

Paper for Consideration by TSM3 S-100 Testbed Software: Phase 3 Simple Viewer

Submitted by:	United States(SPAWAR Atlantic)
Executive Summary:	Update on progress of SPAWAR S-100 Simple Viewer, as well as technical issues encountered during development
Related Documents:	S-100, S-101
Related Projects:	KHOA S-100 Simple Viewer

Introduction

As reported in the TSMAD28DIPWG6-11.2A paper, the United States National Geospatial-Intelligence Agency (NGA) Maritime Safety Office has recognized the need to transition away from the current Vector Product Format (VPF) based Digital Nautical Chart (DNC) navigation datasets, and companion datasets such as Tactical Ocean Data (TOD), to maritime geospatial data products based on the IHO S-100 specification. This will facilitate chart co-production and maintenance, reducing the burden for NGA to maintain a world wide database for the US Department of Defense (DoD). In order to achieve this transition, NGA has recognized the need to promote the development of an S-100 Testbed which will be used for development and testing of S-101 and other S-100 based geospatial data products. SPAWAR is supporting NGA in this effort.

This paper reports the development status of the SPAWAR S-100 Simple Viewer, which is Phase 3 of the S-100 System Overview.

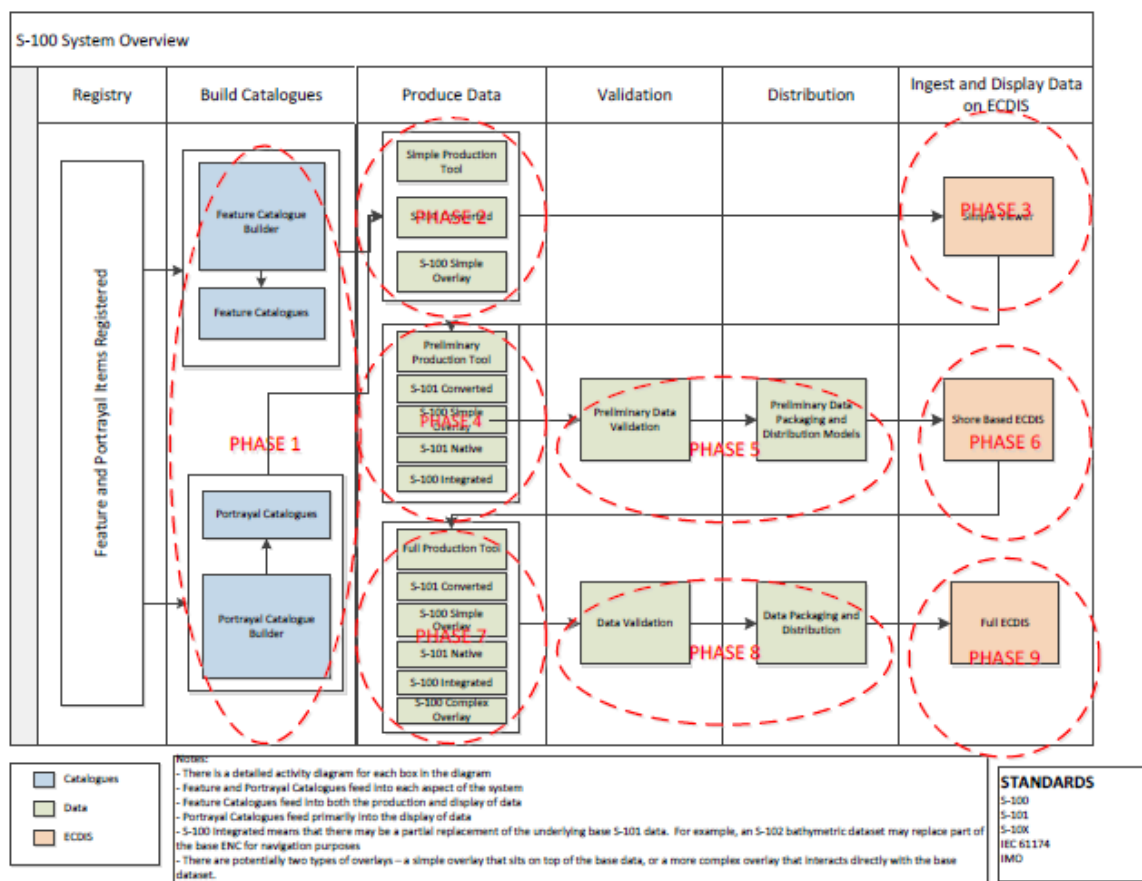


Figure 1 S-100 System Overview

The SPAWAR developed S-100 Testbed will provide the capability required for phases 3, 6 and 9. The goal is to allow display and operation with any compliant S-100 based data product. In addition, there will be a single runtime application which will execute on both the Windows and Linux operating systems.

Status

The current goals of the simple viewer are:

- To better understand the portrayal requirements of S-100 and S-101, as well as verify that those requirements are properly partitioned and implemented.
- Verify the current XML, XSD, and XSLT files that represent information taken from the feature registry and the portrayal registry.
- Verify that the specifications define a clear, unambiguous process for translating from a products dataset to a valid portrayal via automated generation of portrayal instructions.

In order to satisfy these goals, the simple viewer implements a feature catalogue browser, a dataset browser, an error/validation log, and dataset portrayal. A picture of the simple viewer is shown Figure 2.

