30 April 2018

Subject: S-102 Project Team Sessions (09 and 12 April 2018).
Location: Furama RiverFront Hotel, Singapore

1. **Executive Issues:**
   - In conjunction with S-100 Working Group meetings the S-102 Project Team conducted multiple sessions on 09 and 12 April 2018.
   - These meetings were focused on requirements to finalize version 2.0.0 of the S102 Specification. Topics discussed:
     - S102 Metadata
     - S102 Grid Resolutions and File Size
     - S102 Portrayal
     - S100 Part 10c Encoding Development and S102 Alignment with Part 10c
     - S102 Data Quality
     - S102 Feature Catalogue and Portrayal Catalogue
     - S102 Converter
     - S-102 Data Protection Scheme
     - S102 CRS Requirements
     - S102 Tiling Schemes
     - S102 Multi-Resolution Gridding

2. **Attendees:**

   09 April 2018 (Meeting):
   - David W Brazier (United States)
   - David Grant (United States)
   - Julia Powell (United States)
   - Lynn Patterson (Canada)
   - Eivind Mong (Canada)
   - Julian Le Deunf (France)
   - Iji Kim (Korea)
   - Per-olof Seiron (Sweden)
   - Sewoong Oh (KRISO)
   - Hugh Astle (CARIS)
   - Holger Bothien (SEVENCs)
   - Svein Skjaeveland (PRIMAR)

   12 April 2018 (Breakout Session):
   - S-100 WG Membership

3. **Background:**
   - S-102 Version 1.0 was approved by IHO member states in April of 2012.
   - Efforts to draft S-102 Version 2.0 have been ongoing since 2015.
   - During the S-100 WG2 meeting the S-102 project team lead briefed a status update on S-102 version 2.0.0. At S100 WG2 the group set a goal to finalize version 2.0.0 by May 2018 (HSSC10).
   - Effort to finalize version 2.0.0 by May was delayed in order to comply with the recently modified S100 Part 10C HDF5 Encoding.
   - Target date for S-102 Version 2.0 publication: December 2018.

4. **Meeting Minutes:**

a) S-102 Meeting (09 April 2018)

i. S-102 Project Team Members received an updated timeline for S-102 v2.0.0 IHO Publication. Timeline as brief to project team:

- April 2018 – Meeting held to resolve any outstanding issues
- June 2018 – Consolidated S-102 sent out for stakeholder review
- June 2018 – Finalize S-102 convertor script and make available to IHO stakeholder community
- September 2018 – Consolidate stakeholder feedback
- December 2018 – Publish S-102 Edition 2.0.0

**** See S102_v2.0.0_Requirements.pdf.**

ii. **S-102 Metadata (Data Management):** The group revisited a topic from the Genoa meeting focused on New Edition Coverage and Cancel Cell Mechanisms. Prior to the meeting individuals from United States and Canada discussed how use of S100_ExchangeCatalogue attributes ***replacedData*** and ***dataReplacement*** could be used to describe First Edition, Replacement Editions, or Product Cancellations.

- First Edition S-102 products will not contain either attribute.
- Second, Third, Fourth Editions, etc… will contain both the ***replacedData*** and ***dataReplacement*** attributes.
    1. ***replacedData*** flagged as "True" to identify the dataset as replaced.
    2. ***dataReplacement*** would specify the replacement dataset filename.
- Cancelled Products would only contain ***replacedData***.
    1. ***replacedData*** flagged as "False" to identify the dataset as cancelled.

Use of replacedData and dataReplacement attributes for data management was approved by the project team. This approval requires modification to wording within the following sections of the product specification:

1. 11.2.1 Dataset Management
2. Table 12.6 – S102_ExchangeCatalogue.

The proposed modifications were accepted by the project team. See accompanying presentation: S102_DataManagement.pdf for further clarification.

ACTION: US NAVY to update DRAFT S102 v2.0.0 specification, sections 11.2.1 Dataset Management, and Table 12.6 – S102_ExchangeCatalogue.

iii. **S-102 Metadata (Dataset Purpose):** The project team agreed in Genoa (2017) that the primary scope of the S102 product specification (v2.0.0) is safe navigation of maritime vessels. With safe navigation as the primary focus the

project team recognizes that secondary, non-SoN (i.e. Scientific) use cases are not being addressed. The project team also recognizes that someone somewhere is going to make "scientific" S102 dataset. In order to differentiate between Navigational and Scientific data PRIMAR proposed making use of the ***S102_DatasetDiscoveryMetaData*** attribute ***"purpose"*** to document dataset purpose within the exchange set.

