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Information on IHO Standards Related to ENC and ECDIS

Executive Summary

This document provides background information for Electronic Chart Display and Information System (ECDIS) users, port State control (PSC) inspectors and other stakeholders in ENC and ECDIS regarding the IHO standards that relate to the carriage and operation of ECDIS. The following topics are covered:

IHO Standards Background
Regulations Related to ECDIS and ENC
IHO Advice for PSC Inspectors Concerning IHO Standards
(Annex) IHO S-52 ECDIS Presentation Library Edition 4.0 Main Changes

A list of the of the current IHO standards in force is available on the IHO website at https://iho.int/en/standards-in-force (English); and https://iho.int/fr/normes-en-vigueur (French). Further information can be supplied on request. Enquiries should be directed to the IHO Secretariat at info@iho.int.

IHO Standards Background

The International Hydrographic Organization (IHO) is the intergovernmental organization responsible for developing international standards related to hydrographic services as defined in SOLAS regulation V/9. Under its remit, and in support of the relevant performance standards for ECDIS adopted by the International Maritime Organization (IMO), the IHO maintains the following set of standards related to ECDIS:

- S-57 - *Transfer Standard for Digital Hydrographic Data (including the Product Specification for Electronic Navigational Chart (ENC)*;
- S-52 - *Chart Content and Display Aspects of ECDIS*;
- S-52 Annex A - *ECDIS Presentation Library (Preslib)*;
- S-64 - *Test Data Sets for ECDIS*;
- S-58 - *ENC Validation Checks*;
- S-61 - *Product Specification for Raster Navigational Chart (RNC)*;
- S-62 - *Data Producer Codes*;
- S-63 - *Data Protection Scheme*;
- S-65 - *ENCs: Production, Maintenance and Distribution Guidance*;
- S-11 Part A - *Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes*.

As a consequence of the investigations into the anomalous operation of some ECDIS, the IHO undertook in 2012 a review of its standards related to ECDIS. The review revealed that certain

parts of the requirements of the IHO ECDIS-related standards had been interpreted and implemented in different ways by different manufacturers. The investigations made it clear that there were a number of improvements that should be made to reduce the risk of implementation irregularities in the future and improve the clarity of the standards. Feedback from ships at sea also indicated that there were a number of display enhancements that would significantly increase the usability of ENC in ECDIS.

This review led to the development of three new editions of the following IHO ECDIS related standards:

IHO S-52 Annex A ECDIS Presentation Library, Edition 4.0

This standard controls the graphical display of the ENC in ECDIS, from the symbols and line styles that must be used to depict features right through to the colours that govern the day, dusk and night modes. This standard has been extensively updated to address excessive alarms and other ECDIS related display anomalies. A summary of the main changes introduced in IHO ECDIS Presentation Library (PresLib) Edition 4.0 is included at Annex A of this document.

IHO S-63 Data Protection Scheme, Edition 1.2

This standard protects against data piracy by encrypting the ENC information. It also provides a mechanism for mariners to licence ENCs from data providers; and provides authentication assurance that the ENC data being loaded into the ECDIS has come from an approved source. It has been updated to include a new Annex specifying how to implement an ENC update status report.

IHO S-64 Test Data Sets for ECDIS, Edition 3.0

This standard contains sets of ENCs and RNCs designed specifically to support ECDIS manufacturers taking systems through the process of type approval against IEC Standard 61174. It has been updated with new test data sets to ensure the presentation of ENC features displayed in ECDIS is correct.

Regulations Related to ECDIS and ENC

SOLAS Chapter V Regulation 18

4. Systems and equipment installed prior to the adoption of performance standards by the Organization may subsequently be exempted from full compliance with such standards at the discretion of the Administration, having due regard to the recommended criteria adopted by the Organization. However, for an electronic chart display and information system (ECDIS) to be accepted as satisfying the chart carriage requirement of regulation 19.2.1.4, that system shall conform to the relevant performance standards not inferior to those adopted by the Organization in effect on the date of installation, or, for systems installed before 1 January

1999, not inferior to the performance standards adopted by the Organization on 23 November 1995 **.

** Recommendation on Performance Standards for Electronic Chart Display and Information Systems (ECDIS) (resolution A.817(19)).

