ANAVE – Circular de Régimen Interior

Asunto: URGENTE: 31 agosto 2017, fecha límite para actualizar el software del ECDIS

Muy Sres. nuestros:

El 31 de agosto de 2017 expira el plazo para actualizar el software de los Sistemas de Información y Visualización de Cartas Electrónicas (ECDIS) instalados en los buques, según las normas que ha revisado la Organización Hidrográfica Internacional (OHI).

Las empresas deben comprobar, a la mayor brevedad posible, el estado del ECDIS de cada buque, teniendo en cuenta las siguientes recomendaciones:

– Los ECDIS instalados después del 19 de agosto de 2015, en principio deberían cumplir ya las nuevas normas. No obstante, las empresas deben verificar que en el certificado de homologación del equipo se ha incluido una notación indicando que el ECDIS se ha aprobado según la norma IEC 61174:2015 [1].

– Los ECDIS instalados antes del 19 de agosto de 2015 pueden no estar actualizados con la versión 4.0 de la Biblioteca de Presentación de datos ECDIS de la OHI y, en este caso, el certificado de homologación hará referencia a la norma IEC 61174:2008. Las empresas deben contactar cuanto antes con el fabricante del ECDIS para actualizar el software del equipo con la versión 4.0 antes del 31 de agosto de 2017.

Aquellas empresas que tengan dudas sobre el estado de su ECDIS deben consultarlo con el fabricante del equipo.

A partir del 1 de septiembre de 2017, es posible que los ECDIS que usen la versión antigua 3.4 de la Biblioteca de Presentación de datos de la OHI y no hayan sido actualizados no cumplan los requisitos de la regla V/19.2.1.4 del Convenio SOLAS sobre las cartas, sistemas y equipos que se deben llevar a bordo, pudiendo dar lugar a problemas en una inspección de Port State Control.

Una vez que el equipo se haya actualizado, se recomienda comprobar si hay alguna anomalía relacionada con la visualización de los símbolos en la pantalla, usando como guía el documento "Visualización de la información y comprobación del funcionamiento del ECDIS para la versión 4.0 de la Biblioteca de Presentación de datos" de la OHI, que les adjuntamos en el Anexo 1.

Según las directrices de la circular MSC.1/Circ.1503 de la OMI sobre "ECDIS – Guía de buenas prácticas", el software del ECDIS debe actualizarse para mostrar correctamente los símbolos en las cartas electrónicas de acuerdo con la última versión publicada por la OHI, que les adjuntamos en el Anexo 2. La OHI elaboró en 2015 nuevas versiones de las normas S-52 y S-64 que tratan sobre anomalías del ECDIS y cuestiones sobre la fatiga por alarmas e incluyen la actualización de la versión 3.4 de la Biblioteca de Presentación de datos ECDIS a la versión 4.0.

Muy atentamente,

Manuel Carlier
Director General

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[1]	IEC 61174:2015: 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.

10th October 2016

Checking the IHO S-52 Presentation Library edition 4.0 in ECDIS

Background - IHO ECDIS Data Presentation and Performance Check

In October 2011 the IHO issued the ECDIS Data Presentation and Performance Checks, two fictitious ENC cells intended to assist Mariners identifying if their ECDIS was using the latest IHO S-52 Presentation Library, edition 3.4. The dataset also highlighted if there were any known ENC display anomalies present in the ECDIS system. Mariners were asked to run a series of quick ECDIS tests using the check datasets to ascertain if they were experiencing a display issue. If the system was found to be running an old IHO Presentation Library or had a more serious display anomaly Mariners were advised to contact their ECDIS manufacturer to obtain software patches and investigate further to resolve the issues. Results of the tests were to be sent to the IHO to inform the IMO, national Hydrographic Offices and for use in revising IHO standards.

The IHO ECDIS Data Presentation and Performance Checklist were not ever intended for, and are not suitable to be used as a Port State Inspection / Carriage compliance test for ECDIS.

To further address the ECDIS display anomalies and improve the ECDIS user experience the IHO issued S-52 Presentation Library edition 4.0 in September 2014.

The principal benefit of upgrading ECDIS systems to the latest IHO Presentation Library will be the reduction in audible alarms, helping ease the issue of alarm fatigue on the bridge whilst maintaining safety at sea. The introduction of an alert model based on the requirements in the IMO ECDIS Performance Standard will also harmonize ECDIS alarm and indication behaviour across different manufacturers systems.

A number of new symbols have been added to the IHO Presentation Library edition 4.0. These symbols will identify features that require an indication highlight, the location of automatic ENC updates and ENC features that have a temporal attribute.

A number of other significant changes in the S-52 Presentation Library have come directly from Mariner feedback. For example, the names of Fairways and Anchorage Areas will now appear on the ENC display and a hover over function for certain charted features has been introduced.

The IHO co-ordinated with the IEC to align issue dates of S-52 and IEC 61174 – ECDIS Operational and performance requirements, methods of testing and required test results, and as a result in Aug 2015IEC 61174 edition 4.0 was published in Aug 2015. These standard updates affect all new ECDIS systems and new installations from Aug 19th 2015. Current ECDIS users have until Aug 31st 2017 to update their systems to comply with the ECDIS software updating guidance in MSC.1.Circ.1503.

Changes to the IHO S-52 Presentation Library introduced in edition 4.0 will invalidate the tests contained in IHO ECDIS Data Presentation and Performance Checks which were specifically designed and developed for ECDIS using IHO S-52 Presentation Library edition 3.4 or earlier. An ECDIS type approval certificate showing conformance with tests in edition 4.0 of IEC 61174 demonstrates the ECDIS does not have any of the identified ENC display anomalies. The subsequent guidance in this document describes the method by which Mariners can check the ECDIS displays for the new ENC symbols contained in the new IHO S-52 Presentation Library edition 4.0.

ECDIS and the IHO Presentation Library Edition Number

All ECDIS must have a function to display the edition number of the IHO Presentation Library that is in use within the ECDIS. The new IHO ECDIS Presentation Library edition 4.0 clause 19.1 states *'The edition number of the PresLib installed must be available to the Mariner on request'*. This requirement is tested for in the standard IEC 61174 edition 4 clause 5.5.1 Presentation library (S-52/Annex A, Part I/19.1) *'The edition number of the PresLib installed shall be available to the Mariner on request'*.

All Mariners must familiarise themselves with the function in their ECDIS that will display the edition number of the IHO Presentation Library as this varies across ECDIS manufactures. This function will be required when Port State Control officers want evidence that the ECDIS is up-to-date to the latest IHO standards. MSC.1.Circ.1503: *'Additionally, ECDIS software should be kept up to date such that it is capable of displaying up-to-date electronic charts correctly according to the latest version of IHO's chart content and display standards'*.

A list of current IHO Standards in force is maintained on the IHO website.
http://www.iho.int/mtg_docs/enc/ECDIS-ENC_StdsIn_Force.htm

ECDIS Chart 1 and IHO Presentation Library edition 4.0

For a graphical way to establish the ECDIS is correctly displaying the new symbols introduced in IHO S-52 Presentation Library edition 4.0 the Mariner can check ECDIS Chart 1. ECDIS chart 1 is a legend of the entire set of symbols that may be used within an ENC, it is installed on all type approved ECDIS systems.

