

**5<sup>TH</sup> MEETING OF THE HYDROGRAPHIC SERVICES AND STANDARDS COMMITTEE  
Shanghai, China, 5-8 November 2013**

**Paper for Consideration by HSSC5**

**Master Plan for the development and implementation of S-100**

<b>Submitted by:</b>	HSSC Chair, TSMAD Chair, DIPWG Chair, IHB
<b>Executive Summary:</b>	<p>This paper reports on the outcome of action HSSC4/25: “TSMAD and DIPWG Chairs to produce, by the end of January 2013, a ‘master plan’ document for the development of S-100 and S-101, in accordance with the life cycle diagram included in resolution 2/2007, incorporating sequencing with DQWG and DPSWG, and scheming the implications for stakeholders.”</p> <p>The attached draft master plan is to be considered in conjunction with the draft S-101 value added roadmap.</p>
<b>Related Documents:</b>	<p>Final minutes of HSSC 4 (section 5.3.3) HSSC5-05.1B - S-101 Value Added Roadmap HSSC5-05.1D - Regulatory process associated with the implementation of S-100 based products and services HSSC5-10A - Draft HSSC Work Plan</p>
<b>Related Projects:</b>	Development of S-100 and related product specifications

### **Background**

1. At its 4<sup>th</sup> session, HSSC tasked the Chairs of TSMAD and DIPWG “to produce, by the end of January 2013, a “master plan” document for the development of S-100 and S-101, in accordance with the life cycle diagram included in resolution 2/2007, incorporating sequencing with DQWG and DPSWG, and scheming the implications for stakeholders”.
2. The draft attached to this document has been jointly developed by the Chairs of HSSC, TSMAD and DIPWG and the IHB.

### **Analysis**

3. The purpose and the structure of the Master Plan are presented in Section 1 - Introduction. The purpose of the document 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.
4. The contents of the subsequent sections can be summarized as follows:
  - Section 2 provides an overview 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;
  - 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;
- 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.

5. A number of sections require further development.

### **Conclusion**

6. It is recommended that HSSC consider the draft Master Plan in order to agree on the structure of the document and decide on the way forward to finalize it.

### **Action required of HSSC**

7. The HSSC is invited to:
- a. **note** this report;
  - b. **consider** the draft Master Plan,
  - c. **agree** on the structure of the document,
  - d. **decide** on the way forward to finalize it, and
  - e. **take** any other action as appropriate.



**HYDROGRAPHIC SERVICES AND STANDARDS COMMITTEE**  
**COMITE DES SERVICES ET DES NORMES HYDROGRAPHIQUES**

**Master Plan for the Development and Implementation of S-100**

**(Draft)**

**Content**

1	Introduction .....	3
2	Principles of S-100 .....	4
3	Tools and Maintenance of S-100 GI Registry .....	5
4	S10x data product specifications based on the S-100 Model .....	7
5	S-101 ENC: Roadmap for development and introduction.....	7
5.1	Time line.....	8
5.2	Steps in development.....	10
5.3	Steps in implementation .....	11
6	Process for developing and implementing other S-100 based product specifications for IHO products and services.....	11
7	Process for developing and implementing S-100 based product specifications for non-IHO products and services.....	11
8	Impact on / interaction with stakeholders.....	12
8.1	IHO bodies and Member States.....	12
8.1.1	Hydrographic Offices .....	12
8.1.2	Regional Hydrographic Commissions.....	13
8.1.3	IHB .....	13
8.1.4	WEND implementation (including RENCs) .....	13
8.1.5	Technical capacities / technical cooperation .....	13
8.2	Partner Organizations .....	13
8.2.1	Liaison with IMO .....	13
8.2.2	Liaison with ISO .....	13
8.2.3	Liaison with IALA .....	13
8.2.4	Liaison with IEC.....	13
8.2.5	Liaison with IEHG .....	13
8.3	Other Submitting Organizations.....	13
8.4	OEMs.....	14
8.4.1	Type approval.....	14
8.4.2	Downward compatibility .....	14
8.5	Service Providers.....	14

8.5.1	Commissioning of data packages including feature and portrayal catalogues .....	14
8.5.2	Encryption .....	14
8.5.3	SENC distribution .....	14
8.6	Liaison with Trade Organizations .....	14
8.7	End Users .....	14
8.7.1	Development and implementation of S-101 .....	14
8.7.2	Development and implementation of other product specifications .....	15
8.8	Liaison with Users' Organizations .....	15
8.9	Points of contact .....	15

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## 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 an overview 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 S-100 Registry is described in more detail in Section 3 below.

