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

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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

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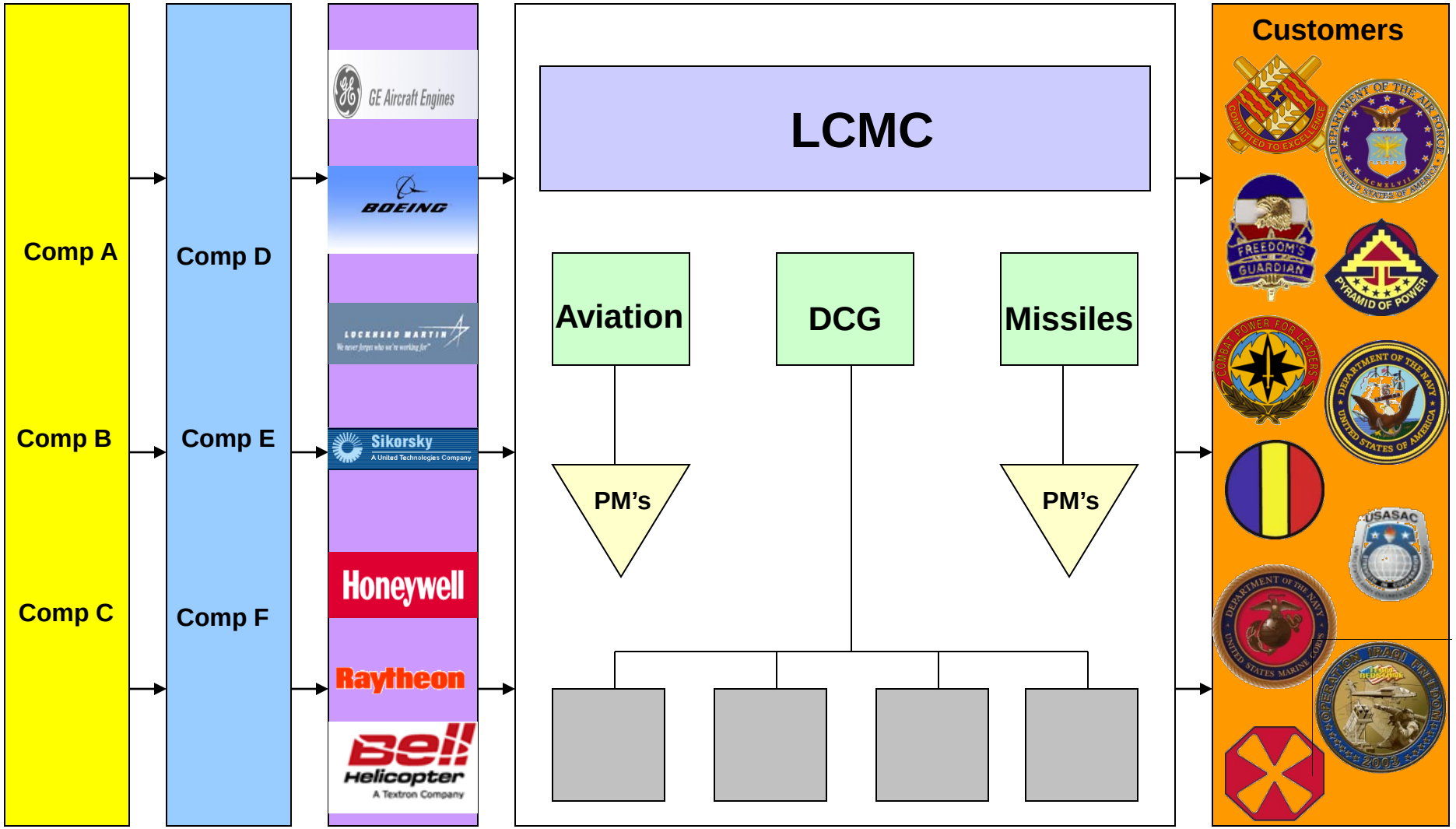
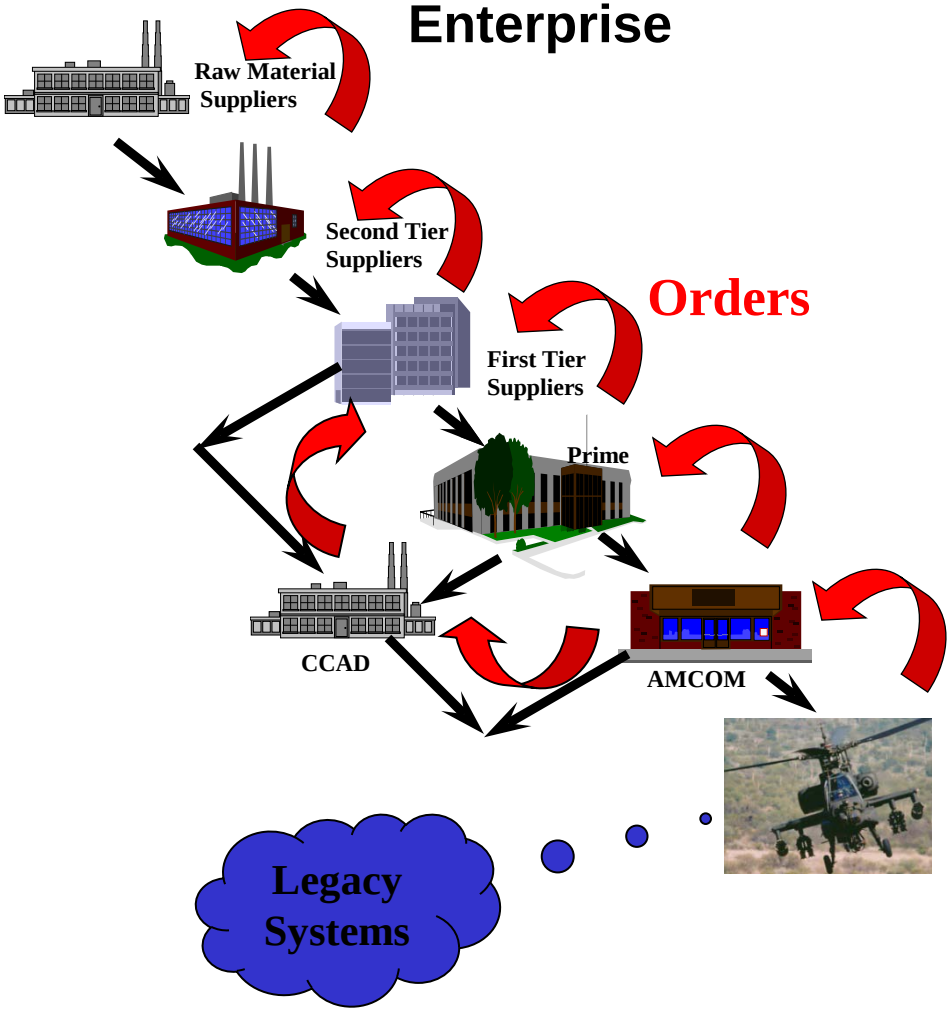
"Factory to Foxhole" Analysis