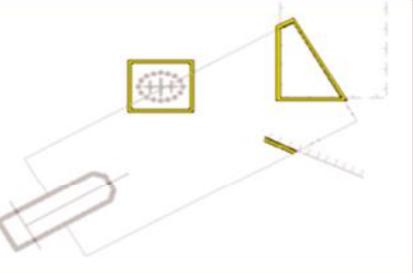The new symbols introduced in IHO Presentation Library edition 4.0 are listed below;

Symbol	Description
	Magenta 'd' symbol for use with features that have temporal attribute populated.
	Indication highlight for use when features pose a danger to the vessels intended track.
	Automatic update symbology for identifying where changes to the ENCs have occurred.

Fig 1. New ENC Symbols introduced in IHO S-52 Presentation Library edition 4.0

ECDIS Chart 1

Only ECDIS updated to IHO Presentation Library edition 4.0 will be able to show the new ENC symbols highlighted in red below. To check the ECDIS display Mariners are requested to open Chart 1, Information about chart display (A,B), and ensure they can view the symbols. ECDIS that have not been updated will not be able to display the new symbols. This is the IHO recommended method for checking that the ECDIS system can display the new symbols in IHO Presentation Library edition 4.0.
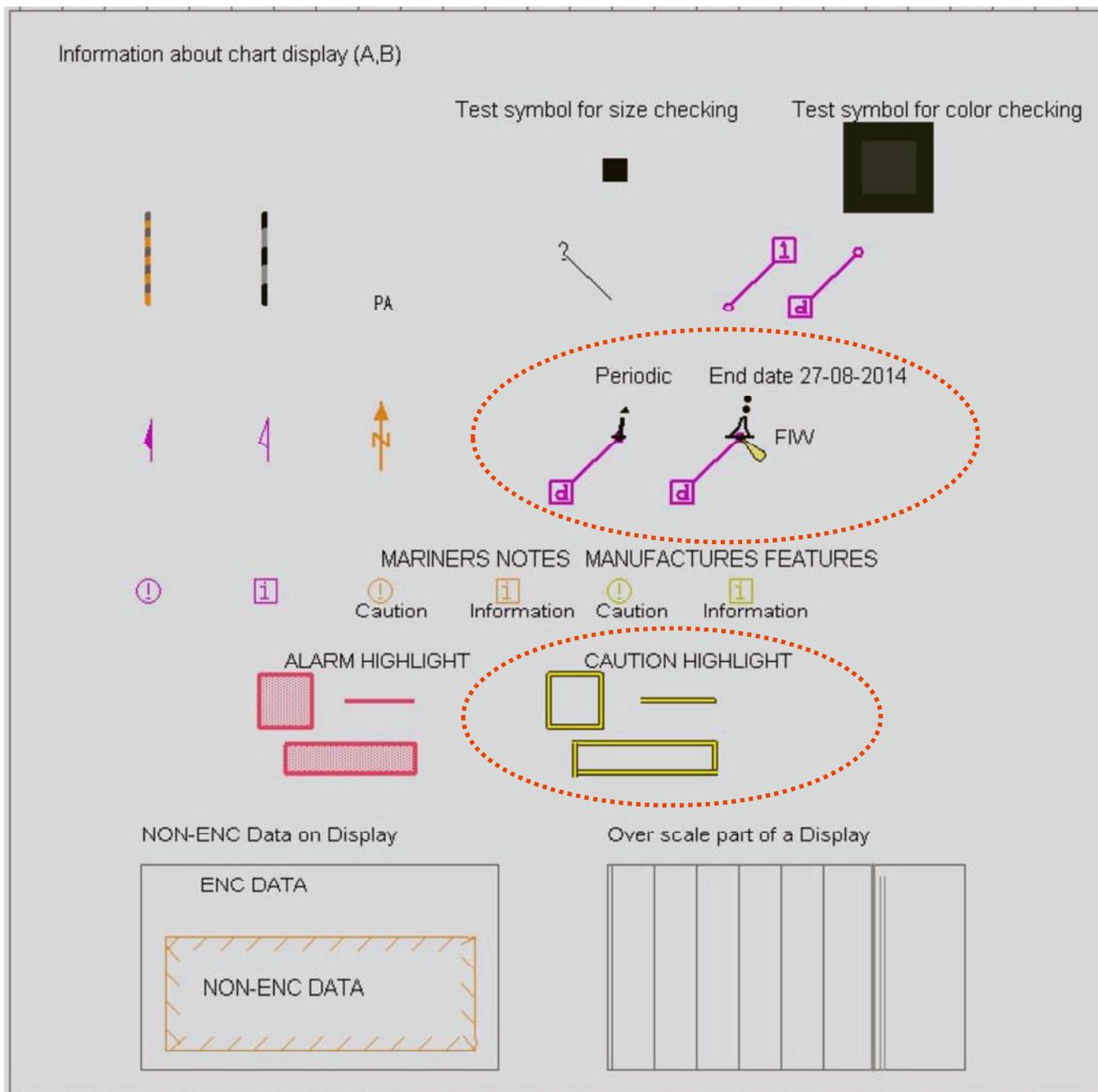
Fig 2. ECDIS Chart 1 Information about chart display (A,B)
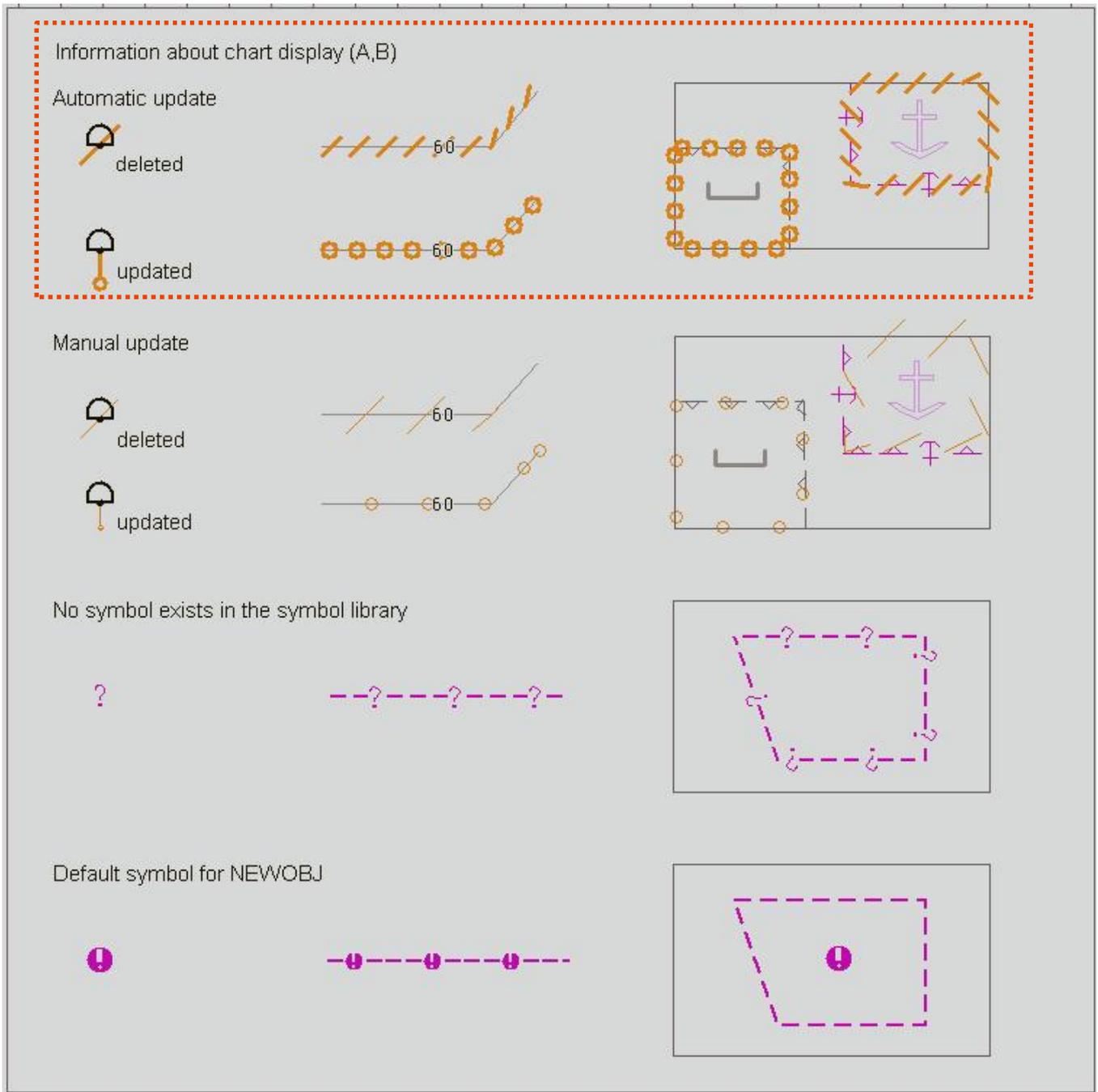
Information about chart display (A,B)

