6TH EAHC CHARTING AND HYDROGRAPHY COMMITTEE (CHC) MEETING

S-100 and e-Navigation

16TH to 18TH AUGUST 2017
TOKYO, JAPAN
S-100 – Universal Hydrographic data Model (Edition 3.0.0 released June 2017)

- Edition 3.0.0 includes numerous clarifications, corrections and extensions intended to accommodate the requirements of new S-100 based Product Specifications.
- Includes the results of 18 proposals that either clarified, corrected or extended S-100 including:
  - Added the HDF-5 encoding
  - SVG elements for portrayal
  - Portrayal Register model
A brief overview of the S-100 Infrastructure
S-100 Working Group activities

S-100 Infrastructure

* Registry + FC/PC Catalogue Builder

- **FDD Register**
- **Portrayal Register**

**Feature Concept**

**FDD Register**

**Portrayal Register**

**S-100 FCB**

**S-100 PCB**

Korea Hydrographic and Oceanographic Agency
### The major components of S-101 and their current status

<table>
<thead>
<tr>
<th>S-101 Component</th>
<th>Current Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Classification and Encoding Guide</td>
<td>Baselined – June 2016</td>
<td>- New items have been registered in the GI Registry.</td>
</tr>
<tr>
<td>8211 Annex</td>
<td>Testing baseline – June 2015</td>
<td>- Changes to the DCEG will undergo a controlled proposal process in order to manage change effectively.</td>
</tr>
<tr>
<td>Feature Catalogue</td>
<td>Testing baseline – June 2015</td>
<td>- Awaiting the FCB connection to the GI Registry to create a new version that contains the new DCEG items.</td>
</tr>
<tr>
<td>Portrayal Catalogue</td>
<td>Partial baseline – July 2015</td>
<td>- CARIS has created a partial portrayal catalogue using the elements from S-52 in the S-100 format.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- There is still more work to be done once the S-100 Register is operational.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- NOAA has funded work on baselining the S-52 CSPs into XSLT 1.0 that will be part of the Portrayal Catalogue.</td>
</tr>
<tr>
<td>Implementation Guidance</td>
<td>In progress</td>
<td>- Will continue to be refined during the S-101 test bed process.</td>
</tr>
<tr>
<td>Validation checks</td>
<td>In progress</td>
<td></td>
</tr>
</tbody>
</table>
Progress has been slowed

- Lack of resources
- Waiting for the S-100 Infrastructure to be updated for use

2017 milestones

- New Feature Catalogue
- Portrayal Catalogue
  - Determination on how complex portrayal will be handled by S-101/S-100
S-100/S-101 Test Bed Timeline

<table>
<thead>
<tr>
<th>Year 1</th>
<th>+2</th>
<th>+3 (2016)</th>
<th>+4</th>
<th>+5</th>
<th>+6 (2019)</th>
<th>+7</th>
</tr>
</thead>
</table>

Korea Hydrographic and Oceanographic Agency
S-100/S-101 Testbed

* Data Validation Checks behind schedule
  - Resources

* S-100 Infrastructure Updates
  - Larger scope of effort than expected

* S-101 Portrayal Catalogue and Conditional symbology
  - Infrastructure and needed to resource the rule creation
S-100 Working Group activities