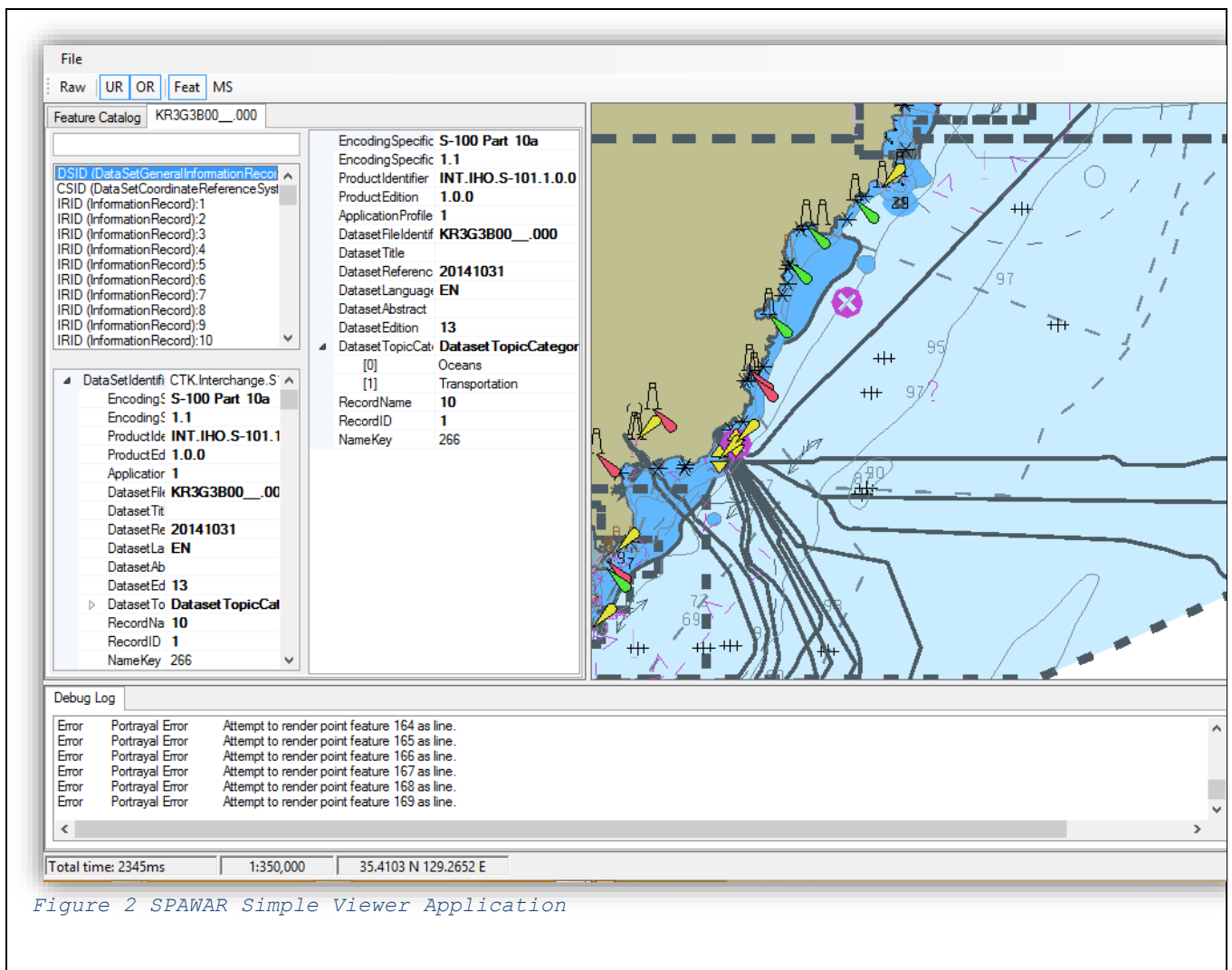


Figure 2 SPAWAR Simple Viewer Application

The left hand side of the screen implements the browser functionality, the right hand side implements the portrayal, and the bottom section implements the error/validation log.