SOLAS Chapter V Regulation 19

2. Shipborne navigational equipment and systems

2.1 All ships irrespective of size shall have:

2.1.4 nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage. An electronic chart display and information system (ECDIS) is also accepted as meeting the chart carriage requirements of this subparagraph. Ships to which paragraph 2.10 applies shall comply with the carriage requirements for ECDIS detailed therein;

2.1.5 back-up arrangements to meet the functional requirements of subparagraph .4, if this function is partly or fully fulfilled by electronic means;*

* An appropriate folio of paper nautical charts may be used as a back-up arrangement for ECDIS. Other back-up arrangements for ECDIS are acceptable (see appendix 6 to resolution A.817(19), as amended).

SOLAS Chapter V Regulation 27

Nautical charts and nautical publications, such as sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications necessary for the intended voyage, shall be adequate and up to date.

MSC.1/Circ.1503 (as amended) ECDIS – Guidance for Good Practice

The mandatory carriage of ECDIS, as required by SOLAS regulation V/19.2.10, was subject to a staged entry into force between 1 July 2012 and 1 July 2018. As per SOLAS regulations V/18 and V/19, for a ship to use ECDIS to meet the chart carriage requirements of SOLAS, the ECDIS equipment must conform to the relevant IMO performance standards. ECDIS units on board are required to comply with one of two performance standards (either IMO resolution A.817(19), as amended; or resolution MSC.232(82)), depending on the date of their installation. Essentially, where an ECDIS is being used to meet the chart carriage requirements of SOLAS, it must:

i) be type-approved;

ii) use up to date electronic navigational charts (ENC);

iii) be maintained so as to be compatible with the latest applicable International Hydrographic Organization (IHO) standards; and

iv) have adequate, independent back-up arrangements in place.

IMO MSC.1/Circ.1503 (as amended) states, 'ECDIS that is not updated to the latest version of the IHO Standards may not meet the chart carriage requirements as set out in SOLAS regulation V/19.2.1.4'.

The changes introduced in the latest versions of the IHO standards will assist port State control (PSC) inspectors in determining if a vessel is complying with the regulations from SOLAS Chapter V. The IHO maintains a list of the current IHO standards in force on its website – https://iho.int/en/standards-in-force (English); and https://iho.int/fr/normes-en-vigueur (French).

IHO Advice for PSC Inspectors Concerning IHO Standards

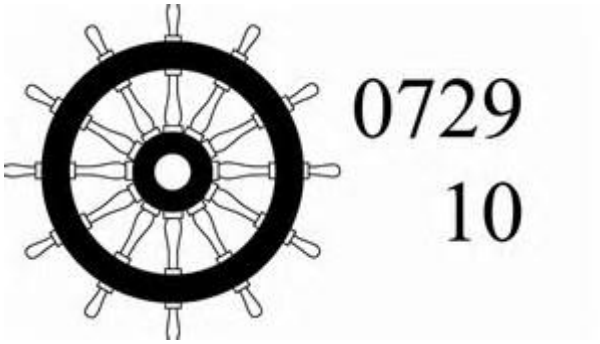
i) be type-approved;

To ensure ECDIS comply with the requirements in the relevant IMO performance standards they are tested against these requirements by approved Notified Bodies. The current testing standard for ECDIS is maintained by the International Electrotechnical Commission (IEC) and is IEC 61174 Edition 4.0 – *Maritime navigation and radiocommunication equipment and systems — Electronic chart display and information system (ECDIS) Operational and performance requirements, methods of testing and required test results*, published in August 2015. All ECDIS that are type approved according to IEC 61174 Edition 4.0 must comply with the display requirements in IHO S-52 Presentation Library Edition 4.0 and IHO S-63 Data Protection Scheme, Edition 1.2.

ECDIS type approved according to the previous editions of IEC 61174 need to be upgraded to the new IHO Presentation Library Edition 4.0. However there is no requirement that these ECDIS be updated to IHO S-63 Data Protection Scheme, Edition 1.2. The impact of this is that:

- Older ECDIS not yet updated to Presentation Library Edition 4.0 will not benefit from the significant changes introduced in Presentation Library Edition 4.0 and may not meet the chart carriage requirements as set out in SOLAS regulation V/19.2.1.4.
- Older ECDIS updated to Presentation Library Edition 4.0 but still using IHO S-63 Edition 1.1 will not be able to display an ENC Status Report from within the ECDIS.

