White Paper
CMII-650C

PLM Improvements Needed to Support CMII Baselines

CMII History and Lessons Learned
Enabling PLM Tools and Lessons Learned
An Assessment of Six Leading PLM Tools
Needed: As-Planned/As-Released Baselines

©CMII Research Institute 1986-2015
Revision C: Released April 17, 2015
Vincent C. Guess
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
<td>2</td>
</tr>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>CMII History and Lessons Learned</td>
<td>3</td>
</tr>
<tr>
<td>Enabling PLM Tools and Lessons Learned</td>
<td>4</td>
</tr>
<tr>
<td>PDM/PLM Tools Must Support CMII Baselines</td>
<td>5</td>
</tr>
<tr>
<td>Business Process Infrastructure and Baselines</td>
<td>6</td>
</tr>
<tr>
<td>As-Planned/As-Released Baselines</td>
<td>7</td>
</tr>
<tr>
<td><strong>Six PLM Tool Assessments</strong></td>
<td>8</td>
</tr>
<tr>
<td>ARAS's PLM Tool Innovator</td>
<td>9</td>
</tr>
<tr>
<td>Siemen's PLM Tool Teamcenter</td>
<td>10</td>
</tr>
<tr>
<td>PTC's PLM Tool Windchill</td>
<td>11</td>
</tr>
<tr>
<td>Dassault's PLM Tool Enovia</td>
<td>12</td>
</tr>
<tr>
<td>Oracle's PLM Tool Agile</td>
<td>13</td>
</tr>
<tr>
<td>Autodesk's PLM Tool 360</td>
<td>14</td>
</tr>
<tr>
<td>Conclusions</td>
<td>15</td>
</tr>
<tr>
<td>Course of Action</td>
<td>15</td>
</tr>
</tbody>
</table>
Introduction

A Product Lifecycle Management (PLM) tool is comprised of integrated modules of functionality. This white paper focuses on the module most essential for supporting the CMII model. It is called an As-Planned/As-Released (AP/AR) Baseline module. It must support all types of as-planned/as-released baselines including an enterprise baseline, product baselines, facility baselines and so on.

Some PLM tools have fixed baselines, but not AP/AR Baselines. Most have a Requirements Management (RM) module for linking customer requirements to internal items and documents. It is not an acceptable alternative to an AP/AR Baseline. This paper assesses six of the leading PLM tools and their ability to support the requirements for CMII AP/AR Baselines.

CMII History and Lessons Learned

CMII evolved in a company that was struggling with quality, schedule and cost problems. The problems were eliminated through development and application of the CMII Business Model and supporting principles, including the AP/AR Baseline and integrated closed-loop change process.

CMII promotes the ability to change faster and document better — it enables organizations to accommodate change and keep requirements clear, concise and valid. Those who cannot do so have no choice but to operate in the corrective action mode, wherein most spend over 40% of their resources on intervention.

FIRST LESSON LEARNED: When documented requirements are clear, concise and valid, quality, schedule and cost problems go away.
SECOND LESSON LEARNED: To accommodate change, the information being changed must be properly identified, structured, linked and owned.

To improve is to change

Deficient Requirements → Quality Problems → Schedule Delays → Cost Overruns
Enabling PLM Tools and Lessons Learned

PLM tools are systems comprised of integrated modules of functionality. Each module may provide multiple features. A bill of material module, for example, may have a feature that enables BOM comparisons.

PLM systems evolved from Product Data Management (PDM) tools. PDM tools are designed to interface with Computer Aided Design (CAD) tools. PLM systems are an integration of the PDM functionality with other modules of functionality such as project management, change management and so on.

The implementation of a complex PLM or ERP system often fails to meet expectations. About half of the implementations are outright failures or achieve less than 50% of the intended features. The Requirements Management module is oftentimes a major contributing factor in PLM failures. Most RM modules are complex and hard to use. Simply linking customer requirements to internal items and documents does not make requirements clear, concise and valid.

Evolution of Enabling Software Tools

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MRP</td>
<td>MRP II</td>
<td>ERP</td>
<td>EDM</td>
<td>PLM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Data Management Module</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMII/IPE Training and Certification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLM Tool</td>
<td>Assessment and CMII Certification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

White Paper CMII-650C
PLM Tools Must Support CMII Baselines

As-planned/as-released baselines are "moving baselines" and the keystone to the CMII Model. Each baseline is a structured index and gateway to all information pertaining to an entity. An enterprise baseline, as shown below, includes the information in the column on the left. An end-item product baseline includes the information in the column in the center. Information systems and facilities have their own baselines.