The feature catalogue browser is shown in Figure 3

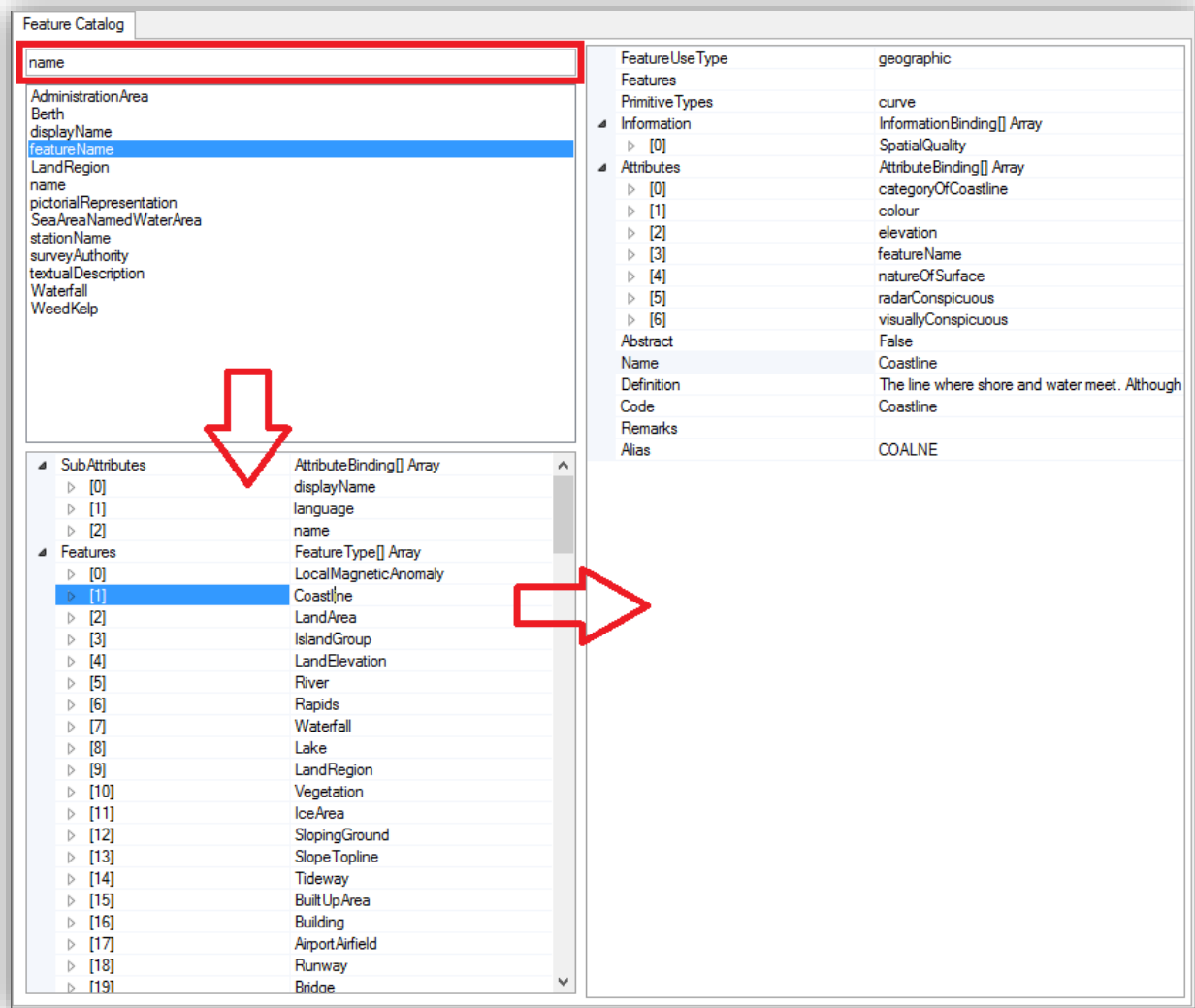


Figure 3 Feature Catalogue Browser

The highlighted input box allows the user to search the feature catalogue. The software performs a case insensitive substring match of the input string against the name, code, definition, remarks or S-57 alias contained within the feature catalog. The search can also be constrained by entering the first three characters as one of:

- [c] – Include only complex attributes
- [s] – Include only simple features
- [a] – Include only attributes
- [f] – Include only features

The search results are shown below the input box. In the absence of a search string all catalog entries are shown.

Selecting a feature type or attribute type shows the schema for the selected item in the lower box. Any element of the schema can then be selected to show its schema to the right. In

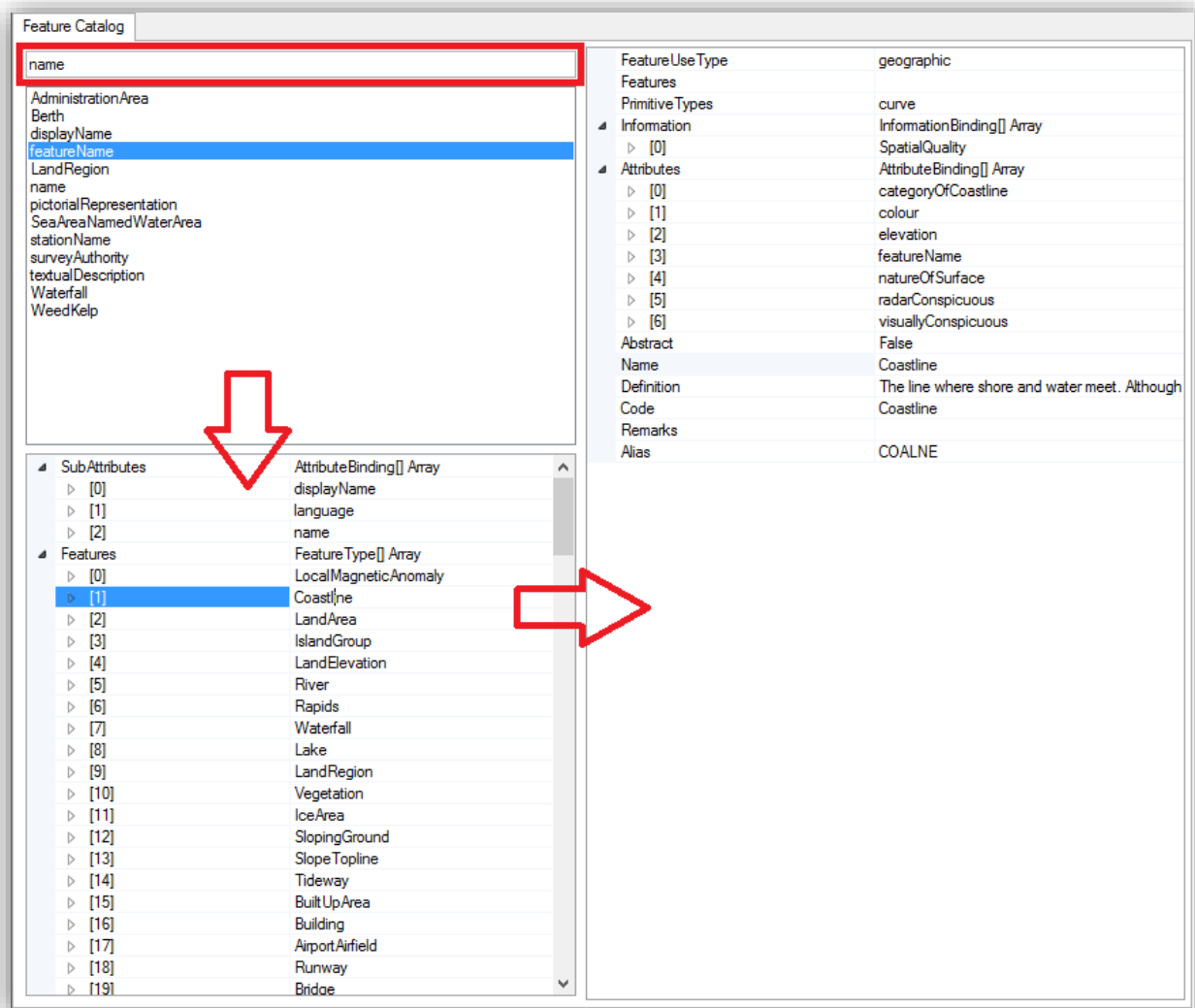


Figure 3, “name” was used as the search input, and all feature and attribute types containing “name” as a substring, as well as feature types containing attribute types which contain “name” as a substring, were shown. “featureName” (an attribute) was selected from the results, and its sub-attributes as well as feature types which contain “featureName” were shown in the lower box. “Coastline” (a FeatureType which contains “featureName”) was then selected, and its schema was shown in the right-hand box.

