SPAWAR S-100 Testbed Project

1 General Information

- **Name of testbed**: SPAWAR S100 Testbed Program
- **Location of testbed:** Norfolk, Virginia
- **Time and duration of testbed:** Ongoing through Phase 6 (Shore Based ECDIS)
- **Contact person(s):** Robert Greer, Robert.a.greer@navy.mil (Project Manager); Mikan Stamenkovich, mikan.stamenkovich@navy.mil (Technical Lead)
- **Testbed website:** N/A
- **Organization(s) involved:** SPAWAR Systems Center Atlantic
- **Last Edited/Updated:** June 11, 2018

2 EXECUTIVE SUMMARY

The SPAWAR S-100 Testbed Project aims to provide empirical proof of the S-100 design through phased implementation of an ECDIS. The testbed will implement data import and validation, data loading and portrayal of S-100 derived data products in the context of a Simple Viewer (Phase 3) and Shore Based ECDIS (Phase 6).

In order to support development through Phase 6 various elements of the S-100 Testbed initiative are exercised by the SPAWAR testbed project. Testing areas include Phase 1 (Feature and Portrayal Catalogue use), Phase 2 (validation of S-101 converted data and S-100 based portrayal). After Phase 3 completes, additional testing during Phases 4 and 5 will be used to support the Shore Based ECDIS development of Phase 6.

3 TESTBED INFORMATION

The primary users are S-100 Working Group members and other interested IHO parties. The testbed aims to identify gaps in utilization of the S-100 family of product specifications with initial focus on S-100 and S-101. Support for products using GML and HDF-5 encodings will follow.

The S-100 testbed phases implemented to date are:

- Build Catalogues (Phase 1)
- Produce data (Phase 2)
- Ingest and Display Data on ECDIS (Phase 3 Simple Viewer)

The category of S-100 Testbed solutions considered in the SPAWAR testbed project were both technical validation of the specifications and operational considerations in the context of ECDIS.

4 TESTBED METHODOLOGY

4.1 METHODOLOGY USED FOR DATA COLLECTION:

Ongoing development efforts for Phase 3 will be presented in this report. As our testbed matures, additional reporting for phases beyond 3 will be included, e.g. Phase 6 (Shore Based ECDIS).

Methodology used for data collection involves sharing our applications with the S-100 WG community via Basecamp. User feedback is collected and presented in this report at S-100 WG meetings.

4.2 SUMMARY INFORMATION ON TESTBED RESPONDENTS / PARTICIPANTS:

No feedback received.

4.3 PROCEDURE USED IN THE TESTBED:

4.3.1 Technical solutions used

SPAWAR S100Viewer application (running on Microsoft Windows 7 and above) via Basecamp distribution to working group community.

4.3.2 Standards

Application specific information and limitations are available in the release notes of the S100Viewer application.

5 TESTBED RESULTS

5.1 SUMMARY OF FINDINGS:

Version 1.5.0.0 of the testbed was made available June 4, 2018 and can be downloaded from the S-100 basecamp site. Contact the S-100 chair for basecamp access.

Changes in version 1.5.0.0:

- Implemented S-52 equivalent portrayal (with caveats as noted in section 5.1.1.6).
- Portrayal now uses new scripting model as described in Parts 13 and 9A.
- Text (viewing groups 11 through 30) is now only displayed if its associated feature is also displayed.
- Added context parameter *IGNORE_SCAMIN*. If this parameter is set, portrayal will not emit any *ScaleMinimum* instructions. This effectively causes all features to be drawn at all display scales. Note that this could be implemented more efficiently by having the manufacturer ignore *ScaleMinimum* instructions in the drawing commands emitted by the portrayal.
- Added portrayal context parameter *NATIONAL_LANGUAGE* and removed viewing group 31 (National Language Text). This context parameter allows the mariner to select his language of

preference for chart text. The portrayal will emit text in the specified language if it is available, otherwise the default language will be emitted.
- Drawing priority is now properly ordered by priority then by drawing type (area, line, point, text).
- Modified performance logging to support Lua portrayal evaluation.
- Updated simulated RADAR sweep to use portrayal color palette.

