY
RTCM SPECIAL COMMITTEE NO. 109

AUGUST 26, 2002

Radio Technical Commission For Maritime Services
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CLASS OF VESSEL

I II III **1.0 SCOPE**

This standard specifies the RTCM recommended minimum requirements for Electronic Chart Systems (ECS). In order to better define requirements applicable to various classes of vessels operating in a variety of areas, certain parameters herein contain more than a single "standard" option. In effect, three very general classes of vessels have been identified: 'I' represents larger vessels; 'II' represents smaller vessels primarily operating in coastal waters or inland waterways; and 'III' represents vessels not covered in I or II. In addition, some special requirements are identified from the IMO Performance Standards for ECDIS for use of a class I ECS as a back-up arrangement for ECDIS. An annotation is made in the left margin to indicate which class(es) of vessel(s) is being referenced. Users, manufacturers, and regulatory authorities thus have a means of differentiating between the needs of various vessels.

I II III **2.0 DEFINITIONS**

2.1 Electronic Chart System (ECS). A navigation information system that electronically displays vessel position and relevant nautical chart data and information from the ECS Database on a display screen, but does not meet all the IMO requirements for an Electronic Chart Display and Information System (ECDIS).

2.2 ECS Database. The database, standardized as to content, quality and updating, issued for use with an ECS.

2.3 Working Database. A database, separate from or in addition to the ECS Database, containing additions, changes and updates to the ECS Database.

2.4 Standard Display. The ECS Database content, the navigational elements, and other display items that must be displayed under certain prescribed circumstances.

2.5 Operating Mode. Any mode of the ECS in which the system is in service and monitoring selected navigation information, whether or not it is displayed on the display screen. This includes alphanumeric display modes, menu modes, and modes where the operator can select or adjust settings.

2.5.1 Planning Mode. An ECS operating mode in which the electronic chart area displayed is determined by the operator for the purposes of looking ahead, studying and planning the intended route and viewing navigational notes.

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2.5.2 Navigation Mode. An ECS operating mode in which the electronic chart area displayed is determined by the vessel's present position. In this mode the vessel's position is always on the display for all levels of electronic chart display resolution (zoom).

2.6 Non-operating Mode. An ECS may make diagnostic and initial configuration modes available while the system is not in service or monitoring navigation information.

2.7 Electronic Chart Display Resolution. Depiction of detail, represented by the smallest distance apart at which two objects can be seen to be separate, depending on the pixel size, i.e., the size represented by a pixel, in meters on the ground, of the ECS Database as represented on the display device.

2.8 ECS Database Resolution. The resolution in meters on the ground of the ECS Database.

2.9 Vector Data Presentation. Method of representing individual chart features digitally by points, lines, polygons and text given through their coordinates, attributes and appropriate code(s).

2.10 Raster Data Presentation. Method of representing all, or part, of a chart digitally by a matrix-like scheme of pixels or grid points.

2.11 Nautical Chart or Nautical Publication. A special-purpose map or book, or a specially compiled database from which such a map or book is derived, that is issued officially by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution and is designed to meet the requirements of marine navigation.

2.12 True Motion Display. A display in which own ship and other dynamic data such as radar targets move with own true motion, while the position of all charted information remains fixed.

2.13 Relative Motion Display. A display in which own ship remains stationary, while all charted information and dynamic data such as radar targets move relative to own ship's position.

2.14 Operator Action. An operator action shall be achieved by hard-key soft-key or voice actuation, including any necessary cursor movement.

2.15 Conspicuous Features. Objects, either natural or artificial, that are distinctly and notably visible.

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2.16 Electronic Chart Display and Information System (ECDIS). A navigation information system which, with adequate backup arrangements, can be accepted as complying with the up-to-date chart required by regulation V/20 of the 1974 SOLAS Convention,[1] by displaying selected information from a System Electronic Navigational Chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and by displaying additional navigation-related information.

2.17 Electronic Navigational Chart (ENC) means the database, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized Hydrographic Offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation. The content, structure and format of the ENC are specified in IHO Special Publication No. 57, including the associated ENC product specification.

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

2.19 Raster Chart Display System (RCDS) means an ECDIS displaying Raster Navigational Charts (RNCs) with positional information from navigation sensors to assist the mariner in route planning and route monitoring and, if required, display additional navigation-related information.

2.20 Raster Navigational Chart (RNC) means a facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized hydrographic office. RNC is used in these standards to mean either a single chart or a collection of charts. The content, structure and format of the RNC are specified in IHO Special Publication No. 61.

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

[1] It should be noted that the 2000 revision of SOLAS chapter V enters into force 1 July 2002. This revision includes changes affecting the numbering of regulations. The new regulation affecting ECDIS is V/19.

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				3.0 GENERAL REQUIREMENTS
				3.1 International Standard IEC 60945
				Except where there is a conflicting requirement in this standard, the ECS shall meet the following requirements of IEC 60945. (See 15.3)
I	II	III	.1	Clause 4.1 - General
I	II		.2	Clause 4.2 - Design and Operation
I	II		.3	Clause 4.3 - Power supply
I	II	III	.4	Clause 4.4 - Durability and resistance to environmental conditions
I	II	III	.5	Clause 4.5 - Interference
I	II	III	.6	Clause 4.6 - Safety precautions
I	II	III	.7	Clause 4.7 - Maintenance
I	II	III	.8	Clause 4.8 - Equipment manuals
I	II		.9	Clause 4.9 - Marking and identification
I				Note: When used as back-up arrangements for ECDIS, the ECS shall also meet the applicable requirements IEC 61174.
				3.2 Diagnostics
I	II	III		3.2.1 Equipment shall be designed with either manual or automatic self-test of major hardware and software functions. Information may be provided by the manufacturer to aid the diagnosing of faults. (See 15.8.9.1)
I	II			3.2.2 Prior to presenting data on the screen, the ECS shall employ diagnostic and error checking routines to ensure that the ECS Database(s) and updates, and additions made by the operator, are correctly stored within the ECS. (See 15.5.4, 15.5.6, 15.5.7)
				3.3 Power Source
I	II			The ECS shall have a primary power source. This requirement for a "primary power" source does not imply a requirement for a "secondary power" source.
I	II			3.3.1 If primary power to the ECS equipment is interrupted for a period of 45 seconds or less, the ECS shall resume operation automatically without operator intervention other than restoring power. When operation resumes, all settings, routes, destinations, zoom levels and screen displays shall be as they were before power loss, with the exception of items that are influenced by external inputs that may have changed. (See 15.9.3.1 and 15.9.3.3)

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I II 3.3.2 If a secondary power source is present and primary power to the ECS is interrupted, warning shall be given to the operator. (See 15.9.3.2)

Note: When used as back-up arrangements for ECDIS, the primary power source for the ECS should be supplied by an emergency electrical power source that is different than the primary power source for the ECDIS.