The AMCOM Supply Chain

The Sequential Enterprise



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

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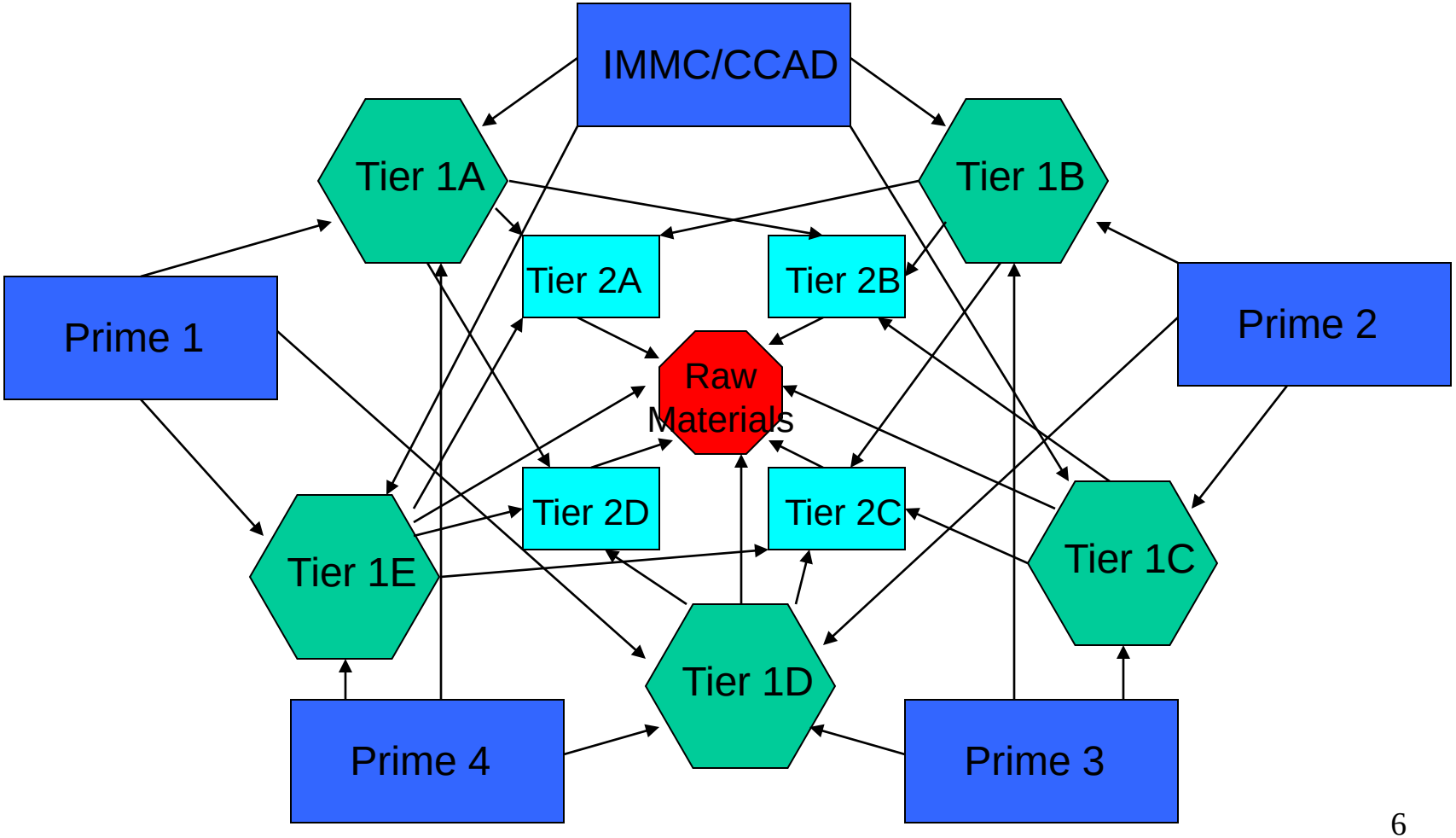
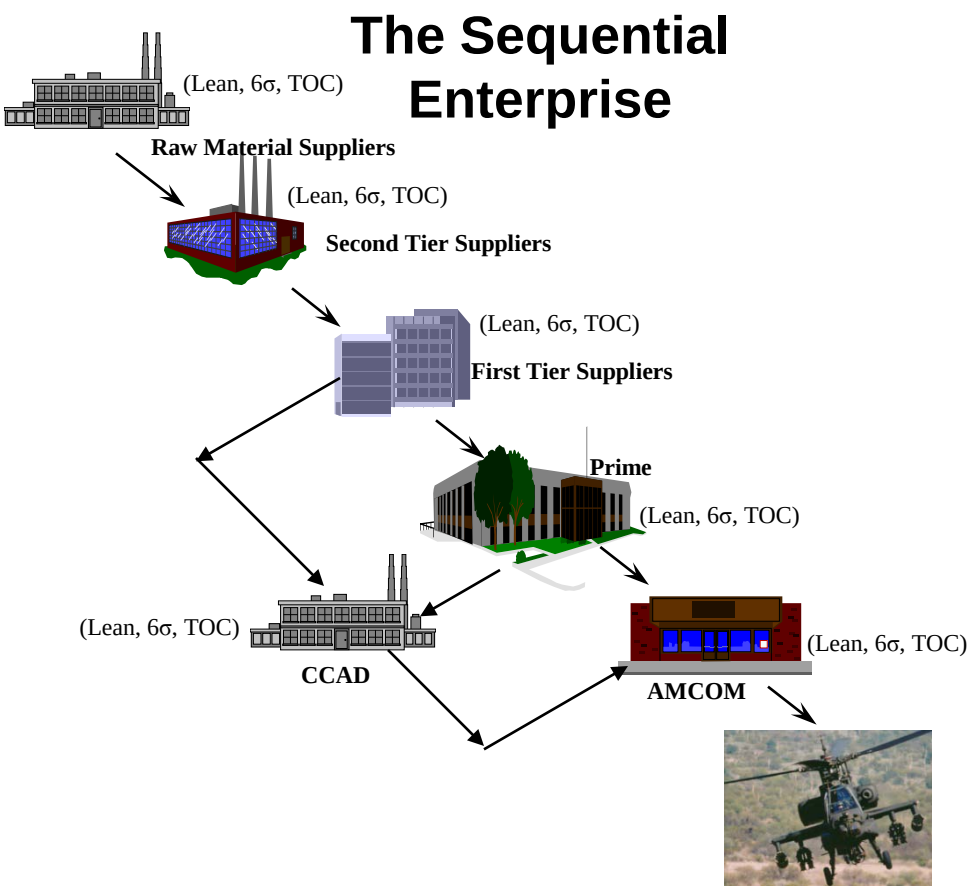
Less suppliers - Competing resources