Automatic update

deleted

updated

Manual update

deleted

updated

No symbol exists in the symbol library

?

Default symbol for NEWOBJ

Fig 3. ECDIS Chart 1 Information about chart display (A,B)

4

MSC.1/Circ.1503
24 July 2015

ECDIS – GUIDANCE FOR GOOD PRACTICE

1   The Maritime Safety Committee, at its ninety-fifth session (3 to 12 June 2015), approved the *ECDIS – Guidance for Good Practice,* as set out in the annex, drawing together relevant guidance from seven previous ECDIS circulars into a single, consolidated document.

2   The undeniable safety benefits of navigating with Electronic Chart Display and Information Systems (ECDIS) were recognized through Formal Safety Assessments submitted to the Organization and experience gained by the voluntary use of ECDIS for many years. ECDIS was mandated for carriage by High-Speed Craft (HSC) as early as 1 July 2008. Subsequently, the mandatory carriage of ECDIS for ships other than HSC (depending on the ship type, size and construction date, as required by SOLAS regulation V/19.2.10) commenced in a phased manner from 1 July 2012 onwards.

3   ECDIS is a complex, safety-relevant, software-based system with multiple options for display and integration. The ongoing safe and effective use of ECDIS involves many stakeholders including seafarers, equipment manufacturers, chart producers, hardware and software maintenance providers, shipowners and operators, and training providers. It is important that all these stakeholders have a clear and common understanding of their roles and responsibilities in relation to ECDIS.

4   ECDIS was accepted as meeting the chart carriage requirements of SOLAS regulation V/19 in 2002. Over the years, IMO Member States, hydrographic offices, equipment manufacturers and other organizations have contributed to the development of guidance on a variety of ECDIS-related matters. Over the years, IMO has issued a series of complementary circulars on ECDIS.

5   While most useful IMO guidance on ECDIS was developed in this incremental manner, the information needed to be consolidated, where possible, to have ECDIS-related guidance within a single circular, which could be easily kept up to date without duplication or need for continual cross-referencing. Such consolidation of information offers clear and unambiguous understanding of the carriage requirements and use of ECDIS.

6   The consolidated guidance termed "*ECDIS – Guidance for Good Practice*" is set out in the annex to this circular (referred to as "Guidance" hereafter). Ship operators, masters and deck officers on ECDIS-fitted ships are encouraged to use this guidance to improve their understanding and facilitate safe and effective use of ECDIS.

7   Members of the Organization and all Contracting Governments to the SOLAS Convention are invited to bring this circular to the attention of all entities concerned. In particular, port States are invited to make the guidance available to their port State control inspectors, and flag States to shipowners, masters, recognized organizations, flag State control inspectors and surveyors. An electronic copy of this circular can be downloaded from the Organization's website at: (http://www.imo.org/OurWork/Circulars/Pages/Home.aspx).

8   This circular revokes MSC.1/Circ.1391, SN.1/Circ.207/Rev.1, SN.1/Circ.266/Rev.1, SN.1/Circ.276, SN.1/Circ.312, STCW.7/Circ.10 and STCW.7/Circ.18.

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ANNEX

ECDIS – GUIDANCE FOR GOOD PRACTICE

TABLE OF CONTENTS

INTRODUCTION

1   The undeniable safety benefits of navigating with Electronic Chart Display and Information Systems (ECDIS) were recognized through Formal Safety Assessments submitted to the Organization and experience gained by the voluntary use of ECDIS for many years. ECDIS was mandated for carriage by High-Speed Craft (HSC) as early as 1 July 2008. Subsequently, the mandatory carriage of ECDIS for ships other than HSC (depending on the ship type, size and construction date, as required by SOLAS regulation V/19.2.10) commenced in a phased manner from 1 July 2012 onwards.

2   ECDIS is a complex, safety-relevant, software-based system with multiple options for display and integration. The ongoing safe and effective use of ECDIS involves many stakeholders including seafarers, equipment manufacturers, chart producers, hardware and software maintenance providers, shipowners and operators, and training providers. It is important that all these stakeholders have a clear and common understanding of their roles and responsibilities in relation to ECDIS.

3   This *ECDIS – Guidance for Good Practice*, referred to as "Guidance" hereafter, draws together relevant guidance from seven previous ECDIS circulars into a single, consolidated document.

It has been laid out in seven sections, namely:

    A.   Chart carriage requirement of SOLAS
    B.   Maintenance of ECDIS software
    C.   Operating anomalies identified within ECDIS
    D.   Differences between raster chart display system (RCDS) and ECDIS
    E.   ECDIS training
    F.   Transitioning from paper chart to ECDIS navigation
    G.   Guidance on training and assessment in the operational use of ECDIS simulators

This guidance is intended to assist smooth implementation of ECDIS and its ongoing safe and effective use on board ships. Ship operators, masters and deck officers on ECDIS-fitted ships are encouraged to use this guidance to improve their understanding and facilitate safe and effective use of ECDIS.

4   Although this guidance replaces seven IMO ECDIS-related circulars, there remain several other IMO circulars that also address ECDIS matters to varying degree and reference should also be made to these circulars where necessary. A list containing the IMO ECDIS performance standards, the seven IMO ECDIS-related circulars that have been replaced and the other IMO circulars that relate to ECDIS is provided in the reference section.

A   CHART CARRIAGE REQUIREMENT OF SOLAS

5   The mandatory carriage of ECDIS, as required by SOLAS regulation V/19.2.10, is 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 nautical 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.