4.0 DISPLAY OF INFORMATION

* Indicates part of the Standard Display. The Standard Display consists of the minimum ECS Database content listed in Section 4.1.1, the navigational elements listed in Section 4.2.2 and the other display items listed in Section 4.2.5.

I II III 4.1 Chart Display

The ECS shall display Nautical Chart or Nautical Publication information, and updates thereto, from the ECS Database without any degradation of information content in a manner clearly distinguishable from other displayed information.

4.1.1 The ECS shall be capable of displaying at least the following minimum ECS Database content, when available, regardless of the format of the ECS Database: (See 15.5.1, 15.5.2, 15.8.1.2)

Note: All elements contained in a raster format ECS Database are part of the Standard Display.

4.1.1.1 Information above and below the High Water Line

* .1 At least one depth contour from the ECS Database.

.2 All depth contours up to and including a depth of 50 meters.

.3 All spot soundings up to and including a depth of 50 meters.

* .4 Indication of all isolated dangers with a depth less than 50 meters (or with depth unknown, when considered dangerous to surface navigation), for example: wrecks, rocks, obstructions, offshore platforms, breakers, etc.

.5 Details of all isolated dangers with a depth less than 50 meters (or with depth unknown, when considered dangerous to surface navigation), for example: wrecks, rocks, obstructions, offshore platforms, breakers, etc.

.6 Navigable canals, navigable rivers.

* .7 Boundaries, for example: fairways, channels dredged areas and swept areas.

.8 Drying Line.

* .9 Coastline.

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* .10 Bridges, overhead pipelines and cables with horizontal and vertical clearances over navigable water.

4.1.1.2 Navigation Aids

* .1 Indication of all fixed and floating aids to navigation.

.2 Details of all fixed and floating aids to navigation including, navigation markings and numbers.

.3 Navigation lines.

* .4 Traffic Routing Systems and Separation Schemes.

.5 Recommended routes.

.6 Conspicuous features.

4.1.1.3 Other Features

.1 Submarine cables and pipelines.

.2 Areas for which special conditions exist such as;

a) Anchorage areas.

* b) Anchorage prohibited areas

* c) Restricted areas, for example: cautionary areas, prohibited areas, fishing prohibited areas, areas to be avoided.

d) Regulated areas, for example: fishing grounds, offshore production areas, dumping areas.

* e) Military practice areas.

f) International boundaries and national limits.

.3 Ferry Routes.

.4 Nature of the seabed, for example: sand, mud, rocks, sponge, etc.

4.1.1.4 Textual Information

* .1 Indication of cautionary notes relating to safety of navigation.

.2 Contents of cautionary notes relating to safety of navigation.

.3 Place names.

4.1.1.5 Metadata

.1 ECS Database producer and identification of the source Nautical Chart. (See 15.5.2)

.2 Date the ECS Database is current through. (See 5.1 and 15.5.2)

.3 The horizontal geodetic datum and the offset to WGS84.

.4 Sounding Datum and Vertical Datum.

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* .5 Scale boundaries or database resolution boundaries, if different. (See 15.8.3.3)

.6 Suitability of the ECS Database for a specific intended navigational purpose[2], based upon the scale and positional accuracy of the source data and the reproduction accuracy, to notify the user that the ECS Database is suitable for use in conjunction with a continuous positioning system of an accuracy consistent with the requirements of safe navigation, as follows:

Navigational Purpose	Scale of Source Data	Horizontal Tolerance of ECS Database
Can be used in restricted waters	≥ 1:20,000	≤ 10 meters
Can be used to approach a harbour	≥ 1:50,000	≤ 50 meters
Can be used for coastal navigation	≥ 1:100,000	≤ 100 meters
Should not be used in conjunction with a continuous positioning system for the above navigational purposes	N/A	> 100 meters

4.1.1.6 Other Information

.1 Horizontal units of measurement (See 15.7.1.1.2)

* .2 Vertical units of measurement (depth and height). (See 15.7.1.2.1 and 15.7.1.2.2)

4.1.2 It shall be possible to present the Standard Display from any operating mode by a simple procedure consisting of no more than two operator actions. (See 15.8.1.1)

4.1.3 When power is applied to the system, the ECS shall display the Standard Display in the Navigation mode at the best ECS Database Resolution for the displayed area surrounding own ship's position, except as provided for in Section 3.3. (See 15.8.1.2)

4.1.4 It may be possible for the operator to add and remove selectively from the Standard Display any categories of information without limit or restriction. An indication shall be provided when the display contains less than the Standard Display. (See 15.8.2.3)

4.2 Navigational Elements

I II 4.2.1 In Planning mode it shall be possible to display: (See 15.9.1.2)

.1 Planned route

[2] It should be realized that modern navigation systems (e.g., differential GPS) might offer a more accurate position than that of the source data from which the ECS Database is derived.

.2 Operator controlled cursor
.3 Waypoint

4.2.2 In Navigation mode it shall be possible to display: (See 15.8.1.2, 15.9.2.2)

I	II	III	*	.1	Own ship
I				.2	Position and time (e.g., DR, EP and fix)
I	II	III	*	.3	Past track
I				.4	Time labels along ship's track
I	II		*	.5	Planned route (if more than one route can be displayed, the selected route shall be clearly distinguishable from other planned routes)
I				.6	Planned course and speed to make good
I	II	III		.7	Operator controlled cursor
I				.8	Electronic bearing line (EBL)
I				.9	Variable range marker (VRM)
I	II			.10	Waypoint
I	II	III		.11	Course and speed over ground vector
I	II	III		.12	Mark (e.g., hazard or clearing line, event, position line, rising/dipping range, wheel-over-point, etc.)
I	II			.13	Ship's heading (if connected to heading reference equipment)
I	II			.14	Vessel tracking symbol (if connected to vessel tracking equipment)
I	II			.15	Annotated mark (e.g., text, tidal stream or current vector, distance to run, planned position with time, etc.)

4.2.3 The ECS shall have the ability to display the following measured, calculated or provided alphanumeric data: (See 15.7.1.2 and 15.7.1.3)

I	II	III		.1 Ship Latitude/Longitude	LAT/LON
I	II	III		.2 Speed-over-ground	SOG
I	II	III		.3 Course-over-ground	COG
I	II			.4 Distance to waypoint (from own-ship)	DTW
I	II			.5 Bearing to waypoint (from own-ship)	BTW
I	II			.6 Cursor range (from own-ship)	RNG
I	II			.7 Cursor bearing (from own-ship)	BRG
I	II			.8 Cross-track-distance (left/right of intended track)	XTD
I	II	III		.9 Datum shift or datum name	DLAT/DLON
I	II	III		.10 Position sensor correction	dLAT/dLON
I	II	III		.11 Magnetic variation	VAR

I II III 4.2.4 Required units. The ECS shall use the following units for display of information:

.1 Position – latitude and longitude in degrees, minutes and decimal minutes (See 15.7.1.1.1)

