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Standards-based Product Lifecycle Management – STEP into PLM

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Presented at the SME WESTEC 2004 – New Frontiers in Manufacturing Technology Conference, Los Angeles, CA
March 23, 2004

Outline

- What is PLM?
- Examples of lifecycle data
- Need for PLM
- Commercial Solutions
- PLM for DoD acquisition lifecycle
- Need for standards
- Recommended standards
- Notional architecture
- Benefits/ Limitations
- Conclusions

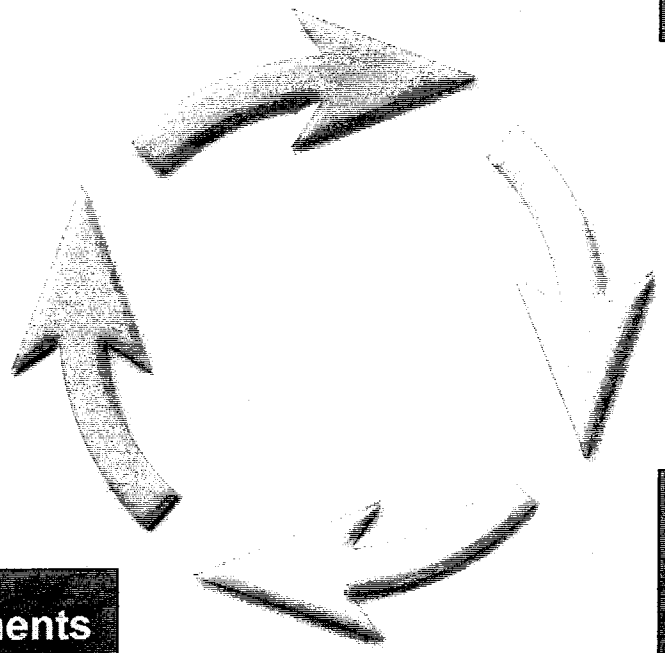
What is PLM?

- **Product Lifecycle Management (PLM)** is an integrated, information-driven approach to all aspects of a product's life, from its conceptual design through manufacture, deployment and maintenance—culminating in the product's removal from service and final disposal.
- PLM software suites enable accessing, updating, manipulating and reasoning about product information that is being produced in a fragmented and distributed environment.
- Another definition of PLM is the integration of business systems to manage a product's life cycle.

Stackpole, B. (2003, May 15, 2003). There's a New App in Town. CIO.