S-100/S-101 Testbed

S-100 System Overview

<table>
<thead>
<tr>
<th>Registry</th>
<th>Build Catalogues</th>
<th>Produce Data</th>
<th>Validation</th>
<th>Distribution</th>
<th>Ingest and Display Data on ECDIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature and Portrayal Items Registered</td>
<td>Feature Catalogue Builder</td>
<td>Simple Production Tool</td>
<td>Preliminary Data Validation</td>
<td>Ingest and Display Data on ECDIS</td>
<td>PHASE 3 - Simple Viewing</td>
</tr>
<tr>
<td>Feature Catalogues</td>
<td>Preliminary Production Tool</td>
<td>S-100 Converted</td>
<td>Preliminary Data Packaging and Distribution Models</td>
<td>Shore Based ECDIS</td>
<td></td>
</tr>
<tr>
<td>S-100 Simple Overlay</td>
<td>Preliminary Data</td>
<td>Portrayal Catalogue Builder</td>
<td>Preliminary Data Packaging and Distribution Models</td>
<td>Full ECDIS</td>
<td></td>
</tr>
<tr>
<td>S-101 Native</td>
<td>Preliminary Data Validation</td>
<td>Full Production Tool</td>
<td>Data Validation</td>
<td>Data Packaging and Distribution</td>
<td></td>
</tr>
<tr>
<td>S-100 Integrated</td>
<td>S-101 Converted</td>
<td>Full Production Tool</td>
<td>Data Validation</td>
<td>Data Packaging and Distribution</td>
<td></td>
</tr>
<tr>
<td>S-101 Native</td>
<td>S-100 Simple Overlay</td>
<td>S-100 Integrated</td>
<td>Full ECDIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-100 Complex Overlay</td>
<td>PHASE 2</td>
<td>PHASE 4</td>
<td>PHASE 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHASE 1</td>
<td>PHASE 5</td>
<td>PHASE 8</td>
<td>PHASE 9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
KHOA S-100 Viewer

- The research contents of joint project between KHOA and NOAA
  - Extending the Simple Viewer that was initially developed by KHOA to incorporate different types of S-100 based products and to handle additional capabilities of S-101 such as:
    - Exchange Sets
    - Support Files
    - Expanded Metadata information
    - S-102 high resolution bathymetry datasets
    - GML format
    - Adopt S-100 Portrayal mechanism
**Outline of S-100 Viewer**

- **Exchange Set Metadata (XML)**
  - **ISO/IEC 8211**
  - **GML**
  - **HDF5**
- **Feature Catalogue**
- **Portrayal Catalogue**
- **Data Set**
- **Geometry**
- **INPUT XML**
- **XSLT Processor**
- **OUTPUT XML**
- **Display Instruction**
KHOA S-100 Viewer

* Drawing results of S-10X test datasets
  - S-101 + S-102 + S-111 + S-124

S-101 Results  S-102 Results  S-111 Results  S-124 Results
Overlay of S-10X test datasets
- S-101 + S-102 + S-111 + S-124
## S-100 Sea Trial using S-10X Test Datasets

- List of S-10X TDS created by KHOA, and the versions of the product specifications used when creating the datasets

<table>
<thead>
<tr>
<th>No.</th>
<th>Product Name</th>
<th>Version</th>
<th>Encoding</th>
<th>Test Datasets (Port Gunsan)</th>
<th>Test Datasets (Port Busan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-101</td>
<td>Electronic Navigational Chart</td>
<td>Draft 0.0.2.</td>
<td>8211</td>
<td>Band6(6 Cells).</td>
<td>Band6(9 Cells).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Band5(2 Cells).</td>
<td>Band5(1 Cells).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Band4(2 Cells).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Band5(2 Cells).</td>
<td>90m grid(1 Cell).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10m grid.</td>
<td></td>
</tr>
<tr>
<td>S-111</td>
<td>Surface currents</td>
<td>Working Draft 1.8.</td>
<td>HDF5</td>
<td>Band6(6 Cells).</td>
<td>Band6(9 Cells).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Band5(2 Cells).</td>
<td>Band5(1 Cell).</td>
</tr>
<tr>
<td>S-124</td>
<td>Navigational Warnings</td>
<td>Draft</td>
<td>GML</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>-</td>
<td>Additional bathymetric layer</td>
<td></td>
<td>8211</td>
<td>2 (1m interval)</td>
<td>1 (1m interval)</td>
</tr>
<tr>
<td>-</td>
<td>Digital list of tide</td>
<td></td>
<td>TXT</td>
<td>2 sets</td>
<td>1 set</td>
</tr>
</tbody>
</table>
S-100 Sea Trial using S-10X Test Datasets