.2 Distance – nautical miles, statute miles, kilometers, yards, feet or meters (See 15.7.1.1.2)

.3 Speed – knots or miles per hour (See 15.7.1.1.3)

.4 Time – hours, minutes and seconds (See 15.7.1.1.4)

.5 Direction – degrees (See 15.7.1.1.5)

.6 Depth/elevation – meters, fathoms or feet (See 15.7.1.1.6)

4.2.5 Other display items. The ECS shall be capable of displaying at least the following in the Planning and Navigation modes: (See 15.8.1.2)

I II III * .1 Chart scale bar or screen range (See 15.8.3.4)

I II III * .2 Orientation and direction of North, if other than North-up (See 15.8.4.1)

I II III * .3 If different from WGS84, horizontal geodetic datum and an indication if a datum adjustment is applied (See 6.2.3 and 15.7.1.2)

I II III * .4 Indication if own-ship position adjustments are applied (See 15.8.6.4)

5.0 PROVISION AND CORRECTION OF ECS DATABASE

I II 5.1 The ECS Database in use shall contain the date to which it is current, including Notices to Mariners that have been applied. (See 4.1.1.5.2 and 15.5.2)

5.2 Chart Updating

I 5.2.1 The ECS shall provide the capability to edit the Working Database or provide a means for the operator to replace the entire ECS Database, or portions thereof, to ensure that the ECS Database is up-to-date for the intended voyage. When a means for manual editing of the Working Database is provided, these edits must be: (See 15.5.3, 15.8.8.1, 15.8.8.2, 15.8.8.3 and 15.8.8.4)

.1 Legible and not reduce the legibility of the surrounding navigable area

.2 Stored separately from the ECS Database

.3 Verifiable and distinguishable from the displayed ECS Database information.

I II 5.2.2 At a minimum the ECS shall provide a means for the operator to mark objects for further reference to the paper chart, or to text describing the change involved. (See 15.8.2.1 and 15.8.2.2)

II III 5.2.3 The ECS shall provide a means for the operator to replace the entire ECS Database, or portions thereof, as provided by the ECS Database manufacturer. (See 15.5.3)

6.0 MESSAGES AND WARNINGS

6.1 The ECS shall provide messages, which may be in the form of text or other indications on the screen that alert the operator but do not require an acknowledgement. At a minimum, the following messages shall be displayed: (See 15.8.9.3)

I	II	III	.1	Display resolution is smaller than the ECS Database resolution for the area (over-zoom condition or magnified) (See 15.8.3.1)
I	II		.2	In an area covered by multiple resolution data, better resolution data is available in the ECS Database (See 15.8.3.2 and 15.8.3.5)
I	II		.3	Indication of the operating mode (i.e. Planning or Navigation) (See 15.9.1.1 and 15.9.2.1)
I	II		.4	Screen display is less than the Standard Display (See 15.8.2.3)
I	II		.5	ECS Database resolution has changed automatically (See 15.8.3.6)

6.2 The ECS shall provide warnings in the form of acoustic alarms[3] and visual indications for the following conditions and require an operator acknowledgement:

I	II	III	.1	Loss of valid positioning data (See 15.8.6.2, 15.8.6.3)
I	II		.2	Off-course deviation limits are reached (See 15.9.2.2.4)
I	II	III	.3	The ECS Database is not referenced to WGS-84 and a datum adjustment has not been applied (See 4.2.5.3 and 15.6.1.2)
I	II	III	.4	Loss of valid data from external equipment (See 15.8.6.2, 15.8.6.3 and 15.8.9.2)
I	II		.5	When a secondary power source is connected to the ECS and primary power has been interrupted (See 15.9.3.2)

The ECS Manufacturer may provide the operator with means to reset an acoustic alarm after it sounds.

I II III 6.3 When the horizontal geodetic datum of the ECS Database is unknown, or other appropriate datum adjustment has not been applied, the ECS shall provide a warning that the ECS Database should not be used in conjunction with a continuous position-fixing system. (See 15.6.1.2)

7.0 DISPLAY OF ADDITIONAL INFORMATION

I II III 7.1 If additional information is added to the ECS display, it shall match the reference system, projection, orientation and resolution of the existing display and shall be clearly distinguishable from the ECS Database information. Such additional information shall also match the true/relative motion presentation of the ECS display. (See 15.8.2.1, 15.8.2.2, 15.8.7.1)

[3] Class III is exempt from the requirement for an acoustic alarm.

I II III 7.2 Radar information may be added to the ECS display. Radar information may include the radar image and radar track data. When radar information is displayed, the ECS shall provide for the following: (See 15.8.2.1, 15.8.2.2 and 15.8.7.5)

.1 The radar reference point and the own-ship position from the position sensor shall be adjustable to a common reference point or to match the radar image to the ECS Database presentation. Any offset shall be clearly indicated. (See 15.8.7.2 and 15.8.7.3)

.2 The capability shall be provided for the operator to remove the radar image and/or the vessel tracking data from the ECS display by a simple operator procedure consisting of no more than two operator actions. (See 15.8.7.4)

I II 7.3 Information from an Automatic Identification System (AIS) may be added to the ECS display. (See 15.8.2.1 and 15.8.2.2)

8.0 DISPLAY PRESENTATION MODES

I II III 8.1 It shall be possible to display the ECS Database in north-up orientation. Other orientations are permitted. (See 15.8.4.1)

8.2 True/Relative Motion Display

I 8.2.1 An ECS shall provide for true motion displays. Additional display modes are permitted. (See 15.8.4.3)

II III 8.2.2 An ECS shall provide for either true or relative motion display. Additional display modes are permitted. (See 15.8.4.2 and 15.8.4.3)

I II III 8.2.3 When true-motion is in use in the Navigation mode, screen redraw shall take place automatically, at a distance from the border of the display,as determined by the mariner. (See 15.8.4.3)

I 8.2.4 It shall be possible to manually change the chart area. (See 15.8.4.4)

I 8.2.5 When true-motion is in use in the Navigation mode, it shall be possible to change the position of own ship relative to the edge of the display. (See 15.8.4.3)

I II III 8.3 Refresh of the Standard Display in Navigation mode shall take less than 5 seconds. Demands by the mariner that cannot be predicted by the ECS, such as display at a different resolution or in a different area may take more than 5 seconds. (See 15.5.5)

9.0 DISPLAYS

I II 9.1 The ECS display shall have a color display. Displayed information shall be clearly visible to an observer, in the conditions of light normally experienced on a vessel by day and by night. (See 15.7.2.2)

.1 The ECS shall have, at a minimum, the capability to represent ECS Database vector data using either the IHO recommended colors and symbols for ECDIS or the symbology associated with the source paper Nautical Chart of the area.

Note: When used as back-up arrangements for ECDIS, the ECS shall have the capability to represent ECS Database vector data using the IHO recommended colors and symbols for ECDIS and navigational elements and parameters using the IEC colors and symbols.

