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NAVIGATION, COMMUNICATIONS AND SEARCH AND RESCUE

Update on the progress of S-100 implementation and availability of printed nautical charts

Submitted by the International Hydrographic Organization (IHO)

SUMMARY

Executive summary: This document provides information regarding the progress on the development and implementation of the IHO Universal Hydrographic Data Model (S-100) intended for use in future S-100 ECDIS as base line standard for the next generation of Electronic Navigational Charts (S-101 ENCs) and other products and services in accordance with resolution MSC.530(106). It also provides information on the continued availability of printed nautical charts.

*Strategic direction, 7
if applicable:*

Output: 7.46

Action to be taken: Paragraph 22

Related documents: Resolutions A.817(19); MSC.232(82) and MSC.530(106); MSC.1/Circ.1503/Rev.2, MSC.1/Circ.1593 and MSC.1/Circ.1595; MSC 106/19; NCSR 7/22/5; NCSR 8/13/1; NCSR 9/16/1; NCSR 10/9, NCSR 10/22; MSC 107/15/2 and MSC 107/20

Introduction

1 The Maritime Safety Committee, at its 106th session, adopted resolution MSC 530(106) on *Performance Standards for electronic chart display and information systems (ECDIS)* (the ECDIS Performance Standards). In doing so, the Committee invited IHO to keep IMO informed on the process of development and implementation of the IHO S-100 framework standard.

2 At MSC 107, the Committee considered document MSC 107/15/2 (Germany and ICS) regarding the future availability of nautical charts printed on paper and, following consideration, requested the Secretariat to liaise with IHO and keep the Committee informed of any relevant developments related to this matter.

3 This document reports on the above issues.

Developments on IHO S-100 framework standard

4 IHO is working to ensure the availability of S-100 based products and services, particularly the next generation Electronic Navigational Charts (S-101), along with additional "Phase 1" product specifications including Bathymetry (S-102), Water Levels (S-104), Surface Currents (S-111), Navigational Warnings (S-124) and Under Keel Clearance Management (S-129), as well as critical framework components such as Interoperability (S-98), Catalogue of Nautical Products (S-128) and Test Data Set for S-100 and ECDIS Type Approval. These are all intended for use in the coming S-100 ECDIS and are being developed within the timeline presented in resolution MSC.530(106). S-100 ECDIS could be voluntarily installed onboard ships as of 1 January 2026 and, from 1 January 2029, all new ECDIS must be S-100 ECDIS.

5 In order to maintain ECDIS devices already installed on SOLAS ships, 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, IHO is committed to ensuring that identical geographic coverage will be provided for S-57 ENCs and S-101 ENCs for a transition period until all ECDIS in operation have become S-101 ENC compatible. During the transition period, IHO will continue the full technical support of both S-57 ENC and S-101 ENC formats and the provision of data services based on S-100.

6 It is noted that NCSR 10 had invited MSC 108 to adopt draft resolution MSC.530(106)/Rev.1 on *Performance standards for ECDIS* to facilitate a standardized digital exchange of ships' route plans. IHO welcomes that the proposed standard for route plans is also based on S-100, developed by IEC as S-421, and that NCSR 10 proposed keeping the transition dates agreed upon at MSC 106. IHO is committed to technically supporting the transition dates of 1 January 2026 and 1 January 2029 in terms of S-421 format definition.

7 For the purpose of the cartographic functionality of ECDIS and the proper provision of data services, IHO maintains a suite of ECDIS-related standards, as referenced in appendix 1 of the ECDIS Performance Standards (resolution MSC.530(106)).

8 IHO's most used ECDIS-related standard in an operational context is currently the transfer standard for digital hydrographic content S-57. This standard has been used for production of 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. However, in the context of e-navigation and digitalization, there is a recognized need for an upgraded technology.

9 In support of improving digitization on board, the exchange of nautical information and the provision of maritime services in the context of e-navigation, 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 for digital data exchange it also incorporates the required elements of S-57 and is aligned with the ISO 19100 series of geographic information standards.

10 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) requires that Maritime Services should be S-100 conformant as a baseline. Several of the Maritime Services proposed in the SIP will be dependent on product specifications being developed by IHO within the S-100 standard.

Under the IHO domain, integrated high-density depth information in a 3D format, real time hydrographic information such as water level and surface currents, maritime safety information (MSI) in ECDIS and sailing direction information could contribute to high precision Under Keel Clearance (UKC) calculations for improved safety, maximized loading and route optimization. S-100 is also an important step towards usage of machine-readable data for future MASS applications. These additional services and others, at the implementation stage, must be fully interoperable with a modernized version of the current ENC.

11 In the context of cyber security, S-100 offers a more secure solution compared to the solution implemented in current S-57 based ECDIS. Improved cyber security in ECDIS is a priority for all stakeholders and as such an important motive to transition from current ECDIS to S-100 ECDIS.

12 IHO continues to collaborate 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 and other S-100 based data services. 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 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. The enhancement of ECDIS functionality to include S-101 ENCs as a mandated transfer standard is a logical and necessary step towards the implementation of the e-navigation concept of harmonized Maritime Services.

