Master Plan for the development and implementation of S-100
Draft V1.0 (framework) - 07 June 2013

Content

1   Introduction

The International Hydrographic Organization (IHO) is an intergovernmental consultative and technical organization established in 1921 to support the safety of navigation, and to contribute to the protection of the marine environment. One of its primary roles is to establish and maintain appropriate standards to assist in the proper and efficient use of hydrographic data and information. Digital hydrographic information has become a basic element of all aspects of use and preservation of the maritime domain. Consequently, a huge variety of stakeholders beyond the community of national hydrographic services is supportive to IHO´s objectives in standardization of hydrographic data: greatest uniformity and interoperability.

This paper describes the development and implementation phases of IHO´s core standardization project over the next five years: The Universal Hydrographic Data Model designated S-100. The S-100 Model was basically designed as the succeeding standard to current IHO Transfer Standard for Digital Hydrographic Data S-57. But S-100 supports a much wider variety of hydrographic-related digital data sources, products, and customers. This includes new geospatial models to support imagery and gridded data, 3-D and time-varying data, and new applications that go beyond the scope of traditional hydrography - for example, high-density bathymetry, seafloor classification, marine GIS, etc..

Due to S-100 wide range of applicability and its strict compliance with the geoinformation standards of the International Organization for Standardization (ISO 19xxx series), the International Maritime Organization (IMO) agreed that S-100 is an appropriate baseline standard for creating a framework for e-Navigation data access and services. The Geospatial Information (GI) Registry constitutes the foundation of the S-100 Model. Like a digital library, the Registry hosts data model entities to design and maintain interoperable data product specifications of nearly unlimited purpose. The Registry also provides dynamic catalogues, which supports harmonization and enables the updating and delivery of data products. Originally intended to cover geospatial data only, it appears that the S-100 concept could be enhanced to all aspects of shipping and the maritime domain at large, including the modelling of non-spatial information e.g. pilot requests, regulatory information and user requirements.

The purpose of this master plan is to determine the long term goals and objectives of the development and implementation of S-100 and related specifications and tools, and to outline the tasks that need to be considered to achieve these objectives and the associated timelines. It expands upon earlier descriptions of the development of S-100, to explain the rationale of what is happening and promote the active involvement of both existing and potential stakeholders. Special emphasis is put on the development and implementation of the product specification S-101 - the standard for the next generation ENC.

➢ Section 2 provides a detailed Description of the S-100 based architecture and governance.
➢ Section 3 addresses use and maintenance of the S-100 Registry
➢ Section 4 discusses existing and planned data product specifications based on the S-100 Registry in general, whereas
➢ Section 5 presents the specific roadmap for the development and implementation of S-101 ENCs,
➢ Section 6 outlines the process for developing and implementing other S-100 based product specifications for IHO products and services, and
➢ Section 7 outlines the process for developing and implementing S-100 based product specifications for non-IHO products and services.
➢ Section 8, finally elaborates the impacts on and interactions with the various stakeholders as anticipated so far.

2   Principles of S-100

S-100 provides a contemporary hydrographic geospatial data standard that can support the variety of hydrographic-related digital data sources, products, and customers. Its main features include:

- Separating the data content from the carrier (file format). In this way, data can be manipulated and encoded without being permanently tied to a single exchange mechanism.

- Manageable flexibility that can accommodate change. The content of product specifications will be a subset of S-100, including separate feature catalogues. This allows the core standard to evolve (through extension) without the need to introduce new versions of product specifications.

- Alignment with the series of current geospatial information standards adopted by the International Organization for Standardization (ISO 191xx). This ensures compatibility, or interoperability, with other domains.

- An ISO-conforming web-based registry containing registers for feature data dictionaries, portrayal and metadata. The registers accommodate both core hydrographic content and other chart related content and can be extended beyond geospatial data. The registry architecture also contributes to the flexibility of the standard.

S-100 specifies, for hydrographic and related information, methods and tools for data management, processing, analysing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations. By following this set of standards users will be able to build constituent parts of an S-100 compliant product specification.

The employment of the notions of registry and registers is one of the most significant aspects in terms of alignment of S-100 with the ISO series of standards. A registry is the entire information system (or location) in which a collection of registers is located. A register is a collection of tables in a database containing identifiers assigned to items with descriptions of the associated items. Descriptions may consist of many types of information, including names, definitions and codes.

The on-line S-100 Registry under development by the IHO consists of five types of Registers:

- Feature Concept Dictionary Register,

- Portrayal Register,

- Metadata Register,

- Product Specifications Register,

- Data Producer Code Register.

The Feature Concept, Portrayal and Metadata Registers are, in effect, managed lists or dictionaries of items. Selections from these three Registers are used to define Feature and Portrayal Catalogues used in individual product specifications. The Product Specification Register is a list of S-100 based product specifications created by recognized organizations describing meta-information about the content, purpose, version, location and availability of those product specifications.

The Data Producer Code Register is the authoritative list of the codes which can, if required, be stipulated in Product Specifications to identify the producers of a particular data product; for example, Hydrographic Offices for ENC producer codes.

An S-100 based product specification is a description of all the features, attributes and relationships of a given application and their mapping to a dataset. It is a complete description of all the elements required to define a particular geographic data product. S-100 provides the framework to ensure that any data product specification will maintain a consistent structure based on the following basic parts:

- product identification,

- data content and structure,

- coordinate reference system,

- data quality,

- data capture,

- data maintenance,

- portrayal,

- encoding,

- product delivery.

