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**IHO SUBMISSION TO IMO SUB-COMMITTEE ON NAVIGATION, COMMUNICATIONS
AND SEARCH AND RESCUE (NCSR 7)**

Reference:

A. 3rd meeting of the IHO Council – Summary Report, 23 October 2019;

Dear Hydrographer,

1. As introduced at the 3rd meeting of the IHO Council, Reference A, the proposed S-100 Implementation Strategy and associated Roadmap for the S-100 Implementation Decade were endorsed by the Council. The Council further tasked the Secretary-General to start engaging with the International Maritime Organization (IMO).

2. To this end the IHO Secretariat has made a submission (Annex A), for discussion at the 7th Session of the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR 7), which will take place at the IMO Headquarters, London, United Kingdom from 15 to 24 January 2020. The document reports on the status of IHO's ECDIS-related standards, presents a roadmap for the introduction of the next generation of S-101 Electronic Navigational Charts (ENC) and explains the resulting implications for existing and new ECDIS installations.

3. Member States are invited to engage with their respective national delegations to NCSR 7 and to brief them on the contents of the IHO document. In particular Hydrographic Offices are urged to obtain the support of their Maritime Administrations for the actions requested of the Sub-Committee, most notably action 23.3 and 23.4, which are necessary to meet the proposed 2024 operational availability date for substantial S-101 ENC coverage. In this respect, Maritime Administrations are also encouraged to submit supporting comment papers to the NCSR 7 before the 26 November 2019 deadline.

Yours sincerely,

Dr Mathias JONAS
Secretary-General

Annex A: IHO Submission to NCSR 7

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SUB-COMMITTEE ON NAVIGATION,
COMMUNICATIONS AND SEARCH AND
RESCUE
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Agenda item 22

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ANY OTHER BUSINESS

Report on monitoring of ECDIS issues by the IHO

Submitted by the International Hydrographic Organization (IHO)

SUMMARY

Executive summary: This document reports on the status of IHO's ECDIS-related standards, presents a roadmap of the introduction of the next generation of S-101 Electronic Navigational Charts (ENC) and explains the resulting implications for existing and new ECDIS installations.

It is part of the continuing monitoring by the IHO of ECDIS issues related to the implementation of the carriage requirements in SOLAS Regulations V/19.2.10 and V/19.2.11.

*Strategic direction,
if applicable:*

Output:

Action to be taken: Paragraph 23

Related documents: A.817(19), MSC.232(82), MSC.1/Circ.1503/Rev.1,
MSC.1/Circ.1593, MSC.1/Circ.1595

Background

1. In accordance with the directive agreed by the 18th International Hydrographic Conference (23-27 April 2012), the International Hydrographic Organization (IHO) continues to monitor the implementation of relevant IHO standards in ECDIS to ensure that issues identified with regard to the operation of ECDIS are collated, analyzed, communicated and resolved as speedily as possible.

Introduction

2. The use of ECDIS with official Electronic Navigational Chart (ENC) data sets contributes to the enhancement of the safety of navigation. In conjunction with the mandatory carriage requirements for ECDIS, all the IHO Member States have undertaken the necessary

measures to meet their obligations to provide official ENC in the mandated data transfer standard, namely IHO S-57.

3. For the purpose of the cartographic functionality of ECDIS and the proper provision of data services, the IHO maintains a suite of ECDIS-related standards, as referenced in appendix 1 of the IMO ECDIS Performance Standards (MSC.232(82)).

4. IHO's most relevant ECDIS-related standard is the transfer standard for digital hydrographic content S-57. This standard has been used for official ENCs since November 2000 and has not been technically updated since then. This period of consolidation has facilitated a stable technical environment for data production and dissemination services to reliably feed ECDIS installations delivered by a variety of Original Equipment Manufacturers (OEM) in compliance with the applicable IMO regulations on ECDIS.

5. The S-57 transfer standard is based on the technological paradigms for data services of the 1990s. In this regard it has become an isolated proprietary solution which does not align to contemporary concepts of data provision. The management of S-57 ENCs is therefore comparably costly and options to combine S-57 ENCs with other information relevant for navigation are therefore limited.

6. In support of digitization on board, the exchange of nautical information and the provision of maritime services in the context of e-navigation, the IHO's S-100 Universal Hydrographic Data Model was adopted by the IMO in 2011 as the basis for technical harmonization of data services providing navigation related information exchange. S-100 is a contemporary, more versatile standard – it incorporates the requirements of S-57 and is aligned with the ISO 19100 series of geographic information standards.