The dataset browser is shown in Figure 4. This browser allows the user to view the contents of a dataset in a tabular manner, and is also used to regenerate the portrayal by moving the centre of the portrayal as individual features are selected.

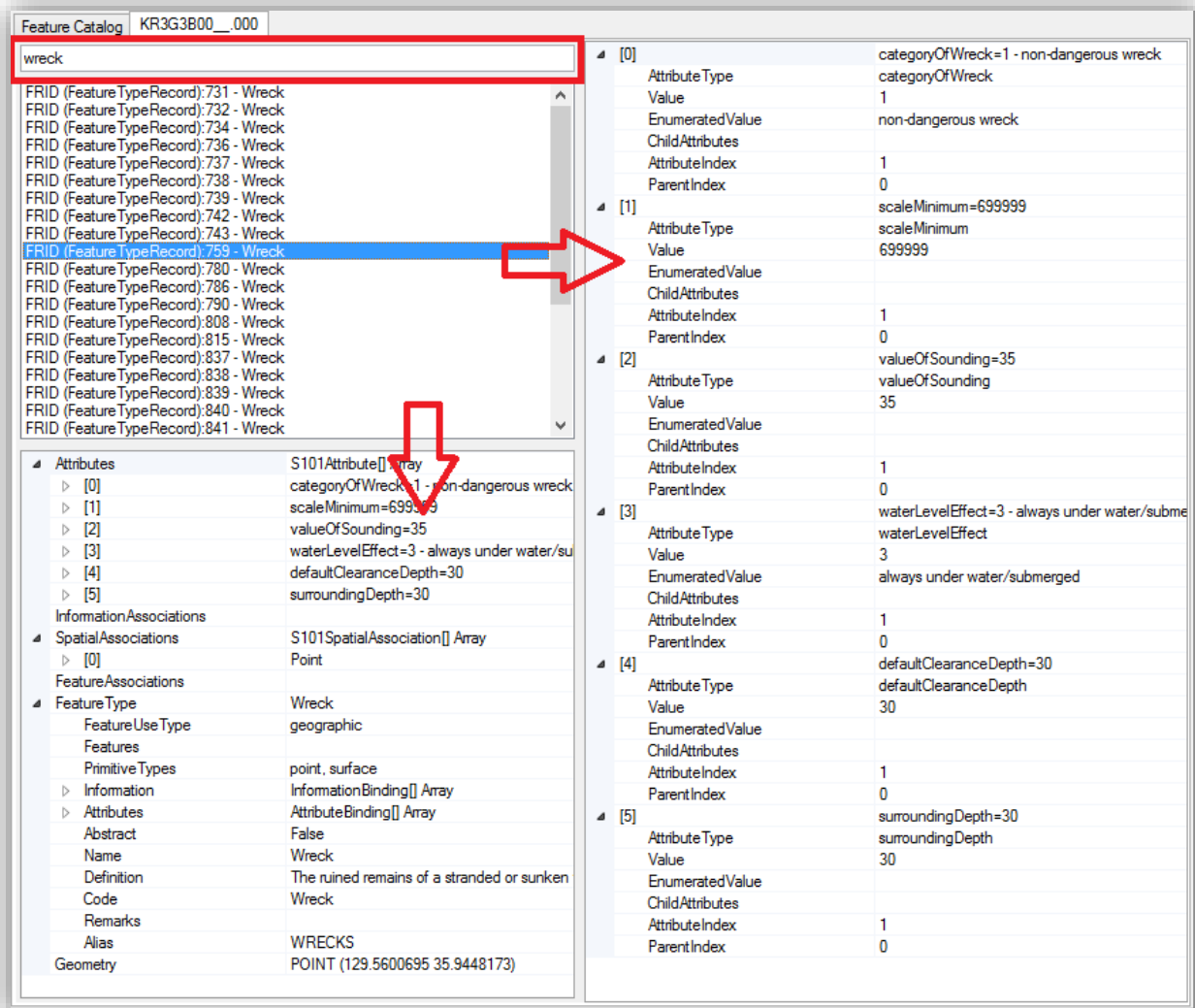


Figure 4 Dataset Browser

The highlighted input box allows the user to search the dataset. Currently, a simple case insensitive substring match of the dataset entries is performed. Eventually, this functionality will be extended to perform an “intelligent” search, similar to the feature catalogue search. The search results are shown below the input box. In the absence of a search string all dataset entries are shown.

Selecting a dataset entry shows the attribute values, spatial associations, feature associations, and feature type of the selected entry. It will also cause the portrayal to regenerate, as described later. In Figure 4, “wreck” was used as the search input, and all feature type records named “Wreck” were displayed. Feature record 759 was selected, causing its attributes, spatial associations, feature associations, geometry, and feature catalog lookup to be shown in the bottom box. Instance values for the selected item on the bottom left are shown to the right – in this case Attributes.

The dataset browser is also used to regenerate the portrayal. Selecting a feature record will refresh the portrayal, with the selected feature centered and highlighted on the display.

