Paper for Consideration by S-100WG3

S-100 Interoperability Workshop

Submitted by:	Republic Of Korea (KHOA) / NOAA
Executive Summary:	This paper presents research activities on the S-100 Interoperability Specification.
Related Documents:	TSM5-5.2 Report on S-100 Interoperability Workshop HSSC9-05.1A S-100 Interoperability Workshop
Related Projects:	IHO S-100/S-101 Test Bed Project

Introduction / Background

The IHO S-100WG agreed to introduce the Interoperability Specification (IS) and the concept of the IS was discussed at the 2nd S-100WG meeting in Genoa, March 2017. According to the discussion at the meeting, the IS has been developed and distributed to S-100 experts and stakeholders for their review.

In order to test the IS, KHOA- NOAA held S-100 Interoperability Workshop at KRISO, Daejeon, Republic of Korea from 29th to 31st August 2017. Further to the development of the IS, the scope of this workshop was to validate the concept of the Interoperability and the Interoperability Catalogue (IC) and to identify the procedure for the validation.

Furthermore, it aims to test the function of the IC and the resulting portrayal on presenting level 0 to 2 within levels 0 to 4 defined by the IS and the IC using the KHOA S-100 Viewer.

This paper reports on the workshop activity and recommendations by the workshop.

Analysis/Discussion

Preparations

The workshop aims to test the following seven product specifications (PSs) among eight which are listed in the interoperability specification. The seven PSs except S-112 were tested by creating the IC. However, in order to validate the IC through the S-100 Viewer requires several relevant systems and data as the followings:

a) Systems

- GI registry
- S-100 Feature Catalogue Builder (FCB)
- S-100 Portrayal Catalogue Builder (PCB)
- SVG symbol Editor
- S-100 Viewer
- S-nxx production tools

b) Data

- S-nxx Test Data Sets (TDS)
- S-nxxx Feature/Portrayal Catalogue
- Interoperability Catalogue

A scenario was also required. This paper does not include detailed information of the systems and information listed above.

Table 1. S-100 product specifications considered for creating S-100 Interoperability Catalogue

No.	Title
S-101	Electronic Navigational Chart (ENC)
S-102	Bathymetric Surface
S-111	Surface currents
S-112	Meteorological and Hydrographic Data AIS Application-Specific Message Dynamic Water Level Data Product Specification
S-122	Marine Protected Areas
S-124	Navigational warnings
S-411	Sea Ice (WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology [JCOMM])
S-412	Met-ocean forecasts (JCOMM)

Structure of S-100 Interoperability Catalogue

The S-100 interoperability catalogue consists of the followings including the case of turning off all interoperability processing.

- **Level 0**: all interoperability processing is turned off. In this case, feature data is passed through unchanged to ordinary portrayal processing
- **Level 1**: feature types from different products, including S-101, are interleaved as specified by display plane and drawing priority information contained in the interoperability catalogue
- **Level 2**: If feature types in other products are determined to be superior to specific ENC feature types, the ENC feature types are suppressed.
- **Level 3**: The ENC is treated as one of the components of the data stack, and selected feature instances from other products may be treated as being superior to or enhancing selected ENC feature instances. The feature instances are selected using selector expressions that use feature type and values of thematic attributes.
- **Level 4**: This level is the same as Level 3, but permitted spatial queries (to determine related subsets) and operations (to define the interoperation result) are explicitly defined using an adequate set of spatially-capable rules.

Main activities of the workshop

The workshop discussed the following items in order to test the functions of the IC efficiently.

- Review a draft Interoperability Specification
- Develop test scenario for the S-100 Interoperability Specification
- Testing the scenario with the test system
- Braining storming on a way forward

Scenarios

Validating the concept of the IS required methods to develop the IC first. To enable that, KHOA therefore developed a prototype Interoperability Catalogue Builder (ICB) and its principle is as below.

- To provide S-101 ENC on top of several S-nxx additional information, the tool identifies features to be applied to the IC level 1 or 2 according to the IS – for example, whether a PS needs to be added on a specific layer among S-101 data or what S-101 feature should be replaced – and creates a scenario what feature will be presented in what cases, how and where.

During the workshop, the test scenarios were developed according to creating procedures of the interoperability catalogue as followings.

1) Level 1 (Interleaving)

No.	Products	Contents
S1-1	S-101 + S-102	S-102(Bathy Surface) DP3 → DP2 S-101(Depth Area) DP3 → DP1 S-101(Dredge Area) DP 3 → DP1
S1-2	S-101 + S-122	S-101(Restricted Area) DP15 → DP14
S1-3	S-101 + S-111	S-111(Surface current) DP 12 → DP4 S-101(Land Area) DP3 → DP5 S-101(Pontoon) DP3 → DP5
S1-4	S-101 + S-124	S-124(Navigational warming) DP larger than 24

