The Army’s Implementation of a Net-Centric Model Based Enterprise

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Purpose: This program seeks to develop, deploy and integrate Model Based Enterprise technologies and processes within the Army's organic base to reduce acquisition costs, risks and lead times

Major Capabilities:
1) Enterprise adoption of mature product data tools to include: Fully-annotated models, 3DPDFs, Digital Work Instructions for manufacturing operations, 3D model validation, 3D based technical publications and 3D based engineering analysis tools.
2) Development and deployment of technical and business processes to support the MBE tools described above.
3) Development and implementation of a Product Data Management system to support the management of data elements throughout the acquisition lifecycle between engineering service agencies, Product Managers, Depots and the defense manufacturing base.
4) Development of standard’s based MBE technologies that allow for the free dissemination and reuse of product data elements within the organic and industrial base.

Warfighter Operational Benefits:
- Reduced training time for field level installation
- Access to relevant product data to support operations
- Reductions in Mean Time to Repair (MTTR)
- Improvements in parts availability

Transition:
- JPO MRAP: TOW-GPK Installation Instructions, 3Q FY12
- PM-SW: CROWS -01 and -05 IETMs, 1Q FY13
- PM-SW: M2A1 Quick Change Barrel 3DTDP, 2Q FY13
- PM-CCS: Service Information Center for Rhino, 2Q FY14
- PM-GCV: Development of RFP language, 2Q FY13

MBE is an enabling capability that drives out acquisition costs
BLUF:
Summary of Major Achievements

• Development and implementation of fully-annotated CAD models
  – Modeling SOP has been adopted by the ARDEC enterprise and has been shared with TARDEC as well.
  – Fully Annotated modeling has been done for the M2A1 and several Spark II Mine Roller Interface brackets (Bradley & Max-Pro)

• Establishment of a CAD validation capability
  – Validation ensures that CAD data can be used to drive manufacturing operations
  – Currently using the established processes to validate the M2A1 Quick Change Barrel 3DTDP

• Creating a 3DTDP for PM-SW’s M2A1 Quick Change Barrel
  – A modern and consistent product definition reduces manufacturing risk and cost
  – The final 3DTDP, to include manufacturing process data, will be used in the upcoming procurement action

• Animated Digital Work Instructions for fielded systems
  – M153 Common Remote Weapon Station: Interactive Technical Repair Manual will be provided to Warfighters to reduce MTTR
  – TOW-GPK: Installation Manuals have been fielded to reduce War fighter assembly times
  – M2: Digital DMWR will reduce training times for new or cross-trained operators at ANAD
  – Max-Pro Dash Interface brackets: Documented assembly and weld processes reduced manufacturing risk for industry

• Deployed a pilot Enterprise Product Data Management (ePDM) environment
  – Created a Windchill 10.1 instance at ARDEC’s PIF
  – Created areas for M24A1, Kiowa Helicopter and M2A1 products
  – Serving as a body of knowledge for AMC’s ePDM initiative.
**BLUF:**

**Major Activities in Process**

- **Create and Deploy a Service Information System (SIS) to support logistics operations**
  - The SIS will be an HTML portal where soldiers can access 3D, interactive logistics data
  - Reductions in assembly time, training and MTTR are feasible under this effort
  - TTA signed with PEO-AMMO

- **MIL-STD-31000: A new product data standard**
  - Will help the acquisition community obtain 3D data from OEMs
  - Provides the basis for standardizing and modernizing the Army’s technical data
  - Helps to ensure that product data can be used to drive manufacturing during sustainment

- **Implementation of MBE capabilities at ANAD**
  - Generation of an MBOM for the M2A1 using MPM-Link
  - Updating and modernizing shop-floor procedures for the M2A1 conversion process
  - Training ANAD Tech Pubs personnel on Digital Work Instruction software

- **Interactive Electronic Technical Manual for installing the SPARK II**
  - Reduce operator training times
  - Reduce SPARK II installation times in theatre

- **Evaluate and implement reverse engineering technologies**
  - Enables the Army to develop 3DTDPs from physical hardware
TECHNICAL INFORMATION ON MBE CAPABILITIES
Proven Technology and Process:

