

Facts about charts and carriage requirements

PRIMAR STAVANGER – IC-ENC
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INTRODUCTION

The SOLAS Convention includes a requirement for all ships to carry up-to-date nautical charts and publications for the intended voyage. This carriage requirement may be satisfied fully or partly by electronic means.

Feedback from people involved in the use of charts and electronic chart display equipment covering manufacturers, distributors, users, ship owners, regulatory authorities, pilots, harbour authorities and others reveal a significant uncertainty about status and regulations applying to the products and equipment available in the market today. In particular, the differences between the status of the various types of equipment and the differences between the various types of data offered to the users are unclear with respect to the regulations in place.

This compendium of facts about chart carriage requirements has been compiled to serve as a reference frame to help resolve the uncertainties existing today.

The compendium has been compiled by the Hydrographic Offices of: Denmark, Finland, France (SHOM), Germany, Norway, Sweden and the United Kingdom.

The references and interpretation of the international regulations in this compendium and the actual implementation as shown in Annex VI have been verified by:

- The Danish Maritime Administration;
- The Finnish Maritime Administration, Maritime Safety Department;
- The France Maritime Administration, Ministry of Infrastructure, Transport, Housing, Tourism and the Sea, Department of Maritime Affairs and Seafarers;
- The German Ministry of Transport, Building and Housing;
- The Norwegian Maritime Directorate;
- The Swedish Maritime Administration, Department for Maritime Policy and Public Affairs; and
- The United Kingdom Maritime and Coastguard Agency.

This document does not replace or amend national or international rules and regulations.

Ship owners should always refer to their national administrations / flag states for the latest information.

This compendium consists of a main document and a number of Annexes. The main document contains a description of various aspects of charts and electronic chart display equipment in the form of questions and answers in a short form. The main emphasis is on what can be used to satisfy the SOLAS carriage requirements for charts.

The Annexes contain more detailed and additional information of the different types of equipment and the different types of digital data available today.

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This compendium is also available at www.primar-stavanger.org and www.ic-enc.org, and will be kept up-to-date on a regular basis.

The editing of the compendium was completed at 25 November 2004

DEFINITIONS

A navigational electronic chart system is a general term for all electronic equipment that is capable of displaying a vessel's position on a chart image on a screen.

There are two classes of navigational electronic chart systems.

The first is an Electronic Chart Display and Information System (ECDIS), which meets IMO/SOLAS chart carriage requirements.

The second is an Electronic Chart System (ECS), which can be used to assist navigation, but does not meet IMO/SOLAS chart carriage requirements.

ECDIS:

ECDIS equipment is specified in the IMO ECDIS Performance Standards as follows:

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS) MEANS A NAVIGATION INFORMATION SYSTEM WHICH, WITH ADEQUATE BACK UP ARRANGEMENTS, CAN BE ACCEPTED AS COMPLYING WITH THE UP-TO-DATE CHART REQUIRED BY REGULATION V/19 & V/27 OF THE 1974 SOLAS CONVENTION.

Where the term ECDIS is used in this document, this is to be understood as those navigational electronic chart systems, which have been tested, approved and certified as compliant with the IMO ECDIS Performance Standards and other relevant IMO Performance standards and thus is compliant with SOLAS ECDIS requirements

ECS:

ECS is specified in ISO 19379 as follows:

ECS IS A NAVIGATION INFORMATION SYSTEM THAT ELECTRONICALLY DISPLAYS VESSEL POSITION AND RELEVANT NAUTICAL CHART DATA AND INFORMATION FROM AN ECS DATABASE ON A DISPLAY SCREEN, BUT DOES NOT MEET ALL THE IMO REQUIREMENTS FOR ECDIS AND IS NOT INTENDED TO SATISFY THE SOLAS CHAPTER V REQUIREMENTS TO CARRY A NAVIGATIONAL CHART.

ECS equipment ranges from simple hand held GPS enabled devices to sophisticated stand-alone computer equipment interfaced to ship systems.

WHERE ARE THE RULES FOR PROFESSIONAL MARINE NAVIGATION WRITTEN DOWN?

The 1974 International Convention for the Safety of Life at Sea (SOLAS 1974), subsequently amended in 2000 and 2002, specifies the requirements for the navigational equipment to be used onboard ships entitled to fly the flag of a party to the convention. This Convention was adopted by the International Maritime Organisation (IMO), the United Nations Organisation that is concerned with maritime transportation.

IMO member states are obliged to adopt IMO rules and regulations into their national legislation. However, only when the convention text has been incorporated into national legislation does it take effect for the individual ships registered in that country. This process of incorporation into national legislation may vary from a few months to several years.

The country in which a ship is registered and hence which flag it is flying is known as the Flag State. It is the national maritime administration representing the flag state, which controls the adherence to the SOLAS carriage requirements (Flag State control).

The national maritime administration is also responsible for port state control. Ships arriving at a port may be subject to port state control by local officials based on flag state regulations and international agreements. Port states cooperate within regions to apply consistent standards, for example the European nations and Canada cooperate under the umbrella of the Paris Memorandum of Understanding (MOU).

WHAT ARE THE IMO REQUIREMENTS FOR THE CARRIAGE OF NAUTICAL CHARTS?

The requirements for carriage of nautical charts are laid down in SOLAS Chapter V.

The relevant regulations are:

- Regulation 2, defines the nautical chart
- Regulation 19¹, specifies the equipment to be carried on different types of ships and
- Regulation 27, specifies the requirement to keep charts and publications up-to-date.

APPLYING IMO REGULATIONS IN DETAIL

The nautical charts and nautical publications referred to in regulation V/2 are in short called “official charts and publications”

¹ Applies to ships constructed on or after 1 July 2002. Ships constructed before 1 July 2002 may comply with regulations V/11, V/12 and V/20 of SOLAS in force prior to 1 July 2002. Regulation V/20 contains the chart carriage requirements.

IMO SOLAS V/2:

NAUTICAL CHART OR NAUTICAL PUBLICATION IS 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.

IMO SOLAS V/19

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) MAY BE ACCEPTED AS MEETING THE CHART CARRIAGE REQUIREMENTS OF THIS SUBPARAGRAPH;

*2.1.5 BACK-UP ARRANGEMENTS TO MEET THE FUNCTIONAL REQUIREMENTS OF SUBPARAGRAPH 2.1.4, 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).*

IMO SOLAS V/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.

From the three regulations referred to in the box above the requirements for charts and publications to be carried can be fulfilled by

- 1) Carriage of official and up-to-date paper charts, or
- 2) Carriage of a type-approved ECDIS, using official and up-to-date Electronic Navigational Charts (ENC) together with an appropriate back up arrangement.

The minimum carriage requirements for charts and publications are satisfied by the use of paper products. After the amendment of SOLAS regulations 1 July 2002 it is allowed to replace the paper charts and publications by electronic means if a suitable back up is provided. Paper charts and publications continue to be the minimum requirement for back up purposes.

WHAT IS A NAUTICAL CHART?

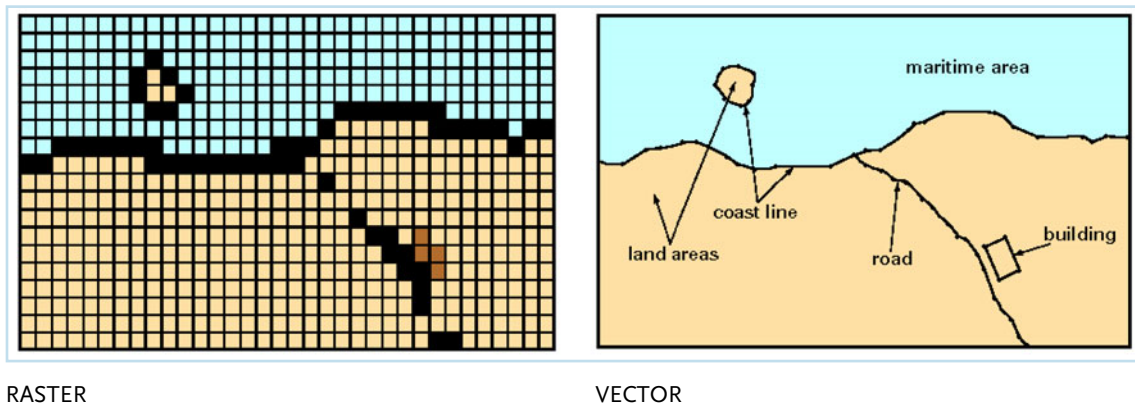
Nautical charts are special purpose maps specifically designed to meet the requirements of marine navigation, showing amongst other things depths, nature of bottom, elevations, configuration and characteristics of coast, dangers and aids to navigation.

Nautical charts offer a graphical representation of relevant information to mariners for executing safe navigation.

WHAT KINDS OF CHART AND CHART DATA ARE AVAILABLE?

Nautical charts can be distributed in analogue form, as paper charts or digitally, as chart data in raster or vector form, (see Annex III for further technical details) and are available from a variety of sources, both governmental and private.

A raster chart is basically just a scanned and passive image of a paper chart, where a vector chart corresponds to a digital analysis by object (points, lines, areas etc.)



WHAT KINDS OF PAPER CHARTS ARE THERE?

There are three kinds of nautical paper charts:

- *Original charts*, established from hydrographic and other surveys and produced by the relevant national authority;
- *“Facsimile” charts*, are exact reproductions or copies of original charts. In some cases however the facsimile may be “modified” to the publishers language and adapted to the distinct style of the publisher. In these circumstances the hydrographic content of the chart remains unchanged; and
- *Recompiled charts*, reproduced from original charts. The recompilation may be to a different scale, omitting information from the original chart and changing the appearance of the original chart.

Recompiled and facsimile charts will be delayed in publication time compared to the original charts. There is no synchronisation between the Notices to Mariners for the original charts and Notices to Mariners for recompiled or facsimile charts produced by other nations.

See Annex II for examples.

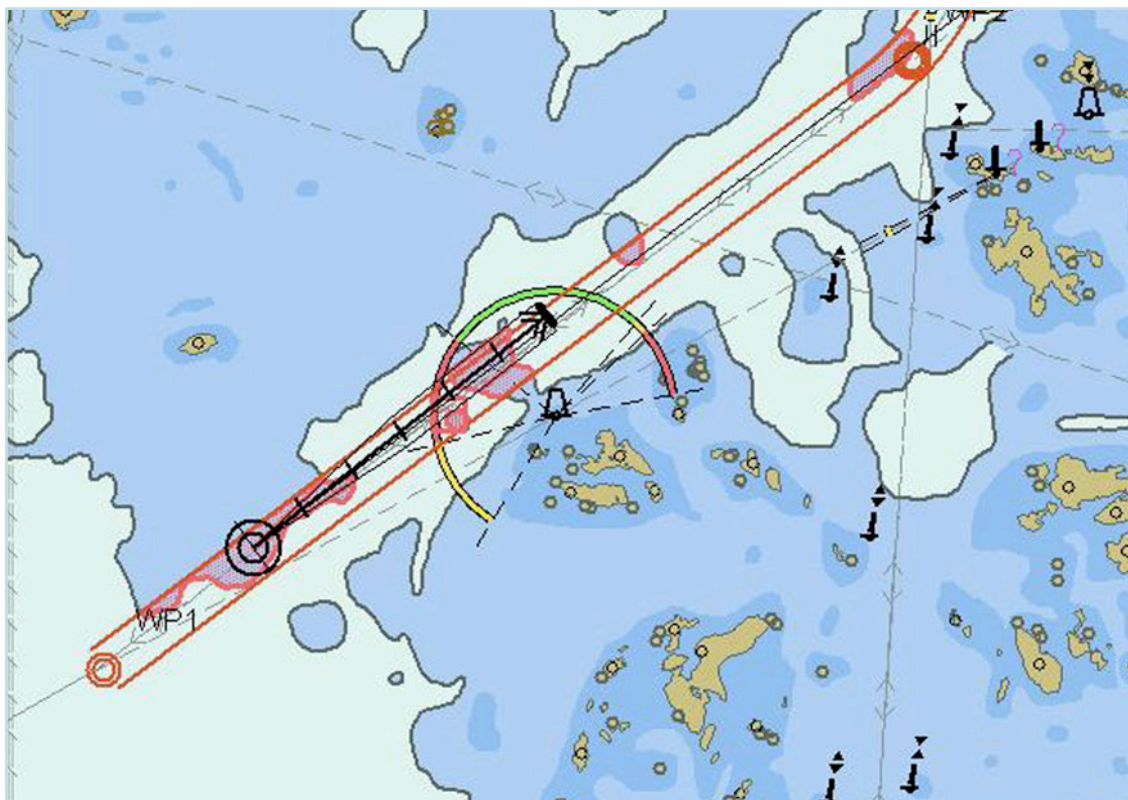
WHAT ARE OFFICIAL CHARTS?

Charts issued by or on the authority of a Government, authorized Hydrographic Office or other relevant government institutions are official and may be used to fulfil carriage requirements (provided they are kept up to date).

All other nautical charts are by definition not official and are often referred to as private charts. These charts are not accepted as the basis for navigation under the SOLAS convention.

There are two kinds of official digital charts commonly available; Electronic Navigational Charts (ENC) and Raster Navigational Charts (RNC).

WHAT IS AN OFFICIAL ENC?



PICTURE: EXAMPLE FROM TYPE-APPROVED ECDIS USING OFFICIAL ENC DATA.

ENC stands for “Electronic Navigational Chart”. The term was originally introduced for digital chart data complying with the IHO chart data transfer standard S-57. By IMO definition ENCs can only be produced by or on the authority of a government authorised Hydrographic Office or other relevant government institution; however the term ENC is not protected and has been widely (and incorrectly) used by private organisations to refer to their own products. To avoid possible confusion the word “official” has been used as a prefix to ENC in this document.

Official ENCs have the following attributes:

- ENC content is based on source data or official charts of the responsible Hydrographic Office;
- ENCs are compiled and coded according to international standards;
- ENCs are referred to World Geodetic System 1984 Datum (WGS84);
- ENC content is the responsibility of the issuing Hydrographic Office;
- ENCs are issued only by the responsible Hydrographic Office; and
- ENCs are regularly updated with official update information distributed digitally.

See section “Meeting carriage requirements for ECDIS” below and Annex III for further details.

HOW DO I RECOGNISE AN OFFICIAL ENC?

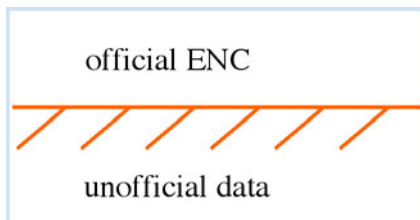
WHEN YOU ARE BUYING:

Only authorized distributors sell official ENCs as an ENC service, which includes the delivery of update information. The distributors are authorized either directly by the originating Hydrographic Office or by a cooperation of Hydrographic Offices.

WHEN USED IN AN ECDIS:

ECDIS distinguishes an official ENC from unofficial data. When unofficial data is used, ECDIS informs mariners that they must navigate by means of an official up to date paper chart by a warning, which appears continuously on the screen.

If unofficial data is shown on the ECDIS display, its boundary is to be identified by a special line style. This boundary is visualized as a “one-sided” RED line with the diagonal stroke on the non-HO side of the line.