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.

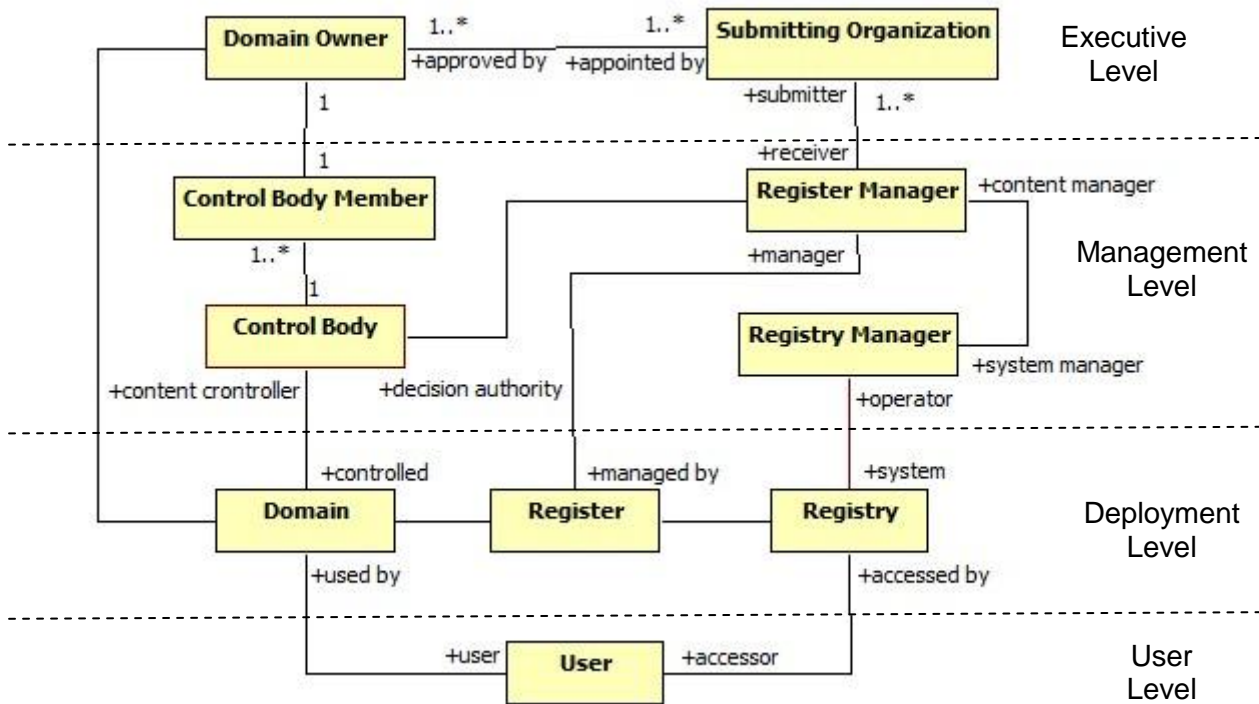
*Clarifications* are defined as non-substantive changes to S-100. Clarifications remove ambiguity and errors in spelling, punctuation and grammar. A clarification shall not cause any substantive semantic change. Clarifications shall be denoted as 0.0.x. Each clarification or set of clarifications approved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



**Figure 1 - Functional Diagram of the S-100 GI Registry.**

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.

Within the Feature Concept Dictionary, the Portrayal and the Metadata Registers each entry is assigned to a recognized “domain”. The purpose of designating domains 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.

