Paper for Consideration by S-100WG Test Strategy Meeting

ECDIS / ENC Standards Dependency for SOLAS Compliance

Submitted by:	IHO Secretariat
Executive Summary:	This paper highlights issues related to ECDIS and ENC standards dependency and their contribution towards achieving SOLAS carriage requirement. These issues need to be considered for S-100 based ECDIS.
Related Documents:	IMO MSC 232(82) IEC 61174 S-100WG4-4.11 – Reviewing of the S-100 Exchange Set Model (KHOA)
Related Projects:	S-100 Universal Hydrographic Data Model, S-101 – Electronic Navigational Chart Product Specification Edition 1.0.0

S-57 Background

The IHO Transfer Standard for Digital Hydrographic Data - S-57 was adopted as the official IHO standard by the XIVth International Hydrographic Conference, Monaco in May 1992. Edition 3.0 was released in November 1996 together with its dependant ENC Product Specification Edition 1.0.0.

In November 2000, Edition 3.1 of S-57 and Edition 2.0 of the ENC Product Specification were released. It was agreed that Edition 3.1 would remain frozen for at least another two years (i.e. until November 2002). The S-57 Standard remains frozen, however three supplements (that make provision for new objects and attributes) have been produced.

The Transition from Paper Charts to ENCs and ECDIS

It was only after the publication of S-57 Edition 3.0.0 that ENCs production began in earnest. Until that time, the main instruments of navigation (as specified in the 1974 SOLAS Convention), were paper charts and nautical publications. Provision had to be made in the Convention to ensure that the ECDIS and digital charts (ENCs), where appropriate for use as the paper chart equivalent. This resulted in the IMO developing the "ECDIS Performance Standard[1]" and the IEC developing a suite of operational tests (IEC 61174[2]) against which an ECDIS could be certified as being able to meet the minimum performance criteria. The IHO also developed the S-64 publication[3] which includes a suite of ENC/RNC test datasets to be used during the "type approval" process.

The S-100 ECDIS will use more multiple types of data, conforming to different product specifications, and based on at least two data encoding. SOLAS Chapter V Regulation 2, (together with its subsequent amendments), specifies the requirements for the charts and navigational equipment to be used on board ships as "*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 …" (see Annex A for full text).*

[1] MSC.232(82) Revised performance standards for ECDIS
[2] (ECDIS) – Operational and performance requirements, methods of testing and required test results
[3] IHO Test Data Sets for ECDIS

Question: can "*a specially compiled database …. designed to meet the requirements of marine navigation"* be interpreted as including other types of data (e.g. S-102, S-104, S-111 …)? The second part of the regulation requires that the data is "*issued officially by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution."*

Impact of S-100 on the 1974 Convention for the Safety of Life at Sea (SOLAS)

It is anticipated that the clauses referencing ECDIS and the use of ENC (see Annex A) in the relevant SOLAS regulations are sufficiently generic and will not require substantive amendments as a consequence of the implementation of S-100 based ECDIS.

The Convention requires that, where an ECDIS is being used to meet the chart carriage requirements of SOLAS, it must be type-approved, have adequate, independent back-up arrangements in place, have up-to-date ENCs loaded and be compatible with the latest applicable IHO standards.

SOLAS regulations V/18 and V/19, require that existing ECDIS equipment must comply with one of two performance standards, depending on the date of their installation. Equipment installed between 1 January 1996 and 1 January 2009 can comply with Resolution A.817(19). Equipment installed after 1 January 2009 must comply with Resolution MSC.232(82).

In 2008 the IMO issued a Safety of Navigation Circular (IMO SN/ Circ. 276) on "***Transitioning from paper chart to ECDIS navigation***", which has been superseded and is now included at Section F of IMO MSC.1/Circ.1503 (as amended) ECDIS – Guidance for Good Practice.