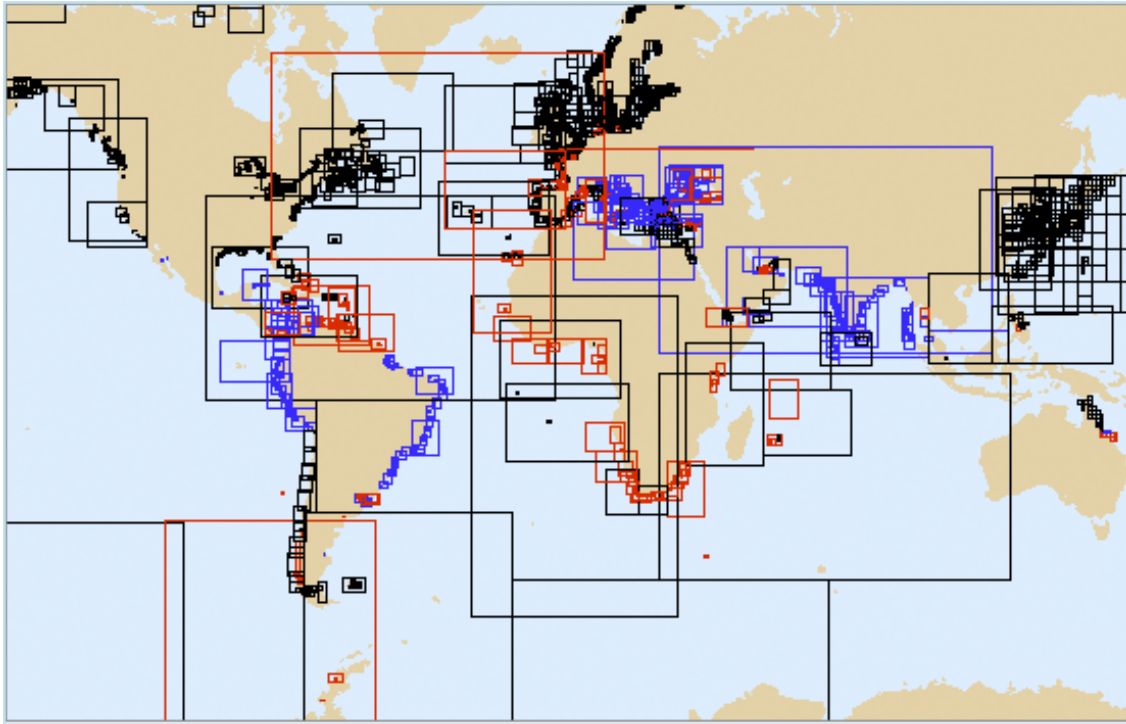
Further the mariner can use an ECDIS function to interrogate the chart display to obtain the chart details like information on originator, edition number and status of updating.

WHERE CAN I GET OFFICIAL ENCs?

The International Hydrographic Organisation (IHO) provides an interactive web catalogue (www.iho.shom.fr) displaying the status of worldwide ENC production. This system has pointers for guiding users to ENC suppliers and distributors. A three-colour scheme is used to distinguish between degrees of accessibility.

This catalogue indicates that a considerable number of ENCs have been or are being produced by Hydrographic Offices. It also shows that only a part of the issued data has been released and made available to the market.

The illustration below shows the front page of the catalogue, which can be found at the IHO web-site at www.iho.shom.fr, look under “ENC”.



SCREENSHOT OF IHO GLOBAL ENC CATALOGUE, 23 NOVEMBER 2004

HOW ARE OFFICIAL ENCs PROTECTED?

A majority of all official ENCs in Europe are only made available to the end users in a protected form compliant with the IHO S-63 Data Protection standard. The standard maintains the integrity in all transactions between the service provider and the end user.

The protection standard enables the end user systems to check the authenticity of the supplied information and verify that it is official ENC data. This feature can also be used to distinguish between official ENCs and unofficial vector data in the market.

WHAT IS AN OFFICIAL RNC?

RNC means “Raster Navigational Chart”. Official RNCs are digital raster copies of official paper charts conforming to IHO Product Specifications RNC (S-61). By definition RNCs can only be issued by, or on the authority of, a national Hydrographic Office. To avoid possible confusion the word “official” has been used as a prefix to RNC in this document.

Official RNCs have the following attributes:

- RNCs are a facsimile of official paper charts;
- RNCs are produced according to international standards;
- RNC content is the responsibility of the issuing Hydrographic Office; and
- RNCs are regularly updated with official update information distributed digitally.

The IMO performance standards for ECDIS states that where official ENC's are not available, RNCs may be used in ECDIS to meet carriage requirements². However, when the ECDIS is using RNCs it should be used together with an appropriate folio of up to date paper charts. See section "Meeting carriage requirements for ECDIS" below and Annex III for further details.

HOW ARE CHARTS KEPT UP-TO-DATE?

In order to meet carriage requirements, official charts must be kept corrected by Notices to Mariners issued by Hydrographic Offices.

UP-DATING PAPER CHARTS

The content of the "Notices to Mariners" has to be manually inserted onto the paper chart. If the amount of change is too large to be inserted manually, a new version of the chart is issued in one of the following forms:

REPRINT	A REPRINT IS AN UPDATED VERSION OF AN EXISTING CHART. A REPRINT IS DONE WHEN THE CHART IS OUT OF STOCK, AND THE REPRINT WILL INCORPORATE THE LATEST NOTICES TO MARINERS. THE PREVIOUS VERSION REMAINS VALID IF CONTINUOUSLY UPDATED BY NOTICES TO MARINERS.
NEW EDITION	A NEW EDITION IS AN EXISTING CHART, WHICH HAS BEEN UPDATED WITH INFORMATION THAT CANNOT BE APPLIED BY THE MARINER BASED ON NOTICES TO MARINERS. USUALLY A NEW EDITION IS ISSUED WHEN NEW SURVEY INFORMATION HAS BEEN INCLUDED OR VERY COMPLEX CHANGES TO BUOYS AND OTHER AIDS TO NAVIGATION ETC. HAVE BEEN APPLIED. A NEW EDITION OF A CHART WILL ALWAYS SUPERSEDE THE PREVIOUS EDITION, WHICH WILL BE WITHDRAWN. A WITHDRAWN CHART NO LONGER MEETS THE CARRIAGE REQUIREMENTS.
NEW CHART	OCCASIONALLY NEW INFORMATION WILL REQUIRE A CHANGE OF COVERAGE OR CONTENT OF A CHART; IN THIS CASE A NEW CHART OF REVISED LIMITS OR SCALE WILL BE ISSUED. IF THE PREVIOUS CHART HAS BEEN WITHDRAWN, IT NO LONGER MEETS CARRIAGE REQUIREMENTS.

UPDATING OFFICIAL ELECTRONIC CHARTS

Official electronic charts are kept up to date by applying regular, for example weekly, update information to the chart data via a data file. The update file may be transferred by wireless transmission, or by a suitable media e.g. CD. The actual updating is applied automatically by the ECDIS to its chart database. This is the preferred update method.

A standard function of ECDIS is the capability of updating the ENC manually on the screen. Objects retrieved from the Notices to Mariners and applied manually to the ENC are marked on the ENC display with an additional orange indicator.



² IMO Resolution A817(19) as amended (1.9 and Annex 7)

HOW DO I CHECK THAT ALL UPDATES HAVE BEEN APPLIED TO THE OFFICIAL ENC?

Updates to official ENCs are sequential, and the sequence is unique to each ENC. A standard ECDIS functionality is the verification that all updates in the sequence have been applied. Thus an indication will be given if an update to a specific ENC has been missed and updating is no longer possible until this missed update is added to the sequence.

Verification of the application of updates can be found in the list of updates already applied, which the ECDIS is required to keep. Should all available ENCs show the same date for the latest update, it is likely that they have not been updated regularly, and the distributor should be contacted for verification. Furthermore it is possible to use traditional sources of information, such as Notices to Mariners, to verify updates.

WHAT IS ECDIS?

ECDIS equipment is specified in the IMO ECDIS Performance Standards (IMO Resolution A.817 (19)) as follows:

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS) MEANS A NAVIGATION INFORMATION SYSTEM WHICH, WITH ADEQUATE BACK UP ARRANGEMENTS, CAN BE ACCEPTED AS COMPLYING WITH THE UP-TO-DATE CHART REQUIRED BY REGULATION V/19 & V/27 OF THE 1974 SOLAS CONVENTION, 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 IF REQUIRED.

ECDIS is a ship borne navigational device and as such it is the responsibility of IMO. It must support the whole range of navigational functions that make use of the characteristics of the chart data and their specific presentation. Moreover, to be an ECDIS the equipment must be shown to meet all the requirements of the IMO performance standards (IMO Resolution A.817(19)) and offer, besides the graphic presentation of chart data, additional information about the characteristics of the displayed features.

Within the ECDIS, the ENC database stores the chart information in the form of geographic objects represented by point, line and area shapes, carrying individual attributes, which make any of these objects unique. Appropriate mechanisms are built into the system to query the data, and then to use the obtained information to perform certain navigational functions (e.g. the anti-grounding surveillance).

The presentation of the current position, range/bearing functions and route planning capabilities are other examples of the minimum ECDIS requirements laid down in the IMO Performance Standards for ECDIS.

The presentation of official ENCs on the screen is specified in another IHO standard, the "Colours and Symbols Specifications for ECDIS IHO S-52", i.e. in its Appendix 2, called "ECDIS Presentation Library". This style of presentation is mandatory.

The use of official ENCs in a tested, approved and certified ECDIS and with appropriate back up arrangements, is the only paperless chart option for vessel navigation.

HOW IS AN ECDIS APPROVED AND BY WHOM?

To ensure that ECDIS equipment intended for onboard use is seaworthy, it must pass type approval and test procedures developed by the International Electrotechnical Commission (IEC) based on the ECDIS Performance Standards of IMO and applying the IHO requirements, S-52 and S-57 in particular.

Type approval is a method to show conformance with IMO requirements on a legal base – it is initiated and required by all flag states, which are Member States of the European Union and by many others outside including United States, Japan and Australia. ECDIS type approval is the certifications process that ECDIS equipment must undergo before it will be considered to comply with the IMO Performance Standards for ECDIS by the international shipping community.

Type approval is normally conducted by recognized organisations or by marine classification societies nominated by Flag States. Some maritime nations also have type approval programs within their maritime safety administration or Department of Marine Transportation. European Governments within the European Union have agreed about mutual recognition of their ECDIS type approval certificates – indicated by the so-called “Wheel Mark” sign of conformity - by the so-called Maritime Equipment Directive.

At the request of IMO, the IEC established the operational methods of testing for an IMO-compliant ECDIS. For each of the sections contained in the IMO Performance Standards for ECDIS, IEC developed appropriate test requirements, procedures and required test results.

Recognized organisations are making use of this test standard to conduct their type approval process.

This also applies to each of the various ECDIS related specifications provided in the current versions of IHO S-52 and IHO S-57 and associated appendices. The IEC ECDIS Test Standard is contained in IEC Publication 61174. In addition IEC 61174 refers to the application of other test standards to an ECDIS. In particular to IEC 60945, containing general requirements for robustness of the device against environmental influences and for software design, and IEC 61162 for data interfacing.

MEETING CARRIAGE REQUIREMENTS WITH ECDIS

Only a type approved ECDIS operating with up to date official ENC's and with appropriate back up may be used to replace all paper charts on a vessel.

Where official ENC's are not yet available, IMO regulations allow Flag States to authorise the use of official raster charts (together with an appropriate folio of paper charts) - see section below.

In all other cases the vessel must carry all paper charts necessary for its intended voyage.

From the regulatory perspective, the most important statement about the legal status of ECDIS is contained in the amended Chapter V of the SOLAS Convention set into force on 1 July 2002. ECDIS is specifically referred to in Regulation 19 "Carriage requirements for ship borne navigational systems and equipment". See fact box in section "What are the IMO requirements for the carriage of nautical charts" above.

However, in order to replace paper charts, such systems must fulfil considerable technical requirements:

- The chart data in use must be official (i.e. official ENC's where available);
- The graphic display on the screen must meet the equipment-independent specification; and
- The equipment must support the full range of navigational functions that can be performed on the traditional paper charts.

BACK UP REQUIREMENTS

No electronic system is completely failsafe. IMO Performance Standards therefore require that the "overall system" include both a primary ECDIS and an adequate independent back up arrangement that provides:

- Independent facilities enabling a safe take over of the ECDIS functions in order to ensure that a system failure does not result in a critical situation; and
- A means to provide for safe navigation for the remaining part of the voyage in case of ECDIS failure.

However, these rather basic statements allow considerable leeway and there are various interpretations as to what are the minimum functional requirements, or what constitute "adequate" back up arrangements.

IMO added Appendix 6 to the performance standards for ECDIS back up requirements, which lists the required functions and availability requirements of back up arrangements, including;

- Chart information using the latest official edition that are kept up-to-date for the entire voyage;
- Route planning capable of performing route planning functions, including taking over the route plan of the primary system, and adjusting a planned route;
- Route monitoring enabling take-over of the route monitoring function originally performed by the primary system, including plotting own ship's position and displaying the planned route; and
- Voyage recording that keeps a record of the ship's actual track, including positions and corresponding times.

The definition of these key functional requirements still leaves open what technical solutions constitute adequate back up arrangements.

OPTIONS FOR BACK UP ARRANGEMENTS

There are a number of possible options that could meet these requirements, including:

- A second ECDIS connected to an independent power supply and a separate GPS position input;
- An appropriate up-to-date folio of official paper charts for the intended voyage;
- An ECDIS operating in the RCDS mode of operation; and

- A radar-based system called "Chart-Radar" according to IMO Performance Standards for Chart Radar³.

At the date of publication of this document, there is no common interpretation of what types of back up arrangements are acceptable by the different national maritime administrations.

For this reason ship owners should consult their national maritime administration for specific advice.

A compendium of different maritime administrations' accepted back up arrangements are found in Annex VI.

WHAT TO DO IN AREAS WITHOUT OFFICIAL ENC COVERAGE?

In 1998 the IMO recognised that it would take some years to complete the world's coverage of ENCs. As a consequence IMO ECDIS Performance Standards were amended adding a new optional mode of operation of ECDIS, the Raster Chart Display System (RCDS) mode⁴. In this mode RNCs can be used in ECDIS to meet SOLAS carriage requirements for nautical charts. However, this is only allowed if approved by the Flag State. The intention of those changes was to allow the ECDIS to operate as far as possible on official chart data; official ENCs where they were available and official RNCs to fill in the gaps.

IMO took note of the limitations of RNCs as compared to ENCs⁵, and the revised ECDIS Performance Standards require that the ECDIS must be used together with "an appropriate folio of up-to-date paper charts" for the areas where RCDS mode is employed. The intention was to allow the number of paper charts carried by a vessel to be reduced where RCDS mode was employed, but only to a level compatible with safe navigation. No definition of an "appropriate folio" was provided by IMO and consequently different Flag States developed individual interpretations.

As there is no common interpretation of the term "appropriate" ship owners should consult their flag state as to whether RCDS mode is allowed and under what conditions.

IN AREAS WHERE ENCs OR RNCs ARE NOT AVAILABLE VESSELS MUST CARRY ALL PAPER CHARTS NECESSARY FOR THE INTENDED VOYAGE.

See Annex VI for specific implementation by a number of maritime administrations.

³ IMO Resolution A477(XII), as amended by MSC64(67)

⁴ IMO Resolution A.817 (19) as amended; 1.9 and Appendix 7

⁵ See IMO SN/Circ.207 in Annex IV for further details

DOES YOUR ECDIS SYSTEM MEET CARRIAGE REQUIREMENTS?