.2 If the ECS uses colors and symbols to represent ECS Database vector data that differ from the IHO recommended colors and symbols or the source paper Nautical Chart of the area, a legend of colors and symbols shall be provided.

.3 If the ECS uses colors and symbols to represent navigational elements and parameters that differ from the IEC recommended colors and symbols, a legend of colors and symbols shall be provided.

.4 Additional windows on the ECS display shall use clearly visible colors, which do not detract from the ECS display.

III 9.2 The ECS display may be either color or monochrome. Displayed information shall be clearly visible to an observer, in the conditions of light normally experienced on the bridge of a ship by day and by night. (See 15.7.2.2)

10.0 SCREEN REQUIREMENT

10.1 Character/Symbol Display Height.

I 10.1.1 The ECS shall be capable of displaying symbols, including alphanumeric characters, with a minimum height of 3.0 mm for vector data. (See 9.1.1, 9.1.2 and 15.7.2.3)

Note: When used as back-up arrangements for ECDIS, the ECS shall have the capability to represent ECS Database vector data, including alphanumeric characters, using the IHO recommended colors and symbols for ECDIS and navigational elements and parameters using the IEC colors and symbols.

II 10.1.2 The ECS shall be capable of displaying symbols, including alphanumeric characters, with a minimum height of 2.5 mm for vector data. (See 15.7.2.3)

Note: Raster character/symbol heights are determined by the source data.

I II III 10.2 Image Aspect Ratio. The aspect ratio of the image displayed on the screen shall be 1:1, such that shapes are correctly proportioned. (See 15.7.2.5)

I II III 10.3 The ECS shall be capable of displaying the ECS Database at an Electronic Chart Display Resolution consistent with the ECS Database Resolution. (See 15.7.2.6, 15.8.1.2)

10.4 Display Screen Requirements. There are five categories of display screens with minimun viewable areas as follows:

A. 460 mm (18.1 in) - diagonal measurement with 1024 x 768 pixels (See 15.7.2.4.1)

B. 380 mm (15.0 in) - diagonal measurement with 800 x 600 pixels (See 15.7.2.4.2)

C. 300 mm (11.8 in) - diagonal measurement with 800 x 600 pixels (See 15.7.2.4.3)

D. 240 mm (9.4 in) - diagonal measurement with 640 x 480 pixels (See 15.7.2.4.4)

E. 125 mm (4.9 in) - diagonal measurement with 320 x 234 pixels (See 15.7.2.4.5)

The ECS shall have a viewable area meeting minimum requirements as follows:

I .1 Category C

Note: When used as back-up arrangements for ECDIS, the ECS shall be capable of providing a usable screen area of 270 mm by 270 mm (Category A) for the ECS Database presentation to meet the applicable requirements of IEC 61174.

II .2 Category D

III .3 Category E

11.0 MODES OF OPERATION

11.1 The ECS shall have a Planning mode.

I II 11.1.1 The Planning mode is used by the operator to study the chart and plan routes. Any area of the ECS Database may be viewed at various levels of zoom. (See 15.9.1)

I II 11.1.2 ECS shall provide the capability for the operator to plan route using rhumb line or great circle. (See 15.9.1.2)

I II 11.1.3 ECS shall provide the capability for the operator to construct and modify routes for use in planned voyages. (See 15.9.1.2)

I II 11.1.4 The capability shall be provided to construct routes that consist of both single waypoints (direct destination) and multiple waypoints. It shall be possible to adjust a planned route by, for example: (See 15.9.1.2)

.1 Adding waypoints to a route;

.2 Deleting waypoints from a route;

.3 Changing the position of a waypoint;

I II 11.1.5 Provision may be made for the operator to specify a limit of deviation from the selected route. (See 6.2.1, 15.9.1.2, 15.9.2.2.4)

I II 11.1.6 If the ECS provides for the manual entry of geographic coordinates, provision may be made to display those coordinates transformed to the datum in use. The precision of the entered data should be preserved for use in navigation calculations. (See 15.8.5.2)

I 11.1.7 The ECS will accept a planned route by transfer from a route-planning device using the Recommended Minimum Sentences (RTE and WPL) from the IEC 61162-1 standard. (See 15.9.1.3)

11.2 The ECS shall have a Navigation mode. (See 15.9.2)

I II III 11.2.1 In the Navigation mode the ECS shall continuously plot the ship's position. (See 15.9.2.2.1, 15.9.2.2.2, 15.9.2.2.3)

I II III 11.2.2 It shall be possible to return to the Navigation mode from any other operating mode by a simple procedure consisting of no more than two operator actions. (See 15.8.6.5)

I II III 11.2.3 In the Navigation mode the ECS shall be capable of employing at least 75% of the usable screen area for the ECS Database presentation. (See 15.7.2.1)

Note: When used as back-up arrangements for ECDIS, the ECS shall be capable of providing a viewable area of 270 mm by 270 mm for the ECS Database presentation to meet the applicable requirements of IEC 61174.

I II III 11.2.4 In the Navigation mode, any windows containing text, diagrams, etc. superimposed over the presentation of ECS Database shall be moveable or temporary. This means that the window can be moved to a less important part of the display, such as on land, or removed from the display. (See 15.9.2.3)

11.3 Electronic Position Fixing System (EPFS)

I II III 11.3.1 The ECS shall accept information from navigation sensors according to the IEC 61162-1 standard.

I II .1 At a minimum, the ECS shall accept the GGA or GNS, GLL, DTM, ZDA, and VTG sentences, as appropriate for external equipment. (See 15.9.2.2.2)

Note: When used as back-up arrangements for ECDIS, the ECS shall also accept the HDT or HDM sentence, as appropriate for external equipment.

III .2 At a minimum, the ECS shall accept the GLL and VTG, or RMA and RMB, or RMB and RMC sentences, as appropriate for external equipment. (See 15.9.2.2.3)

II III 11.3.2 If an EPFS receiver is built-in, an external interface is not required. (No test is required.)

