**Contribution to the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea 2025**

***"Capacity building and the transfer of marine technology: New developments, approaches and challenges"***

This contribution is provided in response to the letter dated 12 December 2024 requesting input from the International Hydrographic Organization to this year's theme of the Open-ended Informal Consultative Process on Oceans and the Law of the Sea 2025 pursuant to General Assembly Resolution 79/144.

**Executive Summary**

1. The International Hydrographic Organization (IHO) is the inter-governmental international organization whose principal aim is to ensure that all the world's oceans, seas and navigable waters are properly surveyed and charted. The work is done by bringing together the national agencies responsible for the conduct of hydrographic surveys, the production of nautical charts and related publications, and the distribution of Maritime Safety Information (MSI) in accordance with the requirement set out in the International Convention for the Safety of Life at Sea (SOLAS) and other international regulations. The current membership of the IHO stands at 100 Member States.

2. Although safety of navigation remains a major drive for the IHO, hydrographic products and services are meant to support all activities associated with the oceans, seas and navigable waters. As every human activity conducted in, on or under the sea depends on knowing the depth and the nature of the seafloor and an understanding of the tides and the currents, hydrography is an essential enabler to the development of the Blue Economy. This has a significant impact on what mankind can do at sea today in a safe, economical, and sustainable manner. It is impeding progress and economic development in many, if not most, coastal States and has a major impact on the effective management, sustainable exploitation, and well-informed governance of the seas and oceans.

3. Through its active technical standardization and capacity building programmes conducted in close liaison with other international organizations, notably the International Maritime Organization (IMO), the International Organization for Marine Aids to Navigation (IALA) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the IHO supports the development and improvement of hydrographic and nautical charting standards, products, and services, especially in digital formats. After yearlong preparatory work the IHO and its expert contributors have finalized the first relevant building blocks of its S-100 standards framework for marine data. S-100 is designed to elevate the management and handling of marine geoinformation to the next level of digitization. These new technical capabilities contribute directly to safe navigation, informed marine spatial planning, coastal management, and marine protected area management in the deep sea as well as the limitation of and recovery from natural disasters. They also provide a technical basis for the implementation of the UN Convention on the Law of the Sea. The S-100 implementation phase has already commenced but requires a concerted approach of governmental marine data providers and commercial players making this geoinformation operational and accessible on the data consumer's side. Capacity Building in both domains is indispensable and therefore addressed in joint initiatives of IHO, IMO and IALA and other key stakeholders.

4. IHO´s S-100 approach to be potentially applicable to all types of marine information including chemistry and biology of the oceans, resulting in interoperable datasets to form "the digital twin of the Ocean" and its subset "the digital twin of the navigable waters" – the latter focused on the digital support of all aspects of sea traffic.


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*General*

***The S-100 implementation roadmap - developing standards, guidance, products and services***

5. IHO standards and guidelines, intended to assist coastal States in meeting their obligations and requirements, fall under three main themes:

- nautical charts, issued on paper or in digital format (Electronic Navigational Charts), which are produced by national Hydrographic Offices to support safe navigation in accordance with the requirements of SOLAS;
- the maritime component of spatial data infrastructures being developed at the national and regional levels, which includes in particular high-resolution bathymetry (depth data) compiled by national Hydrographic Offices;
- the global reference bathymetric data sets developed and made available through the GEBCO programme (General Bathymetric Chart of the Oceans) operated jointly by the IHO and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

6. In a historic breakthrough for digital navigation, the International Hydrographic Organization has released the first set of operational standards within the S-100 framework. This milestone represents the culmination of over 20 years of collaborative efforts by the IHO Secretariat, Member States, and the Hydrographic Services and Standards Committee (HSSC), along with its working groups and project teams. These standards are now accessible via the IHO S-100 Geospatial Information (GI) Registry and the IHO website.

**Integrating Data for Enhanced Navigation**

7. The S-100 framework marks a revolutionary step forward by enabling the integration of diverse datasets within a single Electronic Chart Display and Information System (ECDIS). Mariners will now be able to combine various data layers—such as Electronic Navigational Charts (ENCs), detailed depth information and dynamic information on water level and currents—to enhance situational awareness and decision-making.

8. S-100 will bring four significant benefits: increased safety, enhanced efficiency, optimized loading capacity, and reduced environmental impact. These align with the International Maritime Organization's (IMO) Greenhouse Gas (GHG) Strategy. Furthermore, S-100 implementation represents a critical step towards achieving autonomous navigation and improved cyber security.

