Achieving Operational Excellence thru Continuous PLM/CAx Improvement

PLM – it’s not just a tool

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Engineering Processes and Tools
ATK Aerospace
ATK’s vision is to create *leadership positions* in our aerospace, defense, and sporting markets through application of *affordable innovation* and *execution excellence* in developing and manufacturing *highly engineered* products to generate *superior shareholder returns* over time.

### The Customers and Markets We Serve

<table>
<thead>
<tr>
<th>Aerospace</th>
<th>Defense</th>
<th>Vista Outdoor, Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Aerospace</td>
<td>Satellites, Satellite Components &amp; Subsystems</td>
<td>Sporting Ammunition</td>
</tr>
<tr>
<td>Satellite &amp; Strategic Launch</td>
<td>Small-, Med-, Large-Caliber, Ammunition</td>
<td>Sporting &amp; Tactical Accessories</td>
</tr>
<tr>
<td>Human Space Exploration</td>
<td>Strike Weapons &amp; Missile Warning Systems</td>
<td>Law Enforcement Ammunition</td>
</tr>
<tr>
<td></td>
<td>Facility Management</td>
<td>Sporting Long Guns &amp; Range Systems</td>
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ATK operates in 21 states, Puerto Rico, and internationally.
Agenda

• Center of Excellence (Organizational)
  • Business Challenge – Deploy a single system and single source of truth across ATK

• Model Based (Product) Excellence
  • Business Challenge – Shorten the product development lifecycle and reduce the cost of a Rocket Motor

• Process Excellence
  • Business Challenge – Shorten the product development lifecycle again
Teamcenter, single source of truth across ATK

Cost per User and ATK System Capability

ATK Teamcenter Center of Excellence

- Strong, fully functioning ATK-wide governance model in-place
- Critical mass for effective implementation
- Rapid deployment delivers major cost savings
- Sharing of best practices and common processes
- Promotes commonality, collaboration and secure access
- Knowledge capture and sharing through single system
Difficult to get significant competitive advantage technically
Programs today are driven by a significant element of cost and schedule

Competitive Triad

Same:
• Laws of Physics
• Materials
• Suppliers
• Tools

Ideal State

ATK Past State
2D Drawing Delivery, Model Nightmare (DBE to MBE)
Source of Truth: from Drawing to “2D with 3D Model”

- Command Media
- Standard Work
- Digital Verification
- Checkmate
- Vaulted Checklist
- Signatures
- Certified Modeler
- Examination
- Continuing Education
- 2D Associated with 3D
Delivery Change from Drawings to Models

<table>
<thead>
<tr>
<th>Company</th>
<th>CAD System</th>
<th>VI Modeling Time</th>
<th>As Received</th>
<th>Envelope File Size</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td># Files</td>
<td>File Size</td>
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<tr>
<td>Company A</td>
<td>ProE</td>
<td>16 man-weeks</td>
<td>8,600+</td>
<td>4.3 GB</td>
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<tr>
<td>Company B</td>
<td>ProE</td>
<td>3 man-weeks</td>
<td>4,500+</td>
<td>3.1 GB</td>
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<tr>
<td>Company C</td>
<td>ProE</td>
<td>2 man-weeks</td>
<td>1,100+</td>
<td>274 MB</td>
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<tr>
<td>ATK Aerospace</td>
<td>NX</td>
<td>1 man-week</td>
<td>1</td>
<td>29 MB</td>
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</table>

Note: (Customer used ProE as their Native CAD System)
Integration of E-CAD with M-CAD

**Schematic (logic) – E-CAD**
- Pin number
- Connector
- Wire type
- Data bus couplers
- Lugs
- Shields
- GEI solder shield

**Model (physical) – M-CAD (NX)**
- Bundle diameter
- Length/angle
- Weight
- Braided jacket
- Parts list (BOM)
  - Connectors
  - Backshells (BD)
  - Wire (gauge, color)
  - Marker (BD)
  - Tape, solder shield, heat shrink, etc.