I II III 11.3.3 The ECS shall be capable of processing position input data every 2 seconds at a minimum. The latency between data input and screen-display shall be less than 1 second. (See 15.8.6.1)

Note: The one second latency for display of position is additive to the time required for redraw of the display. (See 8.3)

I II III 11.3.4 If the ECS Database is not referenced to WGS 84 and the datum or datum shift is known, the ECS shall accommodate differences between the datum of the ECS Database and the datum of the positioning system. At a minimum the ECS shall either:

.1 Accept and apply a delta-latitude/longitude to correct for datum shifts between the ECS Database, electronic position fix and other input data containing positional information (See 15.6.1.1), or

.2 Provide a means for the operator to select location data from the display in either the ECS Database datum or the positioning system datum (See 15.8.5.1)

I II 11.3.5 To compensate for positioning system errors, provision may be made for the operator to manually adjust the ship's position. This adjustment is in addition to, and separate from, the datum correction. (See 15.8.6.4)

11.4 Track Recording.

I .1 The ECS shall provide the ability to store and display past track of at least one point every 60 seconds for a minimum of 12 hours with at least one point every 4 hours thereafter. The ECS shall provide sufficient storage capacity for a voyage of 3 months duration. The ECS shall also provide the capability to preserve such data to removable media. The ECS shall not have the capability to manipulate or change the recorded information. (See 15.9.2.2.5)

II .2 The ECS shall provide the ability to store and display past track of at least one point every 60 seconds or 0.1 mile for a minimum of 60 minutes or 6 miles of data. The ECS shall also provide the capability to preserve such data to removable media. The ECS shall not have the capability to manipulate or change the recorded information. (See 15.9.2.2.6)

I II III 11.5 ECS shall provide the ability for the operator to display the coordinates of a selected position or feature on demand. (See 15.8.5.1)

12.0 CALCULATIONS

I II III The accuracy of all calculations performed by the ECS shall be independent of the characteristics of the output device and shall be consistent with the accuracy of the ECS Database. (See 15.6.2)

I II III 12.1 Distance and bearing calculations shall be on the reference ellipsoid associated with the datum in use. (See 15.6.2.1, 15.6.2.5)

I 12.1.1 The ECS shall provide the capability to perform both rhumb line and great circle calculations. (See 15.6.2.5)

I II III 12.2 Distances measured on the display between displayed features or selected points should have an accuracy no less than that afforded by the resolution of the display. (See 15.6.2.1)

I II III 12.3 Latitude/longitude to screen X-Y: The end points of lines displayed on the display screen, the result of locating waypoints or of calculations, shall be located with an accuracy of one pixel for all levels of zoom. (See 15.6.2.3)

I II III 12.4 Screen X-Y to latitude/longitude: Locations of points-of-interest taken from the screen display (using a cursor) shall be accurate to the Electronic Chart Display Resolution in meters. (See 15.6.2.4)

13.0 ECS DATABASE

I II III The contents of the ECS Database are provided in Appendix B.

I II 13.1 The ECS shall indicate when information from the Nautical Chart or Nautical Publication in the ECS Database in use is altered or supplemented by information from other sources. (See 15.5.4)

Note: When used as back-up arrangements for ECDIS, the ECS shall meet the applicable database requirements specified in IEC 61174.

I II 14.0 CONNECTIONS WITH OTHER EQUIPMENT

The ECS should not degrade the performance of any equipment providing sensor inputs. Nor should the connection of optional equipment degrade the performance of ECS below this standard. (See 15.2)

15.0 TEST STANDARDS

I II III The tests specified in this Recommended Standard are defined as "performance checks" as required by IEC 60945. Performance checks are operational checks to determine that facilities provided for operational use of equipment are adequate.

I II III 15.1 Installation and Technical Documentation

15.1.1 The equipment under test (EUT) shall be installed in compliance with the manufacturers' installation manual.

15.1.2 Where the EUT is divided (e.g., route planning on one display and route monitoring on the other) the entire configuration shall be tested together.

15.1.3 The manufacturers shall provide sufficient information and documentation for the EUT to be installed, understood and operated.

I II 15.2 Interfaces

For EUT that accept positioning information from navigation receivers tests may be performed using a stimulator with internal or interfaced equipment or a simulator that transmits data using the IEC 61162-1 standard. During testing, digital signals shall be input into the EUT that contain at a minimum the position, time of position and speed over ground of the own ship. Signals may also be provided as necessary to represent radar returns appropriate to the equipment and the position of the ship. No connection of optional equipment shall degrade the performance of the EUT below this standard. (14.0)

I II III 15.3 Environmental

All the general requirements of IEC 60945 appropriate to its environmental category, i.e. "protected from the weather", shall be carried out. The manufacturers shall declare any preconditioning required before environmental checks. (3.1)

15.4 Test Preparation

I II III 15.4.1 Power Up

The installed EUT shall be powered up in accordance with the manufacturers' recommended procedures. Signal generators shall be activated in a coherent manner to represent a stationary ship at the position selected. All the necessary selections to configure the EUT for the test environment shall be undertaken in accordance with the manufacturers' recommendations and settings.

I II III 15.4.2 Required test items

For these tests the manufacturer's ECS Test Database shall be used.

15.5 ECS Database

I II III 15.5.1 Load the ECS Database and observe that it contains the minimum required data elements. (4.1.1)

I II 15.5.2 Check that the source and currency date of the ECS Database coverage is available. (4.1.1.5.1, 4.1.1.5.2, 5.1)

I II III 15.5.3 Load different ECS Database coverage and ensure that the chart coverage has changed. (5.2.1, 5.2.3)

I II 15.5.4 Add supplemental information from a source other than a Nautical Chart or Nautical Publication to an ECS Database and ensure an indication of the addition is provided. (3.2.2, 13.1)

I II III 15.5.5 Observe that each refresh of the Standard Display is completed in less than 5 seconds. (8.3)

I II 15.5.6 Load an example of a corrupted ECS Database. Verify that the EUT provides a warning to the operator.

I II 15.5.7 Enter an example of a corrupted update to an ECS Database. Verify that the EUT provides a warning to the operator.

I II III 15.6 Accuracy

15.6.1 Check that the system can perform datum transformations using the scale supported by the database, i.e. not over-scaled; that the accuracy of the transformation is consistent with the ECS Database coverage:

I II III .1 Transformation between the local datum and WGS-84 if the EUT uses databases with a datum other than WGS-84; (11.3.4.1, 12.1)

I II III .2 Ensure an alarm is issued when there is no transformation to WGS-84. (6.2.3, 6.3)

I II III 15.6.2 Check that the system can perform the following calculations using the datum and scale (or resolution) supported by the database, i.e. not over-scaled; that the accuracy of the calculations is consistent with the ECS Database coverage; and that the accuracy of measurement is consistent with the Electronic Chart Display Resolution:

.1 True distance and azimuth between two geographical points (12.2)

.2 Geographic position from known position and distance/azimuth (12.2)

.3 Latitude/longitude to screen X-Y (12.3)

.4 Screen X-Y to latitude/longitude (12.4)

.5 Rhumb line and great circle. (12.1.1)

15.7 Visual requirements

15.7.1 Units and legend

I II III 15.7.1.1 Check that at least the following units are included:

.1 Position – latitude and longitude in degrees, minutes and decimal minutes (4.2.4.1)

.2 Distance – nautical miles, statute miles, yards, feet or meters (4.1.1.6.1, 4.2.4.2)

.3 Speed – knots or miles per hour (4.2.4.3)

.4 Time – hours, minutes and seconds (4.2.4.4)

.5 Direction – degrees (4.2.4.5)

.6 Depth/elevation – meters, fathoms or feet (4.2.4.6)

15.7.1.2 Observe that the following elements are always available for inclusion in a standard legend of general information: (4.1.1.6, 4.2.3.9,4.2.5.3)