6   According to SOLAS regulation V/18, ECDIS units on board ships must be type-approved. Type approval is the certification process that ECDIS equipment must undergo before it can be considered as complying with IMO performance standards. The process is carried out by flag Administration-accredited type-approval organizations or marine classification societies in accordance with the relevant test standards developed by, inter alia, the International Electrotechnical Commission (IEC) (e.g. IEC 61174).

7   In accordance with SOLAS regulation V/19.2.1.4, ships must carry all nautical charts necessary for the intended voyage. As defined by SOLAS regulation V/2.2, nautical charts are issued officially by or on the authority of a Government, authorized Hydrographic Office or other relevant government institutions. Ships required to fit ECDIS and ships choosing to use ECDIS to meet the chart carriage requirements of SOLAS should carry Electronic Navigational Charts (ENCs) or, where ENCs are not available at all or are not of an appropriate scale for the planning and display of the ship's voyage plan, Raster Navigational Charts (RNC) and/or any needed paper charts should be carried.

8   IHO provides an online chart catalogue that details the coverage of ENCs together with references to coastal State guidance on any requirements for paper charts (where this has been provided). The catalogue also provides links to IHO Member States' websites where additional information may be found. The IHO online chart catalogue can be accessed from the IHO website at: www.iho.int.

9   As per SOLAS regulation V/27, all nautical charts necessary for the intended voyage shall be adequate and up to date. For ships using ECDIS to meet the chart carriage requirement of SOLAS, all ENCs and RNCs must be of the latest available edition and be kept up to date using both the electronic chart updates (e.g. ENC updates) and the latest available notices to mariners. Additionally, ECDIS software should be kept up to date such that it is capable of displaying up-to-date electronic charts correctly according to the latest version of IHO's chart content and display standards.

10   Relevant appendices of IMO performance standards for ECDIS specify the requirements for adequate independent back-up arrangements to ensure safe navigation in case of ECDIS failure. Such arrangements include: 1) facilities enabling a safe take-over of the ECDIS functions in order to ensure that an ECDIS failure does not result in a critical situation; 2) a means to provide for safe navigation for the remaining part of the voyage in case of ECDIS failure.

B   MAINTENANCE OF ECDIS SOFTWARE

11   ECDIS in operation comprises hardware, software and data. It is important for the safety of navigation that the application software within the ECDIS works fully in accordance with the Performance Standards and is capable of displaying all the relevant digital information contained within the ENC.

12   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.

13   For example, in January 2007, Supplement No.1 to the IHO ENC Product Specification was introduced in order to include, within the ENC, the then recently introduced IMO requirements for Particularly Sensitive Sea Areas (PSSA), Archipelagic Sea Lanes (ASL) and to cater for any future safety of navigation requirements.

14   Any ECDIS which is not upgraded to be compatible with the latest version of the IHO ENC Product Specification or the Presentation Library may be unable to correctly display the latest charted features. Additionally, the appropriate alarms and indications may not be activated even though the features have been included in the ENC. Similarly, any ECDIS which is not updated to be fully compliant with the latest version of the IHO Data Protection Standard may fail to decrypt or to properly authenticate some ENCs, leading to failure to load or install. An up-to-date list of all the relevant IHO standards relating to ECDIS equipment can be accessed from the IHO website (www.iho.int).

15   The need for safe navigation requires that manufacturers should provide a mechanism to ensure software maintenance arrangements are adequate. This may be achieved through the provision of software version information using a website. Such information should include the IHO Standards which have been implemented.

16   Administrations should inform shipowners and operators that proper ECDIS software maintenance is an important issue and that adequate measures need to be implemented by masters, shipowners and operators in accordance with the International Safety Management (ISM) Code.

C   OPERATING ANOMALIES IDENTIFIED WITHIN ECDIS

17   A number of ECDIS operating anomalies have been identified. Due to the complex nature of ECDIS, and in particular because it involves a mix of hardware, software and data, it is possible that further anomalies may exist.

18   These anomalies are particularly apparent in ECDIS units that have been built and type-approved to ECDIS Performance Standards (resolution A.817(19), as amended), (i.e. before 2009). However, ECDIS units type-approved to the revised ECDIS Performance Standards (resolution MSC.232(82)) are still vulnerable to the limitations in as set out in appendix 1, item 5(a).

19   An ECDIS anomaly is an unexpected or unintended behaviour of an ECDIS unit which may affect the use of the equipment or navigational decisions made by the user. Examples include, but are not limited to:

- failure to display a navigational feature correctly, such as:

  - navigation areas recently recognized by IMO such as PSSA and ASL
  - navigational lights with complex characteristics; and
  - underwater features and isolated dangers;

- failure to detect objects by "route checking" in voyage planning mode;

- failure to alarm correctly; and

- failure to manage a number of alarms correctly.

20   The existence of such anomalies highlights the importance of maintaining ECDIS software to ensure that it is capable of displaying up-to-date electronic charts correctly according to the latest version of the IHO's chart content and display standards. It is recommended that appropriate checks are made with the equipment manufacturer. This is of particular importance where ECDIS is the only source of chart information available.

21   IHO has produced an ECDIS Data Presentation and Performance Check (DPPC) dataset that allows mariners to check some important aspects of the operation of their ECDIS. This dataset contains two fictitious ENC cells which deck officers can load into their ECDIS units to assess operating performance and to determine whether there may be any display anomalies that either need to be remedied or otherwise managed in the way that the ECDIS is operated. If the check highlights a problem, the accompanying guidance notes with the check dataset offer suggested courses of action. The check dataset and accompanying instructions can be obtained from ENC service providers, or can be downloaded from the IHO website at: www.iho.int.

22   A list of the known anomalies with advice and information on whether or not the DPPC dataset checks for each anomaly is set out in appendix 1.

23   Given the widespread use and the implementation of the ECDIS carriage requirement, the Committee considered it important that any anomalies identified by mariners are reported to and investigated by the appropriate authorities to ensure their resolution.

24   In order to better understand the extent of the issue, Administrations are invited to collect, investigate and disseminate information about ECDIS anomalies. Administrations or designated bodies are invited to:

        .1   encourage vessels under their flag to report such anomalies, with sufficient detail on the ECDIS equipment and ENCs, to allow analysis;

        .2   treat the identity of the reporter as confidential;

        .3   agree to share information with other IMO Member Governments and international organizations on request; and

        .4   issue alerts to mariners where such anomalies might affect safety of navigation.

D   DIFFERENCES BETWEEN RASTER CHART DISPLAY SYSTEM (RCDS) AND ECDIS

25   ECDIS may be operated in one of the two modes:

        .1   the ECDIS mode when ENCs are used; and

        .2   the RCDS mode when ENCs are not available and RNCs are used instead.

Although in recent years ENC coverage has increased rapidly there could be some areas for which suitably detailed ENCs may not have been issued.

26   The RCDS mode does not have the full functionality of ECDIS and can only be used together with an appropriate portfolio of up-to-date paper charts. Limitations of the RCDS mode is set out in appendix 2.

