FALCON Pilot
Applying Open Standards for PLM Systems Interoperability

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FALCON Pilot Applying Open Standards for PLM Systems Interoperability

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Objectives

• Present the FALCON approach:
  – the application of the PLCS standard and Share-A-space technology as a “master data integrator” within the Falcon Program Architecture

• Demonstrate:
  – Improved data communication from AM General to TARDEC
  – Visibility of richer design data sets to TARDEC
    • Ability to compare
  – Access to details of individual delivered vehicles
PLCS-based lifecycle product data integration & consolidation engine

Windchill PDM

Collaboration Modeling & Simulation Configuration Management

Product Improvements Online Design Reviews What-if Analysis

Spare Part Buys Readiness Prediction

DLA Buys Provisioning Cataloging

Depot Reset/Recap Field Repair & Maintenance

Authoritative Sources of Master Data (Govt. or OEM)

Web Services
Background: the existing process

- The Army receives design data as drawings (pdf files)
- Drawings are held by the Army in Windchill
  - Corresponding meta data is entered manually
- Product structure is supplied as indented parts lists
  - Corresponding data is entered manually into Windchill
- LSAR data is also provided as 1388-2B
  - Including Initial Provisioning Lists (as a report)
- Change documentation held in the Windchill system
  - Other intermediate changes made by AMG held in SAP
- What happens in AM General is not seen by the Army
  - Changes to HMMWV design for manufacturing not delivered to Army by contract
  - Approved changes do not necessarily get into manufacture
Old way of doing business

ECP

New design

OEM

Design change made in 3D CAD

Design configuration controlled within PDM

PDM

2D CAD drawings developed

Drawing BOM structure created manually

PDF files generated

E-mail/FTP/Snail mail to TACOM

Technician manually loads data into Windchill

TACOM Windchill

Create product structure

Fill in metadata

Load drawings

Validate load

As-designed config

As-built config

Non-value add Functions + Loss of config. control

Government initiated ECP

Drawings only – no 3D Loss of config with OEM

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
“To-be” Product Data Process

ECP → New design → OEM

ECP → Design change made in 3D CAD → Design configuration controlled within PDM → OEM PDM

FALCON

Federated Data Access

Single point of entry
User access

TACOM Windchill

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Demonstration Process Overview

1. Load AM General design data
2. Load TARDEC Windchill data
3. Load AM General powerLog (1388-2b) data
4. Consolidated product data review with plug-in
5. Load Vehicle instance data and view in Share-A-space
HMMWV Pilot – Demo Scenario

1. Initial Data Load – AM General SAP Data

- Extract “As Used To Manufacture” data from AM General’s SAP
- Map/transform SAP data to PLCS (ISO 10303-239)
- Load data into Share-A-space
As-manufactured Data stored in AM General SAP

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**Source Document**

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  - FR  INSTL EXHAUST SYSTEM

**Release Latest Level III TDP**

- **12460078**
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  - Release Latest Level III TDP
SAP “As-Built” Structures exported as Flat File by AM General
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SAP to PLCS Mapper executed and resulting PLCS File and Associated Model Files placed on Upload Server.
SAP data as PLCS
PLCS DEX1 File “pulled” to the upload area and Imported into Share-A-Space
SAP data in Share-A-space
HMMWV Pilot – Demo Scenario

2. Initial Data Load – TARDEC Windchill Data

- Current content of TARDEC Windchill
- Extracted data from Windchill as STEP
- Loaded meta data into Share-A-space
  - Not supporting drawings/models
  - Used to enable comparison
Initial Data Load – TARDEC Windchill

TDP “As-Designed” Structures entered directly into Windchill by AM General
AP214/PDM Schema File “pulled” to upload area and imported into Share-A-space
Windchill Data in PDM Schema format

ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Windchill STEP Data', 'windchill_schema'), '2;1');
FILE_SCHEMA(('PDM_SCHEMA'));
ENDSEC;

DATA;
#22= PRODUCT('12460078', 'EXHAUST SYSTEM INSTALLATION', 'EXHAUST SYSTEM INSTALLATION', (3));
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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
What’s happened so far:
Configuration Integration: SAP, WC => Share-A-space

“As Used To Manufacture” Version Release

“As Used to Manufacture” View + As Designed View

As Designed View

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Data load results

- Complete As-Manufactured data set loaded from AM General SAP to Share-A-space
  - 3030 parts plus example CAD models and drawings
- Partial data set loaded from TARDEC’s Windchill system for demo
  - Exhaust sub system comprising 63 Parts
HMMWV Pilot – Demo Scenario