The updated testbed was used to:

- Support review of version 0.9.3 of the S-101 feature catalogue.
- Implement and provide empirical evidence supporting the S-101 scripting support detailed in S-100 Part 13.
- Implement S-101 portrayal via S-100 Part 9a (Lua Portrayal). The updated portrayal is intended to facilitate stakeholder analysis of S-101 Lua based portrayal.

Due to issues discovered with version 0.9.3 of the S-101 feature catalogue, and because the S-101 dataset converter and portrayal have not been updated to use the 0.9.3 feature catalogue, the testbed is currently delivered with version 0.8.10 of the S-101 feature catalogue.

Once feedback on the Lua portrayal is provided, other working group member's assessments of the Lua portrayal initiatives will be included in section 4.2 of this report.

5.1.1 Presentation of data

Issues encountered in data processing are indicated in this section.

5.1.1.1 DCEG

The portrayal of *LocalDirectionOfBuoyage* currently requires spatial evaluation to determine which *NavigationalSystemOfMarks* feature the *LocalDirectionOfBuoyage* falls within. Consistent with *BeaconCardinal*, *LightAllAround*, etc., *LocalDirectionOfBuoyage* should have a *marksNavigationalSystemOf* attribute for evaluation by the portrayal.

Adding a *marksNavigationalSystemOf* attribute to the DCEG will require changes to the feature catalogue, the dataset converter, and the portrayal.

RECOMMENDATION: Add *marksNavigationalSystemOf* attribute to *LocalDirectionOfBuoyage*.

5.1.1.2 Exchange Sets

It is not currently possible to implement automated data discovery and import due to changes to the exchange set schema and the lack of test data. Once published, the updated schema should be used to provide test exchange sets / exchange catalogues which can be used to support automated data discovery and import.

Test exchange sets / exchange catalogues could be produced by the S-101 dataset converter. Currently, when selecting an S-57 catalogue file (CATALOG.031) the converter converts the datasets referenced by the catalogue but does not convert the catalogue itself.

RECOMMENDATION: Update the converter to use the metadata contained in CATALOG.031 to generate an S-101 exchange catalogue.

5.1.1.3 S-101 FC0.9.3

This section details issues which are preventing the use of the feature catalog slated for release with S-101 Version 1.0.

5.1.1.3.1 S-101_0.9.3.xml Line: 7690: *<S100FC:valueType></S100FC:valueType>*

Line 7690 has an Invalid value for *S100FC:valueType* – the value is empty.

RECOMMENDATION: *S100:FC:valueType* must be set to an instance of *S100_CD_AttributeValueType*. Valid values are: 'boolean', 'enumeration', 'integer', 'real', 'text', 'date', 'time', 'dateTime', 'URI', 'URL', 'URN', 'S100_CodeList', 'S100_TruncatedDate'. E.g. *<S100FC:valueType>boolean</S100FC:valueType>*

5.1.1.3.2 S-101_0.9.3.xml Line: 8439: *<S100FC:code>signalSequence</S100FC:code>*

Duplicate key-sequence ['signalSequence'] in key identity-constraint.

The code 'signalSequence' has already been used on line 6378 in a simple attribute (*S100_FC_SimpleAttribute*) definition, here it is repeated in a complex attribute (*S100_FC_ComplexAttribute*) definition.

S100FC.xsd requires that attribute codes be unique. Attributes cannot share the same code, even if one is a simple attribute and the other is a complex attribute.

RECOMMENDATION: Use unique attribute codes.

5.1.1.3.3 S-101_0.9.3.xml throughout

ISSUE: Feature catalogue does not contain any instances of *S100_FC_InformationAssociation.*

We believe this to be an oversight since portrayal needs this information to obtain spatial quality from geometries.

RECOMMENDATION: Add the missing information associations as specified in the DCEG: *spatialQuality*, *additionalInformation*.