All ECDIS approved within the European Union under the Marine Equipment Directive (MED) are given a Wheel Mark which is affixed to the equipment.



The first number denotes the Notified Body that awarded the type approval; the second number denotes the year the equipment passed approval.

ii) use up to date electronic navigational charts (ENC);

Hydrographic Authorities are required to keep nautical charts up to date to include all information considered to be relevant to safety of navigation (including temporary or preliminary information)[1]; and as such regularly issue updates to their ENCs. For an ECDIS to be used for navigation it must have the correct up to date ENCs for the intended voyage. Therefore the only indicator that the ENC data in the ECDIS is up to date is that the latest ENC update available for an ENC as issued by the Hydrographic Authority has been applied to the SENC.

There are currently two chart distribution services an international mariner can sign up to for delivery of ENCs (noting there are also several national distribution services for mariners operating exclusively in national waters).

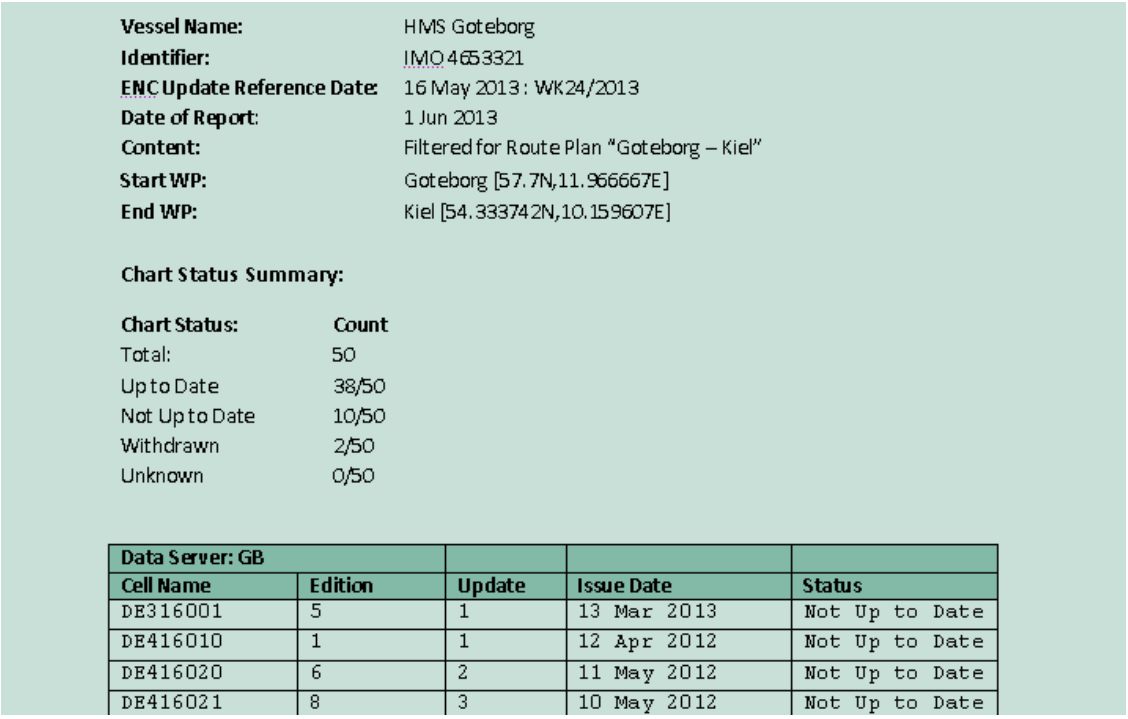
1) Standard subscription - ENC permits are purchased for a known operating area for a fixed periods of time (3 to 12 months). This enables the decryption of these ENCs in ECDIS and enables their use for planning and navigation.
2) Pay As You Sail (PAYS) – Mariners pay a minimal planning fee for upfront use of the entire global ENC data set. A tracking service is fitted to the vessel and as they navigate across ENCs they are charged accordingly. PAYS services can give instant access to most ENC chart across the globe.