- **S-101 ENC**
  - Procedures: S-57 ENC data(ER) → S-101 Converter → Input NEW items or update via S-101 editor
S-100 Sea Trial using S-10X Test Datasets

* S-102 Bathymetric Surface
  - Tools: KHOA S-102 Editor (developed using open source application from the Open Navigation Surface Working Group).
  - Procedures: Survey data → Upload to DEM Database → Converted and edited using the S-102 editor (BAG).
S-100 Sea Trial using S-10X Test Datasets

* S-111 Surface Current
  - Tools: KHOA S-111 Editor.
  - Procedures: Speed and direction of surface current data (sourced by KHOA Tidal prediction S/W) → Created by KHOA S-111 Editor.
S-100 Sea Trial using S-10X Test Datasets

- S-112 Dynamic Water Level Transfer
  - Tools: KHOA ASM Message 8 Encoder, water level service system connecting with AtoN AIS.
  - Procedures: Tidal station → Access and transfer the water level to QC system → Transfer the QC processed values to the water level service system → Encode the water level value to the ASM Message 8 → Send the Message 8 via AtoN AIS → Receive the ASM Message → Display the real time water level value in the sea trial system.
S-100 Sea Trial using S-10X Test Datasets

- S-124 Navigational Warnings
  - Tools: Self-developed Editor
  - Procedures: Source data of navigational warnings → Navigational Warning DB → Extract NW data to S-124 GML

S-100 activities of KHOA
S-100 Sea Trial using S-10X Test Datasets

- S-100 Sea trial system
  - The system includes several functions to turn on/off and check the detailed information in each of the product layers.
KHOA conducted the sea trial to test the S-10X test data

- **Date:** 27 September 2016
- **Place:** Janghang/Gunsan
- **Vessel:** KHOA Survey Ship Huang-Hai-Ro-Ho
S-100 Sea Trial using S-10X Test Datasets

* Survey vessel Huang-Hai-RO-Ho used in the sea trial and the S-100 sea trial system installed on the bridge of the vessel
S-100 activities of KHOA

S-100 Sea Trial using S-10X Test Datasets

* Screen image of S-10X test data in the sea trial system
KHOA has created 7 types of S-10X test data and conducted the sea trial using the S-100 test system. The overall results of sea trial can be summarized like below:

- Insufficient portrayal rules of S-101
- Lack of S-102 portrayal rules
- Need for harmonized display between S-101 and S-111 data
- The method of how to apply the real-time water level with S-101 ENC
- The need for interoperability rules in the system
List of S-100 based 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-112 - Dynamic Water Level Data Transfer
- S-121 - Maritime Limits and Boundaries
- S-122 - Marine Protected Areas
- S-123 - Radio Services
- S-124 - Navigational Warnings
- S-125 - Navigational Services
List of S-100 based product specifications

* S-126 - Physical Environment
* S-127 - Traffic Management
* S-128 - Catalogues of Nautical Products
* S-129 - Under Keel Clearance Management (UKCM)
* S-201 - Aids to Navigation Information
* S-210 - Inter-VTS Exchange Format
* S-401 - Inland ENC
* S-411 - Ice Information
* S-412 - Weather Overlay
Status of agreed outputs

- Guidelines on harmonization of test beds reporting
  - Completed (MSC.1/Circ.1494 dated 21 November 2014)
- Guideline on software quality assurance and human centered design for e-navigation
  - Completed (MSC.1/Circ.1512 dated 13 July 2015)
- Additional modules to the Revised Performance standards for Integrated Navigation Systems (INS) (resolution MSC.252(83)) relating to the harmonization of bridge design and display of information
  - Target date: 2017 (NCSR 4)
  - Correspondence Group coordinated by China
  - IHO input coordinated by the Secretariat in liaison with the Chairs of ENCWG, NIPWG, S-100WG, WWNWS-SC and S-124CG (2nd round closed on 20 Sep)
Guidelines for the harmonized display of navigation information received via communications equipment
- Target date: 2017 (NCSR 4)
- Joint proposal from “interested Member Governments and international organizations” coordinated by Norway
- IHO input coordinated by the Chair of NIPWG