Performance Improvement Efforts



Initiatives in Lean 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

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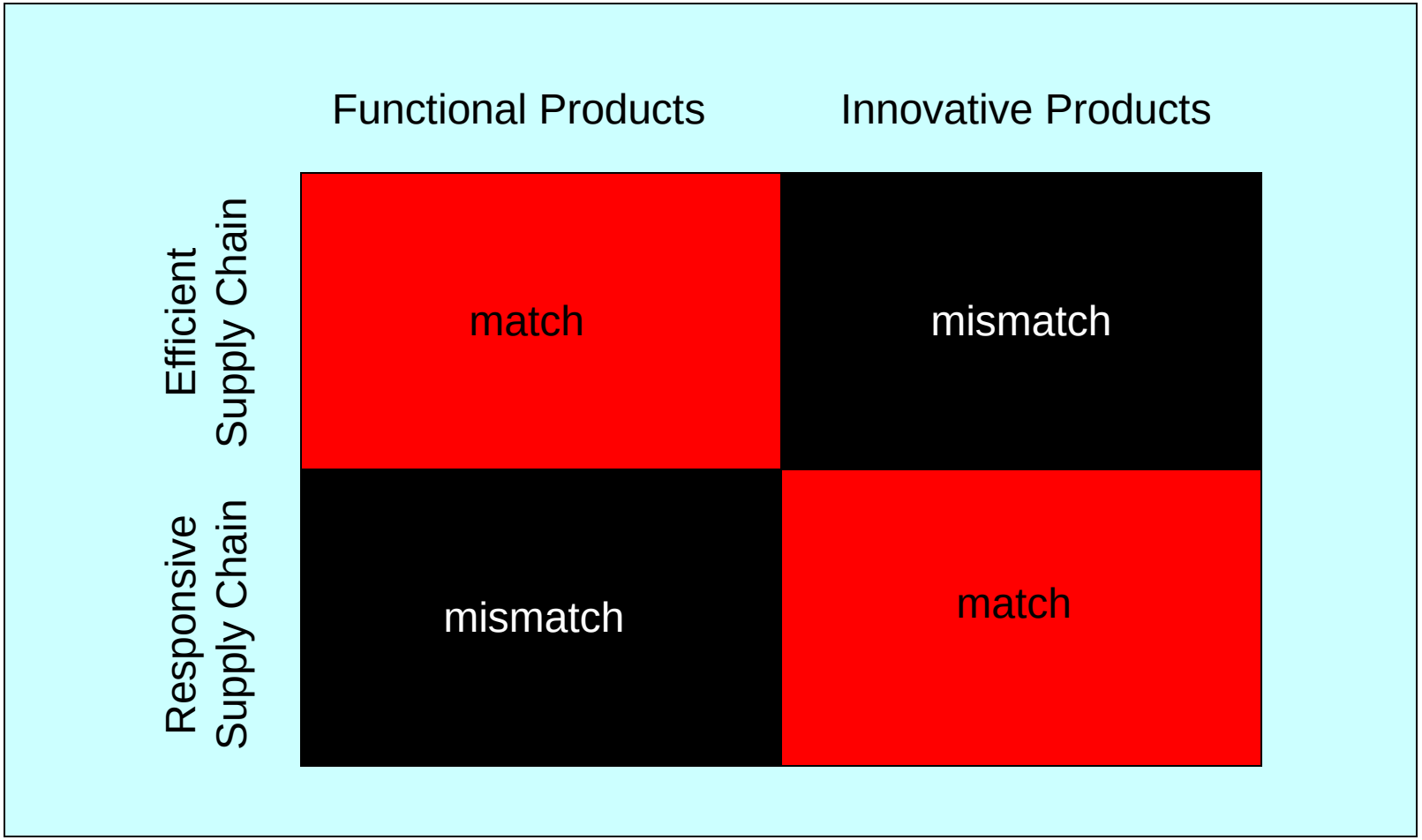
Critical Defense Supply Chain Issues