PLM tools typically provide for product baselines, but ignore the most important enterprise baseline. Most have a "requirements management" module, but no AP/AR baseline module. The value of a PLM tool would be greatly enhanced if it included an as-planned/as-released baseline module fully integrated with a closed-loop change module per the CMII Model.
Process Infrastructure and Baselines

The power of the CMII Model lies in its ability to accommodate change and keep requirements clear, concise and valid. This capability is derived from the business process infrastructure, which includes as-planned/as-released baselines closely coupled with a closed-loop and fast-track change process. This is where PLM tools can provide the most value and where the opportunities for improvement are most notable.

![Core Business Processes and Business Process Infrastructure](image)

- Strategic Business Plan
  - 1.0 As-Planned/As-Released Baselines
  - 2.0 4-Tier, 9-Step Development Process
  - 3.0 Naming, Numbering and Reuse
  - 4.0 Data and Record Integrity
  - 5.0 Document Validation & Release Records
  - 6.0 Changes and Revision Records
  - 7.0 As-Built Records
  - 8.0 Information Systems
- 9.0 Facilities and Asset Management
- 10.0 Security, Safety and Environmental
- 11.0 Business Program Management
- 12.0 Research and Development Engineering
- 13.0 Marketing, Sales and Contracts
- 14.0 Supply Chain Management
- 15.0 Order Fulfillment and Verification
- 16.0 Support, Operation and Maintenance
- 17.0 Human Resources and Training
- 18.0 Financial Accounting and Reporting
- 19.0 Process Oversight and Internal Audit
As-Planned/As-Released Baselines

To understand AP/AR baselines and their applications, it is necessary to understand hierarchies and work flows. Baselines reside in the PLAN phase and ECNs used to upgrade baselines reside in the ACT phase of the project management cycle.

A product baseline is a precise representation of what that product is to be. An as-built product must conform to its documented and baselined requirements which are specified on the work authorization in the DO phase.
Six PLM Tool Assessments

- ARAS's Innovator
- Siemen's Teamcenter
- PTC's Windchill
- Dassault's Enovia
- Oracle's Agile
- Autodesk's PLM 360

The enclosed assessment information is from their websites
# ARAS's PLM Tool Innovator

## Industries Supported
- Aerospace and Defense
- Automotive
- Consumer Goods
- Education
- Food and Beverage
- Government
- Healthcare
- High Tech Electronics
- Industrial Manufacturers
- Medical Devices
- Pharmaceutical
- Transportation and Logistics

## Innovator PLM Modules/Features
- BOM Management
- CAD File Management
- Component Engineering
- Configuration Management
- Document Management
- Engineering Change Management
- Environmental Compliance
- Fashion and Apparel
- Formula and Recipe Management
- Global Product Development
- Lean Product Development
- Maintenance and Calibration
- Manufacturing Process Planning
- Mechatronics
- Microsoft Office Connector
- New Product Introduction
- Outsourced Manufacturing
- Part Traceability
- Product Costing
- Product Data Management
- Product Engineering
- Program Management
- Project Management
- Quality Planning
- Regulatory Compliance
- Requirements Management
- Risk Management
- Supplier Corrective Action
- Supply Chain Management
- Systems Engineering
- Tooling Management
- Variants and Options
- Visual Collaboration
- Visualization Digital Mockup

## Standards Supported
- APQP
- CAPA
- CMII
- CMMI
- DFSS
- DFX
- FDA
- FMEA
- ISO
- Lean
- NPD
- PDM
- PMI
- REACH
- RoHS
- STEP

## One Common Platform

## No AP/AR baseline module. No enterprise baseline.
## Siemens PLM Tool: Teamcenter Unified or just Teamcenter

### Industries Supported
- Aerospace and Defense
- Apparel
- Automotive and Transportation
- Consumer Products and Retail
- Electronics and Semiconductor
- Energy and Utilities
- Federal Government
- Footwear and Accessories
- Industrial Machinery
- Life Sciences
- Marine
- Medical Devices

### Teamcenter PLM Modules/Features
- Engineering Data Mgmt (MCAD, CAM, CAE, etc.)
- Product Data Management (PDM)
- Engineering Structure & Configuration Mgmt
- Engineering Change & Process Mgmt
- Document Management & Technical Pub.
- Business Intelligence
- Integrated 2D/3D visualization & Digital Mkup
- Tailored Industry Solutions

### Standards Supported
- Not Stated

### One Common Platform with Overlay Template per Industry

### No AP/AR baseline module. No enterprise baseline.

### Diagram

```
2000
IMAN
Teamcenter Engineering

2012
Metaphase
Teamcenter Enterprise

2012
Teamcenter
Teamcenter Unified

White Paper CMII-650C
Page 10
```
PTC's PLM Windchill/PDM Link

Industry Orientation
Windchill is industry agnostic in that it is not designed to support a particular industry

Windchill PLM Modules/Features
- Mechanical Design Integration
- Electrical CAD Integration
- Variant and Product Family Design
- Change Management (per CMII)
- Configuration Management
  Emphasis on CAD BOM, EBOM and MBOM
- Integrated Requirements Management
- Manufacturing Process Management
- Outsourcing Support
- Design Verification and Validation
- Manufacturing Process Management
- Retail and Customer Product Support
- Document Management

One Common Platform

Standards Supported
Not Stated

PTC Tutorial: Understanding the CMII Change Process
The Windchill PDM Link change management process adheres to the CMII industry standard closed-loop change process, including terminology. This referenced model emphasizes the fundamental shift from controlling change to accommodating change. Simply put, to change faster and document better.

