Lessons from the Road: The Army Aviation Supply Chain

Presented to the MDA Supply Chain Forum

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Outline

• Scope of Project
• Supply Chain Findings
• Corrective Actions
• Industrial Base Issues
• Future Directions in Aerospace Supply Chain Management
• Final Thoughts
Capabilities

• Research Center at UAH (26 full time employees)
  – Lean Enterprise/Manufacturing
    • Training
    • Value Stream Mapping
    • Kaizen Events
  – Six Sigma and Quality Processes
  – Supply Chain Design and Optimization
  – Dynamic Modeling
  – Transportation Infrastructure
  – Competitiveness/Strategic Management
  – Profitability Improvement
  – Economic Development Strategies
  – Administration of Industry Associations

• MIT Relationships
  – Forum for Supply Chain Innovation
  – Lean Aerospace Initiative
“Factory to Foxhole” Analysis
The AMCOM Supply Chain

Findings and Current Situation

- Growing Lead Times
- No Reserve Inventories
- Sole Source For Specialty Aviation Steels
- Constrained Capacity For Specialty Metals
- Companies In Supply Chain Are Adverse To Risk
- Very Little Communication Or Visibility Of Information In Supply Chain
- Competing Demands on Supply Chain Between Platforms as Well as New Procurement and Overhaul
- High Costs and Readiness Suffers
Less suppliers - Competing resources

IMMC/CCAD

Prime 1

Tier 1A

Tier 2A

Tier 1B

Tier 2B

Prime 2

Tier 1E

Tier 2D

Prime 4

Raw Materials

Tier 2C

Prime 3

Tier 1C

Tier 1D
Performance Improvement Efforts

The Sequential Enterprise

- **Enterprise Value Stream Maps**
  - Prime Through Raw Material
  - Includes Interfaces As Well As Production Processes
  - Over 40 Companies Involved

- **Continuous Improvement Events**
  - Factory-level Value Stream Maps
  - Kaizen Events Performed Based On Findings From Value Stream Mapping Events

- **Multi Echelon Supply Chain Maps Provide Enterprise-Wide Knowledge**

- **Modeling and Simulation of Enterprise Processes and Supply Chain**

Initiatives in Lean Enterprise

- Enterprise Value Stream Maps
- Continuous Improvement Events
- Multi Echelon Supply Chain Maps
- Modeling and Simulation of Enterprise Processes and Supply Chain
Critical Defense Supply Chain Issues

1. Communication and visibility of data throughout supply chain /supplier relations
2. Strategic raw materials
3. Use of ID/RFID/Sensor Networks
4. Designing the supply chain for specific products
5. Smooth/stable funding
6. Structure of contracts
7. Product Life-cycle Management and design for the supply chain
8. Focus on value added processes
9. Integrated Enterprise
Matching Supply Chains with Products

Defining Optimum Strategic Inventories

<table>
<thead>
<tr>
<th></th>
<th>Base Scenario</th>
<th>Base Scenario</th>
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<tbody>
<tr>
<td><strong>Inventory Allowed</strong></td>
<td>Only FG at Prime</td>
<td>Components &amp; Strategic FGI</td>
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<tr>
<td><strong>Prime Production Time</strong></td>
<td>Avg. 405 days, Avg. 100 days, Std. Dev.: 45 days</td>
<td>Avg. 100 days, Std. Dev.: 10 days</td>
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<td><strong>Capital-Revenue</strong></td>
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<td>Working Capital</td>
<td>$5,315,086</td>
<td>$1,834,808</td>
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<td>Cost of Goods Sold</td>
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<td>$3,519,504</td>
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<td>Inventory Turns</td>
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<td>1.918187</td>
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<td><strong>Holding Cost Details</strong></td>
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<td>Total WIP Cost</td>
<td>$5,218,054</td>
<td>$1,790,875</td>
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<td>Working Capital Cost</td>
<td>$970,260</td>
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Prime FG Working Capital
Industrial Base Issues

• Difficulty in working with the U.S. Government
  – Unstable work
  – Source approval process (each part requires approval)

• Lower tier suppliers finding growth in non-aerospace industry over the past decade
  – Helicopter fuel tank supplier issue
  – Growth in non-American automotive

• Multiple Supplier Certifications
  – NADCAP
  – Individual OEM Certifications

• Value of Government Inspection Hold Points
  – Example – aviation part has 38 weeks PLT
  – 13 weeks of which are Government hold points
  – Zero rejections in over 30 years
What can be done?

