Navy Configuration and Logistics DEX Implementation
NSRP Project Number 2012-452
Final Report for Public Release
May 22, 2013

Project Overview

This project leveraged Product Life Cycle Support (PLCS) work performed on previous NSRP and Navy projects to develop a Navy Configuration and Logistics Data Exchange Specification (DEX), implement a prototype data exchange using the DEX, and document the DEX development process and applicable guidance for use on future Navy DEX implementations. The Ship Common Information Model (SCIM) (Reference [1]) was used as the basis for the DEX information requirements. The project team consisted of Ingalls Shipbuilding as lead, with other team members from Northrop Grumman Technical Services, Product Data Services Corporation, Jotne North America, as well as ad-hoc participation by Praeses. The period of performance for the project was January 31, 2012 through January 31, 2013.

Technical Status

- **DEX Development:** The project team completed development of the Navy Configuration and Logistics DEX. The DEX is documented in the DEXlib repository of the PLCS Resources web site (Reference [2]). Open issues with the DEX are described in the Issues section of this report.
- **DEX Test Case Development:** A DEX test case was developed. The DEX test case was populated with sample ship data that complies with the Navy Configuration and Logistics DEX schema and contains the necessary data for population of Configuration Data Managers Database-Open Architecture (CDMD-OA) Record Types 1, 2, and 3 for several pumps in a piping system. This test case was used to validate the DEX specification as published in DEXlib for correctness and completeness, and to develop a DEX to CDMD-OA prototype translator. Jotne's EDMsupervisor toolkit was used to populate the test case. Upon completion of the initial test case, the data was exported from the EDMsupervisor tool in both STEP (ISO 10303) Part 28 (XML) and STEP (ISO 10303) Part 21 (ASCII) formats. The Part 28 XML file was used to develop the DEX to CDMD-OA translator. Open issues with the DEX test case file are described in the Issues section of this report.
- **DEX Prototype Translator Development:** A prototype translator was developed to parse the test case DEX Part 28 XML file and build the appropriate SDIF files for import into CDMD-OA. This data translator demonstrated the feasibility of automating the delivery of certain logistics data to CDMD-OA using the DEX. The project team coordinated with subject matter experts (SME's) at Ingalls to import the data into CDMD-OA and validate the content and format of the input files. This was an iterative process between Ingalls SME's and the project team. For example, the initial CDMD-OA testing failed with two errors identified. The team was able to identify two properties in the source DEX data (parent serial number and allowance equipage list) that should be marked as optional depending on the kind of record being built (see Issues section of this

report). This change was incorporated into the DEX test file as well as the translator application so that the subsequent files imported correctly into CDMD-OA. Open issues with the prototype translator are described in the Issues section of this report.

- **DEX Development Guide:** The DEX Development Guide was completed. The DEX Development Guide provides a PLCS overview, DEX overview, a description of the DEX development process used on this project, and DEX project guidance based on lessons learned from this project.

Deliverables

- Published the final version of the Navy Configuration and Logistics DEX in the DEXlib repository on the PLCS Resources web site (Reference [2]).
- Posted project artifacts including the test data, DEX XML files, and translated CDMD-OA SDIF files on the Integrated Shipbuilding Environment (ISE) Tools web site (Reference [3]).
- Delivered the DEX Development Guide (Reference [4]).
- Delivered the project Quarterly Status Reports and Final Report.

Issues

- The PLCS DEXlib development environment is being migrated to a new DEX development environment known as PLCSlib, which is intended to simplify the DEX development process. PLCSlib is still under development. The pros and cons of using DEXlib versus PLCSlib on this project were considered and a decision was made to use DEXlib instead of PLCSlib due mainly to the team's PLCSlib learning curve and lack of maturity of the PLCSlib environment with respect to standard tools and core templates. The team already had DEXlib experience to leverage. This issue will need to be re-evaluated as PLCSlib matures to determine whether it makes sense to transition to the new PLCSlib for future DEX development projects. DEXlib can be found at Reference [2] and PLCSlib can be found at Reference [5].
- A Navy/Industry team should be formed to plan the organization of the full suite of Navy DEXs prior to the development of any additional individual DEXs. A high-level PLCS concept mapping of the entire suite of DEXs should be documented to ensure that all of the pieces (the individual DEXs) will fit well together and an integrated approach is developed. This would be a great candidate for a future NSRP Research Announcement project.
- This project partially mapped a portion of the SCIM Product Data Management (PDM) chapter in order to provide context for the CDMD-OA data mapping. However, there may have been too much of the SCIM PDM data included in the Navy Configuration and Logistics DEX documentation, causing overlap and potential inconsistencies with the existing Navy Ship Long Term Data Retention (ShipLTDR) DEX developed on a previous Navy Small Business Innovative Research (SBIR) project. It may be more useful to down-scope the Navy Configuration and Logistics DEX to just the CDMD-OA data requirements, so that it can be used in conjunction with the ShipLTDR DEX. This re-scoping may also solve some of the conflicts in design versus operational support lifecycle phase requirements that were only partially addressed during the Navy Configuration and Logistics DEX development wherein the logistics information

managed during the design phase may be applicable to multiple hulls, but CDMD-OA is structured to provide the configuration and logistics information for a single hull. Separating the conflicting requirements into two DEXs may be appropriate.

