The Information Backbone for the Logistics Enterprise

Product Life Cycle Standards

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Agenda

- Introduction to PDES, inc
- The Model Based Enterprise
- STEP through the lifecycle
- PLCS
  - The business context
  - Key capabilities
  - Features
  - Implementations
PDES Inc. 2020 Vision

Be the world leader in accelerating the development, implementation and use of STEP and related product data standards to deliver extraordinary business value

Initiatives

– Model Based Enterprise
  – Model Based Engineering
  – Model Based Manufacturing
  – Model Based Sustainment

– Integration & Data Exchange Testing

– Information Standards
Digital Enterprise View

Digital Enterprise (DE)

Product and a Business View

Model Based Enterprise (MBE) is a component of the DE Technical View

Largest problem by far is interoperability using standard information
Industry has defined MBE from the technical view as...
An integrated modeling/simulation/information environment that enables multi-disciplinary use of information to address all aspects of the life cycle

- Models are defined as information abstractions from enterprise data for application in domain specific use
- Tools and processes are integrated through the application of standard information
- Information is accessible through PLM interfaces
- Key Life Cycle Characteristics predicted through math and science based simulations, and augmented through advanced visualization
Internet-based architecture and federated data models make possible implementations involving thousands of users across many sites.

**Product Life Cycle Support (PLCS)**

**Extended Enterprise enabled by Internet technology**

- **Extended Enterprise of OEM’s, Customer, Partners and Suppliers**
- **Enterprise Integration through dedicated networks**
- **Domain specific information systems** (e.g., CAD, MRPII, Planning)
- **Product Lifecycle Management (PLM)**
- **PLCS Domain**
- **Operational Feedback**
- **Define and implement the support solution, maintain the product configuration**

**Product Life Cycle**

- **Dept Enterprise**
- **Customers**
- **Partners**
- **Tier 1 Suppliers**
- **Tier 2 Suppliers**
- **In-Service**
- **Disposal**
- **Operational Feedback**
Product Life Cycle Support (PLCS)

Extended Enterprise – Importance of PLCS

When set against a timeline – the picture looks more like this!

PLCS Domain

Design for Supportability

In Service Support and Operational Feedback

Typically 25 – 50 years Operational Life

5 – 10 years

Product Life Cycle Support (PLCS)
Setting the Business Context

Business Drivers

- **Reduced Cost of Ownership**
  - Users of products are seeking improved availability, reliability, maintainability and lower cost of ownership

- **Sustainable Business Growth**
  - Companies are seeking to make money through the life cycle support of their products to improve profits, improve quality and be more competitive

- **Protect investment in product data**
  - Users of information systems want to ensure long term usability for product information as IT and processes change
Setting the Business Context
Imagine the opportunities if …

- Configuration management information was always accurate, up to date and immediately accessible
- Maintenance information was precisely tailored to the work to be done
- Spares and inventory costs were minimized through vendor involvement in an integrated supply chain
- In-service feedback was accurate, meaningful and readily available to product designers and support managers
- Change was easy to manage
How to keep the information needed to operate and maintain a product aligned with the changing product over its life cycle?

- Product Definition Information
- Maintenance Schedules
- Tools
- Test Equipment
- Support Facilities
- Storage Requirements
- Transportation
- Consumables
- Software
- Spares
- Training
Setting the Business Context

Typical systems environment – point to point integration

Operational Objectives

5. Requirements Management

6. LSAR

7. FMECA

8. CAD

9. Product Data

10. IETM

11. Parts Supplier Database

12. Depot Maint Mgmt

13. Distribution, Transportation

14. Defects & Failure Reporting

4. Maintenance Management

Functional Requirements

1. Support Data

3. Stock Mgmt

5. Requirements Management

6. LSAR

7. FMECA

8. CAD

9. Product Data

10. IETM

11. Parts Supplier Database

12. Depot Maint Mgmt

13. Distribution, Transportation

14. Defects & Failure Reporting

4. Maintenance Management

Support Data

Part Data

Design Data

FMECA Results

LSA Data

CM Data

SM Data

Defects and Failures

Maintenance Mgt Data

Operational Objectives

Support Data

Part Data

Design Data

FMECA Results

LSA Data

CM Data

SM Data

Defects and Failures

Maintenance Mgt Data
Product Life Cycle Support (PLCS)

PLCS enables cost effective information exchanges

1. Support Data
2. Maintainers Viewing Tool
3. Stock Mgmt
4. Maintenance Management
5. Requirements Management
6. LSAR
7. FMECA
8. CAD
9. Product Data
10. IETM
11. Parts Supplier Database
12. Depot Maint Mgmt
13. Distribution, Transportation
14. Defects & Failure Reporting

Support data
Maintenance Mgmt Data
Part data
Maintenance Mgmt Data
Functional Req.
LSA Data
FMECA Results

Design Data
Design data
Tech Pub Data
Parts Data
Maintenance Mgmt Data
Distribution Data
Defects & Failures

PLCS compliant information exchanges
Product Life Cycle Support (PLCS)

The Vision

Change Directives

STEP for design/mfg

Product Structure
Product Representations
Product Performance
Support Performance
Support Environment
Failure Analysis
Maintenance Analysis
Task Resource Data

Life Cycle Data

Feed and Extract
Query
Respond

Maintain/Dispose

Use

Derived Data

Standard Commercial Transactions
eg S2000M

eg S3000L

eg S5000F

eg S1000D, SCORM

Support and Operational Feedback
Product Life Cycle Support (PLCS)

Capabilities enabled by PLCS

Product Description
Capability to define product requirements and configuration, including relationships between parts and assemblies in multiple product structures (as-designed, as-built, as-maintained)

Work Management
Capability to request, define, justify, approve, schedule and capture feedback on work (activities) and related resources.