7. S-100 is the basis upon which a wider range of digital products and transfer standards for hydrographic and maritime services related applications are based. The e-navigation Strategy Implementation Plan (SIP) (MSC.1/Circ.1595, as updated) requires that Maritime Services be S-100 conformant as a baseline. S-100 supports items such as imagery and gridded data, 3D and time-varying data and new applications that go beyond the scope of traditional hydrography; for example, high-density bathymetry, oceanographic features (tides and currents), sea floor classification and marine GIS. It will also enable the use of web-based services for acquiring, processing, analyzing, accessing and presenting data.

8. The IHO S-100 framework standard specifies methods for data modelling and for developing product specifications. Several test bed projects have been conducted or are about to be conducted to test the use and interoperability of datasets produced according to S-100 based product specifications in a single end user's device.

9. The S-100 framework has matured to an extent that the regular production and dissemination of official ENCs in a new transfer standard, named IHO S-101, can now be envisioned. This new transfer standard is not substantially different from IHO S-57 in terms of cartographic content and maintains the same level in support for safe navigation, but it offers additional, substantial advantages:

- The operational elements of ECDIS software to process cartographic content can be more easily maintained since the display instructions are embedded in the dataset as part of the S-101 ENC delivery.
- S-101 ENCs enjoy a modernized method of encryption to improve robustness against cyber threats;
- The implementation of the capability to read and process S-101 ENCs, including the new encryption mechanism, offers the technical basis for future implementation of e-navigation services relevant to ECDIS as a crucial element of Integrated Navigation Systems (INS).

10. The enhancement of ECDIS functionality to include S-101 ENC is a logical and necessary step towards the implementation of the e-navigation concept of harmonized Maritime Services.

Status of IHO ECDIS-related Standards

11. In accordance with IMO Circular MSC.1/Circ.1503/Rev.1 – *ECDIS - Guidance for good practice* – the up-to-date list of all the relevant IHO standards and publications relating to ECDIS can be accessed from the IHO website (see www.iho.int > ENCs&ECDIS > Current ENC and ECDIS Standards). The ECDIS-related information on the IHO website was updated on 25 April 2019 to reflect the withdrawal of several IHO standards, in particular Edition 3.4 of S-52, Annex A - IHO Presentation Library for ECDIS. The ENC/ECDIS Data Presentation and Performance Check and associated datasets were also removed from the IHO website as they are no longer relevant to the new editions identified in Table 1.

*Table 1
Status of IHO ECDIS-related standards*

Designation	Normative reference for the type approval of ECDIS systems referring to the 4 th edition of IEC 61174 (2015)
<i>S-57 - Transfer Standard for Digital Hydrographic Data</i>	Edition 3.1 (November 2000), in conjunction with: - Supplement 3 (June 2014) - S-57 Maintenance Document No. 8 (March 2002)
<i>S-52 - Chart Content and Display Aspects of ECDIS</i>	Edition 6.1(.1) (October 2014 - with clarifications up to June 2015)
<i>S-52, Annex A - IHO Presentation Library for ECDIS</i>	Edition 4.0(.2) (October 2014 - with clarifications up to July 2017)
<i>S-64 - IHO Test Data Sets for ECDIS</i>	Edition 3.0.2 (July 2017)
<i>S-61 - Product Specification for Raster Navigational Chart</i>	Edition 1.0 (January 1999)
<i>S-63 - IHO Data Protection scheme</i>	Edition 1.2.0 (January 2015)

12. As a result of the withdrawal of Edition 3.4 of S-52, Annex A and updates to S-64 – *IHO Test Data Sets for ECDIS* – some text of MSC.1/Circ.1503/Rev.1 that relate specifically to these publication editions are now out of date and it is considered that the circular no longer provides the guidance to the maritime community for which it was designed. MSC100 agreed to include in its post-biennial agenda an output on “Revision of ECDIS-Guidance of Good Practice (MSC.1/1503/Rev.1)”, assigning NCSR Sub-Committee as the coordinating organ (MSC100/20 paragraph 17.9).

Definition and testing of S-100 compliant product specifications

13. The production of S-100 based datasets to carry specific information such as detailed bathymetry and charting features has been ongoing for some time for test purposes. Systematic tests to improve data interoperability are currently being undertaken for the following S-100 based datasets:

- S-101 ENC Electronic Navigational Chart (ENC) (Edition 1.0.0 published in December 2018 for testing);

- S-102 Bathymetric Surface (edition 2.0.0 published in 2019);
- S-111 Surface Currents (edition 1.0.0 published in December 2018);
- S-122 Marine Protected Areas (edition 1.0.0 published in January 2019 for testing);
- S-123 Marine Radio Services (edition 1.0.0 published in January 2019 for testing);
- S-129 Under keel Clearance Management Systems (edition 1.0.0 published for testing in 2019).