3. Initial Data Load –
AM General powerLog Data
LSA data background

- Mil Std 1388 covers a broad scope of logistic support analysis (LSA) including failure modes, task analysis and spare-parts
  - This analysis is usually undertaken as part of designing the support system for a product
- AM General use a report generated from Mil Std 1388 data to supply provisioning list data to the Army
  - The data and report are created using the powerLog system
    - powerLog is the reference Mil Std 1388 implementation produced by LOGSA
- The data provided by AM General covers a limited subset of Mil Std 1388:
  - A breakdown of the end-item using Logistic Control Numbers (LCNs) to identify relevant positions
    - The data here is a physical breakdown (cf. functional) that corresponds to an assembly structure
  - Links from that breakdown to the corresponding parts
- As much more of Mil Std 1388 is relevant to PLCS it was decided to work with the data as held by powerLog rather than the output report
  - The reduced scope allowed use of existing PLCS DEX capabilities
    - Coverage of the full scope of Mil Std 1388 by PLCS DEXs is not yet in place
AM General powerLog -> PLCS MDI

LSAR

LCN Breakdown

Design View
powerLog LSAR Data exported to MilStd 1388-2B format using powerLog Export capability
LSA data exported as 1388-2B format
MilStd 1388-2B File "pulled" to the upload area, and mapped to a PLCS DEX1 File
MilStd 1388-2B File put on Upload server
powerLog LSAR Data exported to MilStd 1388-2B format using powerLog Export capability
PLCS DEX1 File imported into Share-A-space and connected to the "As_Designed" structure
1388-2B export mapped to PLCS
powerLog data in Share-A-space
HMMWV Pilot – Demo Scenario

4. Consolidated Product Data Review with Windchill Plug-in
Windchill User starts Web Services Client to Share-A-space. The WS Client uses HTTPS (port 443) to communicate.

Windchill User selects a Part in the "As_Designed" structure and queries Share-A-space.

Share-A-space returns linkage to Support Data and comparison with the "as_built" data.

Share-A-space™ App Server (Static IP Address) is located in the loading bay.

FTP upload Server is connected to SAP R/3 in the TACOM NIPRNET/TACOM DMZ.

AM General Corporate Network connects to the AM General DMZ, which includes a Share-A-space loading bay and Share-A-space™ App Server.

SAP and powerLog are located in the AM General Corporate Network.

TACOM DMZ includes a Share-A-space™ App Server (Static IP Address).

TACOM NI PRNET connects to the Windchill PDMLink and Windchill Plug-in Browser.

Windchill User connects to the WS Client using WS - HTTPS (port 443).

Technology Driven. Warfighter Focused.
As-Designed data for the exhaust system comes from TARDEC’s Windchill.

As-Manufactured data for the entire M1097-A2 comes from AM General’s SAP system.

(Plus the LSA data from powerLog)

Both sets of data are now available to navigate and view:
  – Via the Share-A-space interface
  – Via a plug-in to Windchill

Can now look at consistency between As-Manufactured and As-Designed structures:
  – The following slide shows how differences in the structures are presented by use of icons.
Visual representation of data consolidation

Data Consolidation

As-Designed Data Import "As_Designed Structure"

As-Built Data Import "As_Built Structure"

LCN "MaiSup"

as-designed "MecDes"

as-built "MecDev"

NOT Same

Does not exist in other View

The Same

Exists in both views and identical children

The Same

Exists in both views and no children

Reconciling LCN with "As_Designed Structure"

MecDes" "MecDev" "MaiSup"

Application context labels

Each data set is given a label that is used in the Plug-in

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
5. Load Vehicle instance data and view in Share-A-space

- Data on serial numbered structures exported from SAP
- Mapped into PLCS
- Loaded into Share-A-space
- Four serial numbered items per vehicle
  - plus the vehicle itself
Load Serial Numbered Product Data – AM General SAP

AM General Corporate Network
Serial Numbered Product structures

AM General DMZ
SAP CSV

PLCS DEX8.p21

FTPS (port 990)
Share-A-space App server pulls files from suppliers FTP server via FTPS "get" command

TACOM DMZ

Rules

Share-A-space loading bay

Individual View

SAP PLCS DEX8.p21 is pulled into PLCS File Data Flat File Share-A-Space

Serial Numbered data can be viewed in Share in Space View via Plug-in to be developed