5.1.1.3.4 S-101_0.9.3.xml throughout

ISSUE: The catalogue has been modified to reflect changes made to the DCEG. Attribute codes have been added, changed and removed; attribute types have changed, etc. For instance, *qualityOfSoundingMeasurement* has changed to *qualityOfVerticalMeasurement*.

RECOMMENDATION: Update the S-101 dataset converter to align with the FC / DCEG changes.

RECOMMENDATION: Update the portrayal catalogue to align with the FC / DCEG changes.

5.1.1.3.5 S-101_0.9.3.xml throughout

S100FC:alias elements need to be verified against the DCEG. Many of the *alias* elements are missing; for instance *Sounding* should have an *alias* of *SOUNDG*.

Many of the *alias* elements are incorrect, for instance *DryDock* has an *alias* of *Graving dock*, but should have an *alias* of *DRYDOC*. *RadarTransponderBeacon* has an *alias* of *RACON* but should have an *alias* of *RTPBCN*.

We assume the alias is used by the S-101 dataset converter to map S-57 features to S-101 features.

RECOMMENDATION: Update the feature catalogue to match the DCEG.

5.1.1.4 S-101 Product Specification

This section provides testbed related perspective on the SPAWAR technical comments to the S-101 main document. Refer to our comment form for comprehensive comments.

5.1.1.4.1 S-101 Section 4.6, paragraph 2

ISSUE: The sentence indicates the overscale indications are shown on features within the data coverage – instead the indication should be for the data coverage itself.

The overscale indication is not implemented by the viewer. The overscale indication will be implemented as part of the shore based ECDIS as an S-101 product specific feature. Note that the overscale indication and the overscale pattern are distinct items.

5.1.1.4.2 S-101 Section 4.7.1, paragraph 1

ISSUE: Drawing order is incorrect for adjacent data coverage areas with the same maximum display scale. These should be drawn as specified in S-52 10.3.4.1: *NOTE: To ensure seamless presentation of a single intended usage (navigational purpose) all objects of same display priority from all cells in same intended usage must be drawn together.*

The viewer currently draws all data coverages one at a time. This functionality will be supported in a future release and in the shore based ECDIS.

5.1.1.4.3 S-101 Section 4.8.1, Paragraph 4

ISSUE: *"The use of coordinates is restricted to two dimensions, except in the case of soundings which use GM_Point or GM_Multipoint with three dimensional coordinates."* Note: Soundings always use GM_Multipoint. DepthNoBottomFound also uses GM_Multipoint.

The viewer expects features to be encoded as described in the feature catalogue. *GM_Point* is not a valid encoding for soundings.

5.1.1.5 S-57 to S-101 Dataset Converter

As noted in 5.1.1.3.4, the converter should be updated to align with the changes to the DCEG / feature catalogue.

5.1.1.5.1 Encoding of *S100_FC_InformationType::SupplementaryInformation*

While implementing the S-101 portrayal it was noted that labels on *TrafficSeparationSchemeLanePart* were not being portrayed. Upon investigation it was determined that the encoded data supporting portrayal of the label was not present in the data set. Specifically, the IRID record containing the simple attributes *language* and *text* are being encoded without the necessary *information* complex attribute as a container.

While reviewing version 0.9.3 of the S-101 feature catalogue and the latest version of the DCEG it was noted that *SupplementaryInformation* has been changed to *NauticalInformation*.

RECOMMENDATION: Update the converter to support *NauticalInformation*.

5.1.1.5.2 Exchange catalogue

As noted in 5.1.1.1, we recommend that the converter be updated to generate an exchange catalogue as part of the conversion process. As the converter is updated to support feature catalogue and DCEG changes the exchange catalogue will be necessary so that viewing software can associate the converted data with the correct version of the feature catalogue and portrayal catalogue.

5.1.1.6 S-101 Portrayal

As part of the 1.5.0.0 release of the testbed viewer, and supporting the initial release of S-101, a Lua based portrayal was provided. This section details known issues, work remaining, manufacturer responsibilities, and changes from S-52.

