DoD Product Lifecycle Management Initiative

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By Kevin Borek
Department of Defense
Office of Business Transformation
The Mission

The Department of Defense is chartered with maintaining a state of military “readiness” – the ability to mobilize and employ resources at a moments notice – in response to emergency or national crisis anywhere around the globe – on demand.

- DoD, at its root, is a service fulfillment organization, built upon a complex mix of engineered products, interrelated systems and relationships

- DoD isn’t a manufacturer, but configures, maintains and remanufactures products within its inventory

- Organizational emphasis is on mission vs. financial efficiency, but cost obviously matters:

  **Goal: Defense of the Nation at “Best Cost”**
A Complex Organization

The DoD is arguably the most complex enterprise in the world:

• Annual budget over $700B
• DLA spend alone over $70B annually, just in hard consumables!
• A very old enterprise, with many legacy processes
• Roughly 1.5M military service members, millions more in supporting roles
• Complex mix of weapons systems, supporting tools and equipment
• Extremely long asset lifecycle / high degree of technological dependence
• Complex organizational relationships and geographic separation

• All operating within in a Federated Bureaucracy under the direction of 500 CEOs in Washington!
The Challenge

Weapons systems are more dependent than ever upon commercially driven technologies and supporting business processes – and so are competitors

- Geographically and organizationally diverse sources of supply
- Sophisticated technologies
- Complex, interdependent organizations & development techniques
- Rapid technology assimilation & shorter product half-lives
- And….very product data-centric business processes

Synthesis is the new competitive competency

What needs to be done?
One Part of the Solution: Invest in PLM

Product Lifecycle Management (PLM) is an evolving set of business principles, organizational constructs and information management systems used in the governance of modern, technically complex and globally distributed assets.

PLM is more about how an organization manages it’s people, processes and products than any specific technology investment. It’s about how product information is managed across organizational boundaries and how people interact with this information throughout a product’s lifecycle.

As a business management technique, PLM is product (item) vs. organizationally-centric and emphasizes intellectual property management and protection across organizational boundaries in collaborative, arms-reach business engagements.
Why Emphasize Product Data & PLM?

• Modern industrial product realization is built upon a common language, with a supporting foundation of intellectual property

• All modern enterprise business systems are dependent upon this common language (ERP, PLM, MRO) for interoperation

• DoD adoption of PLM principles and alignment with the Industry PLM Value Chain will yield:
  
  • A faster technical response to evolving threats
  • Lower-risk, more cost-effective supplier relationships
  • Better integration with supply chain partners
  • Lower inventory carrying costs
  • Fewer “work-around” contracting and support strategies
  • More efficient legacy product sustainment

• Also, easily a 100B plus annualized cost savings opportunity!
What is Product Data?

Product data visibility is the foundation upon which all other business systems are built in an environment of complex engineered products.

- **Product** data is all of the intellectual property used to describe an item over its lifecycle. In PLM-managed organizations, this data is a shared, enterprise-wide available asset.

**Some examples of data include:**
- Modeling and simulation files
- Specifications
- 2D Drawings and CAD output files
- Software (firmware/hardware)
- Schematics
- Serialized configurations
- Operating instructions
- BOMs & Routings
- Maintenance instructions
- Work instructions
- Reliability / telemetry data
- Test information

**Some data generators & consumers:**
- Weapons systems development
- Weapons systems modification
- Performing field maintenance activities
- Depot-level overhaul
- Mission re-configuration
- Inventory management
- Deployment planning
- Transportation / Logistics
- Re-procurement
- Reliability and warranty functions
## Product Data Requirements

Product data requirements are determined by business process

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Data rights need to be established with partners based upon business intent

4/4/2008
The Product Data Pyramid

Contracting Agency

Tier 1 (Prime)
- Ships, Planes, Spacecraft, Vehicles, etc
- Systems Integrator
- Radar, ECMs, Weapons, Hydraulics, Propulsion, Transmissions, Control Systems, etc.

Available Product Data

Tier 2 (Sub)
- Subsystems Suppliers
- Radomes, Displays, Electronics (box/boards), Gears, Fans, Power Supplies, Antennas, etc.

Tier 3/4/5
- Component Piece Part Suppliers
- Electronic Components, Paints, Coatings, Adhesives, Metals, etc.