**Formboard (manufacturing)**
- Cable manufacturing

**Release Vault:**
- Released schematics (Zuken E³)
- E-CAD logic file (Zuken E³)
- M-CAD logic file (Siemens NX)
- Released drawings (Siemens NX)
- Released models (Siemens NX)
- Released parts list/BOM (Siemens NX)
- Released notes (MS Word)

**Integration of E-CAD with M-CAD**

Information passes from NX model

E-CAD Logic passes from Zuken E³ (*.plmxml)

M-CAD Logic passes from Siemens NX (*.xml)

- Drawing (prt)
- Released notes (MS Word)
Cables – Physical vs. Virtual

ATK Launches Rocket Design with Intelligent E-CAD/M-CAD Solutions

Intelligent CAD Prototype

Physical Prototype
MBE / PMI – Great Benefits

Contract Changes / New Programs allow PMI Delivery (and JT’s)

Analyses Direct from Controlled Models

Manufacturing from Released PMI Model

JT Models & tablets on Factory Floor

This item with Notes and Export Control Statements is shown as an example only, and is NOT ATK released Engineering definition.
Changes makes isolation more apparent and verification more difficult.

Communication is impaired because systems don’t talk to each other – instead relying on human intervention.
Requirement Flow Through Design

System Requirements

Design Requirements

Design

Requirement Validation

Requirement Validation

Design

Validation

Requirements

Design Driven Requirements

Quality

Requirement Status Report

- Passes all
- Passes all w/ info
- Fails w/ warning
- Fails critical (error)
Improving Flow – Process Excellence

Past Condition

We push

- Reschedule
- Date hockey
- Push harder!

We multitask

Problems are not visual

Many tasks are stopped

Ideal State

 Tasks are visual including stops!

We pull

We stay on task

Leaders level work and solve problems

- Projects ready to start
- All upstream processes complete

Ready

Doing (3)

Stuck

Done

Personal Kanban

Leaders level work and solve problems
Rapid Learning Cycle Product Development

Benefits:
- Immediate focus & resolution of critical path items
- Enhanced cross-functional communication
- Clear short-term expectations
- Team accountability
- Reduction of changes
- Increase in design fidelity
- Celebrate success – sense of accomplishment

Key:
- Formal Baselines
- Informal Baselines

[Diagram showing the cycle with milestones such as PSR, SRR, SDR, PDR, CDR, and cycle time reduction indicated.]
Configuration Management
a Business Enabler rather than a Cop

CMII + Teamcenter PLM = Business Process Excellence

- Drawing Trees / Drawing Trees are not understood/utilized
- Not changing part numbers for known non-interchangeable changes
- Misuse of part numbers
- Design numbers used for processes materials
- Baselines
- Change management
- Audits (internal and external)
- No part numbers
- Drawings released as memos
- Change tracking, status, and history
- Baseline records and historical information

CM Revitalization with CMII Foundation!

Identification
- Define product requirements
- Configuration documentation (drawings, specifications, ICDs, FMEA/CIL, D&V plan, etc.)
- Product identification (part numbers, traceability numbers, item master data, etc.)
- Product structure (drawing trees)
- Document identification
- Baselines (as-designed, as-planned, as-built, etc.)
- BOM

Change Management
- Change proposals (internal and external)
- Classification
- Evaluation and coordination
- Documentation
- Implementation and verification
- Baseline departures (deviations and waivers)

Status Accounting
- Product and document records and data management
- Change tracking, status, and history
- Baseline records and historical information

Reviews and Audits
- Major design reviews (PRR, PDR, CDR, etc.)
- Audits (internal and external)
Summary

Global Product Data Interoperability Summit | 2014

Organizational Excellence

Product Excellence (MBE)

Next Steps:
• Analysis process efficiencies and configuration management
• Utilization of the rich product information on the factory floor

Process Excellence