13 The S-100 framework and the related product specifications are not developed and maintained in isolation. Numerous international organizations collaborate actively with the technical bodies of IHO to develop and apply S-100 based products to their respective regulations and services. For the implementation of Phase 1, Route monitoring mode, cooperation with IEC is especially important. The revision of the IEC 61174 ECDIS Test Standard is critical and must be synchronized with the development of the relevant IHO S-100 products. IHO works closely with IEC and will ensure that IHO standards are developed appropriately to support the necessary revision of the mentioned IEC standard. Another crucial element to maintaining protection of communication between ship and shore against illegitimate alterations will be the application of IEC 63173-2, which is the required security layer for S-421 route plan exchange.

14 IHO has agreed on a two Phase implementation for S-100. Phase 1 (Route Monitoring) and Phase 2 (Route Planning). Phase 1 product specifications are viewed as critical for underway navigation while Phase 2 products aim to support decision-making during route planning and the maintenance of infrastructure. The Critical Infrastructure is considered as the foundational tools needed in order for S-100 to work.

Phase 1 (Route monitoring) product specifications

S-101	Electronic Navigational Chart (ENC)
S-102	Bathymetric Surface
S-104	Water Level Information for Surface Navigation
S-111	Surface Currents
S-124	Navigational Warnings
S-129	Under Keel Clearance Management

Critical framework

	IHO Geospatial Information Registry
S-98	Interoperability Specification
S-100	Universal Hydrographic Data Model
S-128	Catalogue of Nautical Products
S-164	Test Data Set for S-100 and ECDIS Type Approval

15 IHO is committed to ensuring that Phase 1 standards are ready in time for Member States to produce official S-100 data in 2025. In order to meet this timeline, IHO has agreed to an ambitious 2024 standards approval process for which it expects S-100 Edition 5.2.0 to be published in May 2024 and for official operational editions of Phase 1 product specifications to be published by December 2024. This includes the operational edition of the new ENC format S-101. Some parts of the critical framework, S-98 and S-164 have been agreed to 2025 approval process to be published by December 2025. Noting the time required for Member State approval and publication of these documents, as well as the need for finalization and publication of the IEC 61174 test standard prior to OEM and production software implementation and type approval, IHO expects that hydrographic offices will be able to enter the production phase of official S-100 data in 2025/26. The respective Regional Hydrographic Commissions are currently working on detailed plans to provide S-101 data provision with substantial regional coverage from 2026 onwards and IHO for Inter-regional Coordination Committee (IRCC) is overseeing this regional approach.

16 IHO notes the critical need for data to support S-100 standards as operational versions of the standards are made available. While IHO has agreed to an implementation strategy for standards production, it recommends that IMO Member States start to consider national or regional implementation plans to ensure data availability to support the full universe of S-100 standards, including but not limited to hydrography. High resolution data such as marine weather, surface currents, navigational warnings, aids to navigation, and more will be needed to realize the full potential of S-100.

17 IHO is committed to ensuring that S-100 standards, including data coverage, are implemented globally and that no country is left behind. National or regional implementation plans should respect the IMO transition dates in the ECDIS Performance Standards, i.e. 1 January 2026 and 1 January 2029. IHO appreciates and looks forward to working with IMO on mechanisms for the development and delivery of S-100 training to support this cause.

Availability of paper charts

18 The Committee should note that the continued maintenance of the printed nautical chart has the full attention of IHO. It is likely that the need for this format of nautical charts will continue to decrease, but IHO recognizes that printed nautical charts will be needed for the foreseeable future by certain ships. IHO will stay in close contact with IMO on this matter and IHO will continue to keep the Committee informed of any relevant developments related to this matter.

19 In keeping with the recognition of the importance of printed nautical charts, IHO supports a well-established global network of Regional Chart Coordinators who continue to track paper chart availability, data consistency, means for updates and overall coordination. Recognizing that situations vary around the world, the coordinators are uniquely qualified with regionally specific knowledge to coordinate nautical charts in their regions. They work as part of the Regional Hydrographic Commissions and regularly report on nautical charting in paper and digital form to IHO.

20 IHO is committed to advancing standards that facilitate printed nautical chart production from digital sources including ENCs. The IHO Nautical Cartography Working Group aims to ensure that all printed nautical charts, including those produced from digital sources, meet the standards prescribed by the Regulations for International (INT) Charts and Chart Specifications of IHO (S-4). The Working Group is comprised of experts in nautical cartography from hydrographic offices around the world and will maintain the printed product related parts of S-4 until the ultimate cessation in the distant future.

21 IHO maintains an international chart web catalogue (link available on <https://iho.int/en/standards-and-specifications>) which is regularly updated to show international chart coverage, including scale, region, production status, and producer for printed and electronic nautical charts.

Action requested of the Committee

22 The Committee is invited to:

- .1 note that IHO Member States are committed to the implementation dates stated in resolution MSC.530(106) on *Performance standards for electronic chart display and information systems (ECDIS)*;
 - .2 acknowledge the progress being made on IHO S-100 product specifications;
 - .3 encourage IMO Member States to develop S-100 data and production implementation strategies;
 - .4 consider how IMO can support the implementation of S-100 to achieve data coverage and coordination between organs involved;
 - .5 consider the impact of resolution MSC.530(106) on the training needs of seafarers; and
 - .6 take any other action it considers appropriate.
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