

Paper for Consideration by TSMAD28

United States S-100 Testbed Development

Submitted by:	SPAWAR Atlantic (US Navy)
Executive Summary:	Introduction and overview of the US S-100 Testbed development project. This work is being executed by the Space and Naval Warfare Systems Center – Atlantic (SPAWAR Atlantic). The US S-100 Testbed development project is being sponsored by the Maritime Safety Office of the National Geospatial-Intelligence Agency (NGA), and is being coordinated with the National Oceanographic & Atmospheric Administration (NOAA).
Related Documents:	IHO S-100 (Universal Hydrographic Data Model) IHO S-101 (ENC Product Specification Draft) TSMAD 27 4.4.3 S-100/S-101 Test Strategy Workshop Outcomes HSSC 5-05.1B: S-101 Value Added Roadmap HSSC5-05.1G rev. 1: Test Bed Projects in support of S-101 Development and Implementation
Related Projects:	TSMAD Work Plan KHOA Test Bed Project

Introduction

The Maritime Safety Office of NGA 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 collaboration with S-101 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 requirement to design and build an S-100 Testbed to support the development and testing of S-101 and other S-10x based geospatial data products. This testbed software and capability will be developed by the SPAWAR Atlantic - Navigation/GIS Integrated Product Team (NGIS IPT), located in Virginia Beach, Virginia. The US S-100 testbed software will be based on a redesign to the existing electronic charting software called the Common Geospatial Extensible Navigation Toolkit (COGENT).

Background

SPAWAR Atlantic has been involved with the design, development, integration and testing of navigation systems, specifically related to electronic charting and safety of navigation, since the late 1980's. In 1988, we worked with NGA (at the time called Defense Mapping Agency - DMA) to establish the US Navy requirement for DNC, and then we developed the original product specification for DNC in 1989. We then worked with NGA to complete the specification, design and development of the Vector Product Format (VPF) relational database standard in the early 90's. Over the following years we worked with NGA in numerous geospatial software research, development, experimentation, data analysis, security and similar projects. The COGENT software development began in 2004 as a derivative from the US Navy Integrated Charting Engine (ICE) ECDIS-N software. ECDIS-N is the US Navy version of ECDIS requirements which uses the international IMO/IHO/IEC ECDIS requirements as the foundation. COGENT is open architecture and modular in design to allow easier integration into other command and control systems or software modules. COGENT is used extensively in the US Navy, including small craft and unmanned vehicle controllers to meet a variety of missions. The current COGENT 2.4 software has over 800 registered users.

Analysis/Discussion - US S-100 Testbed Development Plan

The current TSMAD S-100 system overview is presented in Figure 1. This figure was developed at the S-100 test meeting in Sep 2013. The updated approach provides for an iterative development process of S-100 based data products, and also provides the foundation for more rigorous testing. The S-100 system overview framework divides the overall process into 9 separate phases in order to manage complexity and reduce risk. The primary goal of the framework is to make S-100 based geospatial product development and testing more realistic and achievable.

The S-101 development is intended to provide the base chart layer for safe navigation. The full potential of using S-101 as the base chart layer will be realized when other S-10x products are developed to both aid in the safety of navigation and to meet military missions (e.g. AML). It is clear that a robust stable S-100 Testbed will be essential in developing and producing S-101 data that will be accepted by the maritime community. This is the principal reason that NGA chose to leverage the COGENT software as the foundation for the US S-100 testbed.