I II III .1 Units for depth (4.1.1.6.2)

I II III .2 Units for height 4.1.1.6.2)

I	II	III	.3	Scale of display	
I	II	III	.4	Sounding/vertical datum	
I	II	III	.5	Horizontal datum (4.2.5.3)	
I	II		.6	Great circle / rhumb line indication	
I	II	III	.7	Date and number of last update affecting the ECS Database coverage currently in use	
I	II	III	.8	Edition date of the ECS Database coverage currently in use	
I	II		.9	Chart projection	

15.7.1.3 Observe that the following elements are available as an alphanumeric display of general information. (4.2.3)

I	II	III	.1	Ship Latitude/Longitude	LAT/LON
I	II	III	.2	Speed-over-ground	SOG
I	II	III	.3	Course-over-ground	COG
I	II		.4	Distance to waypoint (from own-ship)	DTW
I	II		.5	Bearing to waypoint (from own-ship)	BTW
I	II		.6	Cursor range (from own-ship)	RNG
I	II		.7	Cursor bearing (from own-ship)	BRG
I	II		.8	Cross-track-distance (left/right of intended track)	XTD
I	II	III	.9	Datum shift or datum name	DLAT/DLON
I	II	III	.10	Position sensor correction	dLAT/dLON
I	II	III	.11	Magnetic variation	VAR

15.7.2 Display characteristics

I II III 15.7.2.1 Measure the displayed chart area while in Navigation mode and check that it is at least 75 percent of the required usable screen area. (11.2.3)

I II III 15.7.2.2 Ensure that the displayed information is clearly visible to an observer, in the conditions of light normally experienced on the bridge of the ship by day and by night. (9.1, 9.2)

I II 15.7.2.3 Measure a displayed character and check that it is displayed at the specified minimum height (i.e., 3.0 mm for class I and 2.5 mm for class II). (10.1.1, 10.1.2)

I II III 15.7.2.4 Measure the display screen and ensure it meets the following minimum requirements: (See 10.4)

.1 460 mm (18.1 in) - diagonal measurement with 1024 x 768 pixels

.2 380 mm (15.0 in) - diagonal measurement with 800 x 600 pixels

.3 300 mm (11.8 in) - diagonal measurement with 800 x 600 pixels

.4 240 mm (9.4 in) - diagonal measurement with 640 x 480 pixels

.5 125 mm (4.9 in) - diagonal measurement with 320 x 234 pixels

I II III 15.7.2.5 Measure the displayed chart area and check that the image is displayed at 1:1 aspect ratio. (10.2)

I II III 15.7.2.6 Verify that the EUT is capable of displaying the ECS Database at an Electronic Chart Display Resolution consistent with the ECS Database Resolution. (10.3)

15.8 Functional Requirements

The following tests shall be performed in Planning mode and Navigation mode. The initial latitude/longitude position shall be consistent with the ECS Database used for the test.

I II III 15.8.1 Standard Display

.1 Systematically operate the EUT in each mode and check to see if the Standard Display can be presented in no more than two operator actions. (4.1.2)

.2 Follow the manufacturer's instructions to initialize the EUT as if power had never been applied. Enter the initial latitude/longitude position. Confirm that the scale displayed conforms to the scale of the ECS Database. Confirm that the data elements of the Standard Display are shown. (4.1.1, 4.1.3, 4.2.2, 4.2.5, 10.3)

I II III 15.8.2 Additional Display Functions

15.8.2.1 If additional information can be added to the EUT display, confirm that the additional information can be displayed on demand. (5.2.2, 7.1, 7.2, 7.3)

15.8.2.2 If additional information can be added to the EUT display, confirm that additional information is clearly distinguishable from the ECS Database information. (5.2.2, 7.1, 7.2, 7.3)

15.8.2.3 If information can be removed from the Standard Display, remove a standard data element and confirm that the EUT provides an indication that less than the Standard Display is shown. (4.1.4, 6.1.4)

15.8.3 Scale and Navigational Purpose

I II III 15.8.3.1 If an over-zoom capability is provided, display the information at a larger scale than that of the ECS Database (over-zoom) by zooming in, and then confirm that the indication is provided. (6.1.1)

I II 15.8.3.2 Display the information at a smaller scale than that of the ECS Database (under-zoom) by zooming out, and then confirm that the indication is provided. (6.1.2)

I II 15.8.3.3 Verify that scale boundaries or database resolution boundaries, if different, can be shown on demand. (4.1.1.5.5)

I II III 15.8.3.4 Confirm that a scale bar or screen range can be provided as part of the display. (4.2.5.1)

I II 15.8.3.5 Chose an area covered by multiple scale data. Start at the smallest scale available and zoom in until an indication that data is available at a better resolution. (6.1.2)

I II 15.8.3.6 Load an example of an ECS Database that contains a resolution boundary and verify that an indication is provided when a vessel crosses a resolution boundary of an ECS Database. (6.1.5)

I II III 15.8.4 Mode and Orientation

15.8.4.1 Ensure that EUT is capable of displaying the ECS Database in north-up orientation. If the EUT is capable of displaying other orientations, confirm that the North direction is identified. (4.2.5.2, 8.1)

15.8.4.2 If relative motion is provided for use in Navigation mode, confirm that screen redraw takes place automatically and own ship remains near the center of the display. (8.2.2)

15.8.4.3 If true motion is provided for use in Navigation mode, reset the display and confirm that the generation of the neighboring area screen redraw takes place automatically at a distance from the border selected by the mariner, keeping own-ship on screen. (8.2.1, 8.2.2, 8.2.3, 8.2.5)

15.8.4.4 Check that it is possible to manually change the chart area and the position of own ship relative to the edge of the display. (8.2.4)

I II III 15.8.5 Object Information

15.8.5.1 Select a point, which may be a feature, symbol or position, and display its geographic coordinates in either the chart datum or the positioning system datum. (11.3.4.2, 11.5)

15.8.5.2 Enter the geographic coordinates of a position, and display that position. (11.1.6)

I II III 15.8.6 Position Integration

15.8.6.1 Connect a continuous positioning system, with an update rate of 2 seconds or less, to the EUT and verify that the correct position is displayed within one second of message receipt. (11.3.3)

Note: The one second latency for display of position is additive to the time required for redraw of the display.