**Key S-100 Product Specifications Adopted**

9. Following the adoption of Edition 5.2.0 of S-100 in June 2024, operational editions of key S-100-based Product Specifications have been approved in December 2024. These include:

- **S-101**: Electronic Navigational Charts (ENCs)
- **S-102**: Bathymetric Surface
- **S-104**: Water Level Information
- **S-111**: Surface Currents
- **S-129**: Under Keel Clearance Management

10. The availability of mature operational standards paves the way for Coastal States to offer official products and services based on these standards, significantly advancing the field of maritime navigation. The adoption also has profound implications for ocean data collection and sea surveys, as these new products will require enhanced data in order to realize their full potential. The availability of operational

versions of these standards represents the real starting point for coastal states to embark on the journey to produce official S-100 products.

**Implementation Progress and Next Steps**

The development of the remaining Phase 1 Product Specifications continues. Navigational Warnings (S-124) and the Catalogue of Nautical Products (S-128) have been submitted for HSSC endorsement, with approval anticipated in early 2025.

Phase 2 will focus on Product Specifications for route planning, with four key standards:

- **S-122**: Marine Protected Areas
- **S-123**: Marine Radio Services
- **S-127**: Marine Traffic Management
- **S-131**: Marine Harbour Infrastructure

The IMO's adoption of the revised Resolution MSC.530(106) on Performance Standards for ECDIS at its 108th Session in May 2024 underscores the global commitment to S-100 implementation. From January 1, 2026, S-100 ECDIS will be legal for use, with a transition period until January 1, 2029, after which all new systems must comply with the updated IMO ECDIS Performance Standards.

***Authoritative Dataset on the Limits of Oceans and Seas***

11. The IHO's responsible technical body is currently taking action to develop a new S-100 based Product Specification named Polygonal Demarcations of Global Sea Areas (S-130). The objective is to use the S-130 Product Specification as a dataset model for the subsequent production of the authoritative S-130 Dataset with global coverage of all geographic limits of the oceans and seas as maintained in analogue form by the IHO since 1919 by means of IHO publication S-23.

***Global map of Marine Protected Areas***

12. The adoption of the Agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ Agreement) on 19 June 2023, has motivated the IHO to invest in the creation of a global map of Marine Protected Areas (MPA) to come a digital dataset in a specific format (S-122). The geographic coverage will be enriched with metadata containing the specific information on the applying regulations for each of the respective areas. This dataset will be created in collaboration with the private foundation *ProtectedSeas* and will eventually become open source with no limitation for reuse.

***Building capacities for the technological leap***

13. The IHO defines capacity building as the process by which the Organization assesses the status of current arrangements and assists States to achieve sustainable development and improvement in their ability to meet hydrographic, cartographic, and maritime safety obligations with reference to recommendations in UNCLOS, SOLAS, and other international instruments. With regard to the uptake of the S-100 framework ecosystem of data production services and their distribution, there is a likewise urgent and compelling need to ensure that hydrographic offices, maritime administrations, and other information providers are made aware of the respective advantages, to become enabled for the transition, are informed on the best ways to do it and have capable well-trained staff to produce and disseminate the datasets.

14. To enhance the readiness to implement the IHO S-100 Universal Hydrographic Data Model and the regular production of the respective products, several activities have already been carried out and others are planned for IHO's network of sixteen Regional Hydrographic Commissions, such as:

- Workshops to raise awareness and promote the exchange of information about the respective local experiences and best regional practices on the implementation of the S-100 data model and production of the datasets.
- Practical training activities to establish the production of S-100 compliant datasets.

15. The recognition of the importance of this very important transformation to the maritime community has driven several initiatives to fund and promote S-100 capacity building activities, including:

- The Regional ENC Coordinating Centres (RENC's), IC-ENC and PRIMAR, implemented mechanisms to fund S-100 activities listed in the IHO Capacity Building Work Programme (CBWP).
- IHO is organizing with other international organizations, especially IMO, IOC and IALA, joint projects led by IHO and IMO to promote the necessary awareness and training in developing countries.
- IHO established a specific Fund Generation Project Team to explore options of alternative funding to enhance and accelerate the programmed capacity building activities in support of the S-100 ecosystem of standards, dataset production and dissemination.

16. The clock for the aspired quantum leap in provision and use of interoperable marine geoinformation is ticking. Thanks to the joint commitment of the affected intergovernmental organizations IHO, IMO and IALA to "deliver as one" and the concerted interaction with the partnered industry, the hydrographic community has every confidence to meet its targets towards the S-100 based creation of "the digital twin of the navigable waters".