ECDIS Carriage Requirements – a summary

ARE OFFICIAL ENC'S AVAILABLE FOR AREA OF OPERATION?	YES	NO	YES	NO
WHAT DIGITAL CHARTS ARE BEING USED IN THE ECDIS BY THE MARINER?	OFFICIAL ENC (COVERAGE AT AN APPROPRIATE SCALE FOR NAVIGATION)	OFFICIAL RNC (COVERAGE AT AN APPROPRIATE SCALE FOR NAVIGATION)	OFFICIAL RNC	PRIVATE CHARTS (6)
WHAT BACK UP SYSTEM IS REQUIRED?	INDEPENDENT ECDIS OR OTHER BACK UP SOLUTION REQUIRED	INDEPENDENT ECDIS OR OTHER BACK UP SOLUTION REQUIRED	NONE REQUIRED (3)	NONE REQUIRED (3)
WHAT ARE THE REQUIREMENTS FOR THE CARRIAGE OF OFFICIAL PAPER CHARTS?	NONE NEEDED (1) (EXCEPT IF BACK UP IS A FOLIO OF PAPER CHARTS)	AN "APPROPRIATE" FOLIO OF UP TO DATE PAPER CHARTS TO BE USED IN CONJUNCTION WITH THE ECDIS IN RCDS MODE	ALL UP TO DATE PAPERCHARTS REQUIRED FOR SAFE NAVIGATION IN AREAS WHERE ENC'S ARE AVAILABLE	ALL UP TO DATE PAPER CHARTS REQUIRED FOR SAFE NAVIGATION FOR THE INTENDED VOYAGE
HOW IS THE ECDIS OPERATING ?	As an ECDIS	As an ECDIS in RCDS MODE	As an ECDIS in RCDS MODE	As an ECS
DOES THE ECDIS FULFIL CHART CARRIAGE REQUIREMENTS?	YES (1)	YES (2)	NO (4)	NO(5)

NOTES TO TABLE ABOVE:

(1) SOME FLAG STATES MAY REQUIRE SPECIFIC DOCUMENTATION TO ALLOW THIS.

(2) REQUIRES APPROVAL OF VESSEL'S FLAG STATE – FLAG STATE DEFINES MEANING OF 'APPROPRIATE'

(3) BACK UP SYSTEM IS ONLY REQUIRED IF ECDIS IS INTENDED TO MEET CARRIAGE REQUIREMENTS

(4) FOR ECDIS TO FULFIL CARRIAGE REQUIREMENTS VESSELS MUST USE ENC'S WHERE THESE ARE AVAILABLE

(5) PAPER CHARTS (NOT THE ECDIS) MUST REMAIN THE PRIMARY MEANS OF NAVIGATION

(6) IF PRIVATE CHARTS ARE USED IN AN ECDIS THE SYSTEM IS REGARDED AS OPERATING AS AN ECS. ECDIS OPERATING AS ECS, ECS SYSTEMS MEETING RTCM STANDARDS OR PRIVATE CHARTS MEETING ISO STANDARDS BEING USED IN ECDIS DO NOT MEET CARRIAGE REQUIREMENTS.

ACCEPTANCE OF ECDIS BY PORT STATE CONTROL

Ships arriving at a port may be subject to port state control by local officials based on flag state regulations and international agreements.

In Europe the port state control acts on the regulations set out in the Paris Memorandum of Understanding. Its ECDIS guidelines explain how a port state control Officer (PSCO) should assess whether a ship is using electronic charts in accordance with SOLAS requirements. Checks may include whether:

- The ship has documentation indicating that the system complies with IMO Performance Standards for ECDIS. In the absence of such documentation, the PSCO should seek confirmation from the Flag State that the system does meet the statutory requirements;
- The system is being used for primary navigation. It should be established if ECDIS is

- used in the ENC mode or RCDS mode or in both modes;
- There are written procedures onboard the vessel for using ECDIS;
- The master and watch-keeping Officers are able to produce appropriate documentation that generic and type-specific ECDIS familiarisation has been undertaken;
- The charts used for the intended voyage are the latest official editions;
- The charts in use are updated; and
- There are approved back up arrangements available to ensure a safe transfer of the ECDIS functions in the event of ECDIS failure and to provide safe navigation for the remaining part of the voyage.

WHAT ARE THE REQUIREMENTS FOR THE SAFE USE OF ECDIS?

The safe use of ECDIS requires the mariner to be trained and appropriate bridge procedures to be established.

WHAT ARE THE REQUIREMENTS FOR ECDIS TRAINING?

The STCW (Standards of Training, Certification and Watch-keeping) and ISM (International Safety Management) codes put the responsibility firmly on the shipowner to ensure that mariners on their vessels are competent to carry out the duties they are expected to perform. If a ship is fitted with ECDIS, the shipowner has a duty to ensure that users of such a system are properly trained in the operation and use of electronic charts and are familiar with the shipboard equipment before using it operationally at sea.

There is no specific regulation or reference to ECDIS systems in the STCW Convention. However, since ECDIS systems are related to electronic charts, references about them are considered to be included in the material covered by the word “chart”:

- Following the functional approach, the Officer in charge of navigational watch must have *“thorough knowledge of and ability to use navigational charts and publications, [...]”*;
- The methods for demonstrating competence are *“using chart catalogues, charts, navigational publications, [...] electronic navigation equipment [...]”*;
- Criteria for evaluating competence are stated as *“The charts selected are the largest scale suitable for the area of navigation and charts and publications are corrected in accordance with the latest information available”*; and
- Finally, a candidate for certification must provide evidence of skills and ability to prepare for and conduct a passage, *“including interpretation and applying information from charts”*.

To encourage effective ECDIS education, the IMO approved a standardised model course for ECDIS training on the operational use of ECDIS in 1999 (IMO course 1.27). This course is offered by approved training institutions and maritime academies. Maritime administrations can provide information on approved institutions. Some flag states have developed their own training courses in ECDIS in order to be able to recognise the training certificates.

Type specific ECDIS training is provided by equipment manufacturers.

WHAT ARE THE ECDIS OPERATIONAL CONSIDERATIONS?

Navigating with ECDIS is fundamentally different from navigating with paper charts.

The ECDIS changes the way work is done on the bridge of a vessel. This requires careful analysis of the facilities and specifications of the installed equipment, hereunder the navigational sensors and the data they acquire and of the rules and regulations applicable to the system and its use in navigation in particular. It requires that the need for new bridge procedures is analysed in view of the change of work processes introduced by the equipment and it requires an appreciation of the human element.

A list of bridge work-processes that are affected by changing to an ECDIS, and which may require that procedures are amended or developed is found in Annex V. This list includes some points for analysis and consideration.

WHAT IS ECS?

All systems, which are not tested to show compliance with the ECDIS Performance Standards, can be generically designated as "Electronic Chart Systems" (ECS). An ECS may be able to use either official ENC's, RNC's or other chart data produced privately and could have functionality similar to ECDIS.

Some ECS equipment manufacturers also produce vector and raster data to use in their products. These suppliers have been producing private chart data for a number of years and have established themselves in the market. They were the pioneers and have established the idea and the use of electronic chart systems on vessels. Their charts are derived from Hydrographic Office paper charts or Hydrographic Office digital data.

Hydrographic Offices do not take any responsibility for the accuracy or reliability of privately produced charts.

Where the vessel operates with ECS, the paper chart remains the official basis for navigation onboard. The vessel must retain and use a full folio of up-to-date paper charts onboard, regardless of the type of electronic charts used.

Because ECS is not intended to meet SOLAS requirements, there are no IMO Performance Standards⁶ for ECS.

⁶ The International Organisation for Standardization (ISO) has developed a Standard for ECS databases (=ECS Charts). Document ISO 19379. The Radio Technical Commission For Maritime Services (RTCM) has developed a recommended Performance Standard for ECS (=ECS Equipment). RTCM Paper 100-2002/SC109-STD. None of these standards are recognized by the IMO.

Some ECS manufacturers also use the term RCDS to describe their systems. In this case the manufacturer is stating that the system uses RNCs and possibly that it has the same functionality as required by the ECDIS Performance Standards. However, such systems cannot be used to meet carriage requirements.

The STCW and ISM codes put the responsibility firmly on the shipowner to ensure that mariners on their vessels are competent to carry out the duties they are expected to perform. If a ship has ECS fitted, the shipowner has a duty to ensure that users of such a system are properly trained in the operation and use of electronic charts, are aware of the limitations compared to ECDIS and are familiar with the shipboard equipment before using it operationally at sea.

FINAL REMARKS

This document is a first version of an information document aimed at giving the international shipping society a compendium, which provides factual information on chart carriage requirements, paper charts and digital charts and chart display equipment.

It is intended to up date and develop the document further.

Feedback from the readers of this document will be welcomed in the continuing process of improving the contents.

Feedback may be addressed to any of the Hydrographic Offices listed in the Introduction.

NORMATIVE REFERENCES

- International Convention for the Safety of Life at Sea (SOLAS), 1974 as amended
- IMO Resolution A817(19): Performance Standards for ECDIS;
- IEC 61174 (2001-10): Electronic chart display and information system (ECDIS) - Operational and performance requirements, methods of testing and required test results
- IEC 60945: Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results;
- IEC 61162: Navigation interfaces – Methods of testing and required test results;
- IHO S-57: IHO Transfer Standard for Digital Hydrographic Data, edition 3.1;
- IHO S-52: IHO Colour and Symbols Specifications for ECDIS, edition 4.2;
- IHO S-61: IHO Product Specification for Raster Navigational Charts, edition 1.0;
- IHO S-62: IHO Codes for producing Agencies; and
- IHO S-63: IHO Data Protection Scheme, edition 1.0.

ANNEX I Glossary/list of abbreviations

ABBREVIATION	EXPLANATION
AIS	AUTOMATIC IDENTIFICATION SYSTEM
ARPA	AUTOMATIC RADAR PLOTTING AID
ECS CHARTS	NON OFFICIAL (PRIVATE) CHART DATA (VECTOR OR RASTER)
ECDIS	ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM.
ECS	ELECTRONIC CHART SYSTEM (NON COMPLYING WITH SOLAS REQUIREMENTS)
ENC	ELECTRONIC NAVIGATIONAL CHART
GPS	GLOBAL POSITIONING SYSTEM
HYDROGRAPHIC OFFICE	NATIONAL HYDROGRAPHIC OFFICE.
IC-ENC	INTERNATIONAL CENTRE FOR ENCs, RENC OPERATED BY UK HYDROGRAPHIC OFFICE
IEC	INTERNATIONAL ELECTROTECHNICAL COMMISSION
IHO	INTERNATIONAL HYDROGRAPHIC ORGANISATION
IMO	INTERNATIONAL MARITIME ORGANISATION
ISM	INTERNATIONAL SAFETY MANAGEMENT CODE
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
NtM	NOTICES TO MARINERS
MoU	MEMORANDUM OF UNDERSTANDING
PRIMAR STAVANGER	RENC OPERATED BY NORWEGIAN HYDROGRAPHIC OFFICE
PSC	PORT STATE CONTROL
PSCO	PORT STATE CONTROL OFFICER
RCDS	RASTER CHART DISPLAY SYSTEM
RENC	REGIONAL ENC COORDINATION CENTRE
RNC	RASTER NAVIGATIONAL CHART
RTCM	RADIO TECHNICAL COMMISSION FOR MARITIME SERVICES
S-52	IHO'S SPECIAL PUBLICATION No. 52. IHO COLOUR AND SYMBOLS SPECIFICATIONS FOR ECDIS
S-57	IHO'S SPECIAL PUBLICATION No. 57. IHO TRANSFER STANDARD FOR DIGITAL HYDROGRAPHIC DATA
S-61	IHO'S SPECIAL PUBLICATION No. 61. IHO PRODUCT SPECIFICATION FOR RASTER NAVIGATIONAL CHARTS
S-62	IHO'S SPECIAL PUBLICATION No. 62. IHO CODES FOR PRODUCING AGENCIES
S-63	IHO'S SPECIAL PUBLICATION No. 63. IHO DATA PROTECTION SCHEME
SATCOM	SATELLITE COMMUNICATION
SENC	SYSTEM ENC
SOLAS	IMO'S CONVENTION FOR SAFETY OF LIFE AT SEA
WEND	WORLD ENC DATABASE
WGS84	WORLD GEODETIC SYSTEM 1984
TERM	EXPLANATION
VALIDATION	PROCESS WHICH AIMS TO SECURE THAT AN ENC IS PRODUCED ACCORDING TO IHO STANDARD S-57
BIMCO	WORLD'S LARGEST ASSOCIATION OF SHIPOWNERS AND OTHERS REPRESENTING MORE THAN 65% OF WORLD'S TONNAGE

ANNEX II Comparison of paper charts

There can be several paper chart series issued officially i.e. by or on the authority of a government, for a given geographic area. There is normally only one original series; all others are some form of copy of the original. There is normally no coordination between the different governments' paper chart series and no synchronization of the update frequencies.

The original series are most often produced by the coastal state, but some coastal states have arrangements with other states to produce the original chart series covering their waters. Examples are France for parts of the Pacific and some parts of the African coast and Indian Ocean, the Netherlands for parts of the Caribbean, the United Kingdom for parts of the Atlantic and Indian Oceans.

Three nations produce and maintain a worldwide chart series. These are the Russian Federation, the United Kingdom and the United States of America. A number of other nations produce chart series that cover an area somewhat larger than their own territorial sea and the immediate adjacent water areas. Examples are France, Japan and Germany. Except for areas where these nations are producing original chart series, all charts within their series are either facsimile or recompiled versions of the original charts.

In the modification process changes to the original scale, content and choice of colours may take place. Delays are likely to appear between the issue of a new edition of the original chart and the corresponding modified copies. There may also be delays between the issue of Notices to Mariners for the original charts and those produced for the derived charts series.

Below are a number of examples of an original chart and three modified copies, which illustrates the variation in the way the chart information is presented. Finally a new original chart of the same area based on new information.

The examples are in sequence:

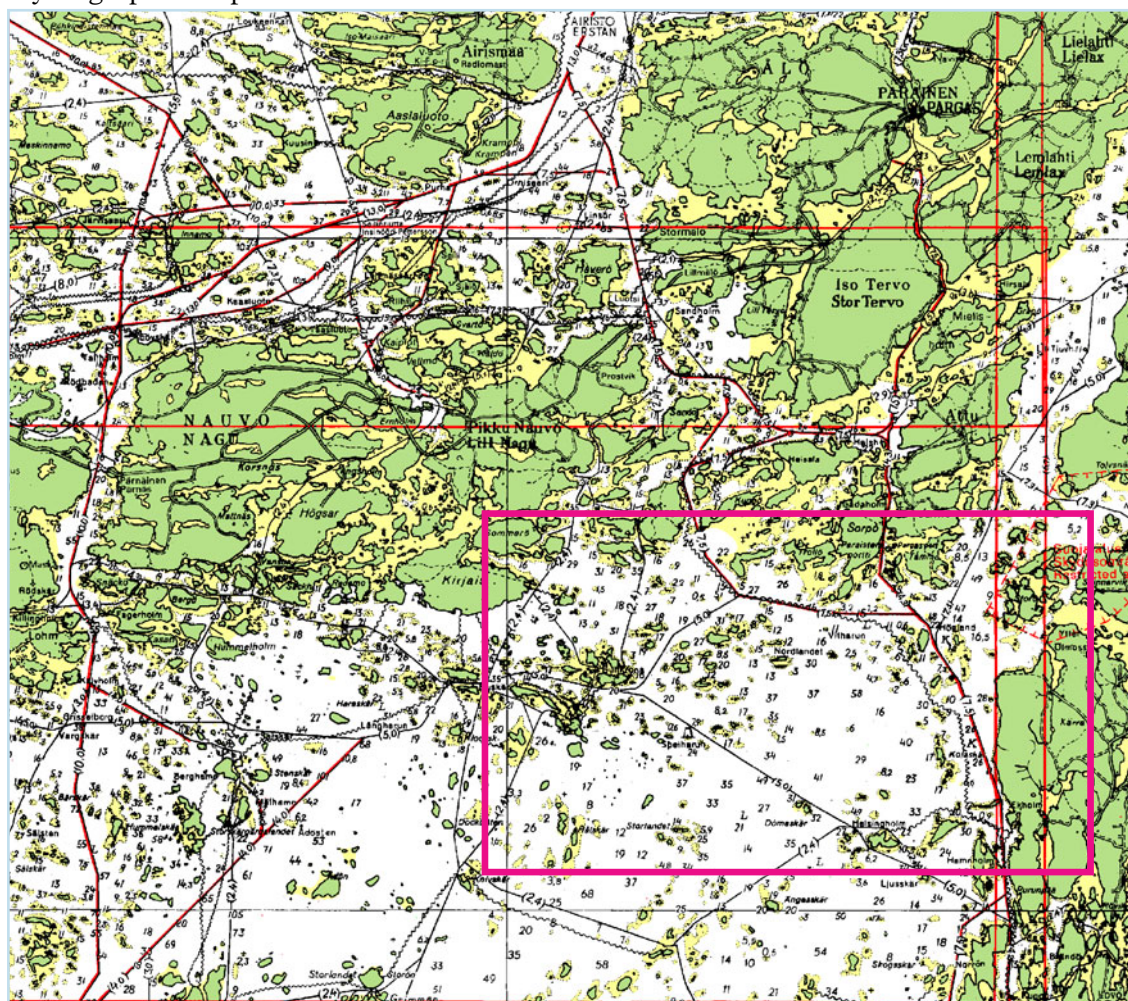
- FI 903. Finnish general chart "Saaristomeri - Skärgårdshavet". Scale 1:200 000. Originally published in 1940, newest edition in 2002. No NtM corrections included.
- BA 2297. British Admiralty general chart "Gulf of Bothnia - Saaristomeri and Ålands hav". Scale 1:225 000. The first edition published in November 1984, newest edition in May 2003. NtM corrections included up to 30/2907/ 2004
- BSH 1300. German general chart "Finnische Küste - Åland-Inseln und Turku-Schären". Scale 1:200 000. The first edition published in March 1981, newest edition in August 2003. NtM corrections included up to 33/2003.
- RU 22059. Russian general chart "Baltic Sea - Port Turku (Abo) to Saaremaa". Scale 1:250 000. The first edition published in July 1995, newest edition in June 2001. NtM corrections included up to August 2002.
- FI 952. Finnish general chart "Baltic Sea - Gulf of Finland. Läntinen Suomenlahti - Västra Finska Viken". Scale 1:250 000. The first edition published in November 2003. No NtM corrections included.