The S-100 GI Registry is owned by the IHO, represented by the President of the IHB Directing Committee. The Registry Owner decides whether a proposed register shall be hosted on the registry and establishes the policy for access. The relevant decisions are made in accordance with IHO regulations.

The day-to-day operation of the Registry is delegated to the Registry Manager. This includes:

- 1) providing registry access for Register Managers, Control Bodies, and Register Users;
- 2) ensuring that information about items in the Registers is readily available to users in relation to those items that are valid, superseded, or retired;
- 3) accepting proposals and forwarding them to all Register Managers.

The Registry Manager is appointed by the Registry Owner.

All registers in the Registry are currently owned by the IHO. The roles and responsibilities of the Register Owner include:

- 1) establishment of the registers;
- 2) management, dissemination, and intellectual content of those registers;
- 3) appointment of the register manager;
- 4) establishment of a procedure to process proposals and appeals made by submitting organizations.

The Register Manager is responsible for the administration of a register. This includes:

- 1) Coordinating with other Register Managers, Submitting Organizations, the related Control Bodies, Register Owner and the Registry Manager;
- 2) Maintaining items within the register;
- 3) Maintaining and publishing a list of Submitting Organizations;
- 4) Distributing an information package containing a description of the register and how to submit proposals;
- 5) Providing periodic reports to the Register Owner and/or the Control Body.

A Register Manager may manage multiple registers.

A Register User is any person or organization interested in accessing or determining the content of a register.

The Feature Concept Register, the Portrayal Register and the Metadata Register are each overseen by two control bodies, a Domain Control Body (DCB) that assesses and endorses proposals and an Executive Control Body (ECB) that oversees the operation of the Registers and adjudicate any disputes. DCB and ECB oversight is not required for the Product Specification Register nor the Producer Agency Code Register because they are both, in effect, non-discretionary lists of entries requiring little or no decision making or vetting. The Control Bodies are composed of technical experts appointed by the Register Owner; each of the domains recognized in a register is represented in the relevant Control Body.

A Submitting Organization is an organization that is qualified under criteria determined by the Register Owner to propose changes to the content of a register. The Register Manager determines whether a Submitting Organization is qualified in accordance with the criteria established by the Register Owner.

Besides the IHO, three other organizations are currently involved in maintaining domains within the S-100 Registry:



- the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) for the domains related to Aids-to-Navigations and associated services;
- the Inland ENC Harmonization Group (IEHG) for the Inland ENC domain;
- the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) of the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO) for the domains related to marine meteorology and oceanography.

The operational procedures for the use of the S-100 Registry are described in IHO publication S-99 - *Operational Procedures for the Organization and Management of the S-100 Geospatial Information Registry*.

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

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.

The work on S-100 based Product Specifications has focused on geospatial products so far. One IHO Product Specification was released in 2012 (S-102 - Bathymetric Surface Product Specification) and three other are being developed (S-101 - ENC Product Specification; S-10x - Marine Protected Areas; S-10x - Digital Routing Guide). Preliminary work has been initiated on nautical publications, surface currents and tidal products. The IHO is developing a generic template to guide the development of product specifications for any marine information overlays.

S-100 based Product Specifications being developed with other organizations include:

- Product Specification for maritime boundaries data, developed by the United Nations Division for Ocean Affairs and the Law of the Sea;
- Product Specification for sea ice, developed by the Expert Team on Sea Ice of JCOMM;
- Product Specification for met-ocean forecasts, developed by the Expert Team on Maritime Safety Services of JCOMM.

IALA has developed guidance to preparing S-100 product specifications related to aids-to-navigations (AtoN) and associated services. It has also initiated the preparation of product specifications for AtoN information, maritime safety information and vessel traffic information.

IEHG is following the development of S-101, and intends to align the product specification for Inland ENCs with S-101.