Impacts of S-101 on the IMO Performance Standards MSC.232(82)

It is anticipated that S-101 ENCs should have very little impact on this document ECDIS Performance Specifications. MSC.232(82) defines "Chart Information" as:

> *The chart information to be used in ECDIS should be the latest edition, as corrected by official updates of that issued by or on the authority of a Government, government-authorized Hydrographic Office or other relevant government institution, and conform to IHO standards.*

Resolution MSC.232(82) includes references to S-52, S-57 and S-63. Any new resolution would have to make reference to S-100 and possibly S-98. The supply chain for delivering data to S-100 ECDIS will need to incorporate both S-63 and S-100 security schemes if the is to be a dual fuel (S-57 and S-101) delivery mechanism. Data product delivery information currently in the S-101, S-102, and S-111 product specification (chapter 11) is not consistent, and it would be difficult to implement them as part of a harmonised data supply chain. The development of test for type approval will also be more difficult. See paper S-100WG4-4.11 which proposes a change to the S-100 Exchange Set Model.

Potential Impacts of S-101 on IEC 61174

The current IEC 61174 includes numerous references to IHO standards and substantive changes / extensions will be required in order to test S-100 ECDIS. Additional test datasets will also have to be developed for "type approval" requirements.

IEC 61174 Edition 4.0.0 makes reference to the following IHO documents.

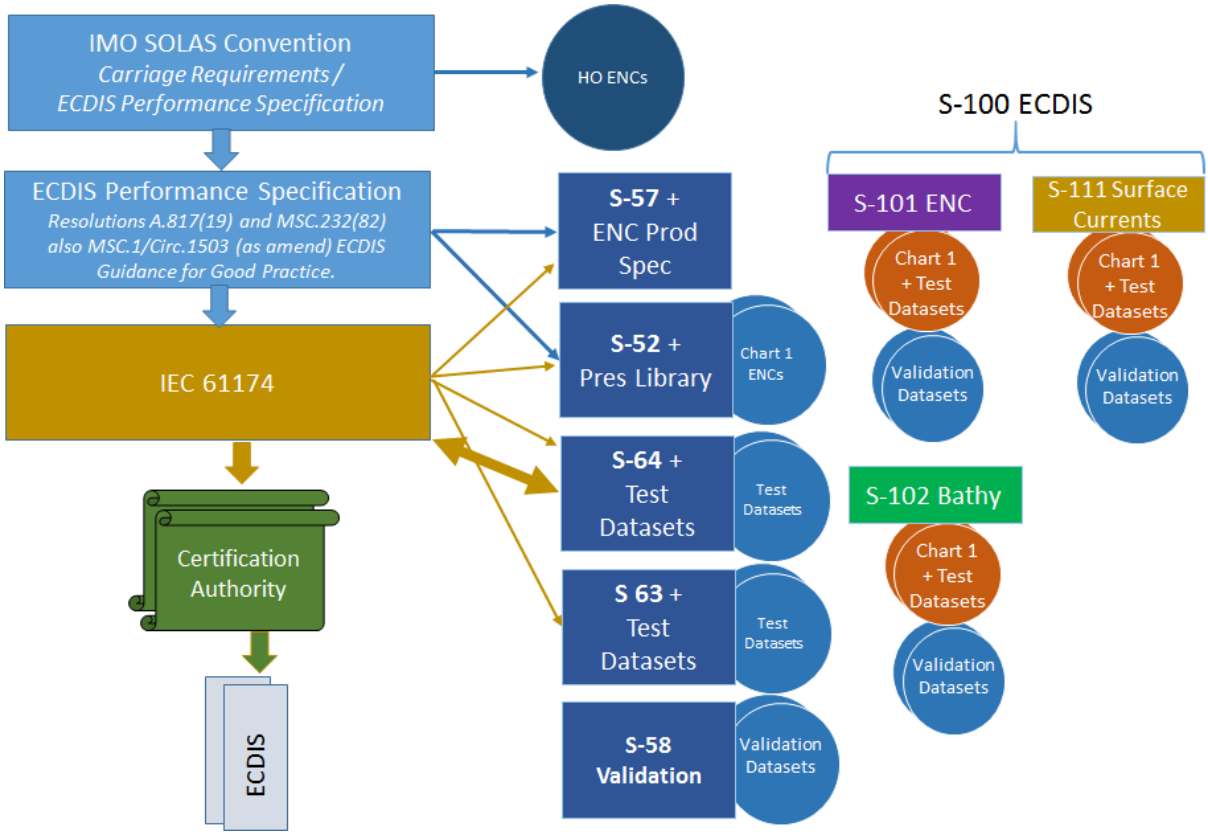
- IHO M-3 Resolutions of the IHO, Chapter A, Section 3, Technical Resolution 3.11