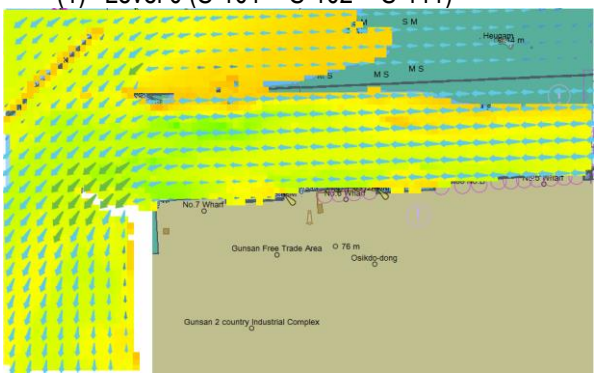
2) Level 2 (Suppressed layer)

No.	Products	Contents
S2-1	S-101 + S-111	S-101 (Current Non-gravitational, Tidal stream, Tideway)
S2-2	S-101 + S-411	S-101 (Depth Area)
S2-3	S-101 + S-412	S-101 (Obstruction, Wreck)

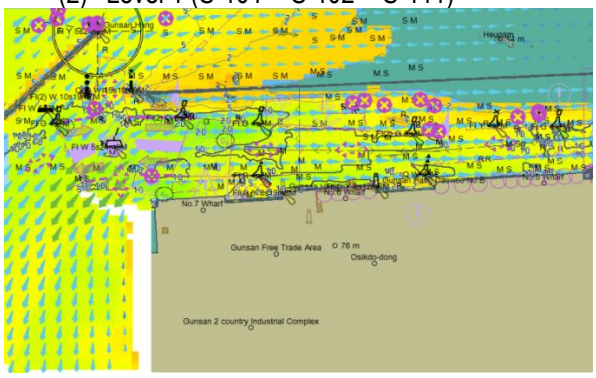
Testing Results

The S-100 IS Workshop discussed the application scenario of the IC and drafted the S-100 ECDIS IC accordingly. With the IC, the workshop was able to come up with the following outcome using the KHOA S-100 Viewer. The images below are the outcome of applying the IC on S-101 ENC, S-102 Bathymetric Surface and S-111 Surface Currents with Levels 0, 1 and 2.

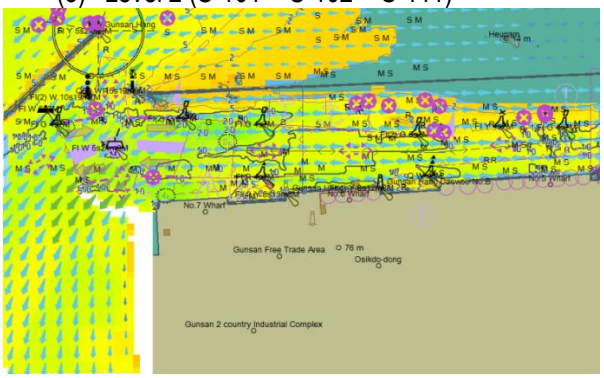
(1) Level 0 (S-101 + S-102 + S-111)



(2) Level 1 (S-101 + S-102 + S-111)



(3) Level 2 (S-101 + S-102 + S-111)



(4) Level 1 (S-101 + S-412)

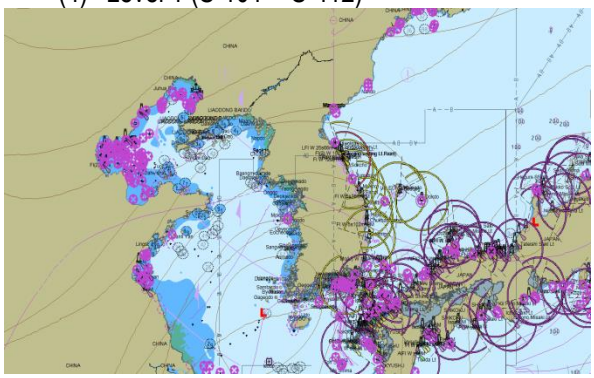


Figure 1. Screen shots of the practical exercises for the IC (Level 0~2)

Conclusions

The workshop tested the concept of how S-nxx data can be displayed on S-100 ECDIS in the future. It successfully tested the functions of the IC one by one on Levels from 0 to 2 within Levels 0 to 4 according to the scenario.
Additional, there were some recommendations, identified by the workshop.

- 4.6.3: Correct references to filtering by attribute values in Level 2.
- 17: Add section clarifying that interoperability actions and rules apply only where the data coverages of the products being operated on do have coverage.
- 4.4.2.4: The example needs to be replaced or corrected to remove the filter by attribute value part.
- Structural change: 2 alternatives:
  - Move selection of features to suppress by attribute value filters to Level 2 from Level 3. Retain hybridizaton in Level 3. If this is done the changes above to 4.6.3 and 4.4.2.4 should be reevaluated.
  - Make 5 levels by inserting a level between current levels 2 and 3 and making selection by attribute values a part of that.
- S-101 should consider having display priority steps of 10 to give more room for interleaving new products with ENC.

Action Required of S-100WG

The S-100WG3 is invited to:

a. **Note** this paper
b. **Enquire** to discuss any issues reported and provide comments or recommendations to the move forward the Interoperability Specification
c. **Consider** to add the Interoperability Catalogue Builder in a list of S-100 infrastructure, if approved, and developing and maintaining the builder should be in S-100WG Work Programme.