Most of the on-going developments are concentrating on geospatial products and services. However, the ability to use the S-100 framework to model substantially non-geographic maritime information, such as notice of arrival and pilot requests, has already been investigated with success as reported to IALA and IHO. S-101 ENC: Roadmap for development and introduction

## **5 S-101 ENC: Roadmap for development and introduction**

An overview of the sequence of activities is listed below. A more detailed description can be obtained in the S-101 Value Added Roadmap. The timescales involved are very much dependent on available resources.

### **5.1 Time line**

Figure 2 provides an estimated time line of events in the development, test and implementation of S-101.

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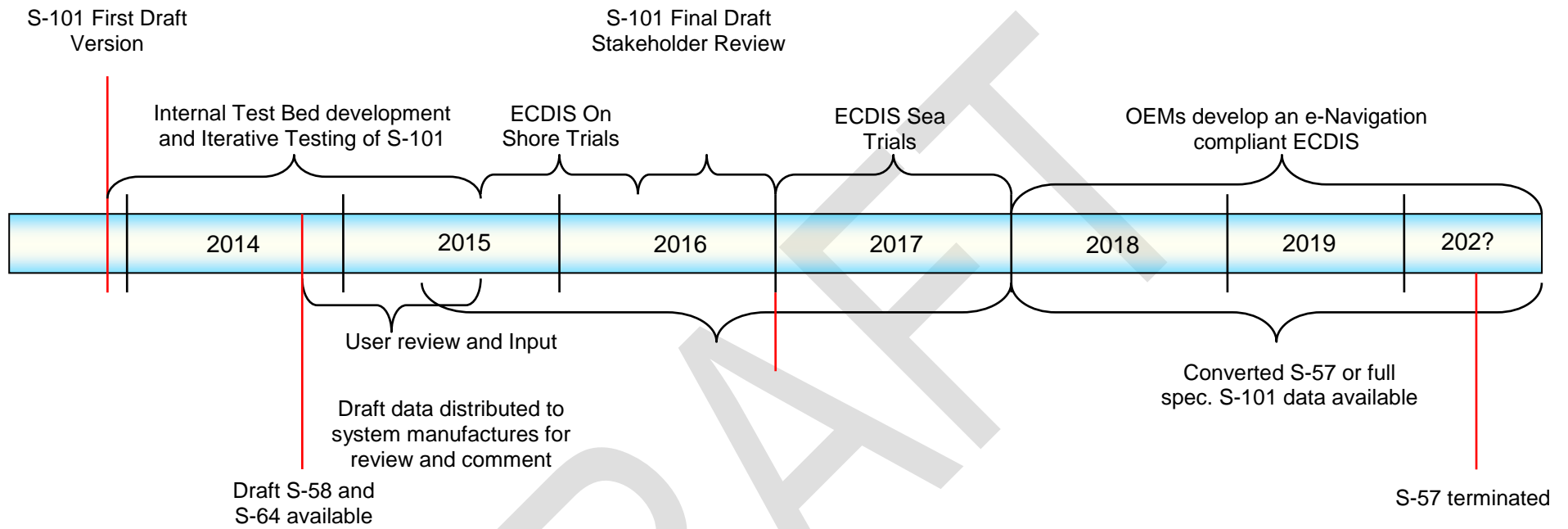


Figure 2 – Projected timescale for the implementation of S-101 as a component of an overarching e-Navigation ECDIS environment

## 5.2 Steps in development

### 5.2.1 S-101 First Draft

The initial draft of S-101 is dependent on the completion of Parts 9 (portrayal model) and 9a (symbol format schema) of S-100. Currently, it is estimated that the first draft will not be fully completed until TSMAD28 in April 2014.

This initial version will be the basis for an extensive testing programme. There are many new concepts which need to be proved and the draft will undoubtedly evolve throughout this period before a stable version can be published for stakeholder evaluation. This revised version will contain all the various catalogues required for testing; feature, portrayal, alerts / indications and agency codes

### 5.2.2 Initial Test Bed

The initial test bed will be defined by the test strategy and test plan that is currently under development by TSMAD. The test strategy will outline the overarching goals of the S-100 test bed, including: test processes, defect management, responsibilities, and form the overarching guidance for the S-101 test bed and iterative test process.