PLM = People + Software + Processes

Examples of lifecycle data



Analysis
-FEA, CFD
-Virtual Prototyping
-Inspection

Manufacturing
-Process Planning
-Numerical Control

Product Design
-2D Drawings
-3D CAD models
-Assemblies
-PDM

Sales/ Marketing
-Procurement
-Tech Data Packages

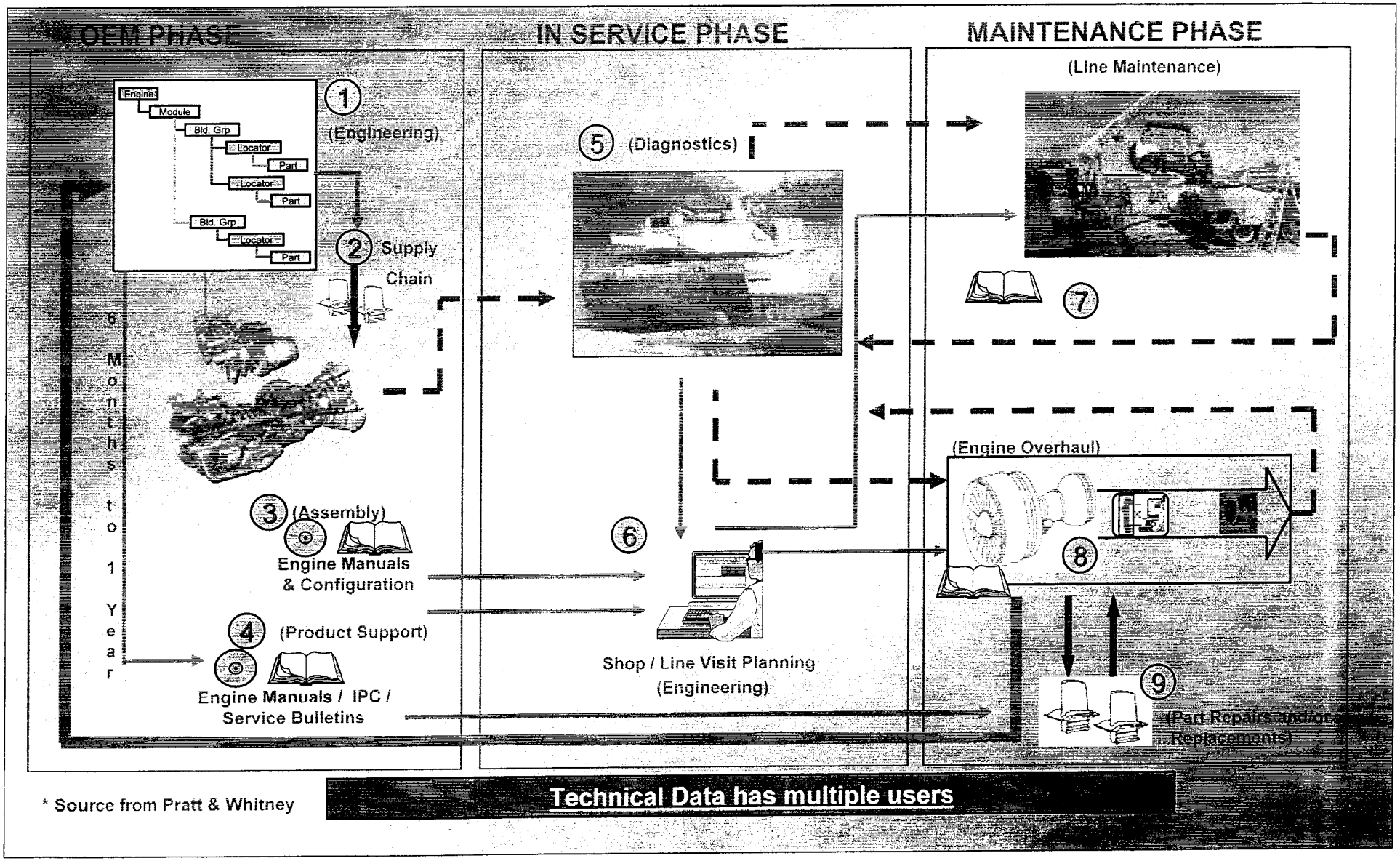
Concept Design
-3D Concept models
-R&D Studies

Sustainment
-Repair Analysis
-Spare Parts Manufacture
-Maintenance Mgmt.
-Failure Analysis

Requirements
-User's SOO
-SOW
-Other documents

Disposal
-Environment Laws
-Recycling Data

Example


OEM PHASE
IN SERVICE PHASE
MAINTENANCE PHASE
(Line Maintenance)
Engine
Module
Bld. Grp
Locator
Part
Locator
Part
Bld. Grp
Locator
Part
1
(Engineering)
2
Supply
Chain
5
(Diagnostics)
7
6 Months to 1 Year
(Engine Overhaul)
3
(Assembly)
Engine Manuals
& Configuration
6
8
4
(Product Support)
Engine Manuals / IPC /
Service Bulletins
Shop / Line Visit Planning
(Engineering)
9
(Part Repairs and/or
Replacements)
* Source from Pratt & Whitney
Technical Data has multiple users

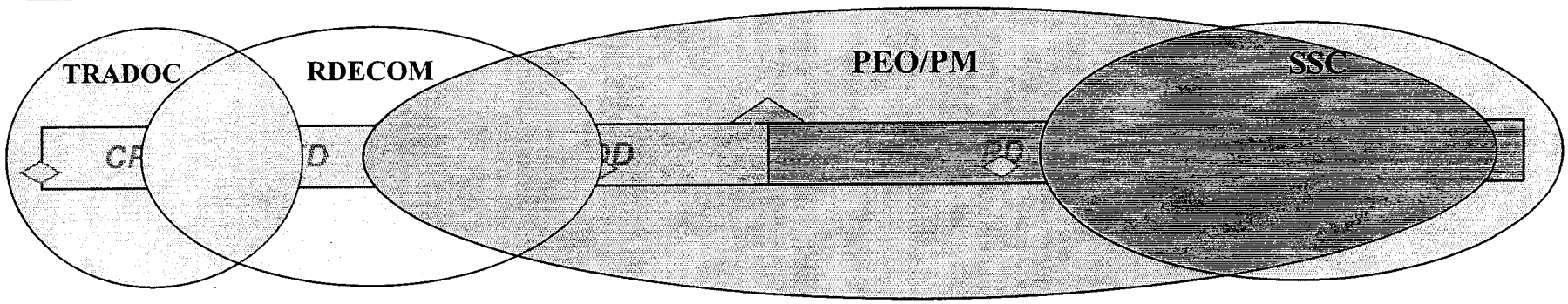
Need for PLM

- Integrate product data throughout the supply chain
- Manage and control product data – store once, use many times
- Improve business efficiency
  - Reduce time to market
  - Shorter cycle and lead times
  - Improved productivity