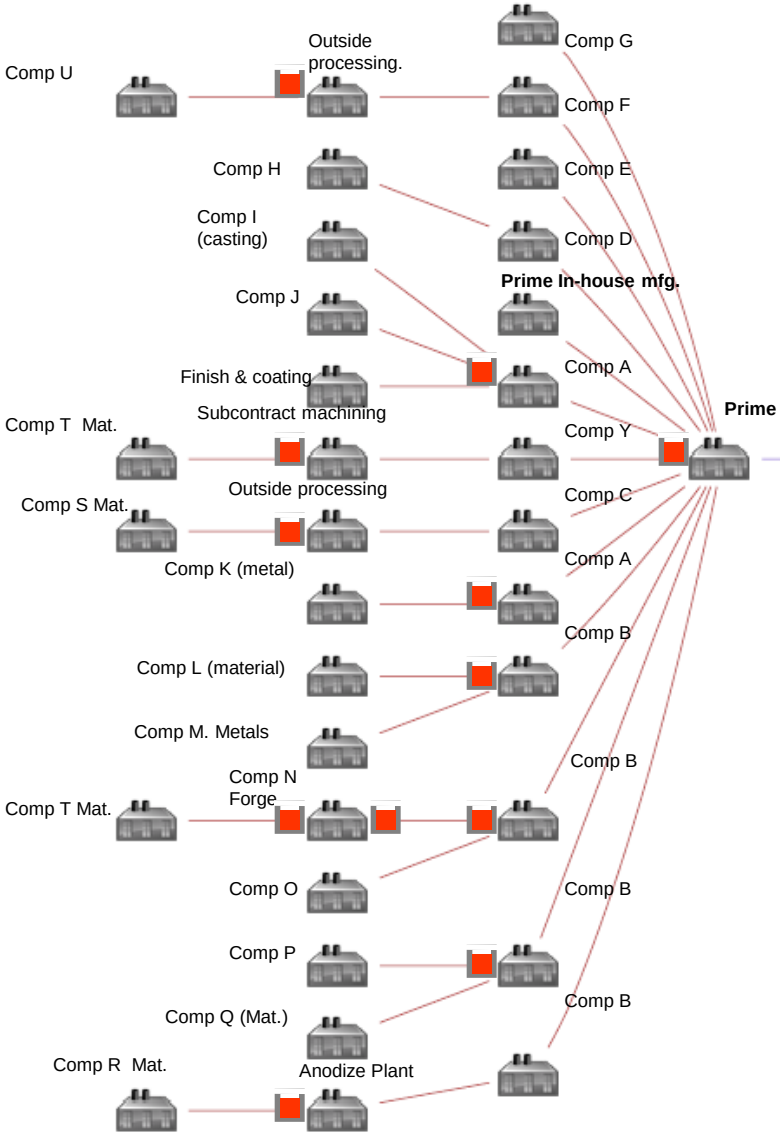
1. Communication and visibility of data throughout supply chain /supplier relations
2. Strategic raw materials
3. Use of ID/RFID/Sensor Networks
4. Designing the supply chain for specific products
5. Smooth/stable funding
6. Structure of contracts
7. Product Life-cycle Management and design for the supply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

Matching Supply Chains with Products



Marshall L. Fisher, Harvard Business Review, March-April 1997

Defining Optimum Strategic Inventories



	Base Scenario	Base Scenario
Inventory Allowed	Only FG at Prime	Components & Strategic FGI
Prime Production Time	Avg. 405 days,	Avg. 100 days,
	Std. Dev.: 45 days	Std. Dev.: 10 days
Capital-Revenue		
Working Capital	$5,315,086	$1,834,808
Cost of Goods Sold	$3,519,504	$3,519,504
Inventory Turns	0.6621725	1.918187
Holding Cost Details		
Total WIP Cost	$5,218,054	$1,790,875
Working Capital Cost		
Prime FG Working Capital	$970,260	$331,320