5.1.1.6.1 Issue: Symbol Colour Palettes

As detailed in item 6 of S-100WG2-8.9 *Recommended Changes to the S-100 Portrayal*, there is no prescribed mechanism to change the colours of SVG symbols when a new S-100 9-A-6 *Palette* is selected. Consequently the testbed viewer does not change the symbol colours when the palette is changed.

RECOMMENDATION: Provide implementation guidance.

5.1.1.6.2 Issue: Contour Labels

Some contour labels are not spaced correctly. Upon investigation it was discovered that the SAFCON5X and SAFCON6X symbols are identical. According to the S-52 ENC symbol catalogue, the SAFCON5X should be offset further to the right than the SAFCON6X symbols. This encoding error is present since at least version 3.3 of the S-52 presentation library DAI files.

RECOMMENDATION: Update the SAFCON5X symbols.

5.1.1.6.3 Issue: Missing Symbols

As detailed at S-100WG3, portrayal of the following feature types is not implemented as symbols are not available; these features are new – they have no S-52 equivalent. They current portrayal catalogue will symbolize these features using default symbology (magenta question mark):

- BuoyEmergencyWreckMarking
- CollisionRegulationLimit
- DiscolouredWater
- OffshoreWindTurbine
- PhysicalAisAidToNavigation
- PilotageDistrict
- TextPlacement
- VesselTrafficServiceArea
- VirtualAisAidToNavigation

RECOMMENDATION: Develop and provide missing symbols with S-101 v2.

5.1.1.6.4 Manufacturer Responsibility: Symbolization of Chart Updates

The portrayal does not generate drawing instructions for symbols associated with automatic or manual chart updates such as CHRVDEL1. The symbols are available in the portrayal catalogue but it is the manufacturer's responsibility to generate drawing instructions and render them as part of the portrayal.

RECOMMENDATION: Update S-101 v2 to indicate manufacturer responsibility.

5.1.1.6.5 Manufacturer Responsibility: Symbolization of Chart Scale Boundaries

Symbolization of the chart scale boundaries requires knowledge of the datasets which are visible, adjacent, and have the same maximum display scale. Portrayal does not have this knowledge.

RECOMMENDATION: Update S-101 v2 to indicate manufacturer responsibility.

5.1.1.6.6 Manufacturer Responsibility: Symbolization of Overscale Data Pattern

Symbolization of this pattern requires knowledge of the display scale, and whether the mariner has intentionally over-scaled the display. Portrayal does not have this knowledge.

RECOMMENDATION: Update S-101 v2 to indicate manufacturer responsibility.

5.1.1.6.7 Manufacturer Responsibility: Symbolization of Non-HO (Non-ENC) Chart Information

Augmenting HO ENC data with Non-HO data requires superimposing SY(CHCRIDnn) / LC(CHCRIDnn). Since the portrayal has no knowledge of non-HO data it cannot portray the superimposed symbology.

If non-HO data is shown on a separate area of the display its boundary must be identified by linestyle LC(NONHODAT); display priority 3, over radar; display base; viewing group 11060, stroke to the non-HO data side of the line.

RECOMMENDATION: Update S-101 v2 to indicate manufacturer responsibility.

5.1.1.6.8 Manufacturer Responsibility: Symbolization of No Data Areas

The screen must be filled with the grey NODTA colour fill together with the fill pattern AP(NODATA03) prior to drawing any other information. This could be done by portrayal at the start of the drawing instructions, however that could obscure other non-S-101 datasets.

RECOMMENDATION: Update S-101 v2 to indicate manufacturer responsibility.

5.1.1.6.9 Work Remaining: Symbolization of Date Dependent Features / Highlight Date Dependent

As detailed at S-100WG3-8.5 there are many issues which need to be addressed within S-100 prior to implementing date dependent portrayal. Once these issues are resolved the S-101 portrayal should be updated to support date dependent features / highlight date dependent.

