Lockheed Martin Aeronautics: Implementing SAP in a Complex Manufacturing Environment

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*Lockheed Martin Aeronautics*

SAP Advanced Manufacturing Summit
September 16-17, 2009
Agenda

1. Lockheed Martin Corporation
2. Understanding the Challenge: Unique Business Requirements
3. Meeting the Challenge: The OneAero Project
4. SAP Functionality for Key Capabilities
5. LM Aero Future Vision
6. Keys to a Successful Implementation
Lockheed Martin Corporation

Lockheed Martin Co.

Electronic Systems

Aeronautics

Information Systems & Global Services

Space Systems

29,000+ Employees Across the Company and Around the World

Palmdale, CA

Fort Worth, TX

Marietta, GA

U-2

YF-22

F-117

F-16

F-35C

F-35A

CTOL

CV

F-35B

STOVL

C-130J

C-5

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Understanding the Challenge: Unique Business Requirements

Global Supply Chain

- Extended, including international customers and suppliers
- Extensive collaboration with global team-mates / suppliers requires integrated co-production
- High volume of subcontracted parts

Product Complexity

- Significant production rate increase scheduled to begin in 2010 and achieve 1 aircraft per day
- High volume of engineering changes
- Deep and intricate bill of material
- Unique requirements derived from managing both assembly and fab shop inventory and capacity

F-35 Monthly Aircraft Delivery Rate
Understanding the Challenge: Unique Business Requirements
F-35 (JSF) Program Overview

The F-35 is a collaborative effort of 9 partner countries with 3,000 deliveries scheduled for the next 30 years. The F-35 is comprised of 3 variants designed for different branches of the armed services.

<table>
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<tr>
<th>Variant</th>
<th>CTOL</th>
<th>STOVL</th>
<th>CV</th>
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<tbody>
<tr>
<td>Acronym</td>
<td>Conventional Takeoff and Landing</td>
<td>Short Takeoff, Vertical Landing</td>
<td>Carrier Variant</td>
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<tr>
<td>Primary Customer</td>
<td>Air Force</td>
<td>Marines</td>
<td>Navy</td>
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<tr>
<td>Variant Name</td>
<td>AF</td>
<td>BF</td>
<td>CF</td>
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Flag images of: Norway, United States, Italy, UK, Australia, Canada, Denmark, Turkey, The Netherlands
Understanding the Challenge: Unique Business Requirements

International Participation

Challenges:
- Support full rate production
- International supply chain
- Consistent process
- Supply chain visibility
- Numerous hand-off’s
- Balancing inventory

Vision:
Integrate the supply chain and provide visibility with a large contingent of suppliers
OneAero Vision: Lockheed Martin Aeronautics will transform business processes, systems and information through the implementation of SAP software, combined with significant process improvements, positioning us to meet the challenges of effectively producing the JSF, achieving horizontal integration and retiring high-risk, aging systems.

* Formerly Visiprise; Currently part of SAP Complex Assembly Manufacturing Solution (CAMS)
The second supply chain launch (L2) marks the initial SAP go-live for the F-35 Joint Strike Fighter program. The phased launch approach, beginning with the F-22 program as a pilot, was chosen to mitigate risk to F-35 production rate goal.
SAP Functionality for Key Capabilities

- **Shop Floor Management (SFM)** *
- **Computer Aided Process Planning (CAPP)** *

**Manufacturing Execution System**

- **Supplier Network Collaboration (SNC)**

**Supplier Collaboration**

- **SAP ECC**

**Network Scheduling**

- **SAP ECC**

**Logistics Execution**

- **Global Trade Services (GTS)**

**Trade Compliance (May 2010)**

- **Transportation Management System (TMS)**

**Transportation Management (May 2010)**

* Formerly Visiprise; Currently part of SAP CAMS
Benefits of SAP CAMS

**Electronic Work Instructions**
Work stations installed where the work is being performed. Increased use of graphics, photographs, videos, caution notations, etc.

**Order Processing Time**
Orders released to the floor in real time, reducing time from order creation to kits on the floor by over 60%.

**Shop Order Visibility**
Current status of any order and where it is located is visible in real time to anyone.

**Nonconformance Process**
Legacy quality assurance system already integrated with the manufacturing execution system.

**Engineering Change Incorporation**
Engineering changes are available to the floor as soon as they are made in the system.
SAP Functionality for Key Capabilities

SAP Enterprise Integration: CAPP, SFM, SAP

Closed-loop Enterprise Integration:
PLM-ERP-MES(CAMS)
SAP Functionality for Key Capabilities

Enterprise Integration: CAPP, SFM, SAP

**CAPP**
- Master Data
  - Maintain BOM & Routing (Plans)
  - Drive Engineering Changes
  - Receive Work Center & Material Updates