To facilitate PSC inspections and to assist mariners in satisfying themselves that their ENC data is “up to date” S-63 was updated to Edition 1.2, adding an additional annex covering the ENC Status Report. Only ECDIS type approved according to Edition 4.0 of IEC 61174 will be capable of displaying the report. The report is a concise and standardized format designed for two individual use cases:

a) To ensure that all ENC cells loaded into the ECDIS SENC are up to date for the next leg of a particular route; and

b) To ensure that all ENCs loaded into the SENC are up to date.

[1] Refer to IHO Publication S-4 clauses B-600, B-601.7, B-633.1 and B-634.1



Vessel Name: HMS Goteborg
Identifier: IMO 4653321
ENC Update Reference Date: 16 May 2013 : WK24/2013
Date of Report: 1 Jun 2013
Content: Filtered for Route Plan "Goteborg – Kiel"
Start WP: Goteborg [57.7N,11.966667E]
End WP: Kiel [54.333742N,10.159607E]

Chart Status Summary:

Chart Status:	Count
Total:	50
Up to Date	38/50
Not Up to Date	10/50
Withdrawn	2/50
Unknown	0/50

Data Server: GB				
Cell Name	**Edition**	**Update**	**Issue Date**	**Status**
DE316001	5	1	13 Mar 2013	Not Up to Date
DE416010	1	1	12 Apr 2012	Not Up to Date
DE416020	6	2	11 May 2012	Not Up to Date
DE416021	8	3	10 May 2012	Not Up to Date

Figure 1 - Example ENC Status Report

If an inspection is carried out on a new ECDIS with this functionality it is important to understand how the ENC Update Status Report works and what the returned values mean.

The top of the report will list vessel name, IMO number and other important data. For the report to work correctly the ECDIS requires a reference date; this enables the system to calculate if an ENC cell has been updated. The date is taken from the last S-63 SERIAL.ENC file installed in the ECDIS which is delivered as part of the ENC exchange set from a data provider.

The data content of each of the header fields is defined in the table below:

Name	**Data Type**	**Description**
1. Vessel Name	Text	The name of the vessel as recorded within the ECDIS.
2. Identifier	Text	A unique identifier, the MMSI or vessel IMO number.
3. ENC Update reference date	Date	The data used as the reference for the status of each of the cells. This is the date stamp of the last data server's service media used to update the SENC. The date is taken from the S-63 SERIAL.ENC, expressed both in standard notation "NN MMM YYYY" and week number as defined in S-63.
4. Date of report	Date	The date the report was run.

Name	Data Type	Description
5. Content	Text	This field denotes the content type of the report. There are two possibilities: 1. "Filtered for Route Plan XXX to YYY" where XXX and YYY are the textual names of the point of origin and destination on the chosen route. 2. Full SENC contents.
6. Start WP	Text	This field is only present if the report is filtered for a route. It should comprise the textual name of the starting waypoint of the route (if one exists) and the lat/lon coordinates of the waypoint. There is no fixed form that the coordinates should take.
7. End WP	Text	This field is only present if the report is filtered for a route. It should comprise the textual name of the last waypoint of the route (if one exists) and its lat/lon coordinates. There is no fixed form that the coordinates should take.

All the cells along an intended route are checked against the last ENC update reference date within the ECDIS. The ENC cells are then given a status; the description of each status type is given below:

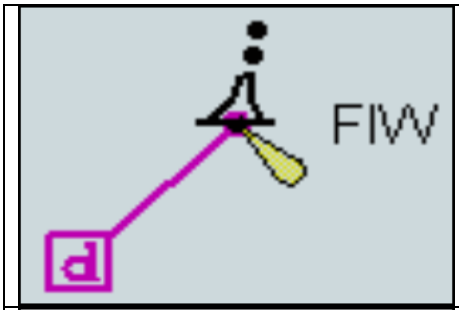
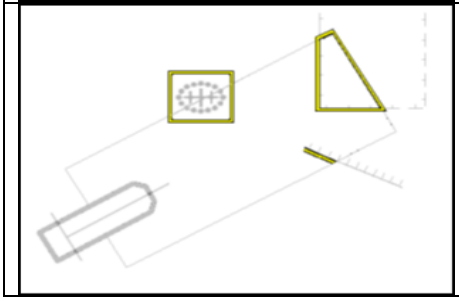
ENC Update 'Status'	Description
Up to date	The ECDIS has all the latest update and/or new edition information for the cell installed as defined by the latest PRODUCTS.TXT data. **NOTE:** The ENC Update reference date must be within the last four weeks from the time of the report execution or the cell shall be displayed as "Not up to date" regardless of its status as defined by the PRODUCTS.TXT data.
Not Up to date	The ECDIS does NOT have installed the latest update and/or new edition for the cell. Again, the reference point for what should be installed is defined by the ENC Update reference date. NOTE: If the reference date is older than four weeks then cells shall be displayed as "not up to date" by definition.
Withdrawn	The number of cells which have been withdrawn by the data server or cancelled but which are still available within the ECDIS.

ENC Update 'Status'	Description
Unknown	Cells for which a status cannot be determined for any reason. If cells from a dataset with a "PARTIAL" PRODUCTS.TXT file are loaded then all cells in a data server's service but not included in the partial PRODUCTS.TXT shall be deemed to be "Unknown" as no definitive information on them can be determined. A "FULL" PRODUCTS.TXT content is required to specify the status of all cells in a data server's service.

iii) be maintained so as to be compatible with the latest applicable International Hydrographic Organization (IHO) standards;

All ECDIS have a function to display the current edition of the IHO Presentation Library being used to display the ENCs. Clause 19.1 of IHO ECDIS Presentation Library Edition 4.0 states: 'The edition number of the PresLib installed must be available to the Mariner on request'. This requirement is therefore tested for in ECDIS type approval – IEC 61174 Edition 4, clause 5.5.1.

For mariners that have upgraded their ECDIS to IHO S-52 Presentation Library Edition 4.0 and require a method to check that their ECDIS is capable of displaying the new symbols introduced in IHO S-52 Presentation Library Edition 4.0, the recommended course of action is to use ECDIS Chart 1.

		Magenta 'd' symbol used on ENC features that have a date dependent attribute populated.
		Indication highlight symbology for objects that pose a danger to the vessel.

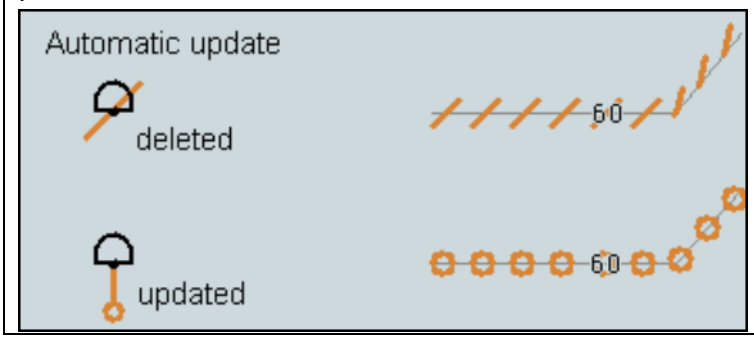
. 	Automatic update symbology for identifying where changes to the ENCs have occurred.

Figure 2 - New ECDIS symbols introduced in IHO S-52 Presentation Library Edition 4.0

iv) have adequate, independent back-up arrangements in place.

Details of a ship's navigational systems and equipment must be recorded in the "Record of Equipment". The means of complying with SOLAS regulation V/19 needs to be indicated (that is, paper charts and/or ECDIS) in the relevant "Record of Equipment". Declaring ECDIS in the ship's "Record of Equipment" makes ECDIS a surveyable item under SOLAS regulation V/19.

The IMO performance standards for ECDIS require that adequate back-up arrangements should be provided to ensure safe navigation, in case of an ECDIS failure. There are various ways for a vessel to achieve this either using:

- Paper charts;
- A second independent IMO compliant ECDIS unit connected to a separate power supply; or
- Chart radar unit connected to a separate power supply.

