TSM7-7.1A rev 2

Paper for Consideration by S-100WG Test Strategy Meeting

S-100 and the IMO Performance Standards

Submitted by:	S100 Working Group Chair
Executive Summary:	This paper is the summary of an investigation on the relevant IMO performance standards to see if S-101 ENCs will meet the need to support SOLAS navigation on ECDIS (reference HSSC11/05)
Related Documents:	IMO MSC 232(82) IEC 61174 TSMAD24/DIPWG4 10.6A
Related Projects:	S-100 Universal Hydrographic Data Model S-98 – S-100 Interoperability for Navigation Systems S-101 – Electronic Navigational Chart Product Specification Edition 1.0.0

Introduction / Background

The IHO has developed the S-100 Universal Hydrographic Data Model as a framework to developed harmonized product specifications for use within navigation systems and for other purposes. In addition, at the most recent IMO Maritime Safety Committee (MSC-101), the IMO reaffirmed that all maritime services under eNavigation should conform to the IHO's S-100 framework standard.

Under the S-100 framework the IHO has developed and released the S-101 Electronic Navigational Chart product specifications (now at edition 1.0.0) with the stated intent that this product specification will eventually replace S-57 based ENCs. In addition, due to the flexible nature of how S-100 is designed, portrayal and data protection/integrity is also included as part of the product specification and thus in a future S-100 based ECDIS the explicit need for S-52 and S-63 conformance is eliminated. The existing ECDIS performance standard (MSC 232(82)) directly requires implementation of S-57, S-52 and S-63.

The Hydrographic Services and Standards Committee (HSSC11/05) assigned an action to the S-100 Working Group to "investigate if S-101 ENCs will meet the current IMO Performance Standards so there is no need to consider proposing amendments to the IMO and report to the IHO Secretariat." This paper will define the current state, look at the optimal state and propose a way forward.

Analysis/Discussion

Currently, there are two standards, external to IHO, which directly affect ENC related parts of ECDIS:

- International Maritime Organisation MSC.232(82) – Revised Performance Standards for Electronic Chart Display and Information Systems
- International Electrotechnical Commission IEC 61174 – Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirement, methods of testing and required test results. Under this standard equipment is type approved as meeting the requirements of the IMO performance standard.

Additionally there are several other standards that are incorporated by reference within the IMO Performance Standard itself with a note stating that the latest editions are available from the International Hydrographic Organization:

- *Special Publication No. S-52, Specifications for Chart Content and Display Aspects of ECDIS*
- Special Publication No. S-52 appendix 1, Guidance on Updating the Electronic

Navigational Chart
- Special Publication No. S-52 appendix 2, Colour and Symbol Specifications for ECDIS
- Special Publication No. S-32, Hydrographic Dictionary
- Special Publication No. S-57, IHO Transfer Standard for Digital Hydrographic Data
- Special Publication No. S-61, IHO Product specification for Raster Navigational Charts (RNC)
- Special Publication No. S-63, IHO Data Protection Scheme
- Miscellaneous Publication No. M-3, *Resolutions of the IHO*

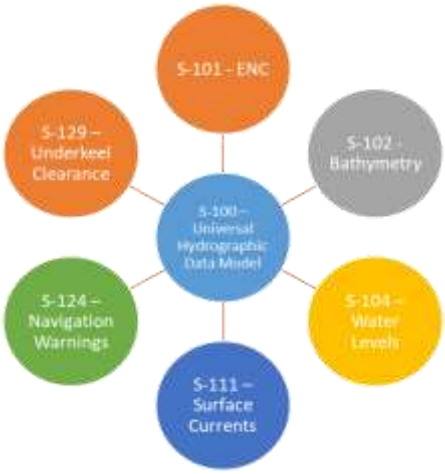
The S-57, S-52 and S-63 are cited:
- as reference to 'appendix 1' of the performance standard within the main body of the performance standard (clauses 2.3 and 3.6);
- as references to IHO standards (i.e. IHO standards listed in 'appendix 1') within the main body of the performance standard (clauses 3.2, 4.2, 4.5, 4.9, 5.1, 9.1 and 10.3 of main body, clause 3.1.5 of Appendix 6); and
- as footnotes within the main body of the performance standard (clauses 4.2, 4.9, 9.1, 10.3).

The key issue, therefore is "**how does the IHO address the inclusion of S-100 as a framework within the IMO performance standard and then also specifically include S-101 as the replacement for S-57 based ENCs."**

While it might seem simpler to only recommend to the IMO that S-101 be included in the list of standards defined within the 'appendix 1' of the performance standard, this does not really move the concept of S-100 based navigations systems forward.

In order for S-101 to work correctly within an ECDIS system, the OEMs must implement at the 'S-100 level' as S-100 is a framework that provides all the methodologies that are utilized within S-101 such as the feature, portrayal, interoperability and alerts & indications catalogue mechanisms, metadata, compliance testing method, data cyber security, data encryption and data encoding.