Chart FI 903 is the source of the three derived charts. To assist in the comparison a square has been drawn on all examples.

Items to compare within the squares are a.o. amount of detail, choice of symbols and line styles. The same comparison should be made towards the new chart of the same area, FI 952.

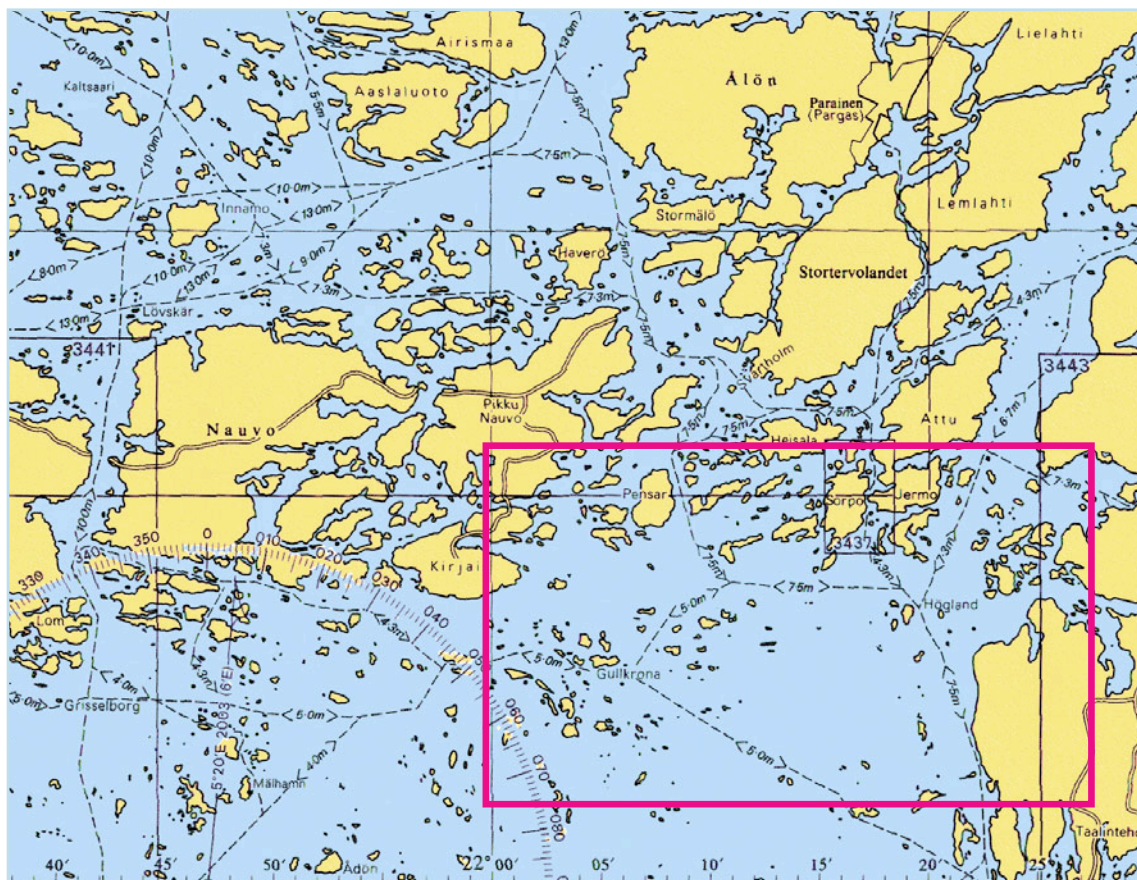
ANNEX II Comparison of paper charts

FI 903. Reproduced by permission of the Finnish Maritime Administration, Hydrographic Department.



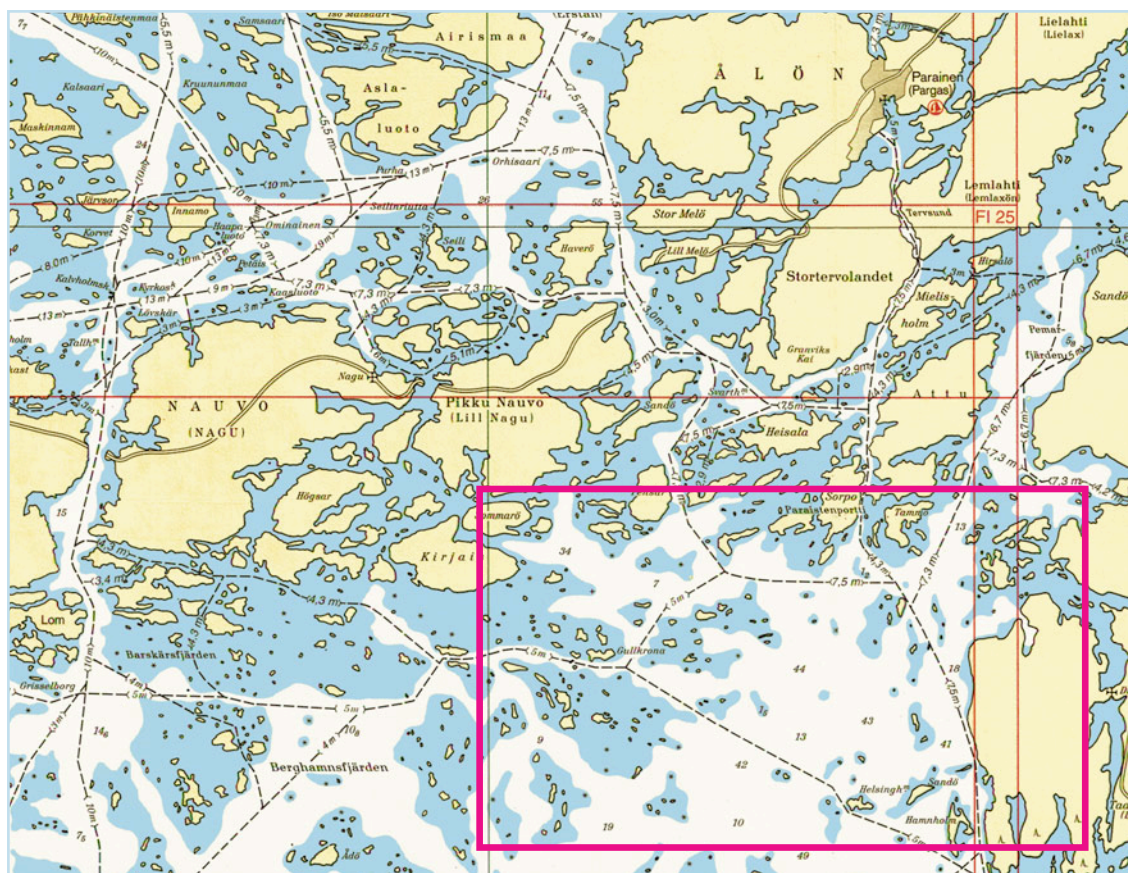
ANNEX II Comparison of paper charts

BA 2297. Reproduced from Admiralty chart 2297 by permission of the controller of Her Majesty's Stationary Office and the Hydrographic Offices of Finland, Sweden and the United Kingdom (www.ukho.gov.uk).



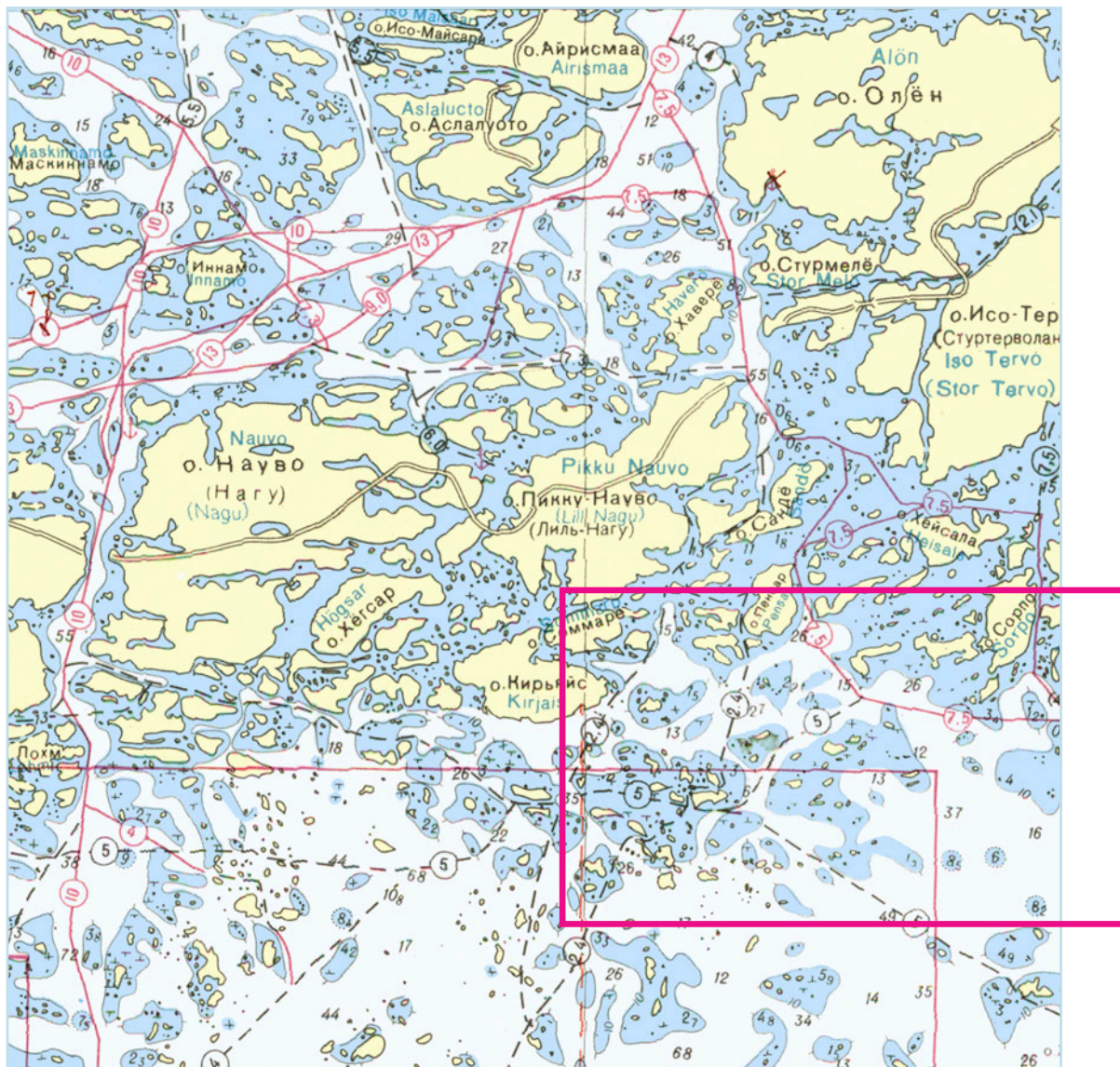
ANNEX II Comparison of paper charts

BSH 1300. Reproduced by permission of Bundesamt für Seeschifffahrt und Hydrographie.



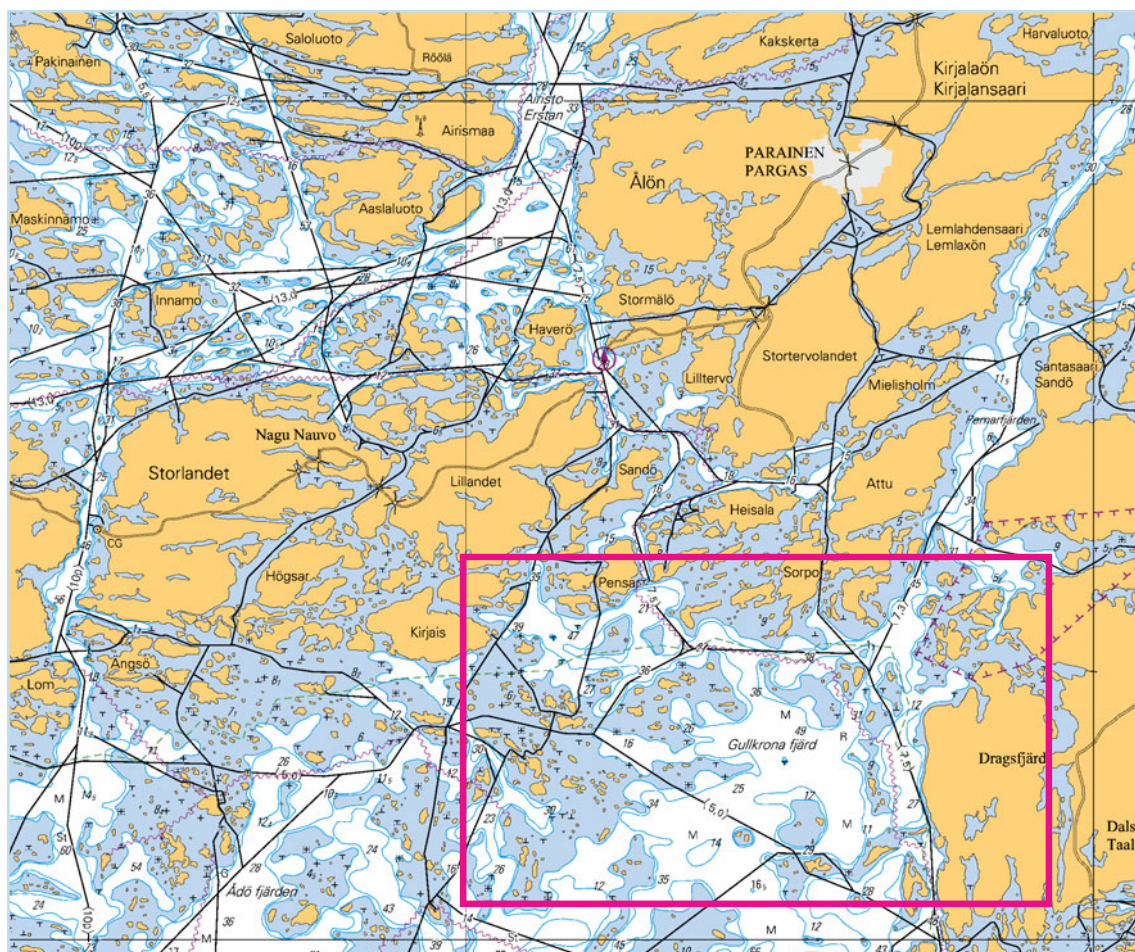
ANNEX II Comparison of paper charts

RU 22059. Reproduced by permission of the Head Department of Navigation and Hydrography.