Where paper charts are being used as a back-up to a single ECDIS using ENCs, they must be kept up to date with the latest Notice to Mariner corrections. An Appropriate Portfolio of Paper Charts (APC) will be required for the whole of the intended voyage where this back-up option is used. The information provided by coastal States regarding their recommendations for the paper charts to be carried in the waters under their jurisdiction may be found by visiting the relevant national hydrographic authority's web site, as listed in IHO Publication P-5, available at https://iho.int/uploads/user/pubs/periodical/P5YEARBOOK_ANNUAIRE.pdf.

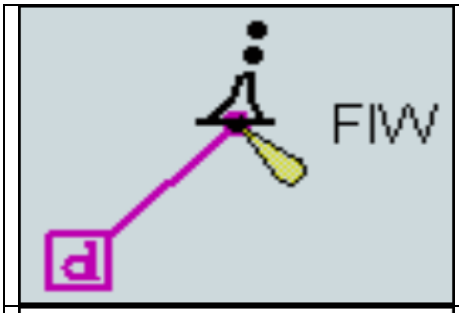
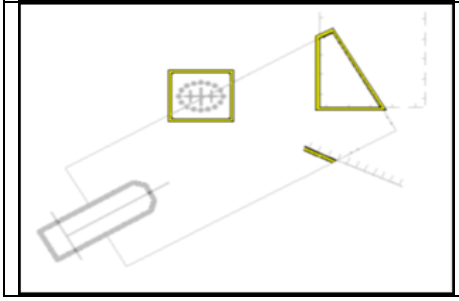
Annex A

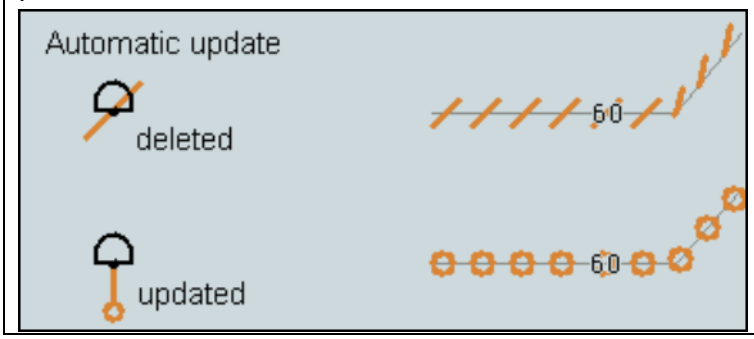
IHO S-52 ECDIS Presentation Library Edition 4.0 Main Changes