By implementing at the 'S-100 level' it allows for the regulated equipment to be able to ingest and display any number of S-100 based product specifications that would be related to safety of navigation. In addition, it would also defeat the intention of S-100 as an inclusive standard by just referencing ENC as the primary output.



Furthermore, it is strongly suggested *that S-98 – the S-100 Interoperability Specification for Navigation Systems* be added as a normative reference to the IMO Performance Standard. S-98 establishes the basic rules on how a subset of S-100 based product specifications should interact with each other on "front-of-bridge" systems. For purposes of discussion "front of bridge" is defined as the area of the bridge for primary navigation and manoeuvring and "back of bridge" is for planning and documentation activities. S-98 provides an interoperability

catalogue that specifies the minimum set of predefined combinations of multiple S-100 based data that are loaded and displayed on navigation systems at any one time. This will enable the mariner to have a clear navigation picture with the different types of data that are available in parallel at any given time without obscuring the underlying chart information.

Currently, S-98 takes into account the interoperability for the following IHO S-100 based specifications:

Specification No.	Title
S-101	Electronic Navigational Chart (ENC
S-102	Bathymetric Surface
S-104	Water Level Information for Surface Navigation
S-111	Surface currents
S-122	Marine Protected Areas
S-124	Navigational warnings
S-129	Underkeel Clearance Management
S-411	Sea Ice (WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology [JCOMM])
S-412	Met-ocean forecasts (JCOMM)

NOTE: The S-100WG is reviewing this list to ensure that there is a use case for the product to be part of "front of bridge" navigation.

It is important to see the carriage requirement in terms of meeting SOLAS V requirements. SOLAS defines the requirement for production (by member states), updating as far as is possible, and carriage of charts and publications (specifically, "charts and nautical publications") by SOLAS vessels. SOLAS also, crucially, defines the equivalence of an ECDIS in meeting the carriage requirement. IMO MSC.232(82) then defines the implementing detail of the ECDIS and IEC 61174, a testing standard to assess candidate systems against the performance standard.

NOTE: IHO S-64, the IHO testing standard to solve ECDIS anomalies is not a part of the 'appendix 1' of the IMO performance standard MSC.232(82). Based on an agreement between IHO and IEC, IEC removed details of the testing of the presentation of ENCs from the IEC 61174 and set the IEC 61174 to reference S-64 in a normative way within the body text of the IEC 61174.

SOLAS makes provision for the use of ECDIS in meeting the mandated carriage requirement for navigational charts. As technology and the availability of information to the maritime community evolves, so must the tools and data available to the mariner for executing primary navigation under the SOLAS convention. There is a need to expand the conversation on what is useful to the mariner for navigating both safely and efficiently by having the ability to take advantage of additional information from nautical publications and from other sources such as tide forecasts, surface currents and high resolution bathymetry and also to define what constitutes the "bare minimum" for safe navigation within the Performance Standard. Historically, navigational publications have always been specifically referenced within SOLAS but with no attendant mandated functionality, content or testing regime for the digital alternative.

The IHO is named in MSC 232(82) (Appendix 1) as an organisation defining standards and specifications in conjunction with the IMO performance standard and it is up to the IHO to specify latest edition of the relevant standards for chart information listed in 'Appendix 1'. This is currently centralised under the IHO webpage at: https://www.iho.int/mtg_docs/enc/ECDIS-ENC_StdsIn_Force.htm

It should also be noted, that any revision of the IMO performance standard to allow IHO S-100 to be used to satisfy SOLAS carriage requirement will, in turn, require those changes of reference to be included in a revision of IEC 61174 to enable type approval testing of new ECDIS. These changes, for example, would encompass the

fundamental shift of portrayal mechanisms into the S-100 framework and their update through portrayal catalogues and the related ability to update feature catalogues.

Conclusions and Recommendations
In order to move navigation technology forward the IHO and the greater maritime community should develop a strategy to accomplish the following actions in order to move ECDIS technology into the 21st century and leverage the rich nature of S-100:

1. Work with the IMO to update the ECDIS Performance Standards to include references to S-100 and S-98 as a legitimate means to discharge SOLAS obligations for safe navigation.
2. Approve a list based on IHO specifications within S-98 that are part of a wider set of specifications that constitute "front of bridge" navigation including, but not limited to, ENC (S-101) based navigation, but stressing that for meeting the minimum set of requirements for ECDIS that S-101 meets the primary intention of SOLAS navigation.
3. Work with IEC to develop a new edition of IEC 61174 that reflects the updated IMO Performance standard references to S-100 and incorporates relevant tests for S-100 and S-98 functionality
4. This work should be aligned with the operational edition of S-101 scheduled for publication in 2022.

Justification and Impacts
If the IMO performance standard and IEC 61174 are not updated to work with S-100 and navigationally relevant product specifications such as S-101 Electronic Navigational Charts, then a large proportion of the work done by the IHO community in defining S-101 and large sections of S-100 will be wasted.

Action Required of HSSC:
The HSSC is invited to:

a. note the report
b. agree to the recommendations proposed in the report