- Mature Fully-Annotated Modeling Standard Operating Procedure
- Over 100 M2A1 models have been complete
- 2 major protection roller interface brackets are complete
  - Bradley Fighting Vehicle
  - Max-Pro Dash MRAP Vehicle.
3D Technical Data Packages

“Prototypical” 3D TDP
Using the standard 3DPDF format
3D Technical Data Packages: Industry Assessment

Objectives:

1. Connect with individuals at supplier companies that are responsible for
   - receiving technical data and models
   - handling quotes/estimation
   - working with models related to design/production

2. Drive target decision makers to view online demonstration/example of the 3D TDP tool and video instructions to describe key features and usage of 3D TDP

3. Gather Feedback from the ARDEC supplier base

Summary of Results:

- 89% of respondents feel that the 3D TDP is better or much better than 2D drawings for conveying design intent.
- 84.4% of respondents plan to use the 3D TDP in their manufacturing planning
- 76.1% of respondents plan to use the 3D TDP to develop their CAM program
- 73.9% of respondents plan to use the 3D TDP as an instrument to convey intent for shop floor

Assessment conducted jointly between NIST, ARDEC and industry partners
Project Objective: Provide validated, 3D product data that can be used to procure QCB kits

Major Deliverables:
1) Fully-Annotated PRO-E models
2) Published nominal .STP files
3) Published design 3DPDFs
4) Validated CAD models and derivatives
5) MPDFs for hard to source components
6) Digital Work Instructions for assemblies

Value Proposition: A modern Product Data package with supplementary manufacturing process data will:

• Increase the number of bids from small manufacturers
• Reduce cost, risk and lead times for system acquisition
Utilized manual and laser scanning techniques to reverse engineer model data

IETM will be immediately fielded when complete: summer, 2012

Single CD containing HTML based menu and multiple 3DPDF work instructions

Instructions have been fielded with each system.
• Replace 2D paper instructions with a digital, interactive format that more effectively conveys each step

**Value Proposition:** Work instructions can be rapidly updated and redistributed based on process & product changes. Reduces lead times and costs associated with training new operators.
Manage different Spark II bracket configurations, provide producibility reviews and manage production operations for PM-CCS
What is a Service Information System

- Service information is interactive, easy to understand and up-to-date
- Service information is specific to the role of the user, their task and the specific configuration of the product
- Service outcomes include a closed-loop to communicate to engineering
- IT investments connect product development, service planning and technical information

SIS provides a 3D animated environment for accessing and viewing critical service information such as TMs, BOM structures and spare parts data

PRODUCT DATA MANAGEMENT ENVIRONMENT

- Vehicle Configuration
  - Spark II
  - Rhino
  - General Info

- 3D CAD models
- Operating Procedures
- Repair Procedures
- BOMs

Product-centric Information

Real-time Product & Configuration Data

END USERS

RHINO 3.0
Implementing Digital Manufacturing Tools to connect and enable an organic manufacturing network
**The Accelerated, Adaptive Army Fabrication Enterprise Vision**

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<tr>
<th>FY13/14</th>
<th>FY15</th>
<th>FY16</th>
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<tbody>
<tr>
<td><strong>Deploy A3FABE Tools and Infrastructure throughout PIF/Army enterprise</strong></td>
<td><strong>Concurrent delivery of Prototype Platform Design (GCV, AVM, etc.)</strong></td>
<td><strong>Concurrent delivery of Prototype Weapon System (ARAS, Crows, XMxxx, ATD)</strong></td>
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<tr>
<td>• Piloting and training on manufacturing tools</td>
<td>• Manufacturing Readiness Feedback</td>
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<td>• Develop PIF MRL feedback loop</td>
<td>• Objective Cost Analysis</td>
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<td>• Select prototype systems for prototype production</td>
<td>• LRIP (PIFe / Depot)</td>
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<td>• Establish organic cloud-based manufacturing technology environment</td>
<td>* Full Rate @ Depots</td>
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<td>• Deploy increments of Complex Assembly and Manufacturing Solutions</td>
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<td>• Deploy MT Connect / Real Time Online architecture at multiple organic sites</td>
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<td>• Utilize advanced physics-based manufacturing planning tools to transfer prototype production knowledge to organic base</td>
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**PIF Enterprise Manufacturing Engineering and Prototype Builds**