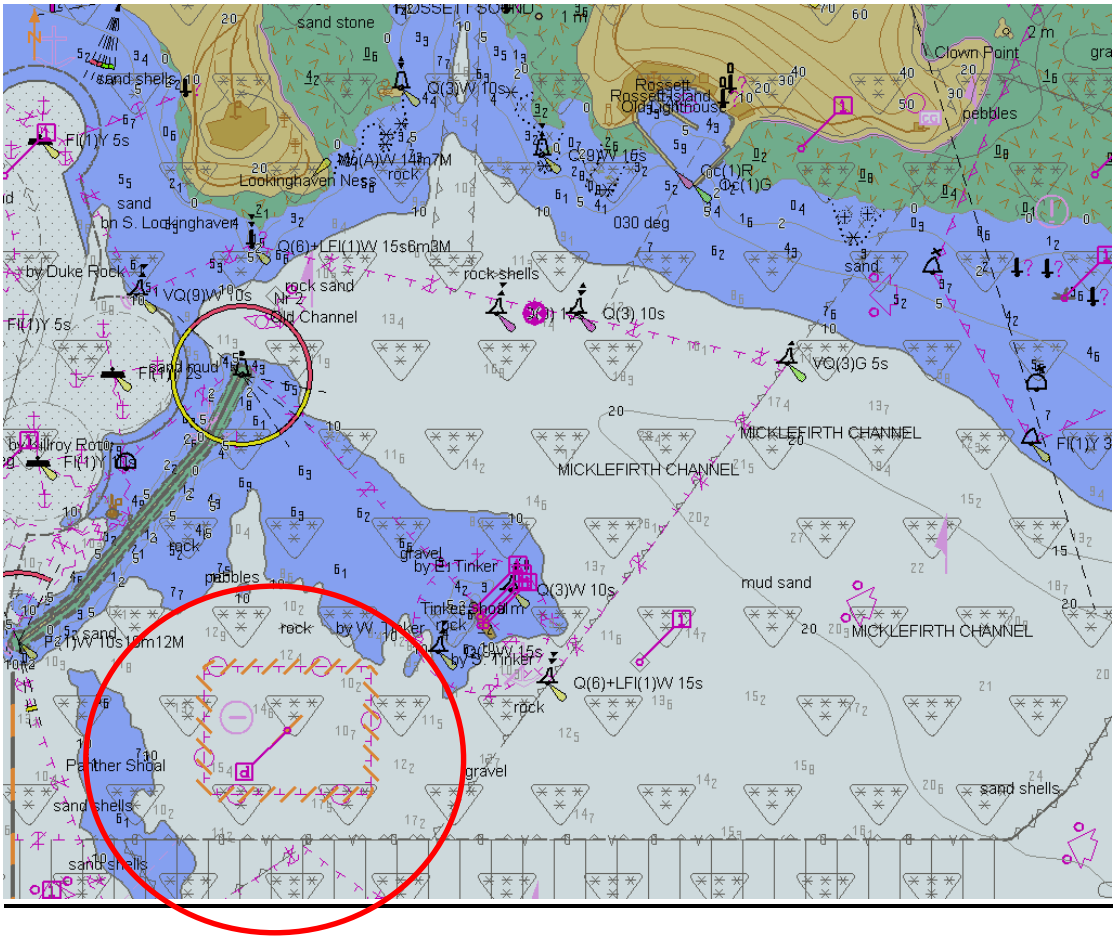
IHO S-52 Changes	Mariner's Benefits
A new section "Detection and Notification of Navigational Hazard" has been added. For each ENC feature and its associated attributes this defines the priority of the alert to be raised when a navigational hazard is detected.	Ensures all ECDIS raise the required alerts in a consistent manner, reducing training needs and improving safety at sea. Reduces the number of alarms raised as a result of ECDIS safety checking.
A new section "Detection of Areas, for which Special Conditions Exist" has been added. Lists the ENC features and attributes that will raise an indication or alert in the ECDIS as defined by the mariner	Ensures all ECDIS raise the required alerts in a consistent manner, reducing training needs and improving safety at sea. Reduces the number of alarms raised as a result of ECDIS safety checking.
Detecting the Safety Contour: The IMO ECDIS Performance Standard (PS) states that rocks, wrecks and obstruction detected inside the safety contour should result in an indication on the ECDIS. The previous edition of S-52 included rocks, wrecks and obstructions to the detection of the safety contour, resulting in alarms, as opposed to indications, being raised. They have been moved to "Detection and Notification of Navigational Hazards".	Reduces the number of alarms on ECDIS, whilst ensuring that the mariner remains aware of dangers as rocks, wrecks and obstructions will still be detected if they meet the "Detection and Notification of Navigational Hazards" criteria.
Added a new symbol 'Indication Highlight' – designed for warning and caution conditions that require an indication highlight on the ENC	Clear and unambiguous presentation of features that require an indication highlight.
New standardized symbols have been added to identify where automatic ENC updates have been applied.	Ensures the mariner is aware of updates that have been applied automatically to their ENCs
New symbol to indicate where in the ENC features with temporal attributes are located.	Will allow mariners to quickly identify where features that have temporal attributes are located, such as seasonal buoys, traffic separation schemes etc.
A means for the mariner to insert a date or date range within the ECDIS to display date dependent features.	Will allow the mariner the ability to plan and check routes, viewing the conditions they will encounter on a given date or time period in the future
Ability to turn isolated dangers in shallow water on/off.	In certain circumstances mariners must navigate across the safety contour, this change allows the mariner the flexibility to navigate in shoal areas with or without the isolated danger symbol displaying on the ENC
Mandatory selector for the display of the shallow water pattern.	Important feature in ECDIS as it becomes increasingly difficult to detect the changes in the ENC depth shades during night navigation.