ANNEX II Comparison of paper charts

FI 952. Reproduced by permission of the Finnish Maritime Administration, Hydrographic Department.



ANNEX II Comparison of paper charts

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IMO

E

Ref. T2/2.07

SN/Circ.213
31 May 2000

GUIDANCE ON CHART DATUMS AND THE ACCURACY OF POSITIONS ON CHARTS

- 1 The Maritime Safety Committee, at its seventy-second session (17 to 26 May 2000), approved guidance on chart datums and the accuracy of positions on charts, given at annex.
- 2 Member Governments are invited to bring this guidance to the attention of all concerned for information and action, as appropriate.

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ANNEX

GUIDANCE ON CHART DATUMS AND THE ACCURACY OF POSITIONS ON CHARTS

1 Many different definitions of a horizontal datum (also known as geodetic datum) exist. However, a practical working definition in use is:

“A horizontal datum is a reference system for specifying positions on the Earth’s surface. Each datum is associated with a particular reference spheroid that can be different in size, orientation and relative position from the spheroids associated with other horizontal datums. Positions referred to different datums can differ by several hundred metres.”

2 The practical result is that a given geographical position, not associated with a specific datum, could refer to different physical objects. In other words, a physical object can have as many geographical positions as there are datums. For example, South Foreland Lighthouse, United Kingdom, has the following positions:

GEOGRAPHICAL POSITION	HORIZONTAL DATUM
51°08′.39 N 001°22′.37 E	referred to OSGB(36) Datum (the local datum for the United Kingdom)
51°08′.47 N 001°22′.35 E	referred to European (1950) Datum (the continental datum)
51°08′.42 N 001°22′.27 E	referred to World Geodetic System 1984 (WGS84) Datum (the world-wide datum used by Global Positioning System (GPS))

3 Most charts are not yet referred to WGS84 Datum. This means that, in those cases, positions obtained from satellite navigation receivers will not be directly compatible with the chart and **must** not be used without adjustment. Hydrographic offices are attempting to refer as many new charts as possible to WGS84, but there remain many areas of the world where information does not exist to enable the transformation to be performed.

4 When known, the horizontal datum of the chart is usually named in the chart title albeit, on its own, this information is of limited benefit to the mariner. Since 1982 many hydrographic offices have been adding “Satellite-Derived Positions” notes (usually situated close to the title) when charts have been revised. This note provides a latitude and longitude adjustment to be applied to positions obtained directly from satellite navigation systems (such as GPS) to make them compatible with the horizontal datum of the chart.

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5 The following provides a worked example:

Satellite-Derived Position (WGS-84 Datum)	64°22'.00 N 021°30'.00 W
latitude/longitude adjustments	<u>0'.07 S 0'.24 E</u>
Adjusted position (compatible with chart datum)	64°21'.93 N 021°29'.76 W

In this example, the shift equates to approximately 230 metres which can be plotted at scales larger than 1:1,000,000.

6 Where known, these adjustments are an average value for the whole area covered by the chart and are quoted to 2 decimal places of a minute in both latitude and longitude, so that the maximum uncertainty is about 10 metres in both latitude and longitude (0.005' and 0.014' will both be rounded to 0.01'). This uncertainty can be plotted at scales larger than 1:30,000 (where it is represented by 0.3 mm on the chart).

7 Inevitably, cases exist where overlapping charts show different latitude or longitude shift values. For example, one chart might show 0.06' and its neighbour 0.07'; for each individual chart the value will be an average, but in the area common to both charts the value will range from 0.064' to 0.066'.

8 In the cases where an adjustment cannot be determined because of the lack of knowledge about the relationship between WGS84 Datum and the datum of the chart, the hydrographic office may add a note to that effect warning that adjustments "may be significant to navigation". The largest difference between satellite navigation derived and charted position reported so far is 7 miles in the Pacific Ocean, but even larger undiscovered differences may exist. Where charts do not contain any note about position adjustment it **must** not be assumed that no adjustment is required.

9 Most manufacturers of GPS receivers are now incorporating datum transformations into their software which enable users to (apparently) receive positions referred to datums other than WGS84 Datum. Unfortunately, many cases exist where a single transformation will not be accurate for a large regional datum. For example, the relationship between WGS84 Datum and European Datum (1950) is very different between the north and south of the region, despite the datum name being the same. Therefore, the position transformed to European Datum (1950) in the receiver by means of a Europe -wide average may differ from the WGS84 Datum position output by the receiver, amended to European Datum (1950) by the shift note on an individual chart. In the light of the 100 metre accuracy of the Standard Positioning Service of GPS this may not be significant, but it is an additional source of error and is of major significance if differential GPS (DGPS) is being used for navigation.

10 It must not be assumed that all charts in a region are referred to the regional datum. For example, although most metric charts of mainland European waters are referred to European Datum (1950), many charts are also referred to local datums. Additionally, as there are no international standards defining the conversion parameters between different horizontal datums; the parameters used by the GPS devices may be different. The hydrographic offices use the best adopted parameters, so mariners are advised to keep their GPS receiver referred to WGS84 Datum and apply the datum adjustment note from the chart.

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11 Apart from the differences in positions between different horizontal datums, two other aspects affect charted positional accuracy. These aspects are:

- the accuracy to which features are surveyed (paragraphs 12 to 16; and
- the accuracy with which they are compiled on to a chart (paragraphs 17 to 21).

Surveying

12 Hydrographic surveys are generally conducted using the best position-fixing technology available at the time. This was limited to accurate visual fixing until the Second World War, but used terrestrial based electronic position fixing (such as Decca, Hifix, Hyperfix and Trisponder) until the 1980s. DGPS is the current standard for most hydrographic surveys.

13 Generally, position fixing for surveying was more accurate than that for navigation in the first two categories, but DGPS is being made more widely available for use by all mariners with the appropriate equipment. The result is that current navigation with DGPS is, commonly, more accurate than position-fixing used for surveys conducted before 1980. The consequence is that, although a modern vessel may know its position to an accuracy of better than 10 metres, the positions of objects on the seabed may only be known to an accuracy of 20 metres or much worse, depending on the age of the latest survey and/or its distance from the coast.

14 Furthermore it is only since the 1970s that surveying systems have had the computer processing capacity to enable the observations to be analysed to enable an estimate of the accuracy of position fixing to be generated. The result is that, although the current accuracy standard of position fixing surveys can be stated (see paragraph 15 below), it is impossible to provide anything other than general estimates for older surveys.

15 The current accuracy standard for positioning is 13 metres for most surveys with the standard of ± 5 metres (both 95% of the time) for certain special purpose surveys. It can be confidently stated that the former value is often significantly improved upon. Further improvements will undoubtedly be made as a result of technological developments, but at present there has to be a balance between the cost of a survey and the quality and quantity of the results achieved.

16 In summary, although the positions of maritime objects derived from modern surveys will be accurate to better than 10 metres, this cannot be used as a general statement about all such objects.

Chart compilation

17 Most paper charts and their derived digital versions are assembled from a variety of sources such as maps, surveys, photogrammetric plots etc. The intention is to provide the mariner with the best available information for all parts of that chart and the usual procedure is to start with the most accurate sources, but it is often impossible to complete the whole chart without resource to older, less accurate, sources. When sources are referred to different datums, transformations have to be calculated and applied to make the sources compatible. The intention is for such transformations to have an accuracy of 0.3 mm at chart scale, this being the effective limit of manual cartography, but, depending on the information available, this may not always be possible.

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18 When the positions of objects critical to navigation are accurately known, the intention is that they are located on a chart to an accuracy of 0.3 mm. The obvious consequence is that accuracy varies with chart scale:

0.3 mm at a scale of 1:10,000 is 3 metres
0.3 mm at a scale of 1:50,000 is 15 metres
0.3 mm at a scale of 1:150,000 is 45 metres

19 The situation will change as chart data becomes available digitally, but much of the early digital data will be derived from these paper charts and the limitations will remain. Furthermore, a pixel on a computer display screen is approximately 0.2 mm square, roughly equivalent to the accuracy available on the paper chart.

20 The situation for mariners is improving with recent surveys referred directly to WGS84 Datum, increasing numbers of charts referred to WGS84 Datum (or to North American Datum 1983 which is the same to all practical purposes) and increased international co-operation in the exchange of information. Unfortunately, it will be many years before all areas are re-surveyed and all charts revised.

21 Until such time, mariners should remain alert to danger. A satellite navigation receiver may output a position to a precision of three decimal places of a minute, but that does not mean that all its positions are accurate to 2 metres or that the resulting position is compatible with the positions of objects shown on modern charts (paper or digital) which may have been established 100 years ago and not surveyed since. The chart title notes and cautions and the source Diagram, which shows the ages of surveys must always be consulted for indications of limitations.

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ANNEX III Types of Digital Charts

OFFICIAL ELECTRONIC CHART DATA

Official electronic chart data are of two general types:

- Official Electronic Navigational Charts (ENC), and
- Official Raster Navigational Charts (RNC).

The inner construction of ENCs and RNCs is fundamentally different:

- ENCs are vector charts, and
- RNCs are raster charts.

The term “Official” (Official ENCs, Official RNCs), indicates that those chart data have been produced under the authority of a government – in contrast to private, i.e. non-official electronic chart data which might be technically of the same type but have been produced without the authority of a government.

OFFICIAL ELECTRONIC NAVIGATIONAL CHARTS (ENC)

GENERAL PRINCIPLES

IMO’s definition for the Electronic Navigational Chart – ENC:

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 USEFUL FOR SAFE NAVIGATION, AND MAY CONTAIN SUPPLEMENTARY INFORMATION IN ADDITION TO THAT CONTAINED IN THE PAPER, WHICH MAY BE CONSIDERED NECESSARY FOR SAFE NAVIGATION.

Official ENCs are vector charts compiled from a database of individual geo-referenced objects from Hydrographic Office’s archives including existing paper charts.

When used in an ECDIS, the ENCs content can be displayed as a seamless pattern in user selected scales presenting user selected chart items. Due to the limited physical size and the limited resolution of computer monitors the chart image generated from ENCs does not fully imitate the known appearance of the paper chart. This apparent disadvantage is compensated by the ENC being a database: special ECDIS operational functions continuously retrieve the ENC content to give warning of impending danger in relation to the vessel’s position and its movement.

ENC DATA FORMAT

In order to facilitate the world-wide uniformity of ENCs issued by different bodies, the IHO Special Publication S-57 “IHO Transfer Standard for Digital Hydrographic Data” is used. S-57 generally describes the standards to be used for the exchange of digital hydrographic data between national Hydrographic Office’s and for the distribution of digital data and products to manufacturers, mariners, and other data users.

The current version 3.1 (2004) of S-57 is not limited to ENC compilation, but the included description of the ENC data format, the ENC product specification and the ENC updating profile are the most important parts of the standard as it stands today.

World Geodetic System 1984 (WGS 84) are being used a reference frame in all official ENCs and for GPS as well.

ANNEX III Types of Digital Charts

ENC VISUALISATION

An ENC contains an abstract description of geographic entities but does not contain any presentation rules. All presentation rules to get the ENCs content displayed are contained in a separate ECDIS software module - the "Presentation Library".

Both the geo-referenced objects contained in the ENC and the appropriate symbolisation contained in the Presentation Library are linked to each other in the ECDIS only when called up for display. The resulting image will differ depending on the selected sea area, the intended display scale and the mariner's pre-settings like ambient light conditions and other operational conditions.

The definition of the Presentation Library for ENCs is contained in Annex A of the IHO Special Publication S-52, Appendix 2 "Colours & Symbols Specifications for ECDIS" (current edition 3.3/2004) and is mandatory for all ECDIS.

The strict separation between the Hydrographic information contained in the ENC, operational information taken from navigation sensors and their situation related presentation by means of the Presentation Library gives the flexibility to display the diversity of ECDIS information, e.g.: physical chart information, (e.g. coastline, depth contours, buoys),

- Physical chart information, (e.g. coastline, depth contours, buoys);
- Traffic routing; specified areas; cautions; etc.;
- Supplementary Hydrographic Office information from light list, etc.;
- Mariner's notes; additional local chart information; manufacturer's information;
- Chartwork such as planned route; electronic bearing lines and range rings etc.;
- Own ship's position and course/speed vector; ship's heading and rate of turn; past track;
- Fix accuracy, or position check from secondary positioning system;
- Possibly, shiphandling options, based on ship's characteristics;
- Alphanumeric navigation information (ship's latitude, longitude, heading, course, etc.);
- Information from radar and other sensors,
- Information from AIS;
- Navigational indications and alarms generated by ECDIS;
- Possibly, telemetered information from shore authorities, (traffic, real-time tides etc.);
- Possibly, ice information;
- Reminders, (e.g. time to contact pilot station); and
- Possibly, a message from other displays (e.g. alarm on engine room display).

Because much experience is embodied in the paper chart, and to avoid confusion in the extended period while paper charts and RNCs as compared to ENCs co-exist, the two presentations should be similar wherever possible.

The ECDIS Presentation Library follows that of the paper chart to the widest extent possible. However, studies and early experience indicated that good visual communication between the ECDIS display and the user requires more flexibility of display than is available from paper charts. Consequently some alternative display methods are being introduced as options in the Presentation Library, e.g.:

ANNEX III Types of Digital Charts

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

Probably no other display application is as demanding as that of ECDIS. Since colour is a prime means of distinguishing features, the maximum range of colours should be available. However, the colours selected must be such that they can be clearly discriminated by a mariner with no more than adequate colour vision, and colour induction effects must be avoided (for example a small green object on a saturated blue background will tend to appear yellow).

The ambient lighting on the bridge varies between the extremes of bright sunlight, which washes out information on the display, and night, when the light emitted by the display has to be low enough that it does not affect the mariner's night vision.

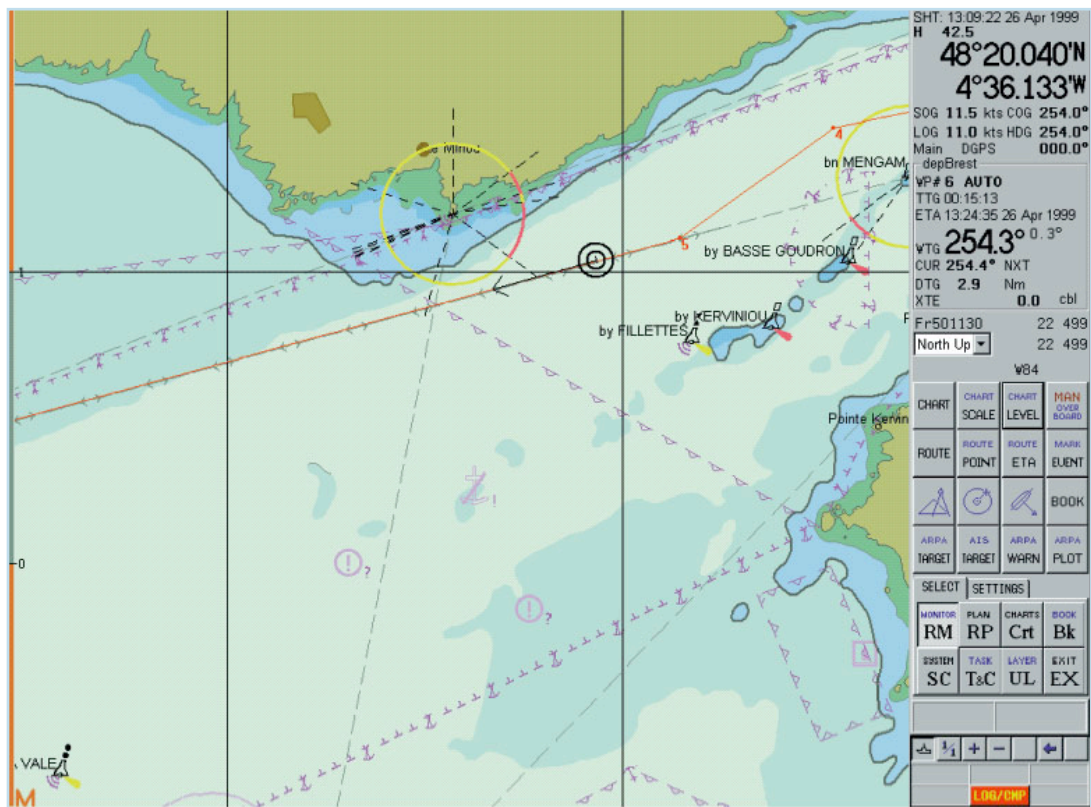
The colour and symbol specifications of S-52 have been designed to meet these difficult requirements rather than less demanding normal day conditions. Because the ECDIS display uses emitted light, compared with reflected light for the paper chart, ECDIS must switch to a negative image of the chart at night, using a dark background in place of the white background of the paper chart, in order not to impair night vision.