**Output:** Prototype weapon system with Army owned, design and manufacturing knowledge for next generation weapon system improvement and sustainment
The Distributed Organic Manufacturing Network
The A3FABE Digital Infrastructure: Today’s set of tools

Business Processes
- SAP eNOVA

Financials
- SAP GFEBS

3D Master
- Windchill 9.1 (ARDEC 3D)

Material Master
- SAP PLM

Prototype Integration Facility (PIF)

Sourcing
- Inbox - Microsoft Outlook

Mfg Execution System
- JobBoss
  - Routes
  - Work Instructions
  - Inventory
  - Job Tracking
  - Material Requirements

Pre-Type Class PLM
- Windchill 9.1 (pace3)
  - Concurrent Engineering
  - Configuration Management

Cam
- X3
- NCSIMUL

Physics Based Mfg Planning
- DEFORM

Shopfloor Execution

Inspection

Logistics Information
- Powerlog-J (SOR)

IETM
- n-GRRAIN®

Requirements
- DOORs
The A3FABE Digital Infrastructure: Tomorrow’s Integrated Solution

Prototype Integration Facility

Material Sourcing
- SAP SRM

Mfg Execution System
- JobBoss

Pre-Type Class PLM
- Windchill 10.1 + MPMLink

Business Processes
- SAP eNOVA

Financials
- SAP GFEBS

3D Master
- Windchill 9.1 (ARDEC 3D)

Material Master
- SAP PLM *

Logistics Information
- Powerlog-J
- IETM
- Arbor-text *

CAM

Knowledge Driven Mfg System (KDMS) *(kCapture, iPlan, Predator)*

Shopfloor Execution

Cloud & Physics-based Mfg Planning Tools

Requirements
- DOORs *

Inspection

- CAD driven Mfg planning and execution

The A3FABE Digital Infrastructure: Tomorrow’s Integrated Solution
## Summary of Accomplishments

| 1Q: | • Established RDECOM Working Groups  
     • Piloting PIF-wide RFAST RFQ process using Windchill Enterprise tool for quotes and job “award”  
     • Piloted organic-to-industry sourcing tool |
|-----|----------------------------------------------------------------------------------|
| 2Q: | • Executed several PIF sourcing quotes event for RFAST parts using Windchill  
     • Deployed MT-Connect enabled platform for prototype projectile inspection data |
| 3Q: | • Initiated Kiowa PLM project to create virtual BOM structure for Nose Mounted Sensor Ground Support Equipment  
     • Initiated PIF BCA MRAP spare parts project  
     • Tested and validated additive manufacturing equipment with weapons system components |
| 4Q: | • Developing SAP SRM tool in prototype production environment  
     • Deployed machining optimization tools and piloted on several complex weapon parts  
     • Supporting DARPA AVM program (iFAB/Fang). CRADA pending.  
     • FY13 Product and Technology planning |
**A3FABE Accomplishments FY12: Digital Inspection**

**Digital Real-Time Inspection:**
- Reduces time for lot acceptance
- Reduces the risk of scrap
- Enables correlation between machining parameters, tool wear and part features
- Enables remote quality management

**ROI = 5:1 – 10:1 (n=1)**

**Process:**
- Operator uses wired equipment to conduct in process inspection procedures
- Dashboard analyzes and displays data based upon engineer’s specification
- Alarm is triggered when inspected dimensions are outside the operation’s defined control limits
Investments in NC optimization software have enabled ARDEC’s PIF to reduce cycle times for machined parts. Components optimized include:

- Armored Cable Box
- Mortar Base Plates

**Results for Cable Box Optimization**

Return on Investment: 69  
Total Cost Savings: $5,250

Baseline: 1h 42m  ($255/part)  
Investment: 30m  ($185)  
Savings: 28m /part  ($70/part)  
Number of Parts: 75  

ROI: \( \frac{(2100m - 30m)}{30m} = 69 \)  
TCS: \( ($70/part \times 75 parts) = $5,250 \)

**Achievable ROI Range**

ROI = 14:1-70:1 (n=3)