14. The IHO Geospatial Information Registry, which is a basic operative element of the S-100 Standard framework, has been operational for a number of years and currently holds several thousand items that have been registered by participating organizations, each of whom maintain their own domains in the Registry. These items have been used to model real world features included in product specifications. As such, the International Association of Aids to Navigation and Lighthouse Authorities (IALA) has endorsed the following product specifications:

- S-211 Edition 1.1.0 – Port Call Messages;

The World Meteorological Organization (WMO) has developed:

- S-411 Edition 1.1.0 – Ice Information;
- S-412 Edition 1.0.0 – Weather Overlay.

Proposed roadmap for the introduction of IHO S-101 ENC as transfer standard for official charts in ECDIS

15. The IHO has developed and released the IHO S-101 Electronic Navigational Chart product specifications (now at edition 1.0.0) with the stated intent that S-101 ENCs will eventually replace S-57 ENCs. Due to the flexible nature of how S-101 is designed, portrayal and data protection/integrity is also included as part of the product specification and thus in a future S-101 compatible ECDIS the explicit need for IHO S-52 (cartographic presentation rules) and S-63 (encryption of data sets) conformant implementation is eliminated.

16. The IHO S-101 ENC product specification will be technically ready and exhaustively tested for regular production of S-101 ENCs by the end of 2022. It is expected that from 2023 S-101 ENCs will be produced through export from commercially-developed upgraded database-driven ENC production systems in parallel to S-57 ENCs and through conversion of S-57 ENCs into S-101 ENCs. S-101 ENCs created by conversion will meet all conditions necessary to support safe navigation as S-57 ENCs.

17. The IHO Council at its third session in October 2019 endorsed the concept of an implementation decade (2020 - 2030) which includes regular production and distribution services for S-100 based products commencing with the achievement of regular service provision of substantive geographic coverage of S-101 ENC in 2024. This timeline is set to achieve synchronization of the implementation of S-101 ENC compatibility with the application of MSC.1/Circ.1593 - *Interim Guidelines for the Harmonized Display of Navigation Information Received via Communications Equipment* - coming into force on 1 January 2024 for new ECDIS equipment by OEMs.

18. The IHO has collaborated closely with industry in the development of data production and encryption software ready to support safe and continuous production and dissemination of S-101 ENCs. IHO Member States have started work on a harmonized approach to enable ENC producing Hydrographic Offices to provide S-101 ENCs for their respective areas of responsibility in 2024, in parallel to the established production of S-57 ENCs. S-101 ENC

distribution will happen via the established dissemination network in partnership with commercial chart suppliers.

19. In order to make S-101 ENC compatibility legally binding for new ECDIS after 1 January 2024, Appendix 1 of the ECDIS Performance Standards (MSC.232(82)) will require to be amended to include reference to the IHO standards S-98, S-100, S-101. S-98 establishes the basic rules on how a subset of S-100 based product specifications should interact with each other. It 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.

20. In order to maintain ECDIS devices already installed on SOLAS vessels which are technically not ready nor required to be upgraded to S-101 ENC compatibility, and to comply with the applicable IMO regulations pertaining to existing navigation equipment, identical coverage will be provided for S-57 ENCs and S-101 ENCs for a transition period until there is no significant number of legacy systems in the field and all ECDIS in operation have become S-101 compatible. This situation is expected near the end of the decade, but will be continuously monitored to enable a decision to be made by the responsible IMO body.

21. As a consequence, new ECDIS systems to be brought into the market at the time when S-101 ENC coverage starts (2024) will have to be capable to process both transfer standard formats: S-57 ENCs and S-101 ENCs.

22. Safety of navigation will be maintained by cartographic content of both S-57 and S-101 standards. From the user's perspective, presentation of cartographic and functional features to meet the IMO mandated content in a mixed environment of S-57 ENCs and S-101 ENCs in one ECDIS device will be seamless and presented under the identical presentation regime for charted features and navigational objects.

Action requested of the Sub-Committee

23. The Sub-Committee is requested to:

- .1 note the maintained status of IHO's ECDIS-related standards;
- .2 acknowledge the ongoing effort to develop and test S-100 based data product specifications;
- .3 acknowledge the proposed introduction of IHO S-101 ENCs as a transfer standard for official charts in ECDIS;
- .4 consider a work item to amend Appendix 1 of MSC.232(82) to include reference to S-98, S-100 and S-101; and
- .5 take any other action it considers appropriate.