The first test bed will be a relatively simple viewer which is capable of importing and portraying data. It will include the ability to import new feature and portrayal catalogues and provide functionality to change the display based on some of the parameters which users can change which affect the display. Examples include the safety contour and depths, day / night environments, etc.

It is anticipated that this phase of testing will be completed by the first quarter of 2015, but only if all the elements are stable and user evaluation and satisfaction have been achieved.

It is important to understand that this test bed will be S-100 based, capable of testing other product specifications which can be either supplementary to S-101 ENC's or another type of GIS application.

### 5.2.3 S-58 and S-64

As part of the test bed process there will need to be versions of S-58 – ENC Validation Checks and S-64 – IHO Test Data developed specifically for S-101. Draft versions will be available by the 4th quarter of 2014.

### 5.2.4 OEM Review

Once a relatively stable version of S-101 has been established during the testing phase this will be distributed to the various manufacturers involved in all processes creating, delivering and using the data. Draft S-101 versions of S-58 and S-64 will be made available during this period. Results of this review will be fed back into the main testing process and new iterations of S-101 developed. Also during this period consideration will be given to the development of performance standards and IEC61174.

### 5.2.5 OEM Implementation

It is intended that once a relatively stable version of S-101 is published ECDIS OEMs, production software and validation tool manufacturers will start to develop their systems in order to contribute to the trials which follow.

This will also be an opportunity for data producers to help test new software and become familiar with the new content and structure of S-101.

### 5.2.6 ECDIS On Shore Trials

It is anticipated that at least one and possibly more S-100 enabled ECDIS will be available for the trials. All aspects of the process will be tested extensively including - data production, validation and distribution; ECDIS type approval and functionality, extensive user involvement, particularly training establishments. A dual fuel regime will test the capabilities and any issues with distributing both S-57 and S-101 ENC datasets.

### 5.2.7 S-101 Final Draft

During the second half of 2016 a thorough stakeholder review will culminate in a paper to the HSSC seeking endorsement of version 1.0.0 and a recommendation to seek M.S. approval to publish.

This version will contain a caveat stating that S-101 is still not available for across the board implementation and will be only used for testing until an announcement is made about a final release date through the IHB.

### 5.2.8 ECDIS Sea Trials

This will be a similar process to the on shore trials, but will emulate a real time environment.

### 5.2.9 S-101 Released for full implementation

At this point the IHO has certified that S-101 is ready for full implementation by the hydrographic community. This will entail the need for hydrographic offices to begin production of S-101 data in addition to S-57 data. This will mean that the distribution systems are in place and that the OEMs have designed and are selling upgraded ECDIS systems.

## 5.3 Steps in implementation

*(to be developed)*

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

*(to be developed)*

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

TSMAD Work Item A.10 enables the working group to liaise with other IHO WGs and external organizations in an advisory capacity.

In order to assist other IHO working groups and external organizations that wish to build S-100 compliant product specifications, TSMAD is in the process of developing easy to use templates. There are currently three templates in development:

- **Vector Based Product Specifications:** This template is designed for users that wish to develop a vector based product specification. A final draft version is currently under revision and a final version will be available in 2014.
- **Gridded Based Product Specifications:** This template is designed for users that wish to develop gridded product specifications. This is currently being developed and is anticipated that it will be available in late 2014.
- **ECDIS Based Product Specifications:** This template will be used in conjunction with vector template and will define various parameters and meta data information which will enable it to be recognized by ECDIS and control its relationship with other product specifications in use. This template will not be available until after the testing period during which various existing S-57 products other than ENC will be converted to the S-100 format and loaded into the test bed with S-101 data.

In addition, to the above templates, TSMAD is also developing an S-100 user guide. The intent of this guide is to provide users new to S-100 an overview of S-100 and how to build a product specification. It will provide checklists of what is needed for a product specification and other useful guidance. This should be available mid 2014.