Commercial solutions

- ERP-based
  - SAP
  - MatrixOne
  - Agile
- CAD-based
  - Unigraphics PLM Solutions
  - IBM-Dassault PLM Solutions
  - PTC

PLM for DoD acquisition lifecycle



CONCEPT EXPLORATION
Analysis of Alternatives
Operational Analysis
Business Process Reengineering

COMPONENT ADVANCED DEVELOPMENT
Advance Concept Tech Demo
Systems Architecture Developed
Component Technology Demo

SYSTEM INTEGRATION
System Definition Effort
Preliminary Design Effort
Functional Baseline
Allocated Baseline

SYSTEM DEMONSTRATION
Product Baseline
Detail Design Effort

LRIP – RATE
Establish Manufacturing Capability
Low Rate Initial Production
Initial Operational Test and Live Fire Test
Full Rate Production
Deployment
Tech Manual Development

SUSTAINMENT
Block Modifications
Engineering Change Proposals
Evolutionary Requirement Development
Test and Evaluation

DISPOSAL
Environmental Compliance

Need for standards

- Interoperability
  - CAD-CAD
  - PDM-PDM
  - PLM-PLM
- Open non-proprietary data formats
- Not tied to a specific software solution
- Easier to handle legacy data
- Potential long term solution to archive product data

Recommended standards

- ISO 10103 – Standard for Exchange of Product Data (STEP)
- STEP is made up of several separate protocols (called Application Protocols – AP) covering a wide spectrum of engineering design
- Is already widely used to exchange 3D solid models (AP 203)
- Protocols for other product data types in development