15.8.6.2 Remove the positioning input to the EUT and ensure that a screen message and acoustic alarm are given. (6.2.1, 6.2.4)

15.8.6.3 Simulate a message from the positioning device that indicates an error condition causing loss of positioning data, and observe that a screen message or acoustic alarm is given. (6.2.1, 6.2.4)

15.8.6.4 If the capability is provided, adjust own-ship position manually. Observe that the amount of the adjustment is displayed on the screen and that the position changes accordingly. (4.2.5.4, 11.3.5)

15.8.6.5 Systematically operate the EUT in each mode (other than the Navigation mode) and check to see if the system can be returned to the Navigation mode in no more than two operator actions. (11.2.2)

I II III 15.8.7 Radar and Plotting Information - Navigation Mode Only

Where the capability for displaying radar and plotting information is provided as part of the EUT:

15.8.7.1 Observe the display without radar overlay, switch on the radar overlay and plotting information and ensure that the ECS Database information is not degraded, and is clearly distinguishable. (7.1)

15.8.7.2 Observe the display at the lowest scale without radar information. Then, with the radar set to a different scale than the EUT, switch on the radar overlay and plotting information and ensure that these match in scale and orientation. Repeat for all combinations of scale settings between the radar and the EUT. (7.2.1)

15.8.7.3 Ensure that the radar information and the displayed position of the ship may be adjusted manually; note that the accumulated offset is clearly indicated to a common reference point. Vary the radar antenna offset and confirm that the position of radar overlay and vessel-tracking data change accordingly. (7.2.1)

15.8.7.4 Ensure that the radar and plotting information may be removed by no more than two operator actions. (7.2.2)

15.8.7.5 If the capability is provided, set the EUT to accept and display transferred plotting targets; set the simulator to stabilized, north-up mode and to 12-mile range; check that the target information is being accepted and displayed correctly. (7.2)

I 15.8.8 Chart Updating

15.8.8.1 Verify that the system can receive and install ECS Database updates. (5.2.1)

15.8.8.2 If a means is available to edit the working Database verify the edits meet the following: (5.2.1)

.1 Legible and not reduce the legibility of the surrounding navigable area

.2 Stored separately from the ECS Database

.3 Verifiable and distinguished from the displayed ECS Database information.

15.8.8.3 Display – Show and Verify

Display the ECS Database to ensure that the contents of the updates have been included. (5.2.1)

15.8.8.4 Manual Editing of the Working Database

Check that the following manual edit procedures may be carried out and that the edits are distinguishable: (5.2.1.3)

.1 Add new features, locating them at selected positions
.2 Delete an existing feature
.3 Mark features for further reference
.4 Add textual information

I II III 15.8.9 Self-tests of major functions

15.8.9.1 Perform manual or automatic self-tests of the major functions, which are supported by the EUT. Verify that the EUT provides appropriate display information and indications. (3.2.1)

15.8.9.2 Simulate the following sensor malfunctions (including for radar if provided for): (6.2.4)

.1 Interruption of sensor input (loss of signal)
.2 Invalid sensor information (status)
.3 Physical breakdown of sensor connection

15.8.9.3 Verify that the system provides suitable alarms or indication of system malfunction arising from failures. (6.1)

15.9 Operational requirements

I II 15.9.1 Planning mode (11.1.1)

15.9.1.1 Ensure planning mode is indicated. (6.1.3)

15.9.1.2 For the route to be planned as described below, the following general guidelines apply:

- The route shall be planned through an area covered by the ECS Database
- Each leg shall be planned with an appropriate off-track limit (e.g. 100 m.), if the capability is provided
- Course changes shall be made, both to starboard and port, between different legs of the route and shall vary from 5 degrees up to 175 degrees
- The length of the legs shall vary from 0.5 nautical miles to at least 3 nautical miles with a total length of at least 25 nautical miles
- Planned speed shall vary between 5 knots and 15 knots

Plan a route with at least 10 waypoints, using both rhumb line and great circle segments: (4.2.1, 11.1.3, 11.1.4, 11.1.5)

.1 Set the planned route
.2 Retrieve the planned route and plan an alternate route
.3 Add three waypoints
.4 Delete three waypoints

.5 Change position of two waypoints
.6 Change the order of waypoints
.7 Save the alternate route

I 15.9.1.3 Input the RTE and WPL sentences (IEC 61162-1) from a route planning device and verify EUT will accept and process the information. (11.1.7)

15.9.2 Navigation mode (11.2)

I II 15.9.2.1 Ensure navigation mode is indicated. (6.1.3)

15.9.2.2 While testing the Navigation mode, the following general guidelines apply: (4.2.2)

- Using the manufacturers' identified database, select the standard display and select a route
- Use the route starting at a way point

I II III .1 Observe that the display shows own ship's position (11.2.1)
I II .2 Simulate the GGA, GLL, GNS, DTM, ZDA, and VTG, HDM, HDT sentences (IEC 61162-1), as appropriate for the EUT, and verify EUT will accept and process the information (11.3.1.1)
III .3 Simulate the Recommended Minimum Sentences RMA and RMB or RMB and RMC (IEC 61162-1), as appropriate for the EUT, and verify EUT will accept and process the information (11.3.1.2)
I II .4 Simulate deviation from intended track and verify that the off-track alarm is activated (6.2.2, 11.1.5)
I .5 Design the distance using a set of waypoints in a route to accommodate a 24-hour transit and follow this track while recording vessel movement. At the end of 24 hours, ensure the EUT has the ability to store and display past track of at least one point every 60 seconds for the most recent 12 hours. Ensure the EUT has the ability to store past track of at least one point every 4 hours after the most recent 12 hours. Ensure the EUT has sufficient storage capacity to provide for one data point every 4 hours for a voyage of three months duration. (11.4.1)
II .6 Design the distance between two waypoints in a route to accommodate a 60-minute transit and follow this track while recording vessel movement. At the end of 60 minutes ensure the EUT has the ability to store and display past track of at least one point every 60 seconds or 0.1 mile. (11.4.2)

I II III 15.9.2.3 Verify that any windows superimposed on the chart display area can be moved to a less important part of the display, such as on land, or removed from the display. (11.2.4)

I II 15.9.3 Power supply

15.9.3.1 Interrupt the primary power supply for 45 seconds, and ensure that the EUT does not need to be re-initialized manually. (3.3.1)

15.9.3.2 Check that proper warnings are given to the operator. (3.3.2, 6.2.5)

15.9.3.3 Operator settings shall be checked that they have not changed. (3.3.1)

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APPENDIX A - REFERENCES

1.0 Normative References

This standard contains references to provisions of other standards. These cited provisions, through reference in this text, constitute provisions of this RTCM Recommended Standard. Users of this Recommended Standard are encouraged to investigate the possibility of applying subsequent amendments to, revisions of, or most recent editions of the normative references listed below. These normative references are:

.1 International Maritime Organization, IMO Assembly Resolution A.694(17) General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and for Electronic Navigational Aids.

.2 International Maritime Organization, IMO Assembly Resolution A.817(19) Performance Standards for Electronic Chart Display and Information Systems.

.3 International Hydrographic Organization, Specifications for Chart Content and Display Aspects of ECDIS, Special Publication No. 52 and appendices.

.4 International Hydrographic Organization, IHO Transfer Standard for Digital Hydrographic Data, Special Publication No. 57, Edition 3.1.

.5 International Hydrographic Organization, Product Specification for Raster Navigational Charts, Special Publication No. 61, Edition 1.0.