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
The serial number of a 1097A2 as held in SAP.
Component serial numbers for the same 1097A2 as held in SAP.
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#14=EXTERNAL CLASS('/IGNORE','Version_identification_code','/IGNORE',\$11);
#15=EXTERNAL CLASS('/IGNORE','In-Service','/IGNORE',\$11);
#16=EXTERNAL CLASS('/IGNORE','Maintenance','/IGNORE',\$11);
#17=EXTERNAL CLASS('/IGNORE','Part_identification_code','/IGNORE',\$11);
#18=EXTERNAL CLASS('/IGNORE','Development_stage','/IGNORE',\$11);
#19=EXTERNAL CLASS('/IGNORE','Mechanical_design','/IGNORE',\$11);
#20=EXTERNAL CLASS('/IGNORE','Name','/IGNORE',\$11);
#21=EXTERNAL CLASS('/IGNORE','Start_Date','/IGNORE',\$11);
#11=EXTERNAL CLASS_LIBRARY('usr:plcs:dlmc1.usr','/IGNORE');
#36=CLASSIFICATION_ASSIGNMENT(#10,\$23,'/IGNORE');
#37=CLASSIFICATION_ASSIGNMENT(#12,\$56,'/IGNORE');
#53=CLASSIFICATION_ASSIGNMENT(#21,\$54,'/IGNORE');
#55=CLASSIFICATION_ASSIGNMENT(#10,\$33,'/IGNORE');
#56=CLASSIFICATION_ASSIGNMENT(#13,\$32,'/IGNORE');
#57=CLASSIFICATION_ASSIGNMENT(#20,\$38,'/IGNORE');
#58=CLASSIFICATION_ASSIGNMENT(#13,\$34,'/IGNORE');
#59=CLASSIFICATION_ASSIGNMENT(#21,\$60,'/IGNORE');
#7=PRODUCT AS REALIZED('/IGNORE','/IGNORE',\$2);
#9=PRODUCT AS REALIZED('/IGNORE','/IGNORE',\$3);
#61=PART VERSION('/IGNORE','/IGNORE',\$4);
#62=VIEW DEFINITION CONTEXT('/IGNORE','/IGNORE','/IGNORE');
#99=VIEW DEFINITION CONTEXT('/IGNORE','/IGNORE','/IGNORE');
#62=PRODUCT_CATEGORY('/IGNORE','part','/IGNORE');
#69=PART VIEW DEFINITION('/IGNORE','/IGNORE','/IGNORE',\$99(),\$61);
#69=PRODUCT DESIGN_VERSION TO INDIVIDUAL(#61,\$7);
#69=PRODUCT DESIGN VERSION TO INDIVIDUAL(#61,\$9);
#66=PRODUCT DESIGN TO INDIVIDUAL(#6,\$2);
#67=PRODUCT DESIGN TO INDIVIDUAL(#6,\$3);
#68=DATE OR DATE_TIME ASSIGNMENT(#66,'/IGNORE',\$7);
#60=DATE OR DATE_TIME ASSIGNMENT(#69,'/IGNORE',\$9);
#66=CALENDAR_DATE(2005,12,2);
#69=CALENDAR_DATE(2005,12,3);
#23=IDENTIFICATION ASSIGNMENT('229994','/IGNORE','$',\$2);
#38=IDENTIFICATION ASSIGNMENT('9C234','/IGNORE','/IGNORE',\$1);
#25=IDENTIFICATION ASSIGNMENT('','$',/IGNORE',$,\$7,\$9);
#27=IDENTIFICATION ASSIGNMENT('6750318','/IGNORE','$',\$8,\$9);
#29=IDENTIFICATION ASSIGNMENT('R','/IGNORE','$',\$41);
#31=IDENTIFICATION ASSIGNMENT('SO016001AJ','/IGNORE','$',\$2);
TACOM User informed of New Serial Data arrival
TACOM User views Serial Data via Plug-in
Conclusions

• The architecture proposed for FALCON has been successfully demonstrated with AM General
  – The PLCS standard and Share-A-space technology provide a “master data integrator” function
  – TARDEC and AM General continue to use existing systems
• Through FALCON, TARDEC can have access to a richer data set from OEMs
  – As-used-to-manufacture data and LSAR data available at TARDEC as well as approved design
  – Access to the data can be made available through TARDEC’s existing tool (Windchill)
• FALCON enables a route for improved data synchronization between AM General and TARDEC
  – Automated processes can be established
  – Manual intervention in the exchange of data can be eliminated
  – Out of Sync data can be identified
• FALCON delivers improved Data Quality
  – Inconsistencies identified between As-released and As-used-to-manufacture
    • Version differences
    • Part numbering and naming differences
  – Different names between LSAR and As-released for same part
• FALCON enables use of simple add-on services via web-services
  – Bill-of-Material comparator (part of the Plug-in)
• FALCON offers the possibility of a through life approach
  – Individual (serialized) data from SAP now available to TARDEC
  – Starting point for tracking configuration of individual vehicles
  – Individual and support data in line with PLCS
FALCON’s use of PLCS as the mediation format and Share-A-space as a host technology provide:

- Reconciliation of product data cross-application
- Configuration control of lifecycle views
- Transparent interoperability services
- Independence between OEM and Army IT systems
- Platform for additional application capability
- Absence of data lock-in

FALCON approach applicable to other vehicle programs

- Demonstration achieved using open approaches without company specific developments