E   ECDIS TRAINING

27   The information provided below aims to assist Member Governments, Parties to the STCW Convention, companies and seafarers in ensuring that training programmes on the use of ECDIS provided to masters and deck officers[1] serving on ships fitted with ECDIS meet the mandatory training requirements of the STCW Convention:

.1   under the provisions of the STCW Convention and Code, all officers in charge of a navigational watch on ships of 500 gross tonnage or more must have a thorough knowledge and ability to use nautical charts and nautical publications (refer STCW Code Table A-II/1);

.2   masters and officers in charge of a navigational watch (both at management and operational level) serving on ships fitted with ECDIS should as a minimum, undertake appropriate generic ECDIS training, meeting the competence requirements of the 2010 Manila Amendments to the STCW Convention and Code;

.3   the 2010 Manila Amendments to the STCW Convention and Code have reinforced ECDIS training requirements and introduced several additional specific competencies in the use of ECDIS for officers both at management and operational level serving on ECDIS-fitted ships(refer to STCW Code Tables A-II/1 and A-II/2). Training in accordance with the 2010 Manila Amendments became effective from 1 July 2013;

.4   masters and officers certificated under chapter II of the STCW Convention serving on board ships fitted with ECDIS are to be familiarized (in accordance with STCW regulation I/14) with the ship's equipment including ECDIS;

.5   STCW Convention regulation I/14, paragraph 1.5, as well as sections 6.3 and 6.5 of the International Safety Management (ISM) Code, require companies to ensure seafarers are provided with familiarization training. A ship safety management system should include familiarization with the ECDIS equipment fitted, including its backup arrangements, sensors and related peripherals. ECDIS manufacturers are encouraged to provide training resources including type-specific materials. These resources may form part of the ECDIS familiarization training;

.6   STCW Convention regulation I/14, paragraph 1.4, requires companies to maintain evidence of the training and ensures that it is readily accessible. For certificates of competency that have expiry dates beyond 1 January 2017, port State control authorities should accept the certificate issued as *prima facie* evidence that the seafarer has met the standard of competence required by the 2010 Amendments in accordance with the control provisions of article X and regulation I/4 of the STCW Convention;

.7   companies should also maintain evidence of the familiarization training in compliance with STCW Convention regulation I/14, paragraph 1.5;

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[1]   Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsements issued to the seafarer concerned (refer to tables A-II/1 and A-II/2 of the STCW Code).

.8 Administrations should inform their port State control officers of the requirements for ECDIS training as detailed in paragraph 7 above; and

.9 attention is also drawn to STCW.7/Circ.16 – Clarification of transitional provisions relating to the 2010 Manila-Amendments to the STCW Convention and Code and STCW.7/Circ.17 – Advice for port State control officers on transitional arrangements leading up to the full implementation of the requirements of the 2010 Manila-Amendments to the STCW Convention and Code on 1 January 2017 .

F TRANSITIONING FROM PAPER CHART TO ECDIS NAVIGATION

28 As an initial step, shipowners and operators should undertake an assessment of the issues involved in changing from paper chart to ECDIS navigation. Ships' masters and deck officers should participate in any such assessment so as to capture any practical concerns or needs of those that would be required to use ECDIS. Such a process will help facilitate an early understanding of any issues to be addressed and will aid masters and deck officers prepare for change.

29 Documenting the assessment of issues, combined with the development of ECDIS standard operating procedures, will help lead to the adoption of robust ECDIS navigation practices, simplification of masters and deck officers' training and facilitate smooth handovers.

30 In addition, shipowners and operators should ensure that their ships' masters and deck officers are provided with a generic ECDIS training and an ECDIS familiarization programme so that the ships' masters and deck officers fully understand the use of ECDIS for passage planning and navigation.

31 In addition to national and international rules and regulations, IMO model course 1.27 and IMO performance standards, IHO has published an online publication "*Facts about electronic charts and carriage requirements*"*.* It is a recommended source of information on ECDIS hardware, training and the technical aspects of electronic chart data. Copies are available free of charge from various sources including: www.iho.int.

32 Shipowners and operators should always refer to their national Administrations for the latest information on ECDIS carriage and use.

G GUIDANCE ON TRAINING AND ASSESSMENT IN THE OPERATIONAL USE OF ECDIS SIMULATORS

33 When simulators are being used for training or assessment in the operational use of Electronic Chart Display and Information Systems (ECDIS), the following interim guidance should be taken into consideration in any such training or assessment.

34 Training and assessment in the operational use of the ECDIS should:

.1 incorporate the use of ECDIS simulation equipment; and

.2 conform to standards not inferior to those given in paragraphs 35 to 37 below.

35   ECDIS simulation equipment should, in addition to meeting all applicable performance standards set out in section A-I/12 of the STCW Code, as amended, be capable of simulating navigational equipment and bridge operational controls which meet all applicable performance standards adopted by the Organization, incorporate facilities to generate soundings and:

.1   create a real-time operating environment, including navigation control and communications instruments and equipment appropriate to the navigation and watchkeeping tasks to be carried out and the manoeuvring skills to be assessed; and

.2   realistically simulate "own ship" characteristics in open‑water conditions, as well as the effects of weather, tidal stream and currents.

36   Demonstrations of, and practice in, ECDIS use should be undertaken, where appropriate, through the use of simulators. Training exercises should preferably be undertaken in real time, in order to increase trainees' awareness of the hazards of the improper use of ECDIS. Accelerated timescale may be used only for demonstrations.

37   Detailed guidance is provided in appendix 3.

APPENDIX 1

LIST OF ECDIS APPARENT OPERATING AND DISPLAY ANOMALIES
(NOT IN PRIORITY ORDER)

In the following list, items 1, 2, 3, 4, 5(b), 6, 7, and 11 are checked against the IHO DPPC dataset dated November 2011:

1   Inability to correctly display symbols for IMO-approved features such as ASLs or PSSAs – ECDIS equipment that does not have the latest version of the IHO Presentation Library installed will, instead of displaying the correct symbol, either show question marks (?) or nothing at all. In some cases the ECDIS may fail to load an ENC that includes such data. An ECDIS retains its type approval certificate regardless of the version of the Presentation Library installed.

Workaround – interrogate any "?" symbol displayed using the "pick report" or refer to paper charts and/or publications.

2   Incorrect display of foul areas and obstructions in some ECDIS equipment – some ECDIS models do not show some underwater features in Standard display mode as expected (however they do activate appropriate alarms). These features are only displayed when the "All" or "Other" display mode is used. Also in some cases different symbols are used to depict these features.

Workaround – use Mode "All" or "Other".

3   On some occasions some stranded/dangerous wrecks and obstructions may not display in any mode; it is believed that this is limited to some ECDIS versions from a single manufacturer who has now produced a software amendment to resolve the problem.

Workaround – use paper charts.

4   An object that falls on a contour line may fail to display in "Standard" mode in some ECDIS equipment.

Workaround – use Mode "All" or "Other".

5   Small (point) land areas, especially those depicted only on small scale (usage band 1 and 2) ENCs may not always be clearly displayed and do not always activate alarms in route planning or route monitoring modes in some ECDIS equipment:

(a)   it is possible for small land features to be obscured by other chart detail such as names or contour labels; and

(b)   some ECDIS equipment may not conduct route checks on small scale ENCs and may therefore not provide an appropriate warning. Where this is the case the land area may not be detected by the "look-ahead" function during route monitoring.

Workaround – careful manual inspection of the largest scale ENC available.