Note: Use of the "purpose" attribute for this purpose requires modification:

- *S100_DatasetDiscoveryMetaData:Purpose* as described in S100 v4.0.0:

  Current Specification:
  Role Name: Attribute
  Name: purpose
  Description: The purpose for which the dataset has been issued.
  Multiplicity: 1
  Type: MD_Identification>purpose CharacterString
  Remarks: For example. New. Re-issue, update, etc.

  Proposed solution:
  Role Name: Attribute
  Name: purpose
  Description: The purpose for which the dataset has been issued.
  Multiplicity: 1
  Type: Class
  Remarks: 1 – navigation use, 2 - other

ACTION: US NAVY to update DRAFT S102 v2.0.0 specification, Table 12.7 – *S102_DatasetDiscoveryMetaData:purpose*.

iv. **S-102 Metadata (Gridding Methodology):** The project team has been discussing how to properly capture gridding methodology within the exchange set for over a year. In Genoa S102 PT members agreed that the specification should not restrict potential gridding algorithms, but we never completed efforts to capture this information within the exchange set. During both S102 sessions in Singapore the project team discussed several proposed solutions (submitted by PRIMAR) to document gridding methodology within the exchange set. Proposed options discussed: Option A) a completely open ended solution providing producers 100% flexibility to select whatever algorithm they desire, and Option B) a more restrictive approach which provides a list of reasonable algorithms deemed acceptable for SoN use.

Option A:
Add additional column in 12.7 S102_DatasetDiscoveryMetadata:
Name: Gridding methodology
Description: Algorithm used to calculate grid values
Multiplicity: 1
Type: CharacterString
Remarks: The name of algorithm used for calculating grid values

Option B:
Add additional column in 12.7 S102_DatasetDiscoveryMetadata:
Name: Gridding methodology
Description: Algorithm used to calculate grid values
Multiplicity: 0..1
Type: Class
Remarks: 1. Basic Weighted Mean, 2. Shoal Bias, 3., 4, 5…..

Note: Either option required a new attribute entry in table 12.7: S102_DatasetDiscoveryMetadata.

The project team decided to move forward with Option B. To ensure all applicable algorithms were identified project team members were asked to provide intended gridding methods to US NAVY for inclusion in S-102 v2.0.0.

ACTION: US NAVY to modify DRAFT S102 v2.0.0 specification, Table 12.7 – *S102_DatasetDiscoveryMetaData* to include the new attribute: griddingMethodology.

ACTION: S102 PT members to provide US NAVY with intended gridding algorithms by 30 April 2018. Final list will be incorporated into remarks section of griddingMethodology attribute, Table 12.7.

v. **S-102 Metadata (Removal of Support File Metadata):** Sections 11.3 (Support Files) and 11.3.1 (Support File Naming) of the DRAFT S102 Specification state "This Data Product requires no support files". To ensure the entire document is compliant with these statements the following tables should be deleted from Section 12 Metadata:

1. Table 12.8 (S102_SupportFileDiscoveryMedatadata)
2. Table 12.8.1 (S102_SupportFileForm)
3. Table 12.8.2 (S102_SupportFilePurpose)

The project team briefly discussed this proposal and approved the deletion of the identified metadata tables.

ACTION: US NAVY to modify DRAFT S102 v2.0.0 specification, Deleting the following tables:

- **Table 12.9 (S102_SupportFileDiscoveryMedatadata)**
- **Table 12.8.1 (S102_SupportFileForm)**
- **Table 12.8.2 (S102_SupportFilePurpose)**

vi. **S-102 Data Protection Scheme:** The project team discussed level of effort required to implement digital signature and encryption using next edition S-63 v2.0.0. Representatives from PRIMAR are actively involved on the S-63 WG and offered to help incorporated this functionality into the specification. It was also noted that it would be relatively easy to implement with version 2 of the specification.