- PTC

No AP/AR baseline module. No enterprise baseline.
Dassault System's PLM Tool Enovia

**Industries Supported**

All 11 serviced by DS
- Aerospace and Defense
- Automotive and Transportation
- Consumer Packaged Goods
- Fashion and Apparel
- High Tech and Semiconductor
- Industrial Equipment
- Life Sciences
  plus 4 others not listed

**Enovia PLM Modules/Features**

- Portfolio Configuration Management
- Requirements Management (Central)
- Program Management
- Decision Support Business Intel
- Compliancy
- Supply Chain Network
- Collaborative Sourcing
- Supplier Performance Monitoring
- IP Work in Progress
- IP Asset Release
- IP Classification and Reuse
- Data Warehouse Indexing and Search
- Business Process Management & Execution
- IP Asset Federation
- I-PLM Collaboration Studio

**One Common Platform**

**Standards Supported**

Not Stated

**No AP/AR baseline module.**  **No enterprise baseline.**
Oracle's PLM Tool Agile

Industries Supported

Not Stated

Standards Supported

Not Stated

Agile PLM Modules/Features

Product Lifecycle Management
- Product Collaboration
- Product Portfolio Management
- Product Governance & Compliance
- Engineering Collaboration
- AutoVue Enterprise Visualization
- Product Quality Management
- Product Lifecycle Analytics
- PLM Cloud Strategies

Product Lifecycle Management for Process
- Formulation and Compliance
- New Product Development
- Product Data Management
- Product Supplier Collaboration
- Product Quality Management
- Product Lifecycle Analytics
- PLM Cloud Strategies

Engineering Data Management
- Product Data Management
- Document Management
- Configuration Management

Enterprise Data Quality

No AP/AR baseline module. No enterprise baseline.
### Industries Supported
- Automotive
- Building Products/Equipment
- Consumer Products
- Industrial Equipment

### Autodesk PLM 360 Modules/Features
- BOM Comparison
- BOM Cost Rollup
- BOM Management
- Change Notifications
- Change Management
- Change Request and Change Order
- Change Traceability
- Component and Product Visualization
- Corrective and Preventive Actions
- Cost Management with ERP
- Cost Reporting
- Design & Production Revision Control
- Inspection Planning
- New Product Introduction *(Proj. Mgmt)*
- Supplier Collaboration
- Supplier Review
- Systems Engineering
- Quality Management
- Quality Management Reporting

---

**One Common Platform**

**Standards Supported**
- Not Stated

---

No AP/AR baseline module.  No enterprise baseline.
Conclusions

Although four of these six PLM tools currently hold CMII certification, those certifications have not been renewed as the PLM providers rolled-out later and later versions of their tool. The ability of the current version of these tools to support the CMII Model and its key elements of:

- As-Planned/As-Released Baselines, combined with
- An integrated closed-loop change process, including
- Fast-Track process capability, and
- Documented requirements co-owned by creators and users

has not been confirmed by an updated CMII assessment.

At the time of certification, the tool providers demonstrated the functionality required to support as-planned/as-released baselines. In some cases, that was 10 years ago. Their current capabilities are not promoted to customers. They are not highlighted on their website. The robustness of this capability is unknown and is essential for a successful implementation of the CMII Model.

The requirements for PLM tools to support an enterprise baseline were established after most tools achieved their initial certification. Those certifications confirmed the tool's ability to support product baselines, but not an enterprise baseline. A key objective of the reassessment process is to confirm the PLM tools ability to support all types of as-planned/as-released baselines.

Course of Action

The PLM tool assessment and certification process has been updated and streamlined. Assessments will be performed per CMII-600 PDM/PLM Tool Assessment Guide and Report released on March 9, 2015. Per this guide, PLM tool assessments must be led by a tool provider's employee who is CMII-certified at the CMIIA or CMIIP level.

This accomplishes three objectives.

- Each tool provider will have at least one CMII professional on their staff.
- Tool providers can easily update their certification status.
- The listing of CMII-certified PLM tools and their ratings as posted on ICM's website at (www.icmhq.com) will always be current.