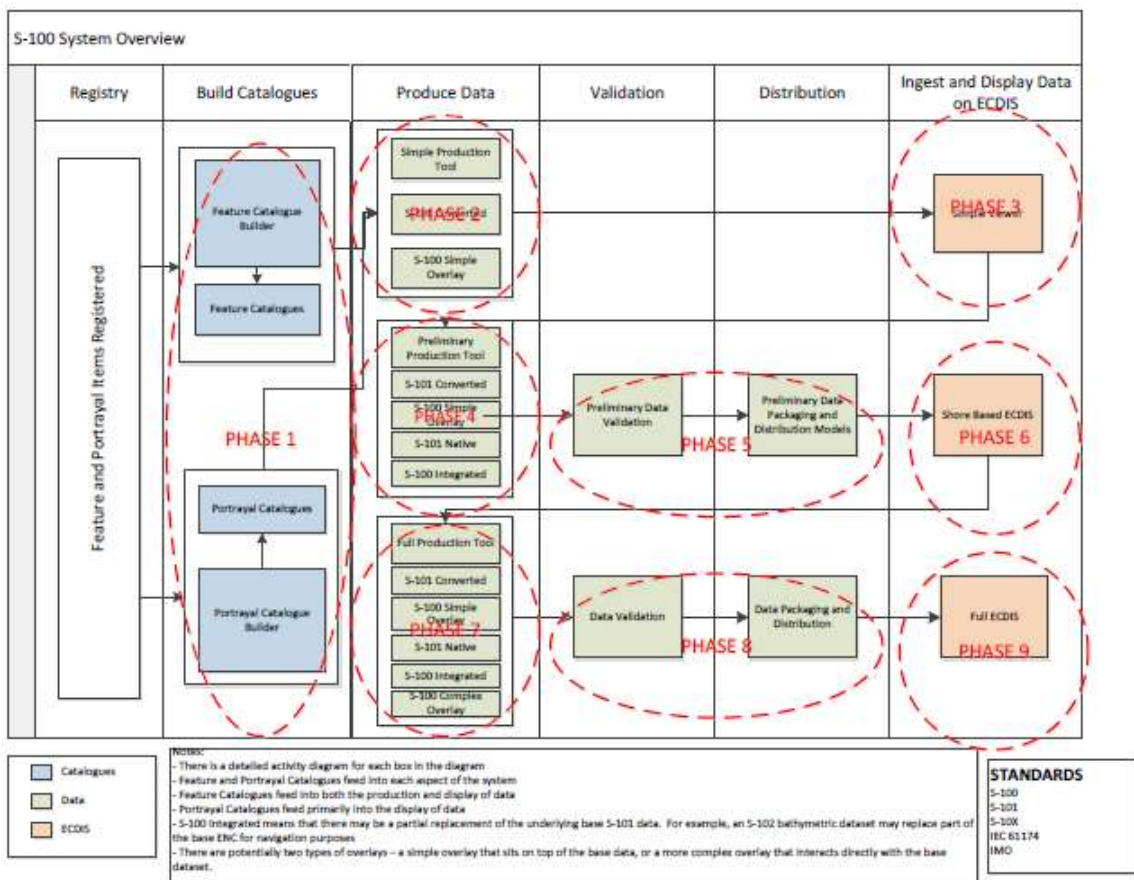


Figure 1 – S-100 System Overview with Phases 1-9

The US S-100 Testbed will provide the capability required in phases 3, 6 and 9. All of these capabilities will be based on modifying the COGENT 2.4 software to create a new 3.x version of COGENT.

The COGENT 3.x software will maintain the open architecture and modular software design. The design goal is to allow display and operation with any compliant S-10x data product encoded in ISO 8211, GML, and HDF5 for S-102. In addition, there will be a single source code configuration that can be compiled in either Windows or Linux. The new design will leverage modern software tools such as the SpatialLite database, C#, UML, XML and GML, resulting in reduced lines of source code to achieve comparable functionality for geospatial data display and operation. The COGENT 2.x architectural complexity – which grew over time from adding features to meet new requirements - will be simplified from the current design, allowing for easier maintenance and enhancement.

Table 1 on page 3 offers some additional description and capabilities for the planned US S-100 Testbed.

Phase	Title	Capabilities
3	Simple Viewer	<ul style="list-style-type: none"> • Import feature and portrayal catalogs • Display S-101 data in accordance with the feature/portrayal catalogs • Provides limited ECDIS capability necessary to display and exercise S-101 and S-10x data • Facilitate the ability to import feature and portrayal catalog updates • Use to validate S-101 datasets from S-57 to S-101 converter • Use to validate natively produced S-101 datasets • Validate and display emerging S-10x data products • Validate and test operation of S-101 and S-10x data products integrated in the same display • Plan is to openly distribute the executable version to any interested party involved in S-101 development • Future goal: Provide some troubleshooting and feedback on errors in the structure or organization of S-10x products during their development cycle • Future goal: Help development and test of the planned integration of S-63 encryption capability in the S-100 standard
6	Shore Based ECDIS	<ul style="list-style-type: none"> • Full ECDIS capability • Support both new S-101 and S-10x data sets • Also operate with legacy DNC/TOD and legacy S-57/AML products • Full complement of external shipboard sensor simulators • Allow synchronized trajectory operations from sensor simulators to more closely emulate the real time at-sea environment • Serve as benchmark performance for S-64 Test Data Set operation • Robust route planning capability • Provide S-10x update capability • Validate and test operation of S-101 and S-10x data products integrated in the same display with simulated routes • Meet NATO WECDIS and emerging US Navy ECDIS requirements
9	Full ECDIS	<ul style="list-style-type: none"> • Full shipboard ECDIS capability • Meet NATO WECDIS and emerging US Navy ECDIS requirements • Designed to work either in dedicated hardware or be integrated into common shipboard computing environment • Will provide for full complement of sensor inputs through separate software called NAVServer. This allows changes to sensor configuration and integration without the need to modify ECDIS software source code. <ul style="list-style-type: none"> ○ Maintains ECDIS software integrity ○ Reduces regression testing requirements

Table 1 - Description and Capabilities for the planned US S-100 Testbed

The planned schedule for the US Testbed effort correlates with the planned IHO schedule for S-101 development. Figure 2 shows the current planned delivery dates for the US S-100 testbed phases (in the gold color). While there is some inherent risk in both project schedules, the US S-100 Testbed effort is planned to stay ahead of related efforts in the S-101 development schedule.