Due to the limitations of ECDIS referred to in 5(a) above, mariners (even those using the most modern systems) should always undertake careful visual inspection of the entire planned route using the "Other/All" display mode to confirm that it, and any deviations from it, are clear of dangers.

6   Incorrect display of the coloured arcs of light sectors – some ECDIS may not display the coloured arcs of complex lights as intended. This is especially prevalent where the sectors straddle 0/360deg (North).

Workaround – use "pick report" function to check light sectors.

7   Some early models of ECDIS are unable to display correctly time-variable data encoded in ENCs. For example features with Date Start and Date End attributes used for the implementation of new traffic routeing measures in ENCs may not be depicted correctly; the result being that both old and new instances are displayed simultaneously. Tests for this were not included in IEC61174 Edition1.

Workaround – use "pick report" function to determine Start/End date/time.

8   Tidal stream data not available in usable form – some early models of ECDIS only provide a comma-separated list of values which is difficult to interpret and use.

Workaround – use Tidal Stream Atlases external to ECDIS.

9   Display of anchorage, berth and channel names may not be easily visible to the mariner and the radius of a maximum swinging circle may not be shown.

Workaround – use "All" or "Other" display mode and "pick report" function to obtain swinging circle information; VTS/Port Authority communications will be able to clarify any necessary names.

10   Three hundred and sixty degree landfall lights not always prominent in comparison to shorter range sector lights.

Workaround – mariners to be aware – use "pick report" to verify light characteristic.

11   ENCs may include certain shoal soundings, especially reported depths, which have been encoded in such a way that they do not display in "Standard" Mode and might not activate an alarm even where the depth is less than the safety contour setting. Most Hydrographic Offices have reported to IHO that they have updated the relevant ENCs to ensure that significant depths are displayed in Standard Mode.

Workaround – operate in a display Mode where all soundings are shown.

12   Areas of foul ground that have no known depth value may be depicted in some ECDIS as isolated dangers and shown in "Standard" mode; this can result in unnecessary screen clutter.

Workaround – no workaround for clutter problem, mariners to be aware and use "pick report" function to determine if the feature is a danger.

13   Where ECDIS includes an option to show isolated dangers in waters shoaler than the safety contour value the symbology used may vary between manufacturers.

Workaround – mariners to be aware and to use "All" or "Other" Mode when operating in such areas.

14   Screen clutter can be a problem when displaying smaller scale ENCs for areas where larger scale coverage is also loaded in ECDIS. This can be more apparent when the user zooms out. This is due to a combination of each manufacturer's ENC loading strategy and the individual ENC producer's encoding policy. Where Hydrographic Offices use SCAMIN (scale minimum) attributes on chart features then this problem is minimized. The intention of the IHO standard is that ECDIS should not display ENC data which has a compilation scale significantly different from the display scale in use. Improvements could be made, in future, by adopting a standardized ENC loading strategy based on a scale range defined within the ENC.

Workaround – the situation can be improved through use of the standard display mode during voyage monitoring and appropriate (but not over) use of the zoom function. This technique has been included in the syllabus of IMO model course 1.27.

15   In some ECDIS equipment the text for some notes in the ENC may be truncated or not displayed at all, and therefore is not available to the mariner.

Workaround – no workaround available; mariners should advise ENC service providers where they observe this problem.

16   Unnecessary alarms and indications – feedback from mariners shows that ECDIS can produce excessive and distracting alarms. This is due to a combination of the interpretation of the requirements of the ECDIS Performance Standards and the ENC encoding. Some control over the number of alarms and indications is available to the mariner in ECDIS built to the revised Performance Standards (resolution MSC.232(82)), but this is not always recognized.

Workaround – the methods available to minimize alarms are included in the syllabus of IMO model course 1.27.

APPENDIX 2

DIFFERENCES BETWEEN RASTER CHART DISPLAY SYSTEM (RCDS) AND ECDIS

The mariners' attention is drawn to the following limitations of the RCDS mode:

1   Unlike ENC, where there are no displayed boundaries, RNCs are based on paper charts and as such have boundaries which are evident in ECDIS;

2   RNCs will not trigger automatic alarms (e.g. anti-grounding). However alarms and indications can be generated with the manual addition, during passage planning, e.g. of clearing lines, ship safety contour lines, isolated danger markers and danger areas to mitigate these limitations;

3   Horizontal datums and chart projections may differ between RNCs. Mariners should understand how a chart's horizontal datum relates to the datum of the position fixing system in use. In some instances, this may appear as a shift in position. This difference may be most noticeable at grid intersections;

4   A number of RNCs cannot be referenced to either WGS-84 or PE 90 geodetic datums. Where this is the case, ECDIS should give a continuous indication;

5   The display of RNCs features cannot be simplified by the removal of features to suit a particular navigational circumstance or task at hand. This could affect the superimposition of radar/ARPA;

6   Without selecting different scale charts the look-ahead capability may be limited. This may lead to inconvenience when determining range and bearing or the identity of distant objects;

7   Orientation of the RCDS display to other than chart-up, may affect the readability of chart text and symbols (e.g. course-up, route-up);

8   It is not possible to interrogate RNC features to gain additional information about charted objects. Whether using ENC or RNC, in the planning process a mariner should consult all relevant publications (such as sailing directions, etc.);

9   With RNC, it is not possible to display a ship's safety contour or safety depth and highlight it on the display unless these features are manually entered during route planning;

10   Depending on the source of the RNC, different colours may be used to show similar chart information. There may also be differences in colours used during day and night time;

11   An RNC is intended to be used at the scale of the equivalent paper chart. Excessive zooming in or zooming out can seriously degrade the displayed image. If the RNC is displayed at a larger scale than the equivalent paper chart, the ECDIS will provide an indication; and

12   ECDIS provides an indication in the ENC which allows a determination of the quality of hydrographic the data. When using RNCs, mariners are invited to consult the source diagram or the zone of confidence diagram, if available.

APPENDIX 3

GUIDANCE ON TRAINING AND ASSESSMENT IN THE OPERATIONAL USE
OF ECDIS SIMULATORS

GENERAL

Goals of an ECDIS training programme

1   The ECDIS trainee should be able to:

.1   operate the ECDIS equipment, use the navigational functions of ECDIS, select and assess all relevant information and take proper action in the case of a malfunction;

.2   state the potential errors of displayed data and the usual errors of interpretation; and

.3   explain why ECDIS should not be relied upon as the sole reliable aid to navigation.

Theory and demonstration

2   As the safe use of ECDIS requires knowledge and understanding of the basic principles governing ECDIS data and their presentation rules as well as potential errors in displayed data and ECDIS-related limitations and potential dangers, a number of lectures covering the theoretical explanation should be provided. As far as possible, such lessons should be presented within a familiar context and make use of practical examples. They should be reinforced during simulator exercises.

3   For safe operation of ECDIS equipment and ECDIS-related information (use of the navigational functions of ECDIS, selection and assessment of all relevant information, becoming familiar with ECDIS man–machine interfacing), practical exercises and training on the ECDIS simulators should constitute the main content of the course.

4   For the definition of training objectives, a structure of activities should be defined. A detailed specification of learning objectives should be developed for each topic of this structure.