STEP on a page

ISO TC184 SC4

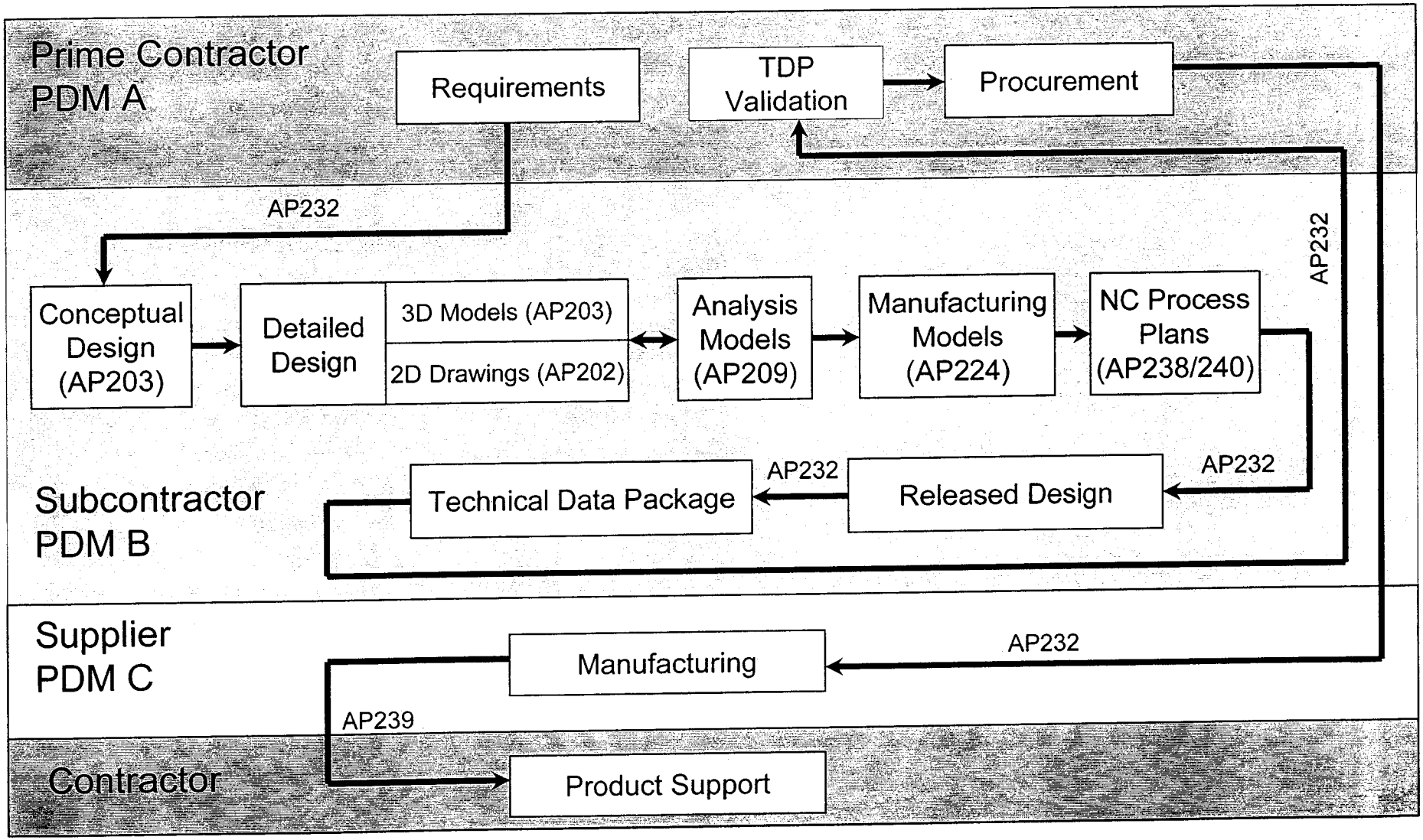
STEP on a Page

ISO 10303

APPLICATION PROTOCOLS AND ASSOCIATED ABSTRACT-TEST SUITES

I 201 Explicit draughting [ATS 301 - X]
I 202 Associative draughting [X]
I 203 Configuration-controlled design (e2+La1+D)[X]
I 204 Mechanical design using boundary rep [I]
X 205 Mechanical design using surface rep [W]
X 206 Mechanical design using wireframe [X]
I 207 Sheet metal die planning and design [I]
X 208 Life-cycle product change process [X]
I 209 Composite & metal structural anal & related design[X]
I 210 Electronic assy, interconnection & packaging design [X]
X 211 Electronic P-C assy: test, diag, & remanuf][X]
I 212 Electrotechnical design and installation [C]
X 213 Num control (NC) process plans for mach'd parts [X]
I 214 Core data for automotive mech design processes (e2+ED)[F]
E 215 Ship arrangement [X]
E 216 Ship moulded forms [X]
X 217 Ship piping [X]
E 218 Ship structures [X]
X 219 Dimension inspection [X]
O 220 Proc. plg, mfg, assy of layered electrical products [X]
C 221 Functional data & their schem rep for process plant [X]
X 222 Design-manuf for composite structures [W]
X 223 Exch of design & mfg product info for cast parts [A]
I 224 Mech pdt def for p. plg using mach'n'g feat (e2+X,e3+A)
I 225 Building elements using explicit shape rep [C] [X,I]
X 226 Ship mechanical systems [C]
I 227 Plant spatial configuration(e2+C) [X]
X 228 Building services: HVAC [X]
X 229 Design & mfg product info for forged parts[X]
X 230 Building structural frame: steelwork [X]
X 231 Process-engineering data [X]
I 232 Technical data packaging: core info & exch [I]
W 233 Systems engineering data repr (to be PAS 20542)[X]
X 234 Ship operational logs, records, and messages[X]
W 235 Materials info for des and verif of products [X]
W 236 Furniture product and project data[W]
W 237 Computational Fluid Dynamics
A 238 Computer numerical controllers
W 239 Product life-cycle support
W 240 Process plans for machined products

Notional architecture



Limitations

- STEP standards are still evolving
- Standards not available for all types of product data
- PLM vendors will need to support STEP standards
- Configuration management between native and STEP files could be a problem
- Potential loss of data through translators
- Need ERP systems to support STEP as well

Conclusions

- PLM recognized as essential for large enterprises to efficiently manage lifecycle product data
- Companies will use best of breed solutions
- Standards essential for interoperability in the supply chain
- STEP standards are still in infancy but hold great potential

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