The current plan for delivery of the Phase 3 simple viewer is Oct 2015. The Phase 6 Shore Based ECDIS will follow one year later in Oct 2016, and then the Phase 9 Full ECDIS capability is planned for delivery in Oct 2017.

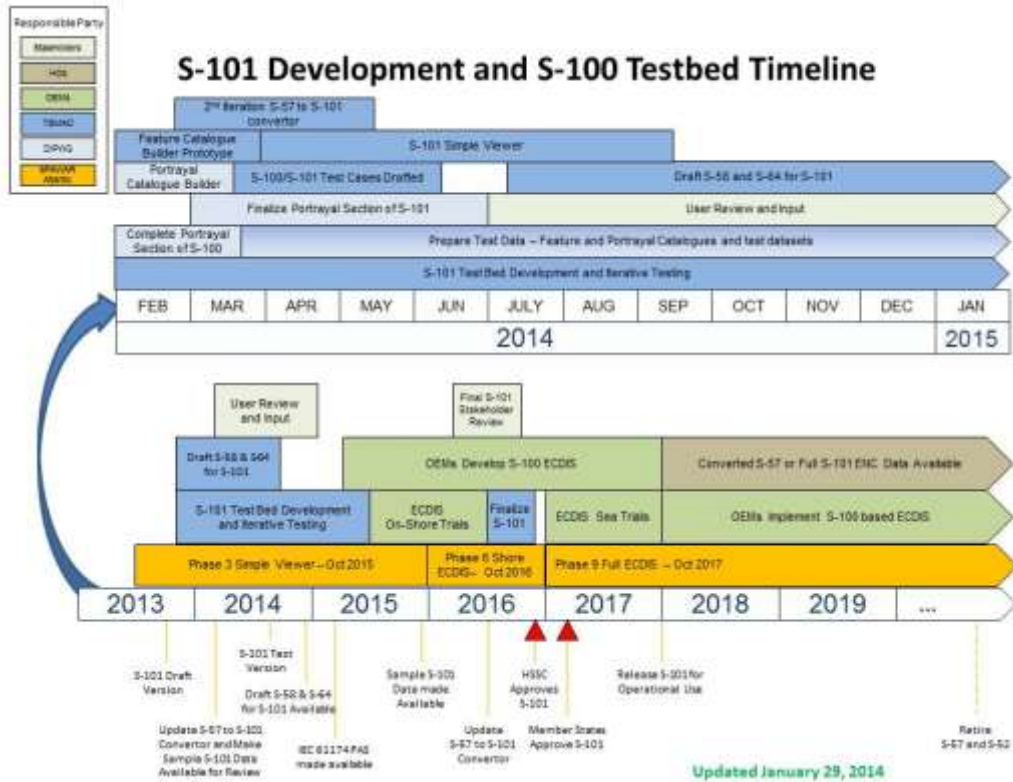


Figure 2 – Planned US S-100 Testbed Schedule (in Gold) overlaid on IHO S-100/S-101 Schedule

Conclusions

SPAWAR Atlantic is developing the US S-100 Testbed based on a redesign to the existing COGENT software. This testbed will provide the capability for the Phase 3 Simple Viewer, the Phase 6 Shore Based ECDIS and the Phase 9 Full ECDIS. In addition, the software is being designed to meet NATO WECDIS and emerging US Navy ECDIS requirements. The primary mission of the testbed is to help the US DOD transition away from VPF based maritime geospatial data products to S-100 based geospatial data products.

Recommendations

It is recommended that the TSMAD integrate the US S-100 Testbed project in the overall TSMAD S-101 and S-10x development activities and related projects. We recommend that the TSMAD continue to hold S-100 Test Strategy workshops. We also recommend that the all countries developing an S-100 testbed collaborate and share information about their respective strategies, plans and schedules including focused technical discussions during future S-100 Test Strategy workshops.

Justification and Impacts

The US S-100 Testbed project is being developed to:

- A. Assist IHO/TSMAD in development of S-101 and other S-10x geospatial data products
- B. Facilitate the US DOD transition to S-100 data products for maritime utilization

Action Required of TSMAD

The TSMAD is invited to:

- A. **Endorse** the continued development of the US S-100 Testbed project.
- B. **Discuss** and explore how the US S-100 testbed could benefit IHO.
- C. **Include** focused technical discussions of testbed development efforts during future S-100 Test Strategy workshops.
- D. **Include** the US S-100 Testbed project as part of the TSMAD Work Plan.