

UN Open-ended Informal consultative Process on Oceans and Law of the Sea “New maritime technologies: challenges and opportunities”

IHO contribution:

The S-100 – Universal Hydrographic Data Model: a revolutionary approach to marine data

There are more and more stakeholders involved in ocean affairs, and each stakeholder has different objectives: using ocean resources, preserving the ocean, obtaining baseline data in order to monitor and measure the impacts of climate change; getting data to monitor ocean currents, whether to maximize productivity for fisheries, get a better understanding of the movement of pollutants or habitats for marine species etc. Precise data is needed to support all these actions, as well as to measure any impacts of human activities. Plus, with the 30 by 30 target of the Global Biodiversity Framework adopted in December 2022, marine geospatial data is needed to monitor progress. By using international standards for the gathering of data at sea but also for the creation of databases and their visualization, this can ensure data from around the world is comparable, interoperable, but also machine-readable. Various standards developed by the IHO can support these actions, and in some areas, are already doing this.

Currently, data gathered around the world and by different parties is often in different formats, using different software etc etc. However the IHO S-100 universal hydrographic data model is already making progress in the maritime world to ensure data from different origins and disciplines can be ingested into compatible digital systems. The S-100 model was recently included in the IMO regulatory framework for Electronic Chart Display and Information Systems (ECDIS). S-100, while originally designed for navigation, this universal data framework can actually be used by a variety of ocean disciplines linked to the protection and sustainable use of the oceans, for example to create data sets on tides and water levels, marine protected areas, ocean currents etc. It can be complimented by data sets developed by other organizations such as the WMO which use the standard for ice and weather data among others. In association with the use of standards/guidelines when gathering ocean data (measurements at sea), such as the IHO S-44 Standard for Hydrographic Surveys, this helps ensure that users around the world follow comparable methods when gathering and processing data. This is particularly important considering the actors from different sectors and industries working with the ocean.

At the UN Ocean Conference held in Lisbon in 2022, many parties mentioned the need for better maps of the ocean, and there is also more and more focus on developing a digital twin of the ocean. Hydrography, coupled with universal data standards, can support all these activities.

The concept and interoperability of S-100

Born in the 90s, the IHO standard S-57 set the reference for international paper charts, which was then complemented by S-52 which provided guidance for Electronic Navigational Charts and how they are displayed in Electronic Chart Display and Information System (ECDIS). This standard has proved its value, with over 35,000 vessels navigating with ECDIS around the globe. However, there has since been great progress in modern information technology and new technical options were calling for something more. The S-100 development concept reflects this need. It started in 2005 with the goal to allow interoperability between a wide range of marine geo-data.

S-100 has therefore become the most important application of the ISO19100 series of Geographic Information Standards, to ease the use of hydrographic data beyond Hydrographic Offices and ECDIS users (coastal zone mapping, security, inundation modeling, etc.), and to plug-and-play updating of data, symbology and software enhancements.

By adopting the S-100 Universal Hydrographic Data Model, the IHO started to develop a versatile standard framework composed of S-100 based Product Specifications so as to describe specific aspects of the real world. The advantage of such datasets, based on the same paradigm, is their mutual compatibility and interoperability. The latter supports a multitude of possible combinations of the geo-information encoded in datasets – independent from which scientific discipline they belong to.

The S-100 Product Specifications and the other domains of application

The IHO S-100 framework can support the creation and maintenance of interoperable marine data product specifications. Already specifications for Electronic Navigation Chart (S-101), Bathymetric Surface (S-102), Surface Currents (S-111), Marine Protected Areas (S-122), Marine Radio Services (S-123), Marine Traffic Management (S-127) and Under Keel Clearance Management (S-129) have received IHO Member States' approval for test and evaluation purposes. The series also includes a product specification for Maritime Limits and Boundaries (S-121), to provide UN's DOALOS (Division for Ocean Affairs and the Law of the Sea) with a suitable format for the exchange of digital vector data pertaining to the maritime boundaries, limits and zones of States to meet their respective UNCLOS deposit obligations.

Many IHO Member States currently engage in significant efforts to establish regular and frequent services utilizing such datasets with national and regional coverage. Since the S-100 framework and the associated web-based infrastructure is not limited to host data product specifications native to the hydrographic domain, the IHO is proactively supporting the expansion of the S-100 concept to marine related domains such as maintenance of fixed and floating aids to navigation (IALA – International Association of Lighthouse Authority), weather and sea ice coverage (WMO – World Meteorological Organization), route plan exchange format (IEC – International Electrotechnical Commission), inland electronic charting (IEHG – Inland ENC Harmonization Group) and oceanography (IOC – Intergovernmental Oceanographic Commission). IHO's S-100 approach is potentially applicable to all sorts of marine information including chemistry and biology of the oceans resulting in interoperable datasets to form the digital twin of the ocean.

The IHO strategy for the Decade

Committed to the guiding principles for innovation, governance and compliance in geospatial information management as drafted by the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) and endorsed by the Economic and Social Council (ECOSOC) in 2015, the IHO strives to enable Member States to produce and provide integrated services of S-101 ENC and other S-100 Products Specifications. The IHO established an engagement strategy to develop a roadmap to implement the S-100 Universal Hydrographic Data Model for the upcoming decade. These include operational infrastructure, technical standardization, coordinated implementation of services, synchronization with IMO and other UN organizations, collaboration with industry, capacity-building within Hydrographic Offices and development of global distribution capability. This will enable IHO Member States, and all other affected stakeholders, including industry partners, to adjust their legal and technical arrangements to contribute to the establishment of S-100 based products services. As new services are matured for S-1xx Product Specifications and relevant production and quality systems are developed, those producer nations with technology and expertise are encouraged to share these within the framework of the IHO Capacity Building strategy, the respective network of fifteen Regional Hydrographic Commissions (RHC) spanning over all sea basins, or bilaterally to support the growth of these new services. This strategy could be broadened to include other disciplines.