Three predefined different colour schemes are therefore provided:

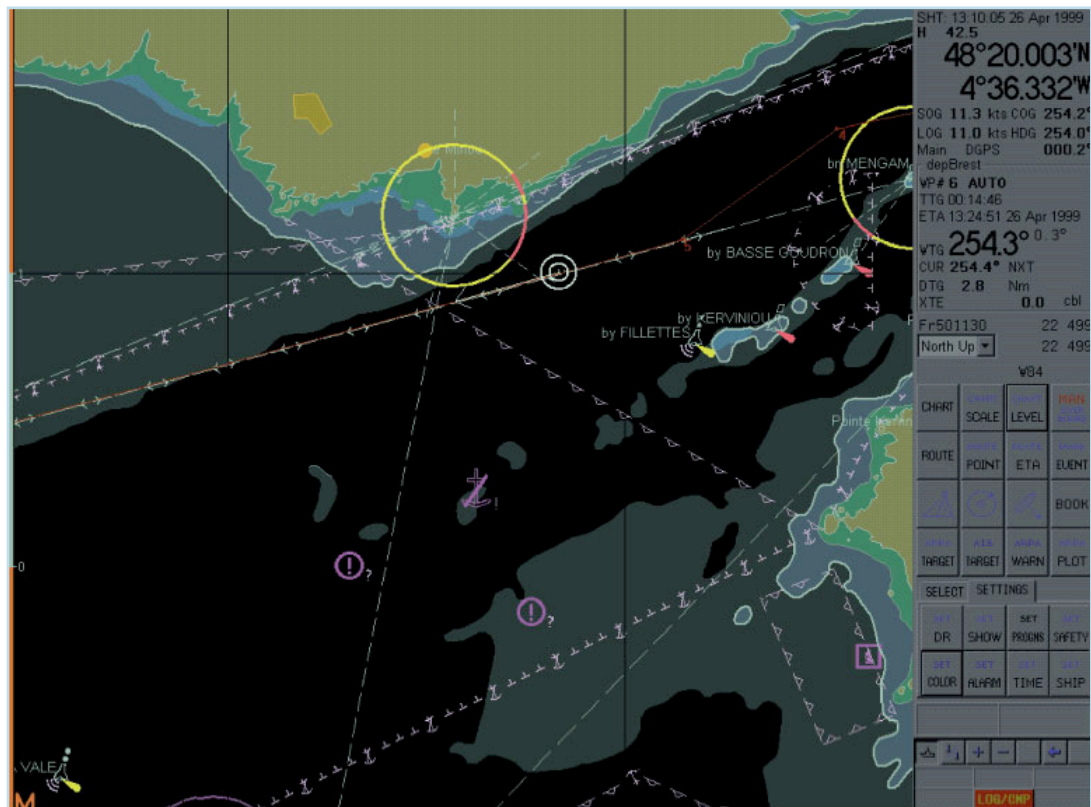
- Day (white background)
- Dusk (black background)
- Night (black background)

Below are illustrated two different colour schemes and the three standard selections of content i.e. Standard Display, Base Display and Full Display.

ANNEX III Types of Digital Charts

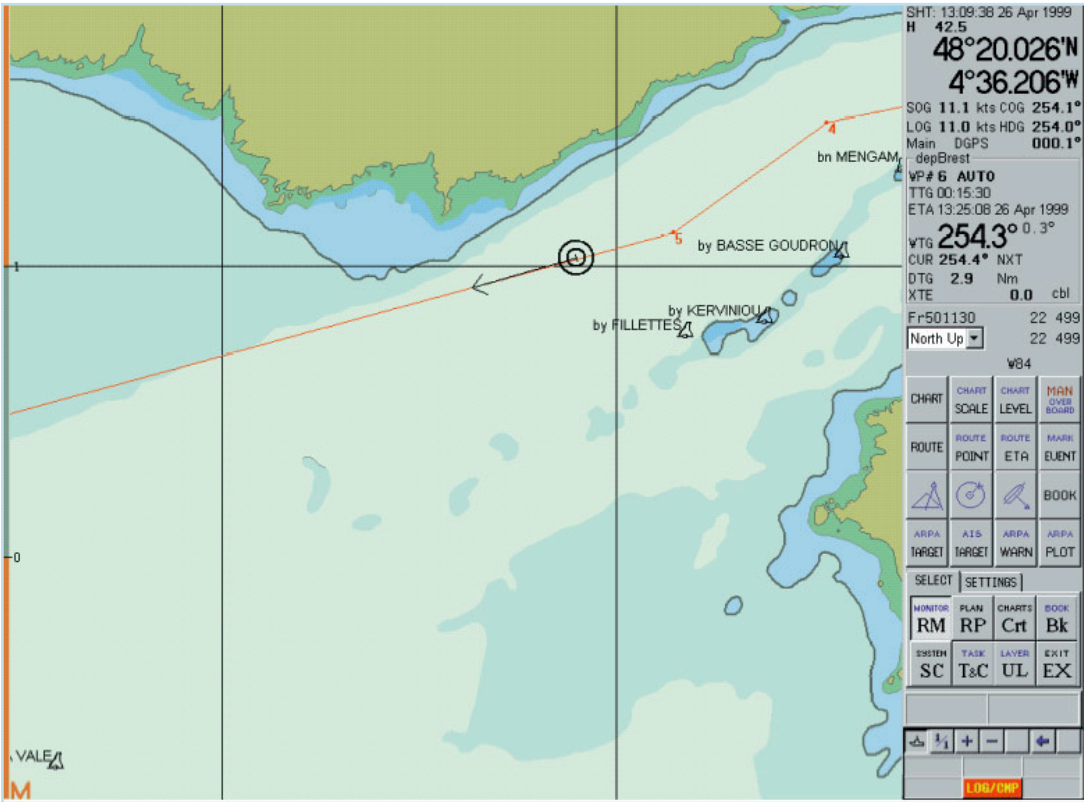


STANDARD DISPLAY, DAY

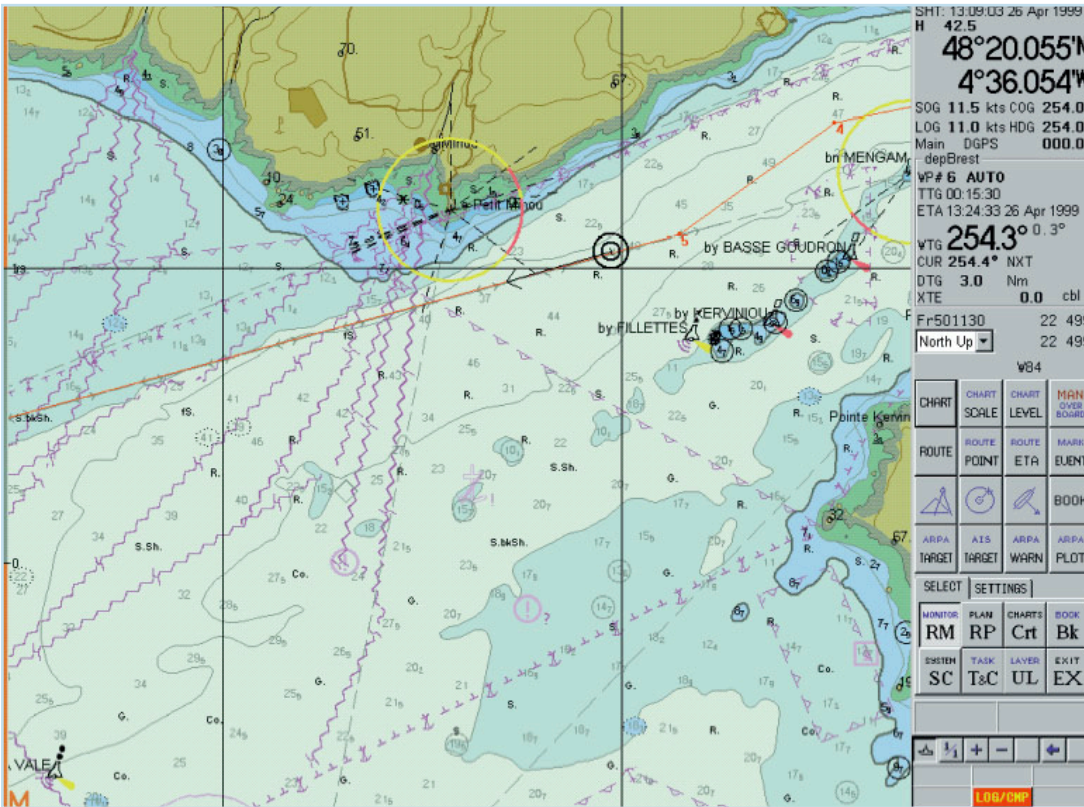


STANDARD DISPLAY, NIGHT

ANNEX III Types of Digital Charts



BASE DISPLAY, DAY



FULL DISPLAY, DAY

ANNEX III Types of Digital Charts

USE OF ENCs IN ECS

It should be noted that many ECS are able to use official ENCs.

ENC DISTRIBUTION

The provision of a timely, reliable worldwide uniform ENC data distribution service is a major organisational challenge. The IHO developed the WEND (World-wide Electronic Navigational Chart Database) concept to meet these requirements. WEND consists of two components:

- A charter describes the principles governing the cooperation between Hydrographic Offices e.g.:
 - By definition, the organisation responsible for charting of an area is also responsible for the ENC production;
 - The relevant standards, especially S-57 must be observed; and
 - The rules of a recognised work quality assurance system (e.g., ISO 9000) should be applied to data production.
- A conceptual schema describes a network of regional centres.
 - Each so-called Regional Electronic Chart Co-ordinating Centre (RENC) takes over the responsibility in its area for the collation of ENCs and up dates for the region;
 - Through the exchange of the regional datasets and their updates between all RENCs each RENC can offer an identical global dataset for ECDIS; and
 - RENCs do not deliver ENCs directly to ships. RENC customers are commercial chart data distributors who - in analogy to paper chart distribution - tailor individual sets of chart data for the special needs of a shipping company or a particular ship.

To date, two RENCs – Primar Stavanger, based in Norway and IC-ENC, based in the United Kingdom, are in operation. However, it has to be noted, that the WEND concept has not been fully adopted through all ENC producing nations yet. A number of nations are still distributing their ENCs individually (e.g. Japan Hydrographic Office, Australian Hydrographic Office, USA - NOAA) either through chart data suppliers or directly.

Principally, WEND focuses on the supply and distribution of ENCs by facilitating the establishment of services intended to satisfy the SOLAS carriage requirement for up-to-date charts. Within this primary purpose, ENCs are to be distributed in the encapsulation described in the S-57 Standard. However, such “plain” S-57 encapsulated ENCs may become easily subject to unauthorised amendment or illegal copying.

IHO has therefore issued the special publication S-63 “IHO Data Protection Scheme” as Standard for protection of ENCs by encryption.

Encryption is a complex technical procedure: S-63 defines security constructs and operating procedures for the RENCs/chart data distributors and provides specifications that allow navigation equipment manufacturers to build S-63 compliant ECDIS. S-63 is already in use for ENC distribution and is supported by the noted two RENCs. Most major ECDIS manufacturers have implemented decryption procedures in conformance with S-63 within their systems.

ANNEX III Types of Digital Charts

WHAT IS A SENC?

An ECDIS does not process the ENC content directly for the matter of display. ENCs in S-57 format are optimised to absorb the Hydrographic object information but this structure is not adequate for the fast generation of the resulting computer image on the screen.

In order to get efficient data structures that facilitate the rapid display of ENC data, ECDIS firstly converts each ENC from S-57 ENC format into an internal format called SENC – System ENC – which is optimised for chart image creating routines.

Such routines are not standardised; they are part of the individual software know-how of the ECDIS manufacturers. Consequently the SENC format differs between the ECDIS of different manufacturers. In contrast to the common uniform ENC format the SENC format is proprietary for each ECDIS manufacturer.

SENC DELIVERY

The WEND system has established an optional distribution mechanism called SENC delivery. This is in addition to the standard ENC distribution. In this case, the RENC delivers the ENCs to a chart data distributor who then performs the ENC-to-SENC conversion (that otherwise would have to happen inside the ECDIS), and deliver the SENCs to the end user.

However, it is up to the individual Hydrographic Offices to decide whether they allow the ENCs for their waters to be distributed in SENC format.

To the date of this publication SENC delivery has only been accepted by a few nations.

It is possible for the ECDIS to determine if the SENC data being displayed is from either an official ENC or a private source by use of the Agency Code (a two character combination which is unique for any data producer) embedded in the data.

Using this code the ECDIS is able to inform the mariners that they must navigate with an official up to date paper chart if SENC data from a private source is in use. The ECDIS will show a warning on the ECDIS screen:

«NO OFFICIAL DATA - REFER TO PAPER CHART »

WHAT SCALE SHOULD AN OFFICIAL ENC BE DISPLAYED AT?

During production, official ENCs are assigned a compilation scale based upon the nature of the source data they are based on, and are allocated to a navigational purpose band related to this. As shown in the table below there are 6 navigational purpose bands (scale ranges are indicative only).

ANNEX III Types of Digital Charts

NAVIGATIONAL PURPOSE	NAME	SCALE RANGE
1	OVERVIEW	<1:1 499 999
2	GENERAL	1:350 000 – 1:1 499 999
3	COASTAL	1:90 000 – 1:349 999
4	APPROACH	1:22 000 – 1:89 999
5	HARBOUR	1:4 000 – 1:21 999
6	BERTHING	> 1:4 000

TABLE: SUGGESTED ASSIGNMENT OF NAVIGATIONAL PURPOSES TO SCALE RANGES

For the future, to facilitate the display of radar video over official ENC's, it is recommended that the Hydrographic Offices set the compilation scales of their official ENC's to be consistent with the standard radar range scales as shown in the following table:

SELECTABLE RANGE	STANDARD SCALE (ROUNDED)
200 NM	1:3 000 000
96 NM	1:1 500 000
48 NM	1:700 000
24NM	1:350 000
12 NM	1:180 000
6 NM	1:90 000
3 NM	1:45 000
1.5 NM	1:22 000
0.75NM	1:12 000
0.5 NM	1:8 000
0.25 NM	1:4 000

TABLE: RADAR RANGE / STANDARD SCALE

HOW ARE OFFICIAL ENC'S NAMED?

Each official ENC is identified by an 8 character identifier e.g. FR 501050. The first two characters indicate the producer e.g. FR for France, GB for Great Britain (a complete list of producer codes is included in the IHO standard S-62). The third character (a number from 1 to 6) indicates the navigational purpose band (as shown in the table above). The last 5 characters are alpha- numeric and provide a unique identifier.

UPDATING ENC'S

In principle the generation and distribution of regular updates uses identical organisational structures as for the production and distribution of ENC's described above. Their frequency is usually synchronised with the chart corrections promulgated with national Notice to Mariners for the affected sea areas.