## **8 Impact on / interaction with stakeholders**

*(to be developed)*

*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*

S-100 has been designed as a framework standard and as such will have minimal or no impact until used in the development of products. The following sub-clauses will only indicate where those organizations or working groups would be involved in tasks maintaining S-100.

An assumption is also made that any product specification is based on S-100.

### **8.1 IHO bodies and Member States**

#### *8.1.1 Hydrographic Offices*

S-100 – Providing WG attendees with the necessary knowledge and experience to maintain S-100

S-101 –

In many respects the changes introduced by S-101 will be transparent to the encoders of ENC's. The largest percentage of features and attributes remain unchanged, but there will be a need to change the techniques used where information types and complex attributes are introduced. As for the new cartographic text feature, it is not inconceivable that new multi-product database solutions will re-use parameters stored during the text placement process for other products like the nautical paper chart.

In view of the above it is anticipated that although changes will be required to production systems this will not be a wholly disruptive experience.

Understanding that producers will not easily be able to switch immediately to producing S-101 datasets and in order to ensure a relatively painless transition from S-57 to S-101 a converter has been developed which can either be used stand alone or built into the export process. This will provide an S-101 version of the existing S-57 ENC and can be used until full specification S-101 ENC's are produced. S-57 will continue to be supported until phased out at a date to be decided.

Although the converter will solve many issues, there will exist a need for carefully managed distribution streams for both S-57 and S-101 data until all ECDIS are S-100 compliant.

The implementation of S-58 will change with the introduction of S-101. Currently there isn't a mechanism to verify that a dataset has been properly validated against the S-58 checks. S-101 datasets will have a certification methodology which will enable ECDIS to verify that data is fit for purpose.

Other IHO Product Specifications –

This would be entirely dependent on the interest a particular HO would have in either assisting with the development of a particular product specification or actually producing the product.

The cost of developing new or extended production systems should be relatively small given the COTS enabling factor of S-100.

Other non-IHO Product Specifications –

This should be a similar scenario to that for IHO Product Specifications.

### 8.1.2 Regional Hydrographic Commissions

S-101 –

S-101 retains its position as the primary product for electronic navigation. RHCs should continue their current role in maintaining consistency and coverage in their area.

S-100 -

With the advent of the e-Navigation initiative it is anticipated that many new products specific to the maritime environment will emerge. RHCs should be aware of this and monitor progress.

### 8.1.3 IHB

#### 8.1.4 WEND implementation (including RENCs)

S-101 –

There should be no change to the current WEND principles other than a RENC's need to manage both S-57 and S-101 data distribution until S-57 is retired.

#### 8.1.5 Technical capacities / technical cooperation

(including activities of IHO Committees, Sub-committees, Working Groups, etc.)

S-100 –

S-100 is governed by Resolution 2/2007, all committees and WGs must follow the processes therein.

Currently TSMAD are the primary WG responsible for S-100, with DIPWG (portrayal) and DQWG (quality) also contributing. TSMAD liaises with other WGs and organizations in advising on the use of and maintenance of S-100.

Other WGs both IHO and non-IHO who develop S-100 based products will normally feed request for change through TSMAD. In exceptional cases which may involve major extension to S-100 proposals would need HSSC approval if it impacted the HSSC Work Programme.

## 8.2 Partner Organizations

### 8.2.1 Liaison with IMO

(see document HSSC5-01D)

### 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)

Any established organization in maritime environment may apply to become a Submitting Organization to the registry. Currently the following organizations have established domains in the registry or intend to in the future.

- Ice domain : WMO-IOC/JCOMM/ETSI
- Port ENC domain: Hamburg port Authority
- Weather: WMO-IOC/JCOMM/ETMSS

## 8.4 OEMs

### 8.4.1 Type approval

S-64 will remain mostly unchanged from the new version currently in preparation for S-57 based ECDIS. The most important change is that there will be a significant reduction in the need to re-type approved systems. The various catalogues can be treated as data much the same as an ENC or other product. The OEMs will only have to prove the process of importing the catalogues.