Revised guidelines and criteria for ship reporting systems (resolution MSC.43(64))
- Target date: 2017 (NCSR 4)
- Interested Member Governments and organizations to submit proposals
- Test beds in progress considering S-100 versus FAL options (EDIFACT, XML, Excel)
- Consideration of the relation with the development of a single window system
Post-biennial outputs

* Guidelines on standardized modes of operation (S-mode)
  - Target date: 2019 (NCSR)
  - Preparatory workshop convened by the ROK reported to NCSR
  - Draft guidance being developed by Australia/AMSA (see HSSC8-05.3A)

* Guidance on definition and harmonization of the format and structure of Maritime Service Portfolios (MSPs)
  - Target date: 2019 (NCSR)
  - MSC 96 invited the IHO to submit a proposal to the MSC and/or to the NCSR to activate the HGDM, “to work on this issue and include the modalities, e.g. venue and frequency for consideration at a later session of the Committee”
  - IALA workshop on shore-based maritime services in May 2016
Activating the HGDM

- Approval to activate the IMO/IHO Harmonization Group on Data Modelling (HGDM)
- Development of guidance on definition and harmonization of the format and structure of MSPs
  - First meeting of the HGDM: 16 - 20 October 2017
  - Meeting agendas
    - Considerations of reports on developments emanating from IHO meetings
    - Considerations of testbed reports related to the application of MSPs
    - Development of a definition for MSPs and consideration for the harmonization of the format and structure of MSPs
The way forward for MSPs

- SIP task T17 “Further develop the MSPs to refine services and responsibilities ahead of implementing transition arrangements”

<table>
<thead>
<tr>
<th>No</th>
<th>Identified Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP 1</td>
<td>VTS Information Service (IS)</td>
</tr>
<tr>
<td>MSP 2</td>
<td>Navigational Assistance Service (NAS)</td>
</tr>
<tr>
<td>MSP 3</td>
<td>Traffic Organization Service (TOS)</td>
</tr>
<tr>
<td>MSP 4</td>
<td>Local Port Service (LPS)</td>
</tr>
<tr>
<td><strong>MSP 5</strong></td>
<td><strong>Maritime Safety Information Service (MSI)</strong></td>
</tr>
<tr>
<td>MSP 6</td>
<td>Pilotage service</td>
</tr>
<tr>
<td>MSP 7</td>
<td>Tugs Service</td>
</tr>
<tr>
<td>MSP 8</td>
<td>Vessel Shore Reporting</td>
</tr>
<tr>
<td>MSP 9</td>
<td>Telemedical Assistance Service (TMAS)</td>
</tr>
<tr>
<td>MSP 10</td>
<td>Maritime Assistance Service (MAS)</td>
</tr>
<tr>
<td><strong>MSP 11</strong></td>
<td><strong>Nautical Chart Service</strong></td>
</tr>
<tr>
<td><strong>MSP 12</strong></td>
<td><strong>Nautical Publications Service</strong></td>
</tr>
<tr>
<td>MSP 13</td>
<td>Ice Navigation Service</td>
</tr>
<tr>
<td>MSP 14</td>
<td>Meteorological Information Service</td>
</tr>
<tr>
<td><strong>MSP 15</strong></td>
<td><strong>Real-time Hydrographic and Environmental Information Service</strong></td>
</tr>
<tr>
<td>MSP 16</td>
<td>Search and Rescue Service</td>
</tr>
</tbody>
</table>
### IHO Discussion on MSP