The error/validation log is shown on the bottom of Figure 2 **Error! Reference source not found.** Currently, this is a simple text display. We plan to implement a browser similar to the feature catalogue and dataset browsers which will allow errors to be selected and the appropriate dataset entry to be selected, and its portrayal displayed.

The simple viewer is using the latest versions of the feature catalogue (0.8.9), and portrayal catalogue (1.0). Additionally, the S-57 converter (0.8.12) is being used to generate S-101 datasets.

Updates to these input items has allowed us to make significant progress in dataset portrayal, and the viewer is now capable of generating charts as shown throughout this paper.

In order to generate a portrayal, the converted S-101 data is loaded and XML feature data is generated. The XML is run through the portrayal rules as defined in the portrayal catalogue, and XML draw instructions are generated. These instructions are used along with the SVG files and colour profiles provided in the portrayal catalogue to generate the portrayal. This process is shown in Figure 5, with items provided from the portrayal catalogue shown in green and manufacturer generated items shown in blue.

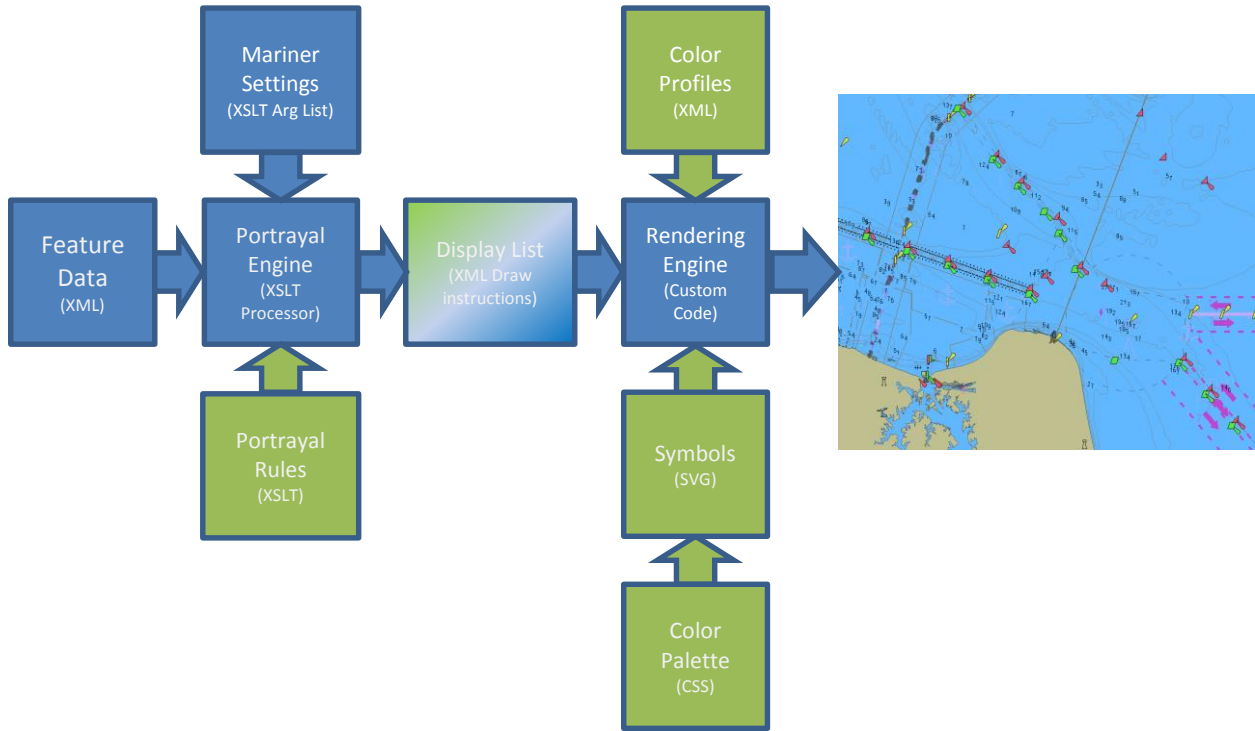


Figure 5 Portrayal Process

Using the portrayal process, we have successfully generated portrayals of both NOAA (U.S. Coast Guard district 5), and Korean (KR3G3800, KR4G3830, KR5G3833) sourced S-57 data converted to S-101. Examples of these portrayals are shown in Figure 6 and Figure 7. We have not yet implemented the portrayal of text, sector lights, soundings, masked edges, and non-path SVG commands (circle and rectangle), therefore features containing these elements are either partially or wholly absent from the portrayal. We anticipate implementation of these remaining portrayal items within a month.