.6 International Electrotechnical Commission, Marine Navigational Equipment - General Requirements, Methods Of Testing And Required Test Results, IEC 60945, Edition 4.

.7 International Electrotechnical Commission, Digital Interfaces for Marine Navigation and Radiocommunication Equipment and Systems, IEC 61162-1 - Part 1: Single Talker and Multiple Listeners, Edition 2.

.8 International Electrotechnical Commission, Electronic Chart Display and Information Systems, Operational and Performance Requirements, Methods of Testing and Required Test Results, IEC 61174, Edition 2.0.

2.0 Informative References

A number of documents are recommended as sources of useful information, although they do not constitute provisions of these RTCM Recommended Standards. These informative references are listed below:

.1 International Maritime Organization, International Convention for the Safety of Life at Sea, 1974

.2 National Marine Electronics Association, NMEA 0183 Standard for Interfacing Marine Electronic Devices, Version 3.0.

3.0 Document Sources

.1 International Maritime Organization (IMO)
4 Albert Embankment
London
SE1 7SR
United Kingdom
Tel: +44 (0)20 7735 7611; Fax: +44 (0)20 7587 3210
E-mail: publications-sales@imo.org
http://www.imo.org

.2 International Hydrographic Bureau
4 Quai Antoine 1er, B.P. 445
MC 98011 MONACO Cedex
Principality of Monaco
Tel: +(377) 93 10 81 00; Fax: +(377) 93 10 81 40
E-mail: info@ihb.mc
http://www.iho.shom.fr

.3 International Electrotechnical Commission (IEC)

3, rue de Varembé
CP 131
CH-1211 Geneva 20
Switzerland
Tel: +41 22 919 0211; Fax: +41 22 919 0300

http://www.iec.ch

.4 National Marine Electronics Association (NMEA)

Seven Riggs Avenue
Severna Park, MD 21146
United States
Tel: +1 (410) 974-9425; Fax: +1 (410) 975-9450

E-mail: info@nmea.org

http://www.nmea.org

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APPENDIX B - ECS DATABASE CONTENT

At a minimum the ECS Database shall contain the following elements when available from Nautical Charts or Nautical Publications:

1.0 Information above and below the High Water Line

.1 All depth contours up to and including a depth of 50 meters

.2 All spot soundings up to and including a depth of 50 meters

.3 Indication and details of all isolated dangers with a depth less than 50 meters (or with depth unknown, when considered dangerous to surface navigation), for example: wrecks, rocks, obstructions, offshore platforms, breakers, etc.

.4 Navigable canals, navigable rivers

.5 Boundaries, for example: fairways, channels dredged areas and swept areas

.6 Drying Line

.7 Coastline

.8 Bridges, overhead pipelines and cables with horizontal and vertical clearances over navigable water

2.0 Navigation Aids

.1 Indication and details of all fixed and floating aids to navigation including, navigation markings and numbers

.2 Navigation lines

.3 Traffic Routeing Systems and Separation Schemes

.4 Recommended routes

.5 Conspicuous features

3.0 Other Features

.1 Submarine cables and pipelines

.2 Areas for which special conditions exist such as;

- Anchorage areas and anchorage prohibited areas
- Restricted areas, for example: cautionary areas, prohibited areas, fishing prohibited areas, areas to be avoided

- Regulated areas, for example: fishing grounds, offshore production areas, dumping areas
- Military practice areas
- International boundaries and national limits

.3 Ferry Routes

.4 Nature of the seabed, for example: sand, mud, rocks, sponge, etc.

4.0 Textual Information

.1 Indication and contents of cautionary notes relating to safety of navigation

.2 Place names

5.0 Metadata

.1 ECS database Database producer and identification of the source Nautical Charts and source Nautical Publications. All parts of the ECS Database compiled from sources other than the Nautical Chart or from other official government sources shall contain information in the metadata that the ECS manufacturer may use to generate an appropriate warning to the user.

.2 Date the ECS database Database is current tothrough. If the database is produced from multiple Nautical Charts, then the date the ECS Database is current through should be the date associated with the latest update to the least up-to-date Nautical Chart.

.3 The horizontal geodetic datum of a vector format ECS Database must be WGS-84. The horizontal geodetic datum of a raster format ECS Database should be WGS84, but it may be produced in its source datum provided the offset to WGS84 is provided in the metadata. Geodetic datum, and the offset to WGS84 if known ("Unknown" if If the ECS Database includes an area for which the datum is unknown, an indication shall be provided in the metadatadata not available).

.4 Sounding Datum and Vertical Datum.

.5 Scale boundaries or database resolution boundaries, if different

.6 An indication of the suitability of the ECS Database for a specific intended navigational purpose, based upon the scale and positional accuracy of the source data and the reproduction accuracy, that may be used by the ECS manufacturer to notify the user that the ECS Database is suitable for use in conjunction with a continuous positioning system of an accuracy consistent with the requirements of safe navigation, as follows:

Navigational Purpose	Scale of Source Data	Horizontal Tolerance of ECS Database
Can be used in restricted waters	≥ 1:20,000	≤ 10 meters
Can be used to approach a harbour	≥ 1:50,000	≤ 50 meters
Can be used for coastal navigation	≥ 1:100,000	≤ 100 meters
Should not be used in conjunction with a continuous positioning system for the above navigational purposes	N/A	> 100 meters

6.0 Resolution

.1 Resolution of the ECS Database is a quantity depending on the digitizing hardware and software, encoding procedures, etc. In general, it is the size (at the scale of the source document) of the smallest unit used to store positions. For vector data, it corresponds to the size of the smallest coordinate unit or sub-unit; for raster data, to the size of the pixels that the bitmap consists of. In both cases, the resolution indicates the size of the smallest spatial feature that can be discriminated, or the minimum distance between two spatial features collected as separate entities.

.2 Resolution of the ECS Database shall be such to ensure that the ECS may generate a detailed, truthful and comprehensible representation of the information derived from source documents, when the ECS Database is displayed at the same scale as the source. In any case, resolution shall be not coarser than 0,2 mm at scale 1:1, or 0,2*N mm at scale 1:N on the source. For example:

Scale	Ground Resolution not worse than:
1:1,000	0.2 meter
1:10,000	2.0 meter
1:50,000	10.0 meter

7.0 Reproduction Accuracy

.1 Reproduction accuracy is defined as the true distance (at the scale of the source document) between the geographic position of a given feature as provided by the source and the position of the corresponding entity as reproduced in the ECS Database.

.2 In theory, reproduction accuracy should be expressed in units of resolution (meaning that it cannot be better than resolution). For the purpose of this standard however, accuracy requirements are defined by an absolute value. Reproduction accuracy of any element of the ECS Database shall be not worse than 0.5 mm at scale 1:1, or 0.5*N mm at scale 1:N on the source.

8.0 Other Information

The ECS Database should include other information necessary for the ECS manufacturer to work with the ECS Database such as horizontal and vertical units of measurement, etc.