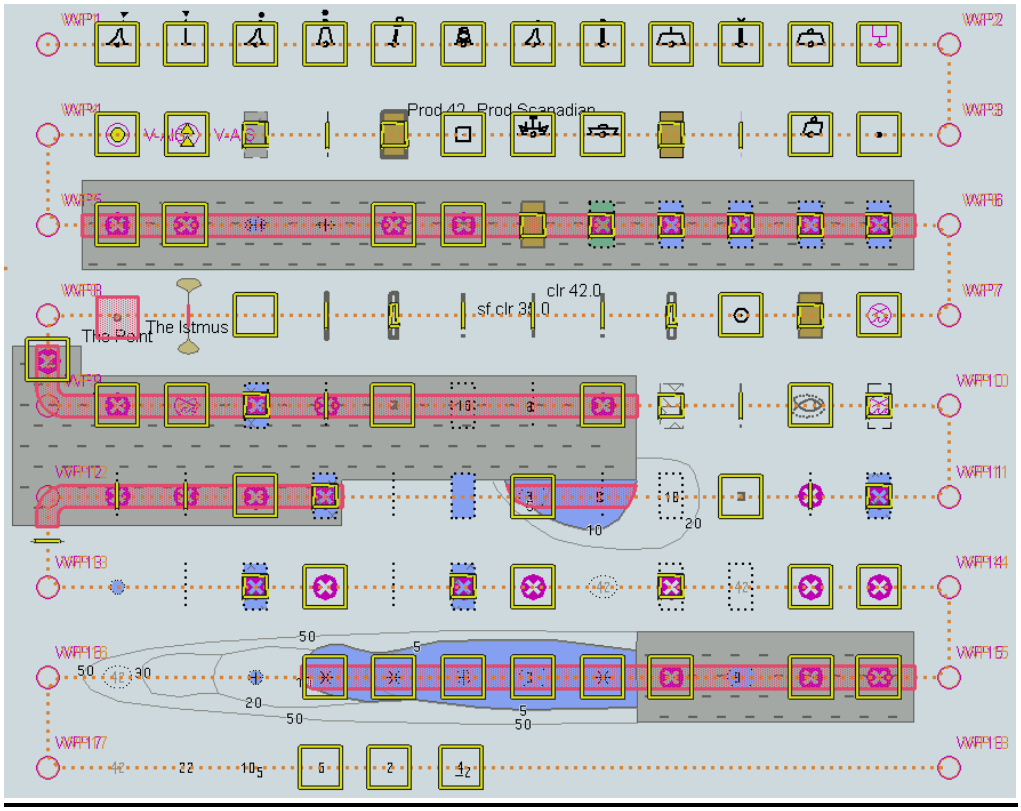
IHO S-52 Changes	Mariner's Benefits
Added guidance on the implementation of the optional "hover-over" function available for a limited number of ENC features	If provided, the hover-over function speeds up the process of ENC enquiry by the mariner. The new guidance ensures that the hover-over function does not result in the ENC presentation becoming obscured.
Display of complete tidal stream panel in ECDIS pick report.	Provides the mariner with tidal data in a form that is similar to the paper chart equivalent
Changes to S-52 display provisions: • Anchorage area – display of name in ENC; • Fairway – display of name in ENC; • Nautical publication – new visible presentation for the meta feature nautical publication.	Allows the mariner to navigate to an anchorage without the need to repeatedly interrogate each area on the ENC by: 1. Presenting the name of fairway on the ENC for quick identification of location; 2. Presenting a graphical indication on the ENC to give mariners the ability to easily select the nautical publication feature using the pick report
Standardization of the ECDIS pick report.	Ensures all ECDIS present pick report information in a consistent manner, reducing training needs and improving safety at sea.
The viewing groups may be used by the mariner to customise the ENC information presented on the ECDIS display. The names of these viewing groups have been standardized.	Ensures all ECDIS use viewing group nomenclature in a consistent manner, reducing training needs and improving safety at sea.

NEW SYMBOLS

		Magenta 'd' symbol used on ENC features that have a date dependent attribute populated.
		Indication highlight symbology for objects that pose a danger to the vessel.

. 	Automatic update symbology for identifying where changes to the ENCs have occurred.

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