- Shift to supportive culture vs. adversarial
- Realistic FAR interpretations
- Make it easier to work with US Government
  - Expand industrial base focusing on companies that have worked with Government in the past
  - Qualify suppliers by part families and similar product lines
- Inspection focus on processes not products
- Focus on true customer and value added processes
  - Understand real demands
  - Streamline administrative lead-time
- Educate Government work force on products and their use not rules and regulations
- Institute multi-year funding
- Evaluate need for multiple certifications
Transforming the Enterprise

- Information Sharing and Visibility
  - Data Analysis & Integration
  - Demands and Forecasts
  - Production and Logistic Issues
  - Collaboration Tool – AMCOM to Prime
  - Collaboration Tool – Prime to Suppliers

- Supply Chain Collaboration Through Organizational Linkages
  (The Toyota Model)
  - Voice of Supplier Committee
  - Supplier Association
  - Supplier Quality Committee
  - Supplier Production/Logistics Issues

- Continuous Improvement
  - Lean/6σ/TOC
  - Internal, External, and Interfaces

- Industrial Base Well-Being
  - Stabilizing the Supply Chain
  - Flexible Contracts for Commodities

- Initiatives for Specialty Metals
  - Pre-positioning raw materials
  - Berry Amendment Waivers
  - DPAS – Tracking DO's, Initiating SPAR’s
  - Economic and Trade Policies
Future Directions in Aerospace SCM

- Innovative contracting especially in the area of raw material suppliers
- Enterprise metric development and dissemination throughout the supply chain
- Use of modeling and simulation
- Aligning products with the correct supply chain
- Collaboration throughout the supply chain
- Expansion of lean
  - Lean Engineering/Product Development
  - Lean Supply Chain (Legacy Systems)
  - Lean Office (Administrative Functions)
Final Thoughts

• Understand your enterprise!
• Determine who’s supply chain it is and then structure the enterprise accordingly
• Supply Chain Management is about behavior – are you contractually incentivizing the behavior you want from your suppliers?
• One supply chain type will probably not adequately support your enterprise
• Focus on a few enterprise metrics
• Collaboration – assume nothing!
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Back-up Charts
Example Supply Chain Map

Lead Time in Prime Procurement System = 200 M-Days

Current Lead Time = 50+100+125 = 275 M-Days

New orders are already 75 days behind schedule!

Notes: (A) – Supplier Admin Lead Times
(M) – Supplier Mfg Lead Times (Mfg days)
(PA) – Prime Administrative Lead Times
Red denotes Prime Lead Times (as noted in procurement system)
Purple denotes monthly capacity without impact to normal throughput

19
Production Lead Time = 917 days

Current State Enterprise VSM

- Company A: Tank Assy (145 CDAYS)
- Company B: Washer (250 CDAYS), Pin Assy 1 (143 CDAYS), Cap (150 CDAYS)
- Company C: Housing (429 CDAYS)
- Company D: Collars (182 CDAYS), Hubs (210 CDAYS), Pin Assy. (168 CDAYS), Ring Assy. 1 (217 CDAYS), Ring Assy. 2 (217 CDAYS)
- Company E: Shaft (266 CDAYS)
- Company F: Forging (385 CDAYS), 280 CDAYS, 238 CDAYS, 385 CDAYS, 392 CDAYS
- Company G: Bearings (497 CDAYS), -1 (102 CDAYS), -2 (157 CDAYS), -3 (132 CDAYS), -4 (121 CDAYS)

MRP:
- Prime Buyer/Planner
- Prime Contacts
- Customer Contracts
- Overhaul
- Field Customers
- Purchasing
- Customer
- Paint and Inspect
- Shipping

Suppliers:
- RAW MATERIALS
- 200 CDAYS, 35 CDAYS, 266 CDAYS
- Company F Forging
- Company E Shaft

TOTAL:
- 567 CDAYS
- 490 CDAYS
- 406 CDAYS
- 609 CDAYS
- 609 CDAYS
- 501 CDAYS
- 599 CDAYS
- 297 CDAYS
- 629 CDAYS
- 618 CDAYS

Production Lead Time = 917 days

1 Day Truck Del.
Truck inter plant

917 CDays TLT
Production Lead Time = 664 days
28% Reduction!

Most suppliers did not have in-house lean capability therefore the OEM and customer facilitated the events

Is there still room for improvement? If so, where should we start?
A Side Note-----
Aviation Steels, Titanium and Aluminum
The Perfect Storm

Reduced US Steel Capacity---Forty Five Bankruptcies Since 1997
Growth in DOD Demand
  – Increased Operational Levels
  – Harsh Environment for Aviation Platforms
Dramatic Jump in Demand for Commercial Aircraft
  – 600 Orders for New Planes in 2004
  – 2,000 Orders for New Planes in 2005
Heightened Demand for New Turbine Helicopters
  – 2000-2005: 900 Produced per Year
  – 2005-2009: 1,100 Expected Annual Production

And Now ..... Oil and Gas Exploration Demand