Feeder Materials

Problem: Generally -
- Limited data rights between suppliers
- Few data interchange formats
- Limited electronic media at lower tiers
- Paper is source at lower tiers
Enterprise View
Product Data is Both Generated and Consumed Over Lifecycle

Enterprise Data

Operations Functions
F/A Reliability
Acquisition
Supply Chain Functions
Maintenance Functions

Modeling and simulation files
Specifications
Drawings and CAD output files
Software (firmware/hardware)
Schematics
Serialized configurations
Operating instructions
Maintenance instructions
Work instructions
Documents

The product data enterprise is not necessarily the same as an “ERP”-serviced enterprise

4/4/2008
The primary objective of PLM is to establish a single-source of authoritative product data through the product life cycle.
Enterprise Catalog (Parts)

- General information about item
- Specific information about variant
- Sourcing data: Acme, United, Federated, etc.

Structured Product Information (Products: Assembled with Parts)

- Variant 3
  - Variant 2
    - As-Designed
      - Vehicle
        - Engine
        - Block
        - Carb
        - Filter XXX-1
  - As-Manufactured
    - Vehicle
      - Engine
      - Block
      - Carb
      - Glue
      - Filter XXX-1
  - As-Maintained
    - Vehicle
      - Engine
      - Filter XXX-1

Product Data Relationships are Key to Modern Enterprise Process Efficiency

Data Emphasis: Piece Part Rqmts. (DLA/ICP)
- Representative Tech. Data: Internal Specifications
- Qualification Data/Reports
- Vendor Data Sheets/Specs
- MSDS/Environmentals

Data Emphasis: Engineering Design (Contractor/DoD PMO)
- Representative Tech. Data: 3D CAD Models / 2D Drawings
- Simulation & Reliability Data
- Schematics
- Specifications & Documentation
- Engineering Parts Lists
- Software/Firmware

Data Emphasis: Manufacturing Processes (Contractor/Depots)
- Representative Tech. Data: Assembly Documentation
- Test Procedures
- Routers
- Tooling Drawings and Specs.
- Test Reports
- Manufacturing Materials Info/MSDS

Data Emphasis: Maintenance Functions (MRO/Field Support)
- IETMS/Procedures
- Performance Data/Reports
- Training Documents
- Configuration Records
- Maintenance Records

Assoc. Business Processes
- Consumables Reprocurement
- Forecasts
- Inventory Mgmt/Control
- Cost Analysis/Improvement
- Vendor Analysis

Assoc. Business Processes: Design / NPI / Acquisition
- Engineering Analysis
- Engineering Change Mgmt.
- Configuration Mgmt.
- Failure Mode Analysis
- Reliability Studies
- Cost/Performance Studies

Assoc. Business Processes: Production Management
- Mfg. Process Development
- Inventory Mgmt. & Control
- Quality Control/Improvements
- Forecasting
- Engineering Change Mgmt.
- Cost Improvement

Assoc. Business Processes: Maintenance Processes
- Configuration Management
- Reliability Studies
- Inventory Management/Control
- Forecasting
- Training

Common: Business Rules, User Authentication, Authoritative Sources, Data Views, ECP/ECN Workflows
PLM is Scalable Across the Enterprise

PDM/PLM Toolsets

Product A

Product B

Product C

Sourcing data: Acme, United, Federated, etc.

General information about item
Specific information about variant

Source Info.

Variant Info.

General Spec.

Filter XXX

Variant 3

Variant 2

As-Designed

Vehicle
  – Engine
  – Block
  – Carb
  • Filter XXX-1

As-Manufactured

Vehicle
  – Engine
  – Block
  – Carb
  – Adhesive
  • Filter XXX-1

As-Maintained

Vehicle
  – Engine
  • Filter XXX-1

As-Designed

Vehicle
  – Engine
  – Block
  – Carb

As-Manufactured

Vehicle
  – Engine
  – Block
  – Carb
  – Adhesive
  • Filter XXX-1

As-Maintained

Vehicle
  – Engine
  • Filter XXX-1

As-Designed

Vehicle
  – Engine
  – Block
  – Carb
  • Filter XXX-1

As-Manufactured

Vehicle
  – Engine
  – Block
  – Carb
  – Adhesive
  • Filter XXX-1

As-Maintained

Vehicle
  – Engine
  • Filter XXX-1
PLM and ERP are Complimentary

Flexibility to Choose your own point(s) of intersection

PLM and ERP are Complimentary

Physical & Financial Transaction Management

PLM Gateway

Flexibility to Choose your own point(s) of intersection

Intellectual Property Management

Source: UGS

4/4/2008
ERP/PLM Systems

... But the first Step is PLM!