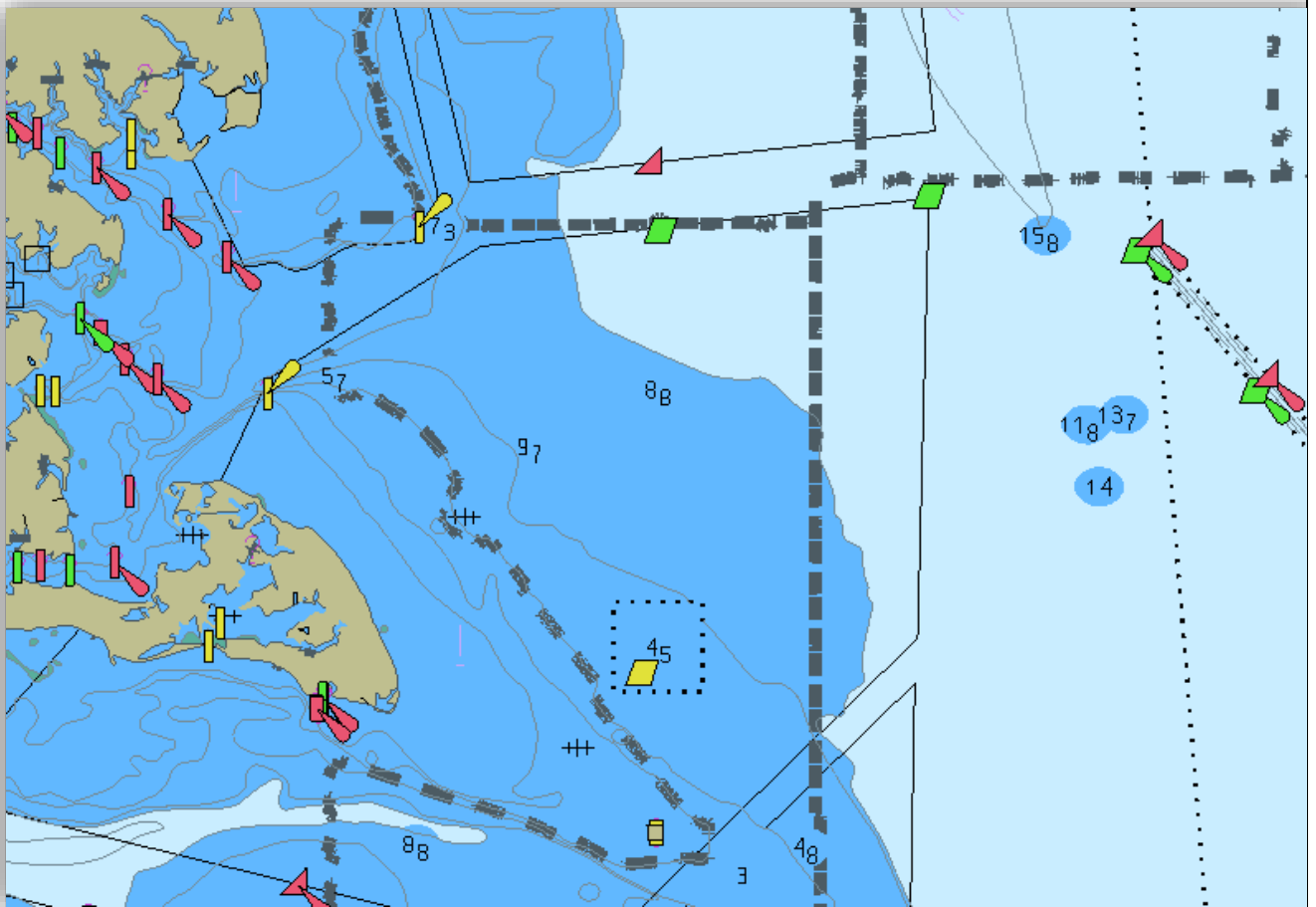


Figure 6 US4VA40M

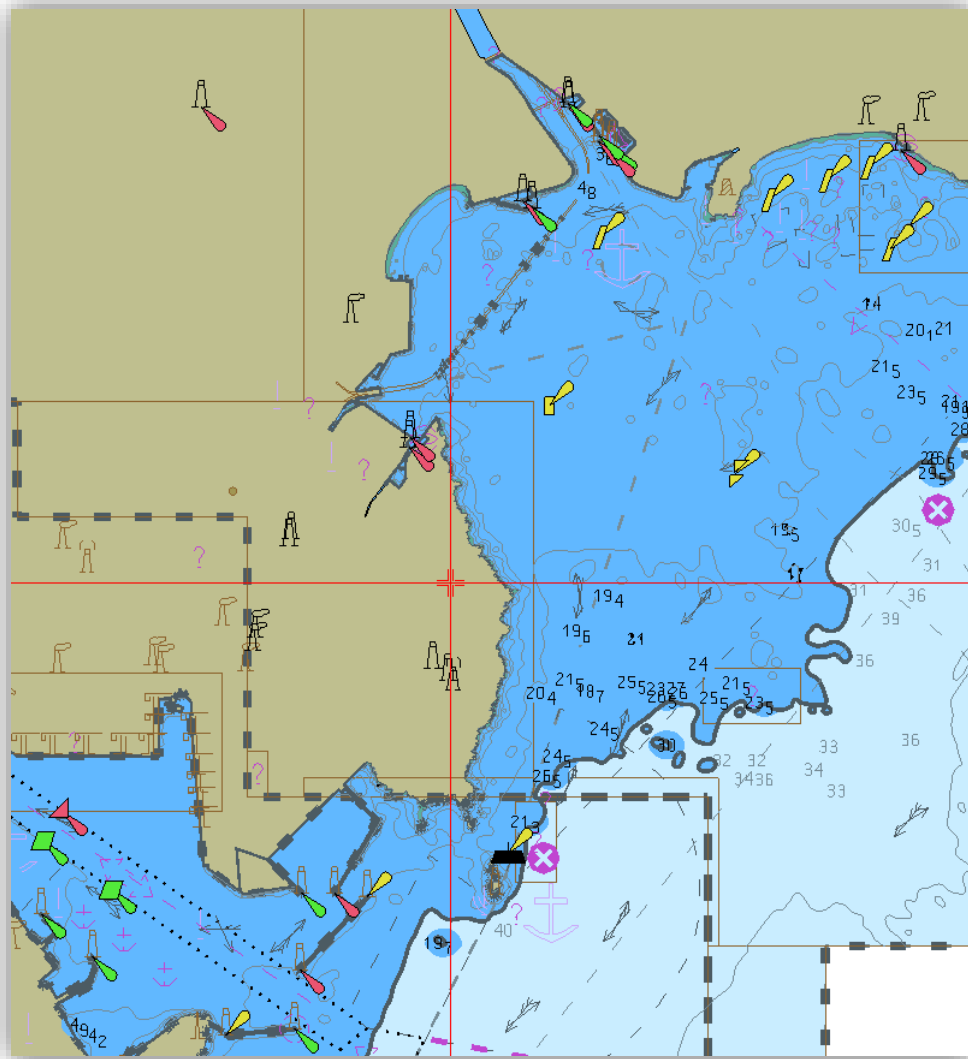


Figure 7 KR5G3B33

Issues

The following sections describe issues discovered during the development and testing of the simple viewer. Issues are numbered for consecutively across sections for clarity.