Property, State and Behaviour
Capability that describes and captures feedback on product properties, operating states, behaviour and usage

Support Solution and Environment
Capability to define the necessary support for a given set of products in a specified environment and to define support opportunity, facilities, personnel and organizations
PLCS – The standard

- A new vision for life cycle support
- A terminology dictionary
- An illustrative process model to provide data context
- A comprehensive data model, standardised through ISO 10303-239 (STEP AP239)
  - Compatible with other modular life cycle APs
- Capability to define data exchange specifications (constrained subsets of AP239)
- Capability to tailor or extend the data model or exchange specifications using external reference data (e.g. existing standards)
PLCS – Key features

- **The Product in focus (PIF):** “what products do you want me to support?”
- A PIF will be supported by one or more support solution definitions: how to support these products
- Each **support solution definition** is based on
  - Deployment environment, with a matching
  - Support solution requirement
- **The deployment environment** defines:
  - A product group – a subset of the PIF needing tailored support
  - A usage pattern
  - A definition of the expected support organizations, locations, facilities and resources
- A **support solution requirement** is a structured requirement statement including performance metrics and targets for support performance
- **Support metrics are required to enable:**
  - Continuous optimization of support solution definition through life, based on feedback from use
  - Specification of an assessment strategy (what data to collect and how)
PLCS – Key features

- **(Each) Support solution definition includes:**
  - Task specifications and task logic (e.g. diagnostic procedures)
  - Relationship of tasks to the product configuration (including “effectivity” /“applicability” to all product versions)
  - Specification of task trigger conditions based on:
    - State of individual product (as identified by UID)
    - Usage of individual product
    - Prior task or other events
  - Identification and quantification of resources needed for each task, including a resource consumption model

- **Task specifications may:**
  - point to an existing document
  - point to an SGML document (e.g. collection of ASD S1000D modules)
  - be fully “machine readable”

- **Task specifications may be linked to resources**
  - Required resources
  - Resource items (products, people, facilities etc)
**DEXs are:**

- Subsets of the AP239 Information model
- Selected to meet a specific data exchange need
- Built from relevant modules
- Supported by usage guidance, capabilities, templates and reference data
- Can be refined from other DEXs

**DEXs may be standardized at any level (work group, company, project, organization, national, international)**

**DEXs enable**

- Consistent implementation of AP239
- Data consolidation through time
PLCS - Status

- PLCS standard published 2005 by ISO as modular STEP AP
- Modules published by ISO as Technical Specifications:
  - PDM modules
  - PLCS modules
  - AP239 information model
- First two DEX completed first Public Review
  - Task Definition
  - Aviation Maintenance
- Publication as OASIS library as new DEX are added
- Open-source DEX development environment in place

www.plcs-resources.org
PLCS – DEX developments

- **OASIS DEX**
  - Product Breakdown for Support
  - Product as Individual

- **US Army LOGSA** – 9 DEX including GEIA-STD-0007

- **Swedish FMV** – Item of Supply and SLCM

- **Norwegian DLO** – 7 Business DEX including IUID, Maintenance

- **UKMoD** – 44 business DEX defined

- **ASD Technical Data Package**

- **ASD S3000L**

- **ASD S5000F**
Current implementations

- **Norwegian frigate**
  - Extending to other NDLO programmes
  - Joint project with USMC
- **Being promoted actively for JSF (incl JSF4i)**
- **NATO/NAMSA - Nasams II**
- **Visby Corvette**
- **Gripen pilot project**
- **BAE Systems Land Systems Hagglunds**
- **Thales**
- **US DoD ELITE project for UH-60 helicopter**
  - Extending to other services as Aviation Maintenance DEX
  - Linked to UID
- **US Army deployment on HMMWV**
  - Plans for Bradley
Current implementations

- **UK MOD pilots for RAF LITS and Navy UMMS**
  - LITS mapping for eg Tornado ATTAC

- **UK MOD Logistics Coherence Information Architecture**
  - Functional model jointly developed between industry and MOD
  - Support to IPTs through central Engagement Team
  - Process support through CBIS project

- **NOLITO**
PLCS works!

- PLCS is accepted as an International Standard
- PLCS has been shown to work as designed
  - Integration architecture
  - System mapping
  - Standardised Interface
- DEX development environment available
  - Documentation
  - Guidance
- In use already
- Designed to link to other standards
  - S1000D
  - SCORM