**PLM/PDM**
- Supported Entities
  - Item/Item Revision
  - Product structure
  - Dataset with files
  - Change info – CR/CO/CN
  - Classification
  - Status info
  - Effectivity
- Process Plan
- Operation
- Work instruction
- Work area
- Resource
- Collaboration Context
- Attributes for the above
- Version/revision info
- Relations between entities

**Business Systems**
- Supported Entities
  - Materiel Master
  - Bill of Materials
  - Document info records w/ files
  - Change masters
  - Classification
  - Status info
  - Effectivity
  - Routing
  - Sequence
  - Operation
  - Work instruction
  - Work center
  - Equipment master
  - Functional location
  - Resource
  - Attributes for the above
  - Version/revision info
  - Object links between entities

Source: UGS
New & Old Need to Co-habitate! Hybrid Data Management Model

Modern OEM Design/Data Mgmt. Techniques

New Products

OEM

Modeled Designs

Design configuration controlled within PLM

OEM PLM

Legacy Products

Old Docs

Digital “Paper”

Design Modularity Federated Data Exch. Contract-Driven Data standards

Combined Products

Hybrid data management solution

Legacy Design/Data Mgmt. Techniques

DoD PLM

Technician manually loads legacy product data into PLM

Old 2D CAD

Old Config. Records

Create product structure

Fill in metadata

Load drawings

Validate load

Old & New Need to Co-habitate!

Model-driven data management
AT&L Initiatives

• **Target** a multi-year AT&L-sponsored program to modernize the business processes associated with DoD Product Lifecycle Management.

• **Evaluate** the strengths and weaknesses of current DoD processes.

• **Identify** the best commercial data management strategies/practices.

• **Establish/Manage** a comprehensive program for process modernization across the Department in conjunction with Component and Support organizational leadership.

• **Measure** outcomes from improvements in technology insertion, organizational business processes, and increased efficiencies within the Acquisition, Procurement, and Logistics enterprises.
PLM Projects: Holistic Approach

“Top-down and bottom-up” w/ emphasis on:

- **Pentagon & OSD:**
  - Organization
  - Law, policy, instruction
  - Funding
  - Acquisition reform
  - Human capital
  - Defense industry engagement

- **Support Organizations:**
  - DLA/ICPs
    - Commodity component management improvement efforts
    - Inventory rationalizations/master data cleanup
  - Support system rationalizations

- **Services:**
  - Cross-service pathfinders with selected products (MRAP, F101, etc.)
  - Weapons support model integration (CLS, PBL, organic support)
  - Weapons support data requirements & management rationalizations
Representative PLM Projects

OSD PLM Project Staff: PLM Marketing / Advocacy

– DoD Internal socialization / education of PLM “vision” & strategy
  • White papers/Presentations
  • Host/sponsor internal meetings w/Service and Support Execs.
  • Internal conferences & presentations
– Congressional advocacy & education
  • Identify specific legal, policy challenges that impede institutional PLM progress
  • Meetings w/Congressional staff and committee members with influence or allied responsibility
– External (industry, trade associations, media)
  • White papers
  • Meetings with industry leaders & DoD suppliers
  • Attend external conferences and presentations
Representative PLM Projects

OSD (Acquisition/Systems Engineering /L&MR) & Services

- Acquisition process review (comparisons & research)
  - Prescriptive process (DoD) vs. prescriptive requirements (industry)
  - Contracts, requirements comparisons within common asset classes and common suppliers
  - Identify law / policy influences over current behavior
- Guidance & Technical standards
  - DoD 5010.12-M revision
  - CDRL requirements updates (including DIDs)
  - CJCSI 3170.01F / DoD 50001 review
- Acquisition Data rights
  - Identify data deliverables by supported business processes (matrix)
  - Establish basic contract language to support data access
  - Define supporting CDRLs
- Associated business processes
  - Develop a better understanding of LSAR and other Service logistics tools and define their relationship to a commercial PDM/ERP deployment (business process list / data map / functions as compared to commercial toolsets)
Representative PLM Projects

Services:

Cross-service pathfinders currently proposed for OSD ’08 funding:

- **MRAP (DLA, Industry & Army)**
  - Map current engineering change propagation through enterprise.
  - Define optimized strategy via PLM tools (automated workflow)

- **Air Force ECSS (DLA, Industry & Air Force)**
  - Establish common business enterprise environment (org, rules, engagement strategies)
  - Populate engine tech. data, variants & configurations in common PDM repository
  - Establish common data linkages & supply chain interfaces
  - Use as beta case for inter-service PLM initiative
Conclusion: PLM is a DoD Priority!