ACTION: PRIMAR and US NAVY to incorporate digital signature and file encryption into version 2 of the specification.

vii. **S-102 File Size Requirements and Grid Resolution Requirements:** In Genoa project team members expressed concerns that the 10MB and 256MB file sizes were too restrictive. Without an actual S-102 dataset to test group members agreed to work over the summer of 2017 to define minimum "suggested" grid resolutions for each display scale identified in Table 11.1 of the 2.0 Specification. The results of this effort were presented and discussed by the project team in Singapore.

Discussion Highlights:

- Current describe grid resolutions in Table 11.1 are identified as "Suggested Grid Resolutions". Multiple PT members proposed to replace the word "Suggested" with "Informative". This slight change in wording is less restrictive, providing maximum flexibility to S102 producers. This modification is also in alignment with the desire to let each producer chose the appropriate grid resolution for their respective products.

- With the simple change in wording the grid resolution values referenced in Table 11.1 were deemed acceptable by project team members.

ACTION: US NAVY to modify DRAFT S102 v2.0.0 specification, Table 11.1: Replace "Suggested Grid Resolution" with "Informative Grid Resolution".

Singapore File Size Requirements:

In addition to the 2017 grid resolution discussion the US NAVY worked on methods to estimate S102 file size for each grid resolution listed in Table 11.1. Information from this effort were distributed to the project team and discussed in at the Singapore meeting.

US Navy noted that there are two items impacting file size: 1) S102 Header File, and 2) S102 Data Records, or nodes. Taking into consideration this information the US NAVY was able to calculate the maximum number of nodes (rows X columns) an uncompressed dataset could contain while remaining under the 10MB and 256MB limits. The results of this effort were entered into Table 11.1, with additional supporting information populated into Annex F (S102 Dataset Size and Production) of the specification.

Discussion Highlights:

- Project Team members found the file size estimates to be helpful, but expressed concern with how the information was presented in the product specification. Example: use of the phrase "Maximum Tile Size" in Table 11.1. This wording implies restrictions.

- Project team members were comfortable keeping the file size information in the product specification, but requested a slight change in wording to provide flexibility. In alignment with "grid resolution" wording, it was

suggested to replace “Maximum Tile Size” with “Informative Tile Size for an Uncompressed File”, thus providing maximum flexibility to the S102 producer.

- It was also noted that the same logic should be applied throughout Annex F of the specification.

ACTION: US NAVY to modify wording DRAFT S102 v2.0.0 specification Section 11.2.2 and Annex F, to include the wording “Informative Tile Size for an Uncompressed File”.

ACTION: US NAVY to modify DRAFT S102 v2.0.0 specification, Table 11.1: Replace the wording “Maximum Tile Size” with “Informative Tile Size”.

viii. **S-102 Portrayal (Colour Scheme):** The most recent DRAFT version of the S102 specification disseminated to the project team prior to S100-WG3 contained multiple portrayal options. The following portrayal options were discussed at both S102 meetings:

- Numerical Display of Grid Node Depth and Associated Uncertainty
- Proposed S102 Navigation Zone Identification
- Colour Option 1: Shading for Safe and Unsafe Navigation Zones
- Colour Option 2: Shading for Safe, Caution, and Unsafe Navigation Zones

During discussions the project team noted there was not a need for S102 v2.0.0 to define new depth zone terminology and colours if existing S-52 colour tokens and depth zone naming were going to be utilized in S100. Use of the S-52 colour tokens and depth zones eliminated any potential confusion by the user since they will already be familiar with the same colour palette and names. The project team was in full agreement to align S102 colouring and depth zone naming with S-52.

Note: S-52 colouring/depth zoning maintains the integrity of a S102PT goal to delineate Safe and Unsafe water.

In addition to colouring the US NAVY proposed a colouring option generated using both depth and uncertainty information (colour option 2). This option was discussed and eventually scrubbed from the product specification because the group wanted to make sure depth values at each grid node fully agreed with charted soundings. Any associated uncertainty in a charted sounding is not reflected in the value and it was important that grid nodes were treated in a similar manner. The project team did note that it was important to retain the uncertainty layer in the S102 dataset, but determined that it would not be utilized for portrayal in S102 v2.0.0.

The project team also chose to scrap the numerical display of grid node depth and associated uncertainty. It was decided to leave display of this information to the OEMs.