### 8.4.2 Downward compatibility

S-100 based ECDIS will need to be fundamentally different from their S-57 counterpart. Although there need not be any major changes made to the human interface, the underlying kernel will require significant reworking in order to take advantage of the "plug and play" planned developments.

The ISO/IEC 8211 format has been retained, but has been updated to align with the S-100 model.

The kernel will need to be capable of importing the various machine readable catalogues - feature, portrayal, alerts and indications, and producer agency codes.

## 8.5 Service Providers

### 8.5.1 Commissioning of data packages including feature and portrayal catalogues

One of the main issues during the transition from S-57 to S-101 ENCs will be the need for a delivery process for both types of data sets. In a similar way, the various catalogues for updating ECDIS are data sets which will require a distribution method. Currently there is ongoing discussion whether this will be undertaken centrally, via WEB based download, through OEMs or service providers etc.

The provision of a more robust and better structured version of S-58 will increase the efficiency of the process and provide better quality control.

### 8.5.2 Encryption

It is thought that S-63 version 2.0 will be introduced with the implementation of S-101. Elements from S-63 like encryption will be included in S-100 version 2.0 and this will then filter down to S-101.

### 8.5.3 SENC distribution

The modified version of ISO/IEC 8211 and content model of S-101 should not cause any major issues with SENC delivery.

## 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-100 ECDIS

Once the viability of the S-57 to S-101 converter has been established through testing it will enable the viability of both S-57 and S-100 based ECDIS running in parallel until either all ECDIS move to S-100 or S-57 data is withdrawn.

Two S-101 Stakeholder Workshops have been held during the development of S-101, primarily designed to ascertain their likes and dislikes of the current ECDIS user experience and to capture their ideas for improving this in the future.

Bearing in mind that the testing phase may influence change, the following are perceived to be beneficial to the overall ECDIS users' future experience. Some are S-101 specific and others are related to the concept of an S-100 enabled ECDIS.



- A new loading strategy will better control the display and scale of data being viewed. The concept of Navigation Purpose is removed and data will only be loaded using maximum and minimum scales for a dataset.
- New feature types and structures which will enable more useful and easier to understand pick reports.
- A new update feature type which will properly pinpoint changes made to data by Notice to Mariner including deleted items.
- A new Information type which will enable more precise use of meta information about features and eradicate the need for and over use of caution areas.
- A new cartographic feature which will enable better placement of text and significantly reduce cluttered displays.
- New methodology for calculating and displaying bathymetric quality information which takes into consideration a vessel's parameters rather than a one fits all solution which is the current case.
- ECDIS will be capable of more easily accepting and displaying products which supplement the ENC.
- A standardized format for route information will enable the ability to share routes.

#### *8.7.1.2 Software maintenance*

Currently one of the major issues is the inability to make changes to standards which require maintenance of ECDIS. S-101 will include new feature and portrayal catalogues which will enable ECDIS to be automatically updated and eventually eradicate un-maintained legacy systems.

It should also be possible to more easily upgrade production systems using the catalogues.

#### *8.7.1.3 Legacy systems / grandfather clause*

The benefits of S-101 will not be fully established until there are only S-100 enabled ECDIS in use. This may require legislative action to achieve.

This also affects the eventually retirement date of S-57 ENCs although their eventual demise could be considered to be a driver in persuading shipping companies to upgrade to S-100 ECDIS.

#### *8.7.2 Development and implementation of other product specifications*

This is very much dependant on the environment and system the specification is to be used. For example if this is ECDIS then specifications would have to be developed using the template referred to in clause 7 above. This may also apply to other GIS applications developed for e-Navigation.

If S-100 based data is to be used in other environments, for example Web Feature Services, then consideration would be given to extending S-100 if required.

### 8.8 Liaison with Users' Organizations

*(potential impact on relation with ICS, IMPA, BIMCO, CLIA, etc.)*

In general, user organizations will probably only be involved or interested in product specifications. As is the case with S-101, users must be actively engaged by means of stakeholder workshops etc. to ensure any product satisfies the requirements of end users as well as all other stakeholders.

### 8.9 Points of contact

*(to be completed)*