Think like an extended enterprise!

DoD PLM investment is an organizational priority
- Ever-more complex development & support environment
- Rapidly evolving technologies and threats
- Higher dependence upon fast-moving commercial technologies

No "Silver Bullets"
- "Standards" have a place, but are only part of the solution
- Organizational vs. purely technological challenge
- A little strategy and a lot of organizational coordination, blocking, and tackling
- Teamwork and extended enterprise focus is key
- Treating suppliers as an extension of the DoD enterprise is important
- PLM needs to be linked to ERP deployments and other tool investments
- Data rights, management, and obligations need to be clearly understood

Unique DoD-specific deployment challenges not faced by commercial industry
PLM: Layman’s View

Think of a Musical Score in Relation to an Orchestra

- Notes on a staff are a common interpreted “language” (enterprise catalog)
- Assemblies of notes yield sounds (products), written onto unique score for orchestra sections – yielding different views of the music for areas of specialization (procurement, design, manufacturing, MRO, operations)
- Common timing is prescribed for the orchestra, such that sounds are executed in accordance with the plan (workflow)

- Each section works uniquely, but within cognizance of a coordinated Enterprise. This is what PLM does for an organization and this is how commercial industry innovates across organizational and geographic boundaries.
Backup Slides
DoD PLM Areas of Emphasis

Begin to address the difficult questions:

- Law, Policy and Instruction
- Enterprise organizational definition
- Complex weapons systems lifecycles & legacy data management practices
Law, Policy and Instruction

DoD operations decisions are intimately linked to Law, Policy and Instruction:

- US Code: Title 10 Armed Forces
- DoD 5000.1 Defense Acquisition System
- DoD 5000.2 Operation of the Defense Acquisition System
  - DoD 5010.12-M Procedures for the Acquisition and Management of Technical Data
- FARs – Federal Acquisition Regulation
- Congressional Depot Caucus: 50/50 rules

...and many others, not always in agreement and with some unintentional outcomes
Current legal requirements can have significant impact on DoD PLM implementation:

- Asset ownership / management responsibility
- Systems acquisition processes
- Intellectual property ownership
- Legacy government-specific data formats
- Congressionally mandated maintenance & support requirements
Define the DoD PLM “Enterprise”

Evolving missions, technologies and threats are driving greater demand for joint Service engagement and improved process efficiencies

But, how does one define a PLM-serviced “Enterprise” within DoD?

- By Service Component – like a corporate division?
- By product vertical (aircraft, ground vehicles, turbines, etc.)
- By support organization (DLA, AMC, ALC, Depot, etc.)
- By geographic region?
- All of DoD – like a corporation?
- Include supply chain partners? What about foreign Gov. partners?

- Fortunately, the product data management enterprise is somewhat independent of the service fulfillment enterprise, allowing for some flexibility.
Product-Centric vs. Service-Centric
PLM Enterprise

• **Advantages**
  – Common “face” to contractor community & field (both real and virtual)
  – Tighter contractual relationships
  – Less confusion & stronger data rights story (IR&D vs. DoD-funded, CDRLs)
  – Common product data management environment
  – Better asset visibility and controls
  – Simplified cross-service support
  – Reduction in associated costs of service duplication & improvements in operational efficiencies
  – Simplified 3rd party support (CLS, PBL, etc.)
A Complex Lifecycle

Average life-expectancies of complex weapons systems are easily 15 years plus. In some cases (aircraft, vehicles) it isn’t uncommon for assets to be 25 or 30 years old, with all attendant problems.

PLM Challenges:
• New and old inventory with mixed data, maintenance and deployment strategies
• Configurations to support mission-specific tasks
• Geographic separation
• Ownership of data management responsibility “shifts” with asset age
• New inventory product data management
• Remanufactured product data management
• Need to support rapid technology insertion
New Products……

Supply Chain Pyramid

Need to maintain alignment between product revisions & configurations

- Data access (rights, format)
- CM synchronization

Many Impacts on Systems Availability
Eventually Become…Legacy Products!

Existing product inventory:
• Legacy data availability & format
• Configuration availability/accuracy
• Information in 100’s of different, often uncoordinated places

Supply chain “pyramid” direct-to-DoD sales
With Government Unique Data Formats

Even with PLM, modern OEM design techniques…

Need to adopt modern design and mfg. data requirements in CDRLs

Drawings only – no 3D
Loss of config with OEM

…can lead to stranded legacy DoD data!