- Given the timeframe for completing the project and the uncertainty of the capabilities of the SolidWorks Enterprise PDM tool to easily import and export the configuration and logistics data required to validate the DEX against the Ship Configuration and Logistics Support Information System (SCLSIS) data, an alternate plan was developed for the data exchange. Instead of developing full translators from SolidWorks Enterprise PDM to the DEX and from the DEX to CDMD-OA, the project developed a prototype test case. The prototype test case included the following products:
    - A DEX XML test case file representing the DEX file translated from a notional sending system. This file was created using a partially manual process facilitated by some automated processes using the Jotne Express Data Manager (EDM) tool.
    - A set of input files for the receiving system, which were created by translating the DEX XML file into CDMD-OA Standard Data Interface File (SDIF) files.
- The CDMD-OA Record Type 3 is currently mapped as a type of document in the DEX. Most of the required properties of AP239 documents are not used in the mapping. It may be more accurate to merely reference a document from the Record Type 3 mapping, rather than sub typing from document.
- Analysis of the import of the sample DEX data into CDMD-OA indicated that two changes may be necessary to both the underlying SCIM PLCS chapter, which contains the requirements of the DEX content, and in the DEX mapping documentation itself.
    - Both the SCIM and the resulting DEX mapping documentation require a value for the Logistics_configuration_item.Parent_serial_number property. The CDMD-OA software expects this property to not be populated in the case that a part has no parent record. Both the SCIM and the DEX documentation should be revised to make this property optional.
    - Both the SCIM and the resulting DEX mapping documentation require a value for the Installed_item.Allowance_equipage_list_column_number property. The CDMD-OA software expects this property to not be populated in some cases. Both the SCIM and the DEX documentation should be revised to make this property optional.
- There were some issues with generation of Record Type 3 Standard Interface Data (RT3 SDIF) in properly identifying the unit identification code (UIC) and parent record identification number (P_RIN) of the Record Type 2 (RT2) record. At this time we think the problem lies within the mapping process done by the translator application and should be relatively easy to address moving forward. Time permitting, Praeses plans to make one more test of the RT3 file generation which would occur after the completion of this panel project.

<u>Schedule</u>

- Milestones
    - Milestones “PLCSlib Public Release” and “PLCSlib standard reference data library available” were delayed. These milestones are not within the control of the project, NSRP, or the Navy. These delays drove the decision to go forward with DEXlib instead of PLCSlib.

    - 1 March 2012 - Contracts in place for all subcontractors
    - 28 March 2012 - Held contract kick-off teleconference
    - 12 April 2012 - Held project team meeting in San Diego, CA
    - 12 June 2012 - Held project team meeting in St. Paul, MN
    - 13 September 2012 - Held project team meeting in San Diego, CA
    - 5 December 2012 - Held project team meeting in New Orleans, LA
- Reports
    - 30 April 2012 - Submitted Q1 Status Report
    - 31 July 2012 - Submitted Q2 Status Report
    - 31 October 2012 - Submitted Q3 Status Report
    - 22 February 2013 - Submitted DEX Development Guide
    - 22 February 2013 - Submitted Final Report

Business Status

- All subcontracts were in place by 1 March 2012
- The period of performance for subcontracts was through 31 January 2013
- All deliverables were completed and submitted to NSRP

Reference Documents

The following documents are referenced in this report.

No.	Date of Document	Document Number, Title, and Revision
[1]	31 October 2012	Ship Common Information Model (SCIM) Deliverable under Task of NSRP ASE Project Technology Investment Agreement (TIA) #2010-627 http://www.nsrp.org/5-Navy_Product_Data.html http://www.nsrp.org/5-Ad_Hoc/SCIM/SCIM_Docs/SCIM.html
[2]	10 February 2010	DEXlib DEX repository: http://www.plcs-resources.org/plcs/dexlib/dex_index.htm
[3]	None	Integrated Shipbuilding Environment (ISE) Interoperability Tools http://www.isetools.org/eb-cgi-bin/yabb2_ISE/YaBB.pl
[4]	15 May 2013	NSRP Information Technology Panel Project, US Navy Configuration and Logistics Business Data Exchange Specification (DEX) Development Guide, Version 1.1
[5]	None	PLCSlib DEX repository: http://www.plcs.org/plcslib/plcslib/