- IHO S-32 Hydrographic dictionary (ECDIS related terms)
- IHO S-52 Specifications for chart content and display aspects of ECDIS edition 6.1
- IHO S-52, appendix 1:2012, Guidance on Updating the Electronic Navigational Chart
- edition 4.0
- IHO S-52, Annex A, Presentation library
- IHO S-52, Annex C, Procedures for maintaining the calibration of displays

178 references

- IHO S-57, IHO transfer standard for digital hydrographic data (*22 references*)
- IHO S-57, Appendix B.1, ENC Product Specification
- IHO S-61:1999, Product specification for raster navigational charts (RNC)
- IHO S-63:2012, IHO Data Protection Scheme (*16 references*)
- IHO S-64, Test data sets for ECDIS (*26 references*)

The diagram below provides an overview the relevant IMO instruments and IHO / IEC standards and datasets.



Standards Dependency Diagram

Operational considerations when using ECDIS

Whereas the ECDIS performance standards provide a "quality benchmark" for ECDIS, it can be argued that the "critical checks" listed in S-58 (ENC Validation Checks), provide a similar benchmark for ENCs. It is proposed that IHO should consider using this mechanism as a quality benchmark for all data products used in an ENC.

Note: Denmark have started developing validation tests for S-101 ENCs and NIPWG have also developed similar test for S-123 S-122 (Marine Protected Areas) and S-123 (Radio Services) and S – 127 (Marine Traffic Management) product specification.

Recommendation

It is recommended that a joint S-100WG and NIPWG correspondence group be established to:

1. Determine whether any amendments to SOLAS Chapter 5 are required to cater for S-100 ECDIS - (if required, recommend what changes are needed).
2. Determine what changes will be required to the ECDIS Performance Standards for S-100 ECDIS.
3. Prepare a provisional report on 1 and 2 above, for consideration and discussion at the next IEC meeting (October 2019).
4. Based on 1, 2 and the outcomes of 3 above, prepare a discussion paper for the next HSSC meeting (11-15 May 2020).

Furthermore, it is recommended that the group be invited to review the data product delivery sections (chapter 12) of those products to be used in ECDIS, to ensure that they are harmonised, and to determine whether any minimum criteria should be included in the S-100 ECDIS Performance Standard for issues such as data loading, and security.

Action Required

The meeting is invited to note the issues presented in the report.

Annex A

Relevant extracts from SOLAS Chapter V

Chapter V of the Convention, together with its subsequent amendments, specifies the requirements for the charts and navigational equipment to be used on board ships.

Regulation 2 defines the nautical chart; (IMO SOLAS V/2 1974 (as amended)):

> *2.2 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.**
>
> *Footnote to regulation 2.2*
>
> > ** Refer to appropriate resolutions and recommendations of the International Hydrographic Organization concerning the authority and responsibilities of coastal States in the provision of charting in accordance with regulation 9.*

Regulation 19 specifies the equipment (including charts) to be carried on different types of ships (IMO SOLAS V/27 (as amended))

> *19.2.1 All ships irrespective of size shall have:*
>
> *19.2.1.4 nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage.* ***An electronic chart display and information system (ECDIS) is also accepted as meeting the chart carriage requirements*** *of this subparagraph. Ships to which paragraph [2.10] applies shall comply with the carriage requirements for ECDIS detailed therein;*
>
> *19.2.1.5 back-up arrangements to meet the functional requirements of subparagraph 2.1.4, if this function is partly or fully fulfilled by electronic means*;*
>
> *Footnote to regulation 19.2.1.5*
>
> > ** 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).*

Regulation 27 specifies the requirement to keep charts and publications up to date. IMO SOLAS V/27 (as amended - see also Resolution MSC.232(82))

> *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.*

Official charts, according to SOLAS V (see above), are charts issued "*by or on the authority of a Government, authorized Hydrographic Office or other relevant government institutions."* They may be used to fulfil carriage requirements (provided they are kept up to date).

An ENC is a vector chart, issued by or on behalf of a Governmental body that complies with the relevant IHO standards. ENCs must be encoded according to relevant IHO standards and issued by (or on the authority of), a Government authorized HO. They must also be regularly updated.

ECDIS equipment is specified in the IMO ECDIS Performance Standard (see Resolution MSC.232(82) as:

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 as amended ……".