S-57 Converter Issues

1. The S-57 converter incorrectly sets the field tree layout for the curve record to CRID/SEGH/C2IT instead of CRID/SEGH/C2IL as shown in Figure 8. We have worked around this by automatically fixing the issue while loading data. The converter was recently updated, and this issue may have been resolved. If not, we recommend this be addressed in the next update.

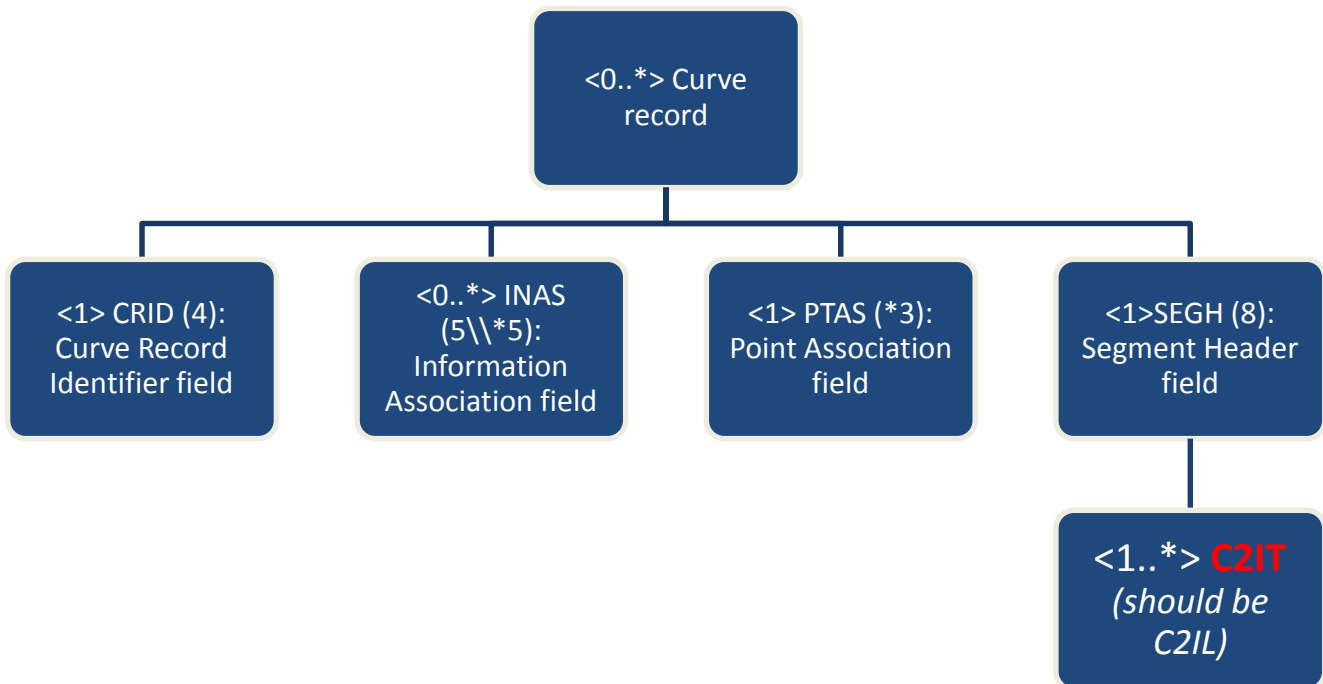


Figure 8 S-57 Converter Generated Curve Record

2. Although the converter is currently essential for generating S-101 data for testing, there are several drawbacks to relying solely on converted data:
 - Some feature types exist only in S-101. These features can't be tested with converted data.
 - Updates are applied prior to conversion, therefore updates can't be tested with converted data.
 - The conversion process is deterministic, meaning native S-101 ENCs may exhibit issues not encountered with converted data.

Feature Catalogue Issues

3. The S-101_FC_0.8.9.xml file has role (RoleCode) set to "ModifiedToSupportQualityOfBathymetricData" which is invalid and causes XSD validation to fail. Valid roles are defined in S100CI.XSD as "resourceProvider", "custodian", etc. We modified our copy of the feature catalogue for testing by setting RoleCode to "publisher". Recommend setting role to a valid value in the next version of the feature catalogue.
4. Currently, S100_FC_ComplexAttribute extends S100_FC_Item. To comply with S-100, S100_FC_ComplexAttribute needs to be an extension of S100_FC_Attribute (reference S-100 pg. 5-13, Table 5-A-13). The issue was noted on line 184 of feature catalogue file S100FC.XSD.

Portrayal Catalogue Issues

5. As presented at TSMAD29, there is no XSD describing the Feature XML input to the XSLT processor. We worked around this by generating our own Feature XML schema based on the provided sample XML data. This has several drawbacks: the generated Feature XML is manufacturer and application specific and despite the fact that it is accepted by the XSLT rules, it may not be sufficient to generate the correct draw instructions for a given feature. As outlined in S-100 v2.0.0, section 9-11, and called out in S-101 section 9.2, we recommend an XSD be provided as part of the portrayal catalogue. This XSD should define the Feature XML schema.
6. While examining the files provided as the portrayal catalogue, it was noted that only the day palette is currently provided. This is true for both colorProfile.xml and SVGStyle.css. The SVG files currently have a hard coded reference to a single CSS file rather than using an automated mechanism. We assume that the manufacturer would be responsible for switching between day, dusk, and night stylesheets, however no explicit guidance is provided. We recommend that use of other palettes be addressed so that it can be tested.
7. Within the portrayal process, there is currently not a good way to treat viewing groups and text groups as separate entities. S-100 doesn't address text groups, and S-101 doesn't specify how to implement them in the portrayal rules. For example, LightDescription.xsl outputs viewing group "27070+23" for its text instruction for light description. Presumably this indicates viewing group 27070 (lights) and text group 23 (light descriptions). Both the viewing group and the text group have to be set for the text to display. The following possible solutions are proposed:
 - Create a "textGroup" element specifically for textInstructions. This would require a change to S-100, or be specific to S-101 portrayal.
 - Allow multiple viewing groups per instruction that must all be true for display. This would require a change to S-100, or be specific to S-101 portrayal.
 - Leave as is and modify the spec to read that a "+" in the "viewingGroup" element means that both the viewing group and text group must be set for display.