Within the Feature Concept Dictionary, the Portrayal and the Metadata Registers each entry is assigned to a recognized "domain". The purpose of designating domains and a related "Domain Control Body" is to ensure that the key stakeholders (as represented by the domains) are consulted in any subsequent proposals to adjust items already contained in a Register. The Feature Concept Register presently encompasses domains for nautical charts, nautical publications, inland ENC, port ENC, sea ice coverage, and marine information overlays (MIO). Other maritime data domains will be included over time as new requirements and applications emerge. Any recognized organization can propose a new domain. Each Register Manager may also propose a new domain depending on the needs of a Register, its existing users or an awareness of any potential new users or new requirements.

Maintenance of S-100 and the release of new versions is governed by the rules laid out in IHO Resolution 2/2007 as amended - *Principles and Procedures for making changes to IHO Technical Standards and Specifications*. Changes to S-100 are coordinated by the "Transfer Standard Maintenance and Application Development Working Group" (TSMAD) of the IHO. Organizations that wish to make changes to S-100, must address their comments to the IHO Secretariat (info@iho.int).

All proposed changes shall be technically and commercially assessed before approval.

The IHO shall release new versions of S-100 as necessary via the IHO web site. New versions shall include clarifications, corrections and extensions. Each version shall contain a change list that identifies the changes between versions of S-100.

Clarifications are defined as non-substantive changes to S-100. Clarifications remove ambiguity and errors in spelling, punctuation and grammar. A clarification shall not cause any substantive semantic change. Clarifications shall be denoted as 0.0.x. Each clarification or set of clarifications approved at a single point in time shall increment x by 1.

Corrections are defined as substantive semantic changes to S-100 to correct factual errors. A correction shall not be classified as a clarification. One correction may result in multiple related actions. All cumulative clarifications shall be included with the release of approved corrections. Corrections shall be denoted as 0.x.0. Each correction or set of corrections approved at a single point in time shall increment x by 1. Correction version control shall set clarification version control to 0.

Extensions are significant changes to S-100. They can include additional information from the IHO or ISO TC211 geographic information standards that were not originally included in S-100 that may be needed for additional applications. Extensions result in a new major version of S-100. One extension may result in multiple related actions. All cumulative clarifications and corrections shall be included with the release of approved extensions. Extensions shall be denoted as x.0.0. Each extension or set of extensions approved at a single point in time shall increment x by 1. Extension version control shall set the clarification and correction version control to 0.

3   Tools and Maintenance of S-100 GI Registry

[Process diagram and associated explanations]

Initial input: Registry Manager

4   S10x data product specifications based on the S-100 Model

Initial input: TSMAD

5   S-101 ENC: Roadmap for development and introduction

The intention of this chapter is to provide an estimated timescale of events (Figure 1) in the development, test and application of S-101. This timely sequence of activities is commented by a more detailed listing of the various processes and impacts which are anticipated to have an effect on the various stakeholders. The timescales involved are very much dependent on available resources.

Initial input: TSMAD (to be derived from the S-101 roadmap)

5.1   Time line

[Simplified time scale]

5.2   Steps in development

- S-101 First Draft (October 2013)
- Initial Test Bed (2013 - 2015)
- S-58 and S-64 (2014)
- OEM Review (2014 - 2015)
- OEM Implementation (2015 - 2017)
- ECDIS On Shore Trials (2015 - 2016)
- S-101 Final Draft (2016)
- ECDIS Sea Trials (2017)
- S-101 Released for full implementation (2018)

5.3   Steps in implementation

6   Process for developing and implementing other S-100 based product specifications for IHO products and services

Initial input: TSMAD

7   Process for developing and implementing S-100 based product specifications for non-IHO products and services

Initial input: to be decided

8   Impact on / interaction with stakeholders

Initial input by TSMAD

Each sub-section will consider impact and interaction associated with respectively:

- S-100 modeling,

- development and implementation of S-101 (based initially on the S-101 impact study),

- development and implementation of other IHO Product Specifications

- development and implementation of non-IHO Product Specifications

8.1   IHO bodies and Member States

8.1.1   Hydrographic Offices

8.1.2   Regional Hydrographic Commissions

8.1.3   IHB

8.1.4   WEND implementation (including RENCs)

8.1.5   Technical capacities / technical cooperation
(including activities of IHO Committees, Sub-committees, Working Groups, etc.)

8.2   Partner Organizations

8.2.1   Liaison with IMO

8.2.2   Liaison with ISO

8.2.3   Liaison with IALA

8.2.4   Liaison with IEC

8.2.5   Liaison with IEHG

8.3   Other Submitting Organizations
(discuss the impact on organizations not listed in 8.2 which may wish to contribute to the development of the S-100 registers)

8.4   OEMs

8.4.1   Type approval

8.4.2   Downward compatibility

8.5   Service Providers

8.5.1   Commissioning of data packages including feature and portrayal catalogues

8.5.2   Encryption

8.5.3   SENC distribution

8.6   Liaison with Trade Organizations
(potential impact on the relation with CIRM, RTCM, RTCA, CNITA, etc.)

8.7   End Users

8.7.1   Development and implementation of S-101

8.7.1.1 Advantages of S-101 ECDIS

8.7.1.2 Software maintenance

8.7.1.3 Legacy systems / grandfather clause

8.7.2   Development and implementation of other product specifications

8.8   Liaison with Users' Organizations
(potential impact on relation with ICS, IMPA, BIMCO, CLIA, etc.)

8.9   Points of contact