Simulator exercises

5   Exercises should be carried out on individual ECDIS simulators, or full-mission navigation simulators including ECDIS, to enable trainees to acquire the necessary practical skills. For real‑time navigation exercises, navigation simulators are recommended to cover the complex navigation situation. The exercises should provide training in the use of the various scales, navigational modes, and display modes which are available, so that the trainees will be able to adapt the use of the equipment to the particular situation concerned.

6   The choice of exercises and scenarios is governed by the simulator facilities available. If one or more ECDIS workstations and a full-mission simulator are available, the workstations may primarily be used for basic exercises in the use of ECDIS facilities and for passage‑planning exercises, whereas full-mission simulators may primarily be used for exercises related to passage‑monitoring functions in real time, as realistic as possible in connection with the total

workload of a navigational watch. The degree of complexity of exercises should increase throughout the training programme until the trainee has mastered all aspects of the learning subject.

7   Exercises should produce the greatest impression of realism. To achieve this, the scenarios could be located in a fictitious sea area. Situations, functions and actions for different learning objectives which occur in different sea areas can be integrated into one exercise and experienced in real time.

8   The main objective of simulator exercises is to ensure that trainees understand their responsibilities in the operational use of ECDIS in all safety-relevant aspects and are thoroughly familiar with the system and equipment used.

Principal types of ECDIS and their display characteristics

9   The trainee should gain knowledge of the principal types of ECDIS in use; their various display characteristics, data structure and an understanding of:

        .1   differences between vector and raster charts;

        .2   differences between ECDIS and ECS;

        .3   differences between ECDIS and RCDS;

        .4   characteristics of different types of ECDIS; and

        .5   characteristics of systems for special purposes (unusual situations/emergencies).

Risks of over-reliance on ECDIS

10   The training in ECDIS operational use should address:

        .1   the limitations of ECDIS as a navigational tool;

        .2   potential risk of improper functioning of the system;

        .3   system limitations, including those of its sensors;

        .4   hydrographic data inaccuracy; limitations of vector and raster electronic charts (ECDIS vs RCDS and ENC vs RNC); and

        .5   potential risk of human errors.

Emphasis should be placed on the need to keep a proper look-out and to perform periodical checking, especially of the ship's position, by ECDIS-independent methods.

Detection of misrepresentation of information

11   Knowledge of the limitations of the equipment and detection of misrepresentation of information is essential for the safe use of ECDIS. The following factors should be emphasized during training:

        .1   performance standards of the equipment;

        .2   radar data representation on an electronic chart, elimination of discrepancy between the radar image and the electronic chart;

.3   possible projection discrepancies between an electronic and paper charts;

.4   possible scale discrepancies (overscaling and underscaling) in displaying an electronic chart and its original scale;

.5   effects of using different reference systems for positioning;

.6   effects of using different horizontal and vertical datums;

.7   effects of the motion of the ship in a seaway;

.8   ECDIS limitations in raster chart display mode;

.9   potential errors in the display of:

      .1   the own ship's position;

      .2   radar data and ARPA and AIS information;

      .3   different geodetic coordinate systems; and

.10   verification of the results of manual or automatic data correction:

      .1   comparison of chart data and radar picture; and

      .2   checking the own ship's position by using other independent position‑fixing systems.

12   False interpretation of the data and proper action to be taken to avoid errors of interpretation, should be explained. The implications of the following should be emphasized:

.1   ignoring overscaling of the display;

.2   uncritical acceptance of the own ship's position;

.3   confusion of display mode;

.4   confusion of chart scale;

.5   confusion of reference systems;

.6   different modes of presentation;

.7   different modes of vector stabilization;

.8   differences between true north and gyro north (radar);

.9   using the same data reference system;

.10   using the appropriate chart scale;

.11   using the best-suited sensor to the given situation and circumstances;

.12   entering the correct values of safety data:

          .1   the own ship's safety contour;

          .2   safety depth (safe water); and

          .3   events; and

.13   proper use of all available data.

13   Appreciation that RCDS is only a navigational aid and that, when operating in the RCDS mode, the ECDIS equipment should be used together with an appropriate portfolio of up-to-date paper charts:

          .1   appreciation of the differences in operation of RCDS mode as described in appendix 2; and

          .2   ECDIS, in any mode, should be used in training with an appropriate portfolio of up‑to-date charts.

Factors affecting system performance and accuracy

14   An elementary understanding should be attained of the principles of ECDIS, together with a full practical knowledge of:

          .1   starting and setting up ECDIS; connecting data sensors: satellite and radio navigation system receivers, radar, gyro‑compass, log, echo-sounder; accuracy and limitations of these sensors, including effects of measurement errors and ship's position accuracy, manoeuvring on the accuracy of course indicator's performance, compass error on the accuracy of course indication, shallow water on the accuracy of log performance, log correction on the accuracy of speed calculation, disturbance (sea state) on the accuracy of an echo-sounder performance; and

          .2   the current performance standards for electronic chart display and information systems adopted by the Organization[2].

Practice

Setting up and maintaining display

15   Knowledge and skills should be attained in:

          .1   the correct starting procedure to obtain the optimum display of ECDIS information;

          .2   the selection of display presentation (standard display, display base, all other information displayed individually on demand);

          .3   the correct adjustment of all variable radar/ARPA display controls for optimum display of data;

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[2]   See relevant/appropriate performance standards adopted by the Organization.

.4   the selection of convenient configuration;

.5   the selection, as appropriate, of required speed input to ECDIS;

.6   the selection of the timescale of vectors; and

.7   performance checks of position, radar/ARPA, compass, speed input sensors and ECDIS.

Operational use of electronic charts

16   Knowledge and skills should be attained in:

.1   the main characteristics of the display of ECDIS data and selecting proper information for navigational tasks;

.2   the automatic functions required for monitoring ship's safety, such as display of position, heading/gyro course, speed, safety values and time;

.3   the manual functions (by the cursor, electronic bearing line, range rings);

.4   selecting and modification of electronic chart content;

.5   scaling (including underscaling and overscaling);

.6   zooming;

.7   setting of the own ship's safety data;

.8   using a daytime or night-time display mode;

.9   reading all chart symbols and abbreviations;

.10   using different kinds of cursors and electronic bars for obtaining navigational data;

.11   viewing an area in different directions and returning to the ship's position;

.12   finding the necessary area, using geographical coordinates;

.13   displaying indispensable data layers appropriate to a navigational situation;

.14   selecting appropriate and unambiguous data (position, course, speed, etc.);

.15   entering the mariner's notes;

.16   using north-up orientation presentation and other kinds of orientation; and

.17   using true- and relative‑motion modes.

Route planning

17   Knowledge and skills should be attained in:

.1   loading the ship's characteristics into ECDIS;

.2   selection of a sea area for route planning:

.1   reviewing required waters for the sea passage; and

.2   changing over of chart scale;

.3   verifying that proper and updated charts are available;

.4   route planning on a display by means of ECDIS, using the graphic editor, taking into consideration rhumb line and great-circle sailing:

.1   using the ECDIS database for obtaining navigational, hydro‑meteorological and other data;

.2   taking into consideration turning radius and wheel‑over points/lines when they are displayed on chart scale;

.3   marking dangerous depths and areas and exhibiting guarding depth contours;

.4   marking waypoints with the crossing depth contours and critical cross‑track deviations, as well as by adding, replacing and erasing of waypoints;

.5   taking into consideration safe speed;

.6   checking pre-planned route for navigational safety; and

.7   generating alarms and warnings;

.5   route planning with calculation in the table format, including:

.1   waypoints selection;

.2   recalling the waypoints list;

.3   planning notes;

.4   adjustment of a planned route;

.5   checking a pre-planned route for navigational safety;

.6   alternative route planning;

.7   saving planned routes, loading and unloading or deleting routes;

.8   making a graphic copy of the monitor screen and printing a route;

.9   editing and modification of the planned route;

.10 setting of safety values according to the size and manoeuvring parameters of the vessel;

.11 back-route planning; and

.12 connecting several routes.