ACTION: US NAVY to modify DRAFT S102 v2.0.0 specification, Section 9. Effort to include removal of numerical display of depth and uncertainty, removal of colour option 2, modification of colour option 1. Colour option one modifications to include alignment of depth zone terminology and

colouring with S-52.

ix. **S-102 Alignment with S100 DRAFT Part 10c HDF5 Encoding:** PT members were provided a status brief on efforts to finalize S100 Part 10c HDF5 encoding. Finalization of Part 10C has been needed for several years and was recently tasked for completion at the 2017 S100 Test Strategy meeting in Virginia. Development of this encoding guide impacts multiple S100 product types including S102. There are currently 3 product specifications using the HDF5 file format (S102, S111, and S121).

ACTION: US NAVY is working to modify DRAFT S102 v2.0.0 specification to align with updated S100 Part 10c. Full alignment to be achieved by June 2018.

x. **S-102 Data Quality (2 parts):**

1) PT members were provided an update on efforts to obtain guidance/feedback from the Data Quality Working Group (DQWG). This past January PRIMAR presented a paper on behalf of the S-102 PT to DQWG. The DQWG provided some feedback and agreed to review our next DRAFT version (S102 v2.0.0).

The DQWG did suggest that the PT look at S121 section on Data Quality. US NAVY reviewed the Data Quality section of the S121 specification and worked to populate Section 6.0 of the S102 Specification with information on data quality.

2) The PT also discussed a paper from SHOM covering two topics: a) Assuring that horizontal uncertainties of the data source are saved in the S-102 product, and b) Fixing a CRS in space and time (i.e. epoch of the survey) for the use of all metric resolution gridded data.

SHOM Topic 1 was deemed important but the project team noted that it may take some time and effort to complete this effort. Since we have run out of time for version 2.0 the effort was tabled for a future version of S102.

SHOM Topic 2 was identified as minimal effort to support and will be incorporated into the version 2 specification. As 27 April the US NAVY was working with S100 Part 10c developers to pin down how to encode the Epoch attribute within the exchange set.

ACTION: US NAVY is working to modify DRAFT S102 v2.0.0 specification to align with updated S100 Part 10c. Full alignment to be achieved by June 2018.

xi. **S-102 Converter Update:** Status on the BAG to S102 converter was provided to the project team. US NAVY completed initial development of the converter late in 2017, but required additional modifications were required to fully align with modifications in Part 10c HDF5 Encoding. US Navy is planning to complete modifications to the converter by June 2018. When complete the converter will be uploaded to the IHO website for download.

ACTION: US NAVY to complete S102 converter and provide to S100 Working Group for testing.

xii. **S-102 CRS Requirements:** Prior to the Singapore meeting there were concerns that specific CRS requirements (i.e. UTM projected data) would not be addressed within the specification. Following discussions with project team members it was agreed that UTM projected data would be acceptable as long as the projection was referenced to WGS84. With this issue resolved project team members discussed with software manufacturers how projected data would be managed by the chart system. The project team was informed that any projected data would be un-projected at time of ingest.

To properly document input CRS the project team agreed to list all approved EPSG codes for Un-projected, UTM, and Polar Projected data. SEVENCs identified and provided the required ESPG codes for UTM and Polar Projections to the project team. The final list of codes for section 5.3 of the specification are as follows:

- EPSG: 4326: WGS84
- EPSG: 32601 - 32660: WGS 84 / UTM Zone 1N to Zone 60N
- EPSG: 32701 - 32760: WGS 84 / UTM Zone 1S to Zone 60S
- EPSG: 5041: WGS 84 / UPS North (E,N)
- EPSG: 5042: WGS 84 / UPS South (E,N)

ACTION: US NAVY to update section 5.3 Horizontal Coordinate Reference System with updated EPSG codes. Additional information to be included stating that projected datasets will be un-projected at time of ingest by charting system.

xiii. **S-102 Tiling Schemes:** Specific tiling schemes were not discussed at this meeting. It was however noted that the project team will need to provide information to support future tiling schemes for Un-projected, UTM, and Polar projected data.

xiv. **S-102 Multi Resolution Gridding:** The project team noted that Multi-Resolution datasets were desired but agreed that version 2.0 of the product spec would not address this type of gridding. Version 2.0 will only address fixed gridded datasets.

b) S-102 Breakout Meeting (12 April 2018)

i. For the S102 Breakout session the agenda items from 09 April were revisited for PT members unable to make the Monday session. All agenda items and decisions were approved by the greater PT during the Thursday session.