**SFM**
- Shop Floor Orders
  - Execute Operations
  - Collect Data
    - As-Built Data
    - Earned Standards
  - Locate Orders
  - Shop Order Maintenance

**Production Orders**
- Master Data
  - Maintain Work Center and Material Master
  - Receive BOM/Routing Updates

**Network Orders**
- Create Projects
- Drive Schedule
- Receive Activity Updates

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Supplier Collaboration: SNC

User Interaction
- Web Based User Interface
  - Offers online and message-based communication with suppliers including multiple alert & notification methods

Business Processes
- Purchase Order Collaboration
  - Provides suppliers opportunity to adjust purchase order information (quantity, date, etc.)
- Supplier Managed Inventory
  - Supports Min/Max supplier inventory management
- Work Order Collaboration
  - Facilitates monitoring of milestones during repair operations

Basic Services
- SNC Basic Services
  - Master Data
  - Exception Management
  - Data Validation

Powered by SAP NetWeaver™
XML Message Exchange
PS-Networks support project-oriented manufacturing model:

- Provides powerful, but flexible scheduling tool
- Tight integration with Planning and Material Management
- Supports greater visibility to shopfloor operations
Increased usage of lean manufacturing methods deployed through enhanced logistical execution capabilities will drive timely and accurate movement of material within the extended supply chain.

**Demand Driven Replenishment**
- Kitted parts are issued upon request from shop floor

**Kitting Capacity Control**
- Unique storage type used to represent kitting capacity
- Kitting by shop order
- Adjustable kitting horizon

**Fully RF Enabled Warehouse**
- IM transactions including receiving, issuing and kanban
- WM transactions including picking, kitting, transfers and cycle counting

**Aftermarket Inventory (3PL)**
- Segregated inventory to support 3PL processes, aftermarket services and government bonded stock

**WIP Visibility Tracking**
- Fully RF enabled WIP tracking
- Inherent reporting capabilities provide increased accuracy of WIP visibility
SAP Functionality for Key Capabilities

Trade Compliance: GTS *(Future Release Capability)*

- Global Trade Services (GTS)
  - Export / Import
    - Sanctioned Party List screening
    - Automatic License Determination and Value Adjustment
    - Customs Documentation Generation
      - Electronic communication with U.S. Customs A.E.S. (export only)
  - Tight Integration with ECC
    - Automatic screening of Customers/Suppliers against Sanctioned Party List
    - Automatic screening of Sales Orders/Deliveries for Export
    - Automatic screening of Purchase Orders/Inbound Deliveries/Advanced Shipping Notices for Import
SAP Functionality for Key Capabilities

Transportation Management: TMS
(Future Release Capability)

Global Visibility: visibility of delivery schedules associated with both inbound and outbound shipments

Inbound:
- Consolidation of shipments inbound to localized groupings of manufacturing facilities and 3PL

Outbound:
- Consolidation of international shipments to subcontractors in Europe and the Far East
Widening the Market Aperture Provides Opportunity for Significant Transformation of the LM Aeronautics Company

**Factory Material Flow**
- Material is drawn through production system as it is consumed
- Directed put-away combined with wave picking
- Reliable high-velocity flow of materials from suppliers to point-of-use

**Fighter Production System™**
- Organizational alignment
- Integrated master plan and critical path schedule based on allocation of resources
- Integration of activities with focus on touch points

**Supplier Collaboration and Development**
- Working with the supply chain to support full rate production
- Enhance strategic relationships with key suppliers
- Establish a repeatable process and playbook for engaging suppliers in material replenishment activities
Keys to a Successful Implementation: Launch 1 Success Factors

Exhaustive testing, thorough data cleansing and validation, detailed and interactive training courses and our partnership with SAP, Deloitte and BackOffice were critical to our success.
Thank You!
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| 3     | a. – d. Lockheed Martin Corp.  
|       | e. Map with small planes | a. – e. All photos are from the Consulting Onboarding deck from D1 |
| 5     | a. Large F-35  
| 10    | a. Electronic Work Instructions  
|       | b. Order Processing Time  
|       | c. Shop Order Visibility  
|       | d. Non-Conformance Process  
|       |       | b. Creative Commons, [http://search.creativecommons.org/#](http://search.creativecommons.org/#), Search for “stack of paper”  
| 15    | a. Demand Driven Replenishment  
|       | b. All others | a. Lockheed Martin Website, [http://www.lockheedmartin.com/data/assets/aeronautics/gallery/f35/flightsf/flight02/ae070108_27_01133.jpg](http://www.lockheedmartin.com/data/assets/aeronautics/gallery/f35/flightsf/flight02/ae070108_27_01133.jpg)  
|       |       | b. FMF Warehouse Photos – 2009 |
| 18    | a. FMF  
|       | b. FPS  
|       | c. SCD | a. FMF Warehouse Photos - 2009  