Route monitoring

18 Knowledge and skills should be attained in:

.1 using independent data to control ship's position or using alternative systems within ECDIS;

.2 using the look-ahead function:

 .1 changing charts and their scales;

 .2 reviewing navigational charts;

 .3 vector time selecting;

 .4 predicting the ship's position for some time interval;

 .5 changing the pre-planned route (route modification);

 .6 entering independent data for the calculation of wind drift and current allowance;

 .7 reacting properly to the alarm;

 .8 entering corrections for discrepancies of the geodetic datum;

 .9 displaying time markers on a ship's route;

 .10 entering ship's position manually; and

 .11 measuring coordinates, course, bearings and distances on a chart.

Alarm handling

19 Knowledge and ability to interpret and react properly to all kinds of alarm systems, such as navigational sensors, indicators, data and charts alarms and indicator warnings, including, switching the sound and visual alarm signalling system on/off, should be attained in case of:

.1 absence of the next chart in the ECDIS database;

.2 crossing a safety contour;

.3 exceeding cross-track limits;

.4 deviation from planned route;

  .5 approaching a waypoint;

  .6 approaching a critical point;

  .7 discrepancy between calculated and actual time of arrival to a waypoint;

  .8 information on under-scaling or over-scaling;
  .9 approaching an isolated navigational danger or danger area;

  .10 crossing a specified area;

  .11 selecting a different geodetic datum;

  .12 approaching other ships;

  .13 watch termination;

  .14 switching timer;

  .15 system test failure;

  .16 malfunctioning of the positioning system used in ECDIS;

  .17 failure of dead-reckoning; and

  .18 inability to fix vessel's position using the navigational system.

Manual correction of a ship's position and motion parameters

20 Knowledge and skills should be attained in manually correcting:

  .1 the ship's position in dead-reckoning mode, when the satellite and radio navigation system receiver is switched off;

  .2 the ship's position, when automatically obtained coordinates are inaccurate; and

  .3 course and speed values.

Records in the ship's log

21 Knowledge and skills should be attained in:

  .1 automatic voyage recording;

  .2 reconstruction of past track, taking into account:

    .1 recording media;

    .2 recording intervals;

    .3 verification of database in use;

  .3 viewing records in the electronic ship's log;

.4   instant recording in the electronic ship's log;

.5   changing ship's time;

.6   entering the additional data;

.7   printing the content of the electronic ship's log;

.8   setting up the automatic record time intervals;

.9   composition of voyage data and reporting; and

.10   interface with a voyage data recorder (VDR).

Chart updating

22   Knowledge and skills should be attained in:

.1   performing manual updating of electronic charts. Special attention should be paid to reference ellipsoid conformity and to conformity of the measurement units used on a chart and in the correction text;

.2   performing semi-automatic updating of electronic charts, using the data obtained on electronic media in the electronic chart format; and

.3   performing automatic updating of electronic charts, using update files obtained via electronic data communication lines.

In the scenarios where non-updated data are employed to create a critical situation, trainees should be required to perform ad hoc updating of the chart.

Operational use of ECDIS where radar/ARPA is connected

23   Knowledge and skills should be attained in:

.1   connecting ARPA to ECDIS;

.2   indicating target's speed vectors;

.3   indicating target's tracks;

.4   archiving target's tracks;

.5   viewing the table of the targets;

.6   checking alignment of radar overlay with charted geographic features;

.7   simulating one or more manoeuvres;

.8   corrections to own ship's position, using a reference point captured by ARPA; and

.9   corrections using the ARPA's cursor and electronic bar.

See also STCW Code section B-I/1, Guidance regarding the use of simulators (pertaining to radar and ARPA), especially paragraphs 17 to 19 and 36 to 38.

Operational use of ECDIS where AIS is connected

24   Knowledge and skills should be attained in:

      .1   interface with AIS;

      .2   interpretation of AIS data;

      .3   indicating target's speed vectors;

      .4   indicating target's tracks; and

      .5   archiving target's tracks.

Operational warnings, their benefits and limitations

25   Trainees should gain an appreciation of the uses, benefits and limitations of ECDIS operational warnings and their correct setting, where applicable, to avoid spurious interference.

System operational tests

26   Knowledge and skills should be attained in:

      .1   methods of testing for malfunctions of ECDIS, including functional self-testing;

      .2   precautions to be taken after a malfunction occurs; and

      .3   adequate back-up arrangements (take over and navigate using the back-up system).

Debriefing exercise

27   The instructor should analyse the results of all exercises completed by all trainees and print them out. The time spent on the debriefing should take between 10% and 15% of the total time used for simulator exercises.

REFERENCES

IMO PERFORMANCE STANDARDS FOR ECDIS

1   RESOLUTION A.817(19): PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)

2   RESOLUTION MSC.64(67): RECOMMENDATIONS ON NEW AND AMENDED PERFORMANCE STANDARDS

3   RESOLUTION MSC.86(70): ADOPTION OF NEW AND AMENDED PERFORMANCE STANDARDS FOR NAVIGATIONAL EQUIPMENT

4   RESOLUTION MSC.232(82): ADOPTION OF THE REVISED PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)

OTHER IMO CIRCULARS RELATED TO ECDIS

1   MSC.1/Circ.982: GUIDELINES ON ERGONOMIC CRITERIA FOR BRIDGE EQUIPMENT AND LAYOUT

2   MSC.1/Circ.1091: ISSUES TO BE CONSIDERED WHEN INTRODUCING NEW TECHNOLOGY ON BOARD SHIP

3   MSC.1/Circ.1221: VALIDITY OF TYPE APPROVAL CERTIFICATION FOR MARINE PRODUCTS

4   MSC.1/Circ.1389: GUIDANCE ON PROCEDURES FOR UPDATING SHIPBORNE NAVIGATION AND COMMUNICATION EQUIPMENT

5   SN.1/Circ.213: GUIDANCE ON CHART DATUMS AND THE ACCURACY OF POSITIONS ON CHARTS

6   SN.1/Circ.243/Rev.1 AMENDED GUIDELINES FOR THE PRESENTATION OF NAVIGATIONAL-RELATED SYMBOLS, TERMS AND ABBREVIATIONS

7   SN.1/Circ.255: ADDITIONAL GUIDANCE ON CHART DATUMS AND THE ACCURACY OF POSITIONS ON CHARTS

8   SN.1/Circ.265: GUIDELINES ON THE APPLICATION OF SOLAS REGULATION V/15 TO INS, IBS AND BRIDGE DESIGN

9   SN.1/Circ.288: GUIDELINES FOR BRIDGE EQUIPMENT AND SYSTEMS, THEIR ARRANGEMENT AND INTEGRATION (BES)

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