<table>
<thead>
<tr>
<th>MSP</th>
<th>Service</th>
<th>Provider</th>
<th>Short Description</th>
</tr>
</thead>
</table>
| MSP XX | Hydrographic Services | National Hydrographic Authority/Organization | Provision of SOLAS V compliant static and real-time nautical information based on the S-100 universal hydrographic data model. The nautical information is also available for other stakeholders.  
In addition to the protection of the environment, the aim is to promote navigation awareness, and safeguard navigation at sea by providing descriptive information such as:  
areas of the sea, nature and form of the coast, nature of waterways, shipping routes, water depth, obstructions and other dangers to navigation, aids to navigation system, details of aids to navigation, harbours, tide surge prediction, tidal currents, tidal streams, Ephemerides and nautical almanacs for celestial navigation.  
The real-time hydrographic and environmental information service provides information such as: current speed and direction, height of the tide, wave height, marine habitat and bathymetry.  
A sophisticated licensing service is established. |

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**Note:** The table entry for MSP XX indicates a comprehensive approach to providing critical hydrographic and environmental information to enhance maritime navigation and safety.
# e-Navigation underway 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Day 1: Jun 18 (Sun)</th>
<th>Day 2: Jun 19 (Mon)</th>
<th>Day 3: Jun 20 (Tue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30-09:30</td>
<td>Registration</td>
<td></td>
<td>Session III</td>
</tr>
<tr>
<td>09:30-10:10</td>
<td>Opening Session</td>
<td></td>
<td>Implementation of the Maritime Service Portfolio and Supporting Infrastructure</td>
</tr>
<tr>
<td>10:10-10:30</td>
<td>Arriva</td>
<td></td>
<td>Chair: Prof. Axel Hahn, Univ. of Oldenburg</td>
</tr>
<tr>
<td>10:30-12:00</td>
<td>Coffee Break</td>
<td></td>
<td>Coffee Break</td>
</tr>
<tr>
<td>10:30-12:00</td>
<td>Session I</td>
<td></td>
<td>Session III</td>
</tr>
<tr>
<td>10:30-12:00</td>
<td>Harmonious approach of e-Navigation</td>
<td>Chair: Mr. Jorge Arroyo, USCG</td>
<td>(Continued)</td>
</tr>
<tr>
<td>12:00-14:00</td>
<td>Lunch</td>
<td></td>
<td>Lunch</td>
</tr>
<tr>
<td>14:00-18:00</td>
<td>Hotel Check-in / Registration</td>
<td>Session II</td>
<td>Session IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Regional Cooperation &amp; Collaboration towards e-Navigation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chair: Dr. Jin Hyoung Park, KRISO</td>
</tr>
<tr>
<td>14:00-18:00</td>
<td></td>
<td></td>
<td>Coffee Break</td>
</tr>
<tr>
<td>18:00-20:00</td>
<td>Pre-conference Dinner</td>
<td>Gala Dinner (Hosted by Minister)</td>
<td>Network Building Dinner</td>
</tr>
</tbody>
</table>

**Theme**

Implementing e-Navigation in the Asia-Pacific Region
e-Navigation underway 2017
e-Navigation underway 2017
Facilitating e-Navigation
Contributing to Goals of e-Nav

North-America
Academic-Driven

International
Industry-Driven

Asia-Pacific
Government-Driven

e-Navigation Underway Conferences
Coordinating Steering Group
IMO e-Navigation

e-Navigation underway 2017

- S-100
- IMO-IHO HGDM

Let’s Do e-Navigation!

IMO

2006

Concept

2014

Concept to Reality

2017

2018

2019

2020

Korea Hydrographic and Oceanographic Agency
**Recommendation**

- **E-Navigation activities**
  - HGDM activated and will have a first meeting in October
  - European e-navigation test bed project
  - SMART Navigation project is on going
  - E-Navigation underway Asia Pacific organized
  - E-Navigation is an important topic which can’t ignore by HO

- **EAHC member states is invited to**
  - Monitor the e-Navigation activities
  - Attend the regional meeting on e-Navigation (Sea trial and test bed)
  - Prepare what to do for e-Navigation
Thank you