Updates may reach the ship via different ways depending from the capabilities of the service provider and the communication facilities onboard:

- On data distribution media, e.g. CD;
- As e-mail attachment via SATCOM; and
- As broadcast message via SATCOM plus additional communication hardware.

ANNEX III Types of Digital Charts

RESUME OF MAIN CHARACTERISTICS OF OFFICIAL ENC'S

- Vector data in IHO S-57 format ;
- Are referred to WGS 84 ;
- Issued by Hydrographic Offices or on behalf of them ;
- Flexible visualisation provided through the Presentation Library (S-52);
- Unauthorised changes or illegal copying is avoided by use of the S-63 protection scheme;
- SENC delivery is an alternative distribution method of ENC content in a proprietary ECDIS manufacturer format; and
- Regular updates are provided via data distribution media or wireless via SATCOM.

OFFICIAL RASTER NAVIGATIONAL CHARTS (RNC's)

GENERAL PRINCIPLES

Official RNC's are digital copies of paper charts conforming to IHO special publication S-61 Product Specifications for Raster Navigational Chart (RNC) that are issued by, or on the authority of a national Hydrographic Office.

When displayed on an ECDIS screen they appear to be a facsimile of the paper chart however, they contain significant metadata to ensure that they have certain minimum functionality; e.g. a means for geo-referencing positions on the chart, automatic updating of the RNC from digital files (and the ability to show the state of correction) and the display of the RNC in day or night colours as appropriate.

As a digital copy of the original paper chart, a RNC has no intelligence and other than visually, cannot be interrogated for e.g. automatic route checking or hazard warnings; however some of these limitations can be minimised by manual user input to the ECDIS.

RNC DATA FORMAT AND PRODUCTION

RNC's are normally produced by digitally scanning the stable colour bases used in the multi-colour printing process. Unlike ENC's there is not a single accepted format for RNC's. The main formats are

- BSB (used by USA, Canada, Cuba and Argentina), and
- HCRF (used by UK, Australia and New Zealand).

RNC VISUALISATION

- RNC's are designed to be displayed at the same resolution as that which they are provided. Excessive zooming in or out of the same image seriously degrades the RNC image. RCDS allows charts of appropriate scale to be displayed; when the user wants to zoom in then a larger scale chart will be displayed and similarly on zooming out a smaller scale chart will be used;
- Orientation of the RCDS display to other than north-up (e.g. course-up or route-up), may affect the readability of chart text and symbols;
- RNC's incorporate very similar colour palettes to the day/night colours used by ENC's. It is mandatory for RCDS to have the capability to use different colour palettes;
- RNC's are treated as individual charts (not seamless like ENC's). However, it is possible for ECDIS to automatically load adjoining chart based on the meta data provided;
- ARPA radar targets can be overlaid onto an RNC. It is also possible for a radar video image to be scaled to fit the RNC. Scaling the RNC to fit the radar video image is

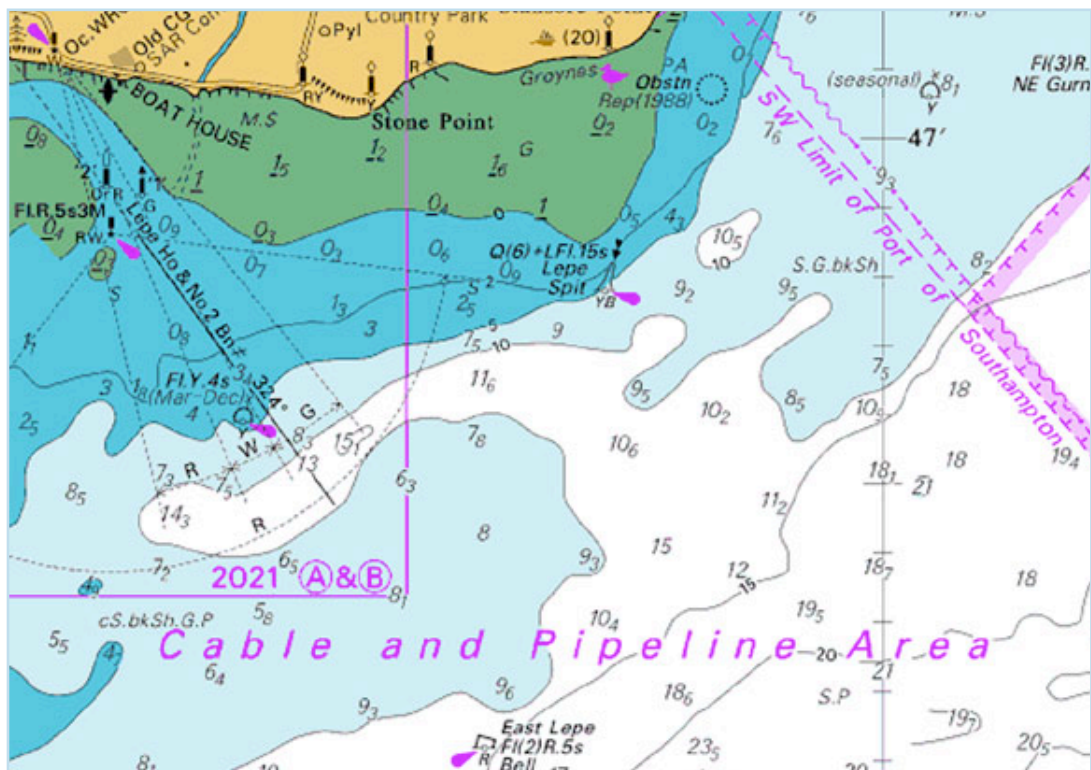
ANNEX III Types of Digital Charts

unsatisfactory as this is likely to result in a degraded chart image; and

- RNCs include significant meta data to allow the ECDIS to make maximum use of the image. For example chart notes and tide panels may be accessed directly by the RCDS rather than the user having to scroll to the appropriate area of the chart.

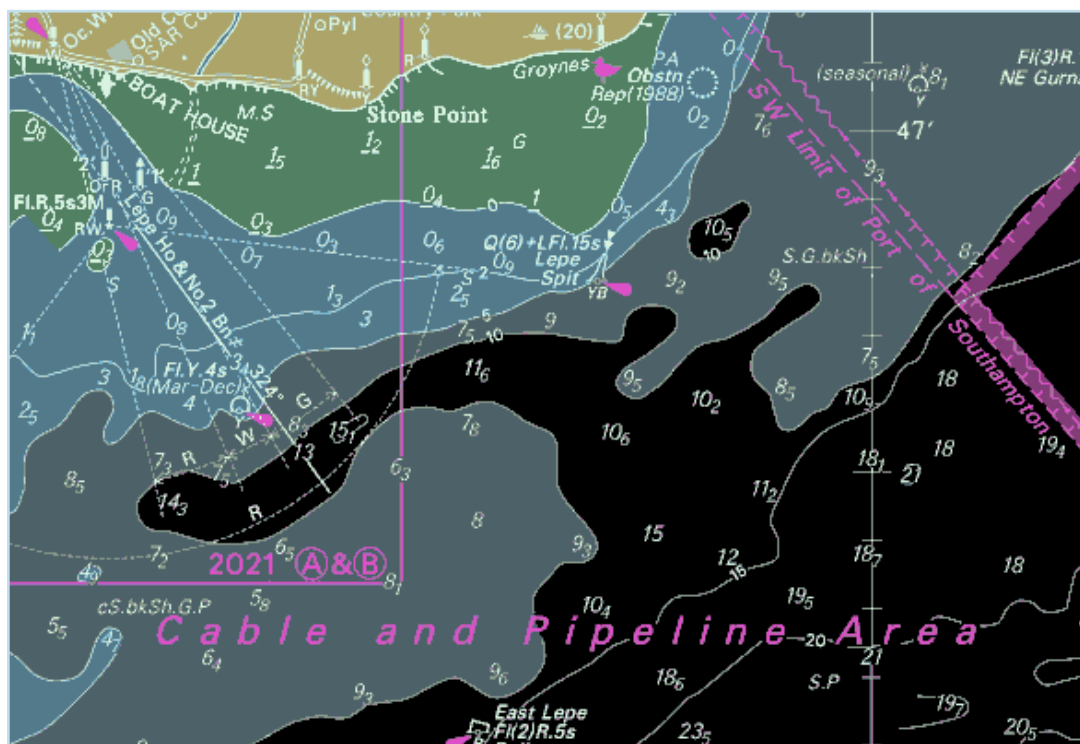
RNCs maintain the horizontal datum of the paper chart from which the RNC has been derived. Mariners should understand, how the chart horizontal datum relates to the datum of the position fixing system. In some instances, this may appear as a shift in position. (Any differences will be most noticeable at grid intersections and during route monitoring). Where the difference between the local horizontal datum and WGS 84 is known, an adjustment should be automatically applied by the ECDIS.

Below are illustrated Day and Night colour schemes of a RNC



RNC DISPLAY, DAY

ANNEX III Types of Digital Charts



RNC DISPLAY, NIGHT

RNC UPDATING

- Updates can be supplied as complete refreshed images or as patches (tiles or areas) that the RCDS can superimpose on the original RNC. The latter method is normally used as this minimises the amount of data to be provided;
- Updates are provided in line with those made available for the equivalent paper chart; and
- Most RNC services currently rely on CD as the transfer media.

RESUME OF MAIN CHARACTERISTICS OF OFFICIAL RNCs:

- Digital copies of paper charts geographically referenced and including additional meta-data to allow RCDS usage;
- Familiar chart display;
- Issued by Hydrographic Offices according to IHO S-61 Standard;
- Most routine navigation tasks achievable on the paper chart can be accomplished with the use of RNCs in RCDS; and
- Updates are regularly supplied in line with the paper chart.

IMO has issued SN Circ.207 illustrating the functional differences between ECDIS and RCDS modes, see Annex IV.

ANNEX III Types of Digital Charts

NON-OFFICIAL/PRIVATE CHART DATA

From the general point of view the types of non-official/private chart data are similar to official chart data:

- Private vector chart data, and
- Private raster chart data.

Data produced by private data manufacturers are not controlled by an official body.

PRIVATE CHART DATA FORMAT AND PRODUCTION

There are differences in the type and quality of data being sold. While many companies take care in the production of electronic chart data to ensure both completeness and accuracy, this cannot be assumed for all.

In 2003 ISO issued a specific standard for private chart data; this standard was produced on the initiative of the industry: ISO 19379 applies to both private vector charts and to private raster charts. Chart data certified according to ISO19379, is now available on the market.

Chart data published by private companies is entirely under the product liability of the producing company. The responsibility and product liability for official charts rests with the government of the producing nation.

Private chart data, regardless of the format in which it is supplied to the market does not meet the requirements specified by the IMO Performance Standards for ECDIS.

In contrast to ENC's and RNC's there are many proprietary formats used. Consequently, chart data from different manufacturers are incompatible with each other – and so are the ECS which make use of them.

EXAMPLES OF PRIVATE VECTOR CHARTS :	EXAMPLES OF PRIVATE RASTER CHARTS:
C-MAP CM93	MAPTECH,
LIVECHARTB	MAPMEDIA,
BLUECHART	NDI,
C-MAP NT+	SOFTCHART
TRANSAS TX-97	
NAVIONICS GOLD	
NAVICARTE	

ANNEX IV IMO SN/Circ. 207 Differences Between RCDS and ECDIS

INTERNATIONAL MARITIME ORGANIZATION

4 ALBERT EMBANKMENT
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Ref. T2/6.01

SN/Circ.207
7 January 1999

DIFFERENCES BETWEEN RCDS AND ECDIS

1 The Maritime Safety Committee, at its seventieth session (7 to 11 December 1998), adopted amendments to the performance standards for Electronic Chart Display and Information Systems (ECDIS) to include the use of Raster Chart Display Systems (RCDS).

2 These amendments permit ECDIS equipment to operate in two modes:

- .1 the ECDIS mode when ENC data is used; and
- .2 the RCDS mode when ENC data is not available.

However, 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.

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

- .1 unlike ECDIS where there are no chart boundaries, RCDS is a chart-based system similar to a portfolio of paper charts;
- .2 Raster navigational chart (RNC) data, itself, will not trigger automatic alarms (e.g. anti-grounding). However, some alarms can be generated by the RCDS from user-inserted information. These can include:
 - clearing lines
 - ship safety contour lines
 - isolated dangers
 - danger areas
- .3 horizontal datums and chart projections may differ between RNCs. Mariners should understand how the chart horizontal datum relates to the datum of the position fixing system. In some instances, this may appear as a shift in position. This difference may be most noticeable at grid intersections and during route monitoring;
- .4 chart features cannot be simplified or removed to suit a particular navigational circumstance or task at hand. This could affect the superimposition of radar/ARPA;
- .5 without selecting different scale charts, the look-ahead capability may be somewhat limited. This may lead to some inconvenience when determining range and bearing or the identity of distant objects;

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ANNEX IV IMO SN/Circ. 207 Differences Between RCDS and ECDIS

SN/Circ.207

- 2 -

- .6 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);
- .7 it may not be possible to interrogate RNC features to gain additional information about charted objects;
- .8 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;
- .9 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 nighttime;
- .10 an RNC should be displayed at the scale of the paper chart. Excessive zooming in or zooming out can seriously degrade RCDS capability, for example, by degrading the legibility of the chart image; and
- .11 mariners should be aware that in confined waters, the accuracy of chart data (i.e., paper charts, ENC or RNC data) may be less than that of the position-fixing system in use. This may be the case when using differential GNSS. ECDIS provides an indication in the ENC which allows a determination of the quality of the data.

3 Member Governments are requested to bring this information to the attention of the relevant authorities and all seafarers for guidance and action, as appropriate.

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ANNEX V ECDIS - Procedural and organisational considerations

Navigating with ECDIS is fundamentally different from navigating with paper charts.

The table below lists a range of bridge work-processes that are affected by changing to an ECDIS system, and which may require that procedures are amended or developed. The table includes some points for analysis and consideration.

It is not implied that all items mentioned should result in corresponding written procedures, nor is it implied that the list in any way is conclusive.