8. The draw instructions generated by the portrayal catalogue for point land areas generates an extraneous line instruction. This is in addition to the (correct) point symbol. For example:

```
<pointInstruction>
  <featureReference>5040</featureReference>
  <viewingGroup>12010</viewingGroup>
  <displayPlane>OVERRADAR</displayPlane>
  <drawingPriority>12</drawingPriority>
  <symbol reference="LNDARE01" />
</pointInstruction>
<!-- This line instruction shouldn't be present -->
<lineInstruction>
  <featureReference>5040</featureReference>
  <viewingGroup>12010</viewingGroup>
  <displayPlane>OVERRADAR</displayPlane>
  <drawingPriority>12</drawingPriority>
  <lineStyle>
    <pen width="0.32"><color>CSTLN</color></pen>
  </lineStyle>
</lineInstruction>
```

9. Obstructions shoaler than one meter are not symbolized properly. The XSLT rules produce

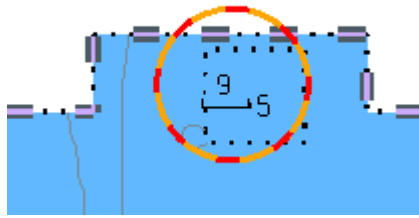


Figure 9 Incorrect

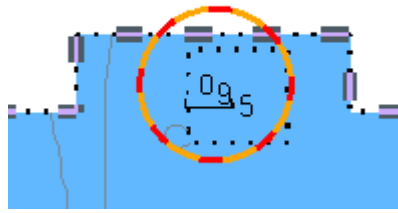


Figure 10 Correct

incorrect draw instructions, resulting in the incorrect portrayal shown in Figure 9. The correct portrayal is shown in Figure 10. This issue likely applies to any feature type portrayed using the SOUNDSXX symbol, however further investigation is required to confirm this assumption. The incorrect draw instructions for the portrayal shown above are:

```
<pointInstruction>
  <featureReference>6216</featureReference>
  <viewingGroup>33010</viewingGroup>
  <displayPlane>OVERRADAR</displayPlane>
  <drawingPriority>18</drawingPriority>
  <symbol reference="SOUNDS19" /> <!-- Should be SOUNDS10 -->
</pointInstruction>
<pointInstruction>
  <featureReference>6216</featureReference>
  <viewingGroup>33010</viewingGroup>
  <displayPlane>OVERRADAR</displayPlane>
  <drawingPriority>18</drawingPriority>
  <symbol reference="SOUNDS5" /> <!-- Should be SOUNDS59 -->
</pointInstruction>
```

10. The QualityOfBathymetricData feature is incorrectly symbolized with a 2mm wide line. S-52 specifies a 0.64mm wide line. In S-52 line widths are expressed in 0.32mm units, so 2 units is equivalent to 0.64mm. It is clear that for this feature, the "2" was copied directly from the S-52 rules, rather than converted to millimeters. This appears to be an isolated issue affecting only this feature, no other similar issues have been found. An example feature and generated draw instructions are:

```
<QualityOfBathymetricData id="6979" primitive="Surface">
  <dataUnassessed>1</dataUnassessed>
  <categoryOfTemporalVariation>5</ categoryOfTemporalVariation >
</QualityOfBathymetricData>

<lineInstruction>
  <featureReference>6979</featureReference>
  <...>
  <lineStyle>
    <intervalLength>5.4</intervalLength>
    <pen width="2"> <!-- Should be 0.64 -->
    <color>CHGRD</color>
  </pen>
  <...>
</lineStyle>
</lineInstruction>
```

11. Masked edges are not used by the current XSLT rules. There is no reference in the portrayal rules to masked relations. We assume the symbolization of masked edges should be skipped by the manufacturers rendering engine. If this is the case, we recommend this be documented.
12. Some XSLT portrayal rules use S-57 attribute codes. To work around this issue, we generate Feature XML input to the XSLT containing both the S-101 attribute, and its S-57 equivalent (if applicable). The S-57 equivalent is obtained from the feature catalogue. We recommend that the portrayal catalogue be modified so that only S-101 attribute codes are used.

Summary

Despite the issues identified in the preceding section, we have been able to use the current versions of the catalogues to successfully portray S-101 data sets generated from S-57. Once native S-101 data is available, we will be able to test the portrayal of S-101 unique feature types. Additional work remaining for the viewer includes:

- Implement rendering of text, sector lights, soundings, masked edges, and non-path SVG commands.
- Implement Viewing Groups (awaiting resolution of issue 7).
- Implement Text Groups (awaiting resolution of issue 7).
- Implement Palette Selection (awaiting resolution of issue 6).
- Extend Validation and Reporting for Feature and Portrayal Catalogues.
- Extend Portrayal to other S-100 Products – dependent on data availability. We are working with SCWG, and WECDIS groups.

We plan to deliver the first version of the simple viewer within the next few months.

The TSM3 is invited to:

- A. Note the progress reported.
- B. Note the issues reported.
- C. Endorse the work of SPAWAR LANT in support of NGA Maritime Safety Office.