RECOMMENDATION: Address portrayal of date dependent features in S-100 v5 / S-101 v2.

5.1.1.6.10 Work Remaining: Highlight Info / Highlight Document

This information was encoded in *SupplementaryInformation*, but as of FC 0.9.3 is encoded in *NauticalInformation*. The S-101 dataset converter does not support either encoding. The portrayal needs to be updated to examine *NauticalInformation* and output appropriate symbology using viewing group 31030 (Highlight Info) and viewing group 31031 (Additional Documents).

In order to minimize the need to regenerate the portrayal there are no context parameters provided for Highlight Info / Highlight Document. The display of the highlight symbols can be controlled via the viewing groups. We recommend adding a new viewing group layer to support toggling these symbols on / off.

RECOMMENDATION: Update portrayal for S-101 v2 to support Highlight Info / Highlight Document.

RECOMMENDATION: Add viewing group layer to turn on / off viewing groups used for highlight symbols.

5.1.1.6.11 Work Remaining: *LocalDirectionOfBuoyage*

Current portrayal of LocalDirectionOfBuoyage only shows the arrow with the magenta circles, not the red and green circles.

RECOMMENDATION: Update portrayal.

6 UNRESOLVED ITEMS FROM PREVIOUS REPORTS

The following items were noted in previous reports and have not been resolved.

1. Modify the S-101 XSLT portrayal catalogue to conform with S-100 Part 9 drawing instruction sorting rules via the addition of a RADAR_OVERLAY context parameter and modification of the portrayal rules.

   Recommend closing as OBE if no S-101 XSLT portrayal is to be provided.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS:

The S-101 based portrayal provided with testbed viewer 1.5.0.0 provides a baseline for evaluating S-101 portrayal and implementation of Lua based scripting support.

7.2 RECOMMENDATIONS:

1. Update the DCEG for S-101 v1
   a. Add *marksNavigationalSystemOf* attribute to *LocalDirectionOfBuoyage*
2. Update the S-101 feature catalogue v0.9.3 for S-101 v1

    a. Fix validation issues
    b. Add missing information associations (*spatialQuality*, *additionalInformation*)
    c. Add missing / fix incorrect *alias* elements
    d. Add *marksNavigationalSystemOf* attribute to *LocalDirectionOfBuoyage*
3. Update the S-101 dataset converter for S-101 v1
    a. Support changes to the DCEG / feature catalogue
    b. Convert S-57 catalogue file to S-101
4. Update the S-101 portrayal catalogue for S-101 v1
    a. Align with changes to the DCEG / feature catalogue
    b. Update SAFCON5X symbols
    c. Update portrayal to emit all instructions for *LocalDirectionOfBuoyage*
5. Update S-101 document for S-101 v2
    a. Note manufacturer portrayal requirements
        i. Overscale pattern
        ii. Chart scale boundaries
        iii. Chart updates
        iv. Non-HO Chart Information
        v. Symbolization of No Data Areas
6. Update S-100 document for S-100 v5
    a. Provide for portrayal of date dependent features
    b. Provide guidance on implementing palette changes for SVG symbols
7. Update the S-101 portrayal catalogue for S-101 v2
    a. Develop and provide missing symbols
    b. Add support for portrayal of date dependent features
    c. Emit highlight symbols based on value of *NauticalInformation*
    d. Add viewing group layer to toggle highlight info / highlight document
8. Update the testbed viewer for S-101 v2
    a. Implement guidance on palette changes for SVG symbols
9. Review the S-101 Lua Portrayal Catalogue implementation and provide feedback.

8 PUBLICATIONS

N/A

9 REFERENCE MATERIAL

S-100 Edition 3.0.0 Final

S-101 ENC Product Specification Baseline 1.0.0

SPAWAR S-100 Viewer v1.5.0.0

S-101 Lua Portrayal Catalogue

S-101 Feature Catalogue v0.8.10

S-101 Feature Catalogue v0.9.3