PROCEDURE	CONSIDERATIONS
VOYAGE PLANNING	<p>VOYAGE PLANNING IS DIFFERENT ON AN ECDIS COMPARED TO A PAPER CHART. THERE ARE A NUMBER OF AVAILABLE FEATURES, SUCH AS SAFETY CONTOURS, ALARMS, CLICK-AND-DROP FACILITIES FOR WAYPOINTS AND MARKERS, ETC. WHILE IT IS STILL POSSIBLE TO MAKE ERRORS IN VOYAGE PLANS (VPS) THEY ARE LIKELY TO BE DIFFERENT IN TYPE FROM THE ERRORS MOST FREQUENTLY OBSERVED ON PAPER CHARTS. CONSIDERATION SHOULD BE GIVEN TO DEVELOPING A “BEST PRACTISE” FOR ECDIS VPS.</p> <p>ISSUES SUCH AS WHICH CHART TYPES ARE AVAILABLE IN THE ECDIS FOR THE SEGMENTS OF THE VOYAGE SHOULD BE CONSIDERED. THE PROCESS ANALYSIS SHOULD ALSO COVER THE SITUATIONS WHERE VESSELS ARE OPERATING ECDIS IN ADDITION TO TRADITIONAL PAPER CHARTS, WHERE VPS ARE DRAWN ON PAPER CHARTS AS WELL AS PROGRAMMED ON THE ECDIS.</p> <p>THE VP FORMAT SHOULD BE CONSIDERED. THE EXISTING FORMATS IN USE MAY NOT HAVE BEEN DRAWN UP WITH ECDIS IN MIND, AND A VP FORMAT PRODUCED BY THE ECDIS MAY NOT FULFIL THE NEEDS OF THE COMPANY. HOW SHOULD AN ECDIS VP BE BACKED UP DURING VOYAGE EXECUTION, IN CASE THE ECDIS MUST BE RESET OR THE NAVIGATION SENSORS FAIL?</p>
APPROVAL OF VPS	<p>VP VALIDATION OR APPROVAL PRESENTS ANOTHER SET OF NEW CONSIDERATIONS. VALIDATING A VP MADE ON AN ECDIS IS DIFFERENT FROM VALIDATING A PAPER CHART BASED PLAN. THE PLAN MAY ALSO HAVE TO DEAL WITH ISSUES SUCH AS THE PLANNED SETTINGS OF THE EQUIPMENT AND THE ALARMS. IT REQUIRES A DIFFERENT MINDSET TO REVIEW A PAPER PLAN THAN IT DOES TO REVIEW A PLAN MADE ON A COMPUTER. IT IS COMPARABLE TO THE DIFFERENCE BETWEEN READING A COMPLEX PAPER ON A PC COMPARED TO READING PAPERS IN HARD COPY.</p>
COMMUNICATION TO OTHER OFFICERS	<p>VP PRESENTATION OR COMMUNICATION TO OTHER OFFICERS MUST ALSO BE CONSIDERED. ONCE A VP HAS BEEN PREPARED AND APPROVED IT SHOULD BE COMMUNICATED TO THE OTHER OFFICERS. THE COMMUNICATION OF THE VP WILL IN MANY WAYS BE SIMILAR TO THE APPROVAL. HOWEVER, IT IS AN ISSUE, WHICH REQUIRES SEPARATE ATTENTION TO ENSURE THAT ALL BRIDGE OFFICERS ARE PROPERLY PREPARED FOR THE INTENDED VOYAGE. COMMUNICATION OF THE VP COULD COVER THE PRESENTATION TO THE BRIDGE OFFICERS AT THE BEGINNING OF THE VOYAGE AS WELL AS THE OFFICER’S REVIEW OF THE PART OF THE VOYAGE LIKELY TO BE SAILED DURING A WATCH.</p>
VOYAGE EXECUTION	<p>THE VOYAGE EXECUTION IMPACTS ON VARIOUS BRIDGE PROCEDURES, AND THE CONSEQUENCE OF THE NEW PROCEDURES INTRODUCED WITH THE ECDIS SHOULD BE ANALYSED AND APPRECIATED. IT CONCERNS E.G. ISSUES SUCH AS THE CHANGING OF THE WATCH AND THE SETTINGS OF THE EQUIPMENT.</p>

ANNEX V ECDIS - Procedural and organisational considerations

PROCEDURE	CONSIDERATIONS
SHARING OF VPs	<p>VPs MAY BE STORED AND SHARED BETWEEN SEVERAL USERS OR SHIPS. IT IS POSSIBLE FOR AN OFFICER WITH A FEW KEYSTROKES TO PRINT AND PRESENT A COMPLETE AND COMPREHENSIVE VP – POSSIBLY MADE FOR A VESSEL WITH DIFFERENT CHARACTERISTICS.</p> <p>VPs CAN BE SENT ASHORE FOR APPROVAL OR FOR THE CREATION OF A VP BANK. ALTHOUGH THE SHARING OF VPs MAY BE ECONOMICALLY ATTRACTIVE, THERE MAY BE LEGAL AND OTHER CONSIDERATIONS</p>
BOTH PAPER CHARTS AND ECDIS IN USE	<p>WHERE VESSELS CARRY AN ECDIS IN ADDITION TO A PAPER CHARTS. IN THOSE SITUATIONS THE ROLE OF THE ECDIS AND THE CHARTS SHOULD BE CONSIDERED. IF THE ECDIS IS USED FOR REAL TIME NAVIGATION, THE STATUTORY REQUIREMENTS REGARDING MONITORING OF THE PROGRESS OF THE VOYAGE AND MARKING OF POSITIONS SHOULD BE CONSIDERED.</p> <p>E.G.</p> <ul style="list-style-type: none"> • ARE POSITIONS MARKED IN PAPER CHARTS SOLELY FOR RECORD KEEPING PURPOSES? • WHAT STEPS ARE TAKEN TO ENSURE THAT INTENDED TRACKS MARKED ON THE PAPER CHARTS CORRESPOND WITH THE ECDIS INFORMATION? • ARE ALL PERSONS CONCERNED WITH THE NAVIGATION OF THE VESSEL USING THE SAME EQUIPMENT ACCORDING TO THE BRIDGE PROCEDURES? <p>UNTIL ALL THE WORLD IS COVERED BY ENCs, IT IS MOST LIKELY THAT MOST VESSELS TO SOME DEGREE WILL HAVE TO OPERATE A DUAL – OR TRIPLE – SYSTEM WITH PAPER, RASTER AND VECTOR CHARTS.</p>
CHANGE OF WATCH	<p>IT SHOULD BE POSSIBLE FOR THE OFFICER TAKING OVER THE WATCH TO LOOK THROUGH THE INTENDED TRACK ON AN ECDIS IN PREPARATION TO TAKE OVER THE WATCH AT THE SAME TIME AS THE EQUIPMENT IS IN USE FOR MANOEUVRING IN CONFINED WATER OR IN DENSE TRAFFIC CONDITIONS.</p> <p>CONSIDERATIONS SHOULD INCLUDE:</p> <ul style="list-style-type: none"> • THE DEGREE OF DETAILS REGARDING THE SETTINGS OF THE EQUIPMENT TO BE COVERED IN HANDING OVER THE WATCH, • THE AMOUNT OF TIME TO BE ALLOCATED TO THE CHANGE OF WATCH, • THE CONSIDERABLE NUMBER OF POSSIBLE SETTINGS ON AN ECDIS WHICH OFTEN REQUIRES THAT A RANGE OF SUB-MENUES ARE CALLED UP, • WHETHER THE VERIFICATION OF SETTINGS ABOVE IMPACTS ON THE AVAILABILITY OF THE SYSTEM FOR NAVIGATION PURPOSES.
STANDARD ECDIS SETTINGS	<p>CONSIDERATION SHOULD BE GIVEN TO WHICH ECDIS SETTINGS SHALL BE DICTATED BY THE BRIDGE PROCEDURES, AND WHICH SETTINGS SHOULD BE LEFT TO THE OFFICER TO DECIDE UPON. FOR MOST SETTINGS THE DEGREE OF FREEDOM AND THE LEVEL OF AUTHORITY SHOULD BE CONSIDERED, FOR INSTANCE IN RELATION TO THE FOLLOWING ITEMS:</p> <ul style="list-style-type: none"> • STATUTORY REQUIREMENTS • CORPORATE PROCEDURES AND GUIDELINES • MASTER'S STANDING ORDERS • VP RECOMMENDATIONS • OFFICER OF THE WATCH PREFERENCES • DAY OR NIGHT

ANNEX V ECDIS - Procedural and organisational considerations

PROCEDURE	CONSIDERATIONS
HUMAN ELEMENTS	<p>THE HUMAN ELEMENT MUST ALSO BE APPRECIATED. WHILE YOUNG NAVIGATORS WILL OFTEN BE QUICK TO EXPLORE THE ECDIS AND LEARN THE DETAILS, THE OLDER AND MORE EXPERIENCED SENIOR OFFICERS MAY BE MORE RELUCTANT USERS.</p> <p>THE DANGER IS THAT ELECTRONIC NAVIGATION BECOMES AN EXERCISE THAT IS CONTROLLED BY THOSE WITH A FLAIR FOR COMPUTERS RATHER THAN THOSE WITH EXPERIENCE IN NAVIGATION. ON THE OTHER HAND YOUNG OFFICERS MAY RELY TOO MUCH ON THE ELECTRONIC SYSTEMS, AND FORGET TO CROSS CHECK THE INFORMATION GIVEN. PROCEDURES AND TRAINING PROGRAMMES MAY BE DESIGNED TO ACCOMMODATE THESE CONCERNS.</p> <p>THE DEGREE OF FAMILIARISATION TRAINING REQUIRED FOR THE VARIOUS STAFF POSITIONS ONBOARD SHOULD BE CONSIDERED. THE APPROVAL OF A VP REQUIRES EQUIVALENT KNOWLEDGE OF THE SYSTEM TO THAT EXPECTED OF THE PERSON DOING THE PLANNING.</p> <p>WHAT LEVEL OF FAMILIARISATION IS REQUIRED OF A NEWLY ASSIGNED WATCH OFFICER BEFORE THAT PERSON IS ALLOWED TO STAND INDIVIDUAL WATCHES?</p>
AUDITING	<p>VESSELS ARE AUDITED BY INTERNAL AND EXTERNAL PARTIES. HOW IS IT ENSURED THAT THE COMPANY'S INTERNAL AUDITORS CAN VERIFY THAT THE SYSTEM IS SET UP AND OPERATED IN ACCORDANCE WITH THE CORPORATE PLANS?</p> <p>WHAT TRAINING IS NEEDED FOR THE AUDITORS AND SUPERINTENDENTS?</p> <p>ARE ECDIS AUDITING AND INSPECTION PROCEDURES REQUIRED?</p>

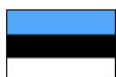
Compendium on Flag State ECDIS requirements

Present version
25 November 2004.



FLAG NATION STATUS: Denmark

Country	Chart Requirement for navigation	ECDIS req. if use of ENC's	Use of private charts for navigation	Use of official raster charts for navigation
Denmark	Up-to-date paper charts Up-to-date ENC's on ECDIS	ECDIS on bridge with ECDIS as back-up on independent energy source. ECDIS on bridge with an appropriate folio of up-to-date paper charts as back-up	Use of private produced charts are not for navigation	Official raster charts in ECDIS mode or other modes are not for navigation



FLAG NATION STATUS: Estonia

Country	Chart Requirement for navigation	ECDIS req. if use of ENC's	Use of private charts for navigation	Use of official raster charts for navigation
Estonia	Up-to-date paper charts Up-to-date ENC's on ECDIS	ECDIS on bridge with ECDIS as back-up on independent energy source ECDIS on bridge with an appropriate folio of up-to-date paper charts as back-up	Use of private produced charts are not for navigation	Official raster charts in ECDIS mode or other modes are not for navigation



FLAG NATION STATUS: Finland

Country	Chart Requirement for navigation	ECDIS req. if use of ENC's	Use of private charts for navigation	Use of official raster charts for navigation
Finland	Up-to-date paper charts or up-to-date official ENC's on ECDIS basis.	ECDIS on bridge with ECDIS as back-up on independent energy source.	Use of private produced charts are not for navigation.	Raster charts are not for navigation. When sailing in waters not covered by ENC charts or when no up to date ENC charts are available on board, up to date paper nautical charts must be used.



FLAG NATION STATUS: France

Country	Chart Requirement for navigation	ECDIS req if use of ENC's	Use of private charts for navigation	Use of official raster chart for navigation
France (for the ships subject to SOLAS): ref : Règlement annexé à l'arrêté du 23 novembre 1987, modifié, relatif à la sécurité des navires."	Up-to date official paper charts (in French or English language) Up to date ENC's on ECDIS	ECDIS on bridge with as back up, whether a second ECDIS on independent energy source, or an appropriate up-to-date folio of official paper charts for the intended voyage.	Private charts (paper or electronic) are not for navigation.	Official raster charts (RNCs in A817(19)) may be used in RCDS mode where ENC's are not available and in that case an appropriate folio of up-to-date official paper charts is to be used in conjunction with ECDIS equipment.



FLAG NATION STATUS: Greece

Country	Chart Requirement for navigation	ECDIS req. if use of ENCs	Use of private charts for navigation	Use of official raster charts for navigation
Greece	Up-to-date paper charts or up-to-date official ENCs on ECDIS basis	ECDIS on bridge with ECDIS as back-up on independent energy source	Private produced charts are not used for navigation	Official raster charts can be used only in combination with up-to-date paper charts



FLAG NATION STATUS: Germany

Country	Chart Requirement for navigation	ECDIS req. if use of ENCs	Use of private charts for navigation	Use of official raster charts for navigation
Germany Nachrichten für Seefahrer (German Notices to Mariners) 01/2004	Up-to-date official ENCs on ECDIS. Where ENCs or RNCs are not available official paper charts must be used.	ECDIS type-tested and approved according to the applicable performance standards of IMO and IEC. As back-up a second ECDIS on independent power source or a complete folio of up-to-date paper charts for the operating area	Use of private produced charts or private produced chart data are not allowed for navigation	If official ENC data for the area to be navigated are not yet available, official raster chart data operated in the "RCDS mode" may be used. In this case, additional carriage of a reduced folio of up-to-date paper charts is mandatory. The ship's master is responsible for selecting appropriate charts.



FLAG NATION STATUS: Latvia

Country	Chart Requirement for navigation	ECDIS req if use of ENC's	Use of private charts for navigation	Use of official raster chart for navigation
Latvia	Up-to-date paper charts or up-to-date ENC's on ECDIS basis.	ECDIS on bridge with ECDIS as back up on independent energy source.	Privately produced charts are not to be used for navigation.	Official raster charts in raster chart display system (RCDS) mode or other modes are not produced in Latvia and are not to be used for navigation in Latvian waters.



FLAG NATION STATUS: Netherlands

Country	Chart Requirement for navigation	ECDIS req if use of ENC's	Use of private charts for navigation	Use of official raster chart for navigation
Netherlands IMO SLS. 14 Circ191	ENC's where available; RNC's elsewhere. Where ENC's or RNC's are not available official paper charts must be used.	ECDIS is used as a backup then the systems must have independent and uninterruptible power supplies. Paper charts or other backup arrangements may be accepted.	Use of private produced charts are not for navigation.	RNC's may be used where ENC's are not yet available – no additional paper charts are required.



FLAG NATION STATUS: Norway

Country	Chart Requirement for navigation	ECDIS req if use of ENC's	Use of private charts for navigation	Use of official raster chart for navigation
Norway	Up-to date paper charts Up to date ENC's on ECDIS.	ECDIS on bridge with ECDIS as back up on independent energy source. Can be ECDIS planning station behind bridge. Further, Norway accepts the back up solutions in Annex of resolution MSC 64(67).	Use of private produced charts are not for navigation.	Official raster charts in RCDS mode or other modes are not for navigation.



FLAG NATION STATUS: Poland

Country	Chart Requirement for navigation	ECDIS req. if use of ENC's	Use of private charts for navigation	Use of official raster charts for navigation
Poland	Up-to-date paper charts or up-to-date official ENC's on ECDIS basis for the intended voyage.	ECDIS on bridge As back-up a second ECDIS on independent energy source or an appropriate folio of up-to-date paper charts.	Privately produced charts are not permitted to be used for navigation.	Raster charts are not for navigation. When sailing in waters not covered by ENC charts or when no up to date ENC charts are available on board, up to date paper charts for the intended voyage must be used.



FLAG NATION STATUS: Singapore

"Singapore accepts the use of ECDIS which meet the requirements of SOLAS Chapter V and resolution A.817(19) as amended."



FLAG NATION STATUS: Sweden

Country	Chart Requirement for navigation	ECDIS req. if use of ENCs	Use of private charts for navigation	Use of official raster charts for navigation
Sweden	Up-to-date paper charts or up-to-date official ENCs on ECDIS basis for the intended voyage.	ECDIS on bridge. As back-up a second ECDIS on independent energy source or an appropriate folio of up-to-date paper charts	Use of private produced charts or ECSs are not for navigation.	Raster charts are not for navigation. When sailing in waters not covered by ENC charts or when no up to date ENC charts are available on board, up to date paper charts for the intended voyage must be used.



FLAG NATION STATUS: United Kingdom

Country	Chart Requirement for navigation	ECDIS req. if use of ENC's	Use of private charts for navigation	Use of official raster charts for navigation
United Kingdom MCA website and MCA Marine Guidance Note 194	ENCs where available; RNCs elsewhere. Where ENC's or RNCs are not available official paper charts must be used.	ECDIS meeting IMO and IEC standards An approved backup consisting of a second ECDIS; paper charts or other arrangement	Use of private produced charts are not for navigation.	RCDS mode of operation is allowed where ENC's are not available, A risk assessment is required to determine what paper charts are required – see MGN 194