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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

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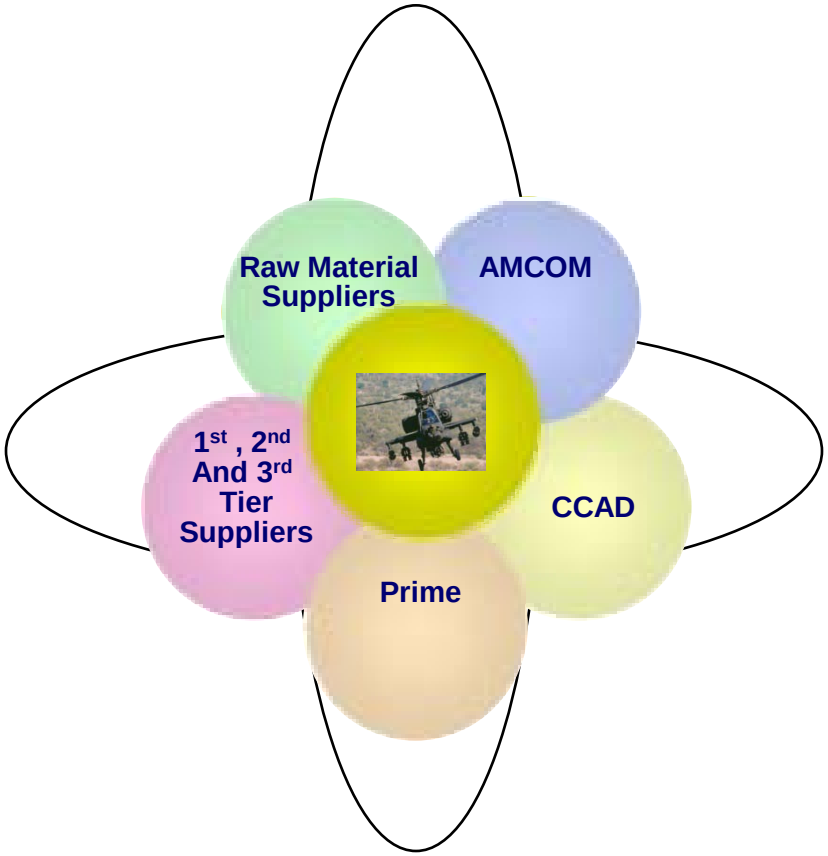
What can be done?

- 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

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Future Directions in Aerospace SCM

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

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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!

Contact Information

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Back-up Charts

Complexity of 1st Tier

End Item B

Company A
A 134 Days

Company B
A 176 Days

Company C
A 155 Days

Company D
A 210 Days

Company E
A 080 Days

Company F
A

Company G
A 120 Days
B 120 Days
C 120 Days
D 120 Day
E 189 Days

Company H
A 197 Days

Company I
A 120 Days
B 110 Days

Company J
A 210 Days
B 239 Days
C 170 Days
D

Company K
A 075 Days
B

Company L
A 167 Days

Company M
A 119 Days

Company N
A

Company O
A 231 Days
B 120 Days
C 168 Days
D 155 Days
E

Company P
A 300 Days
B 320 Days
C 290 Days
D 250 Days

Company Q
A

Company R
A 180 Days
B 180 Days

Company R1
A 170 Days

OEM/Command

Company S
A 180 Days
B 170 Days
C 230 Days
D 250 Days
E 275 Days

Company T
A 100 Days
B 113 Days
C 210 Days
D 176 Days
E 197 Days
F 281 Days
G 260 Days

Company U
Base
Shield

Company V
A 260 Days

Company W
A 126 Days
B 100 Days

Company X
A
B

Company Y
A 150 Days

Company Z
A 150 Days

Company AA
A
B

Company BB
A 110 Days

Company CC
A 100 Days
A 100 Days

Company DD
A 250 Days
B 250 Days
C 250 Days
D 197 Days
E 275 Days
F 250 Days
G 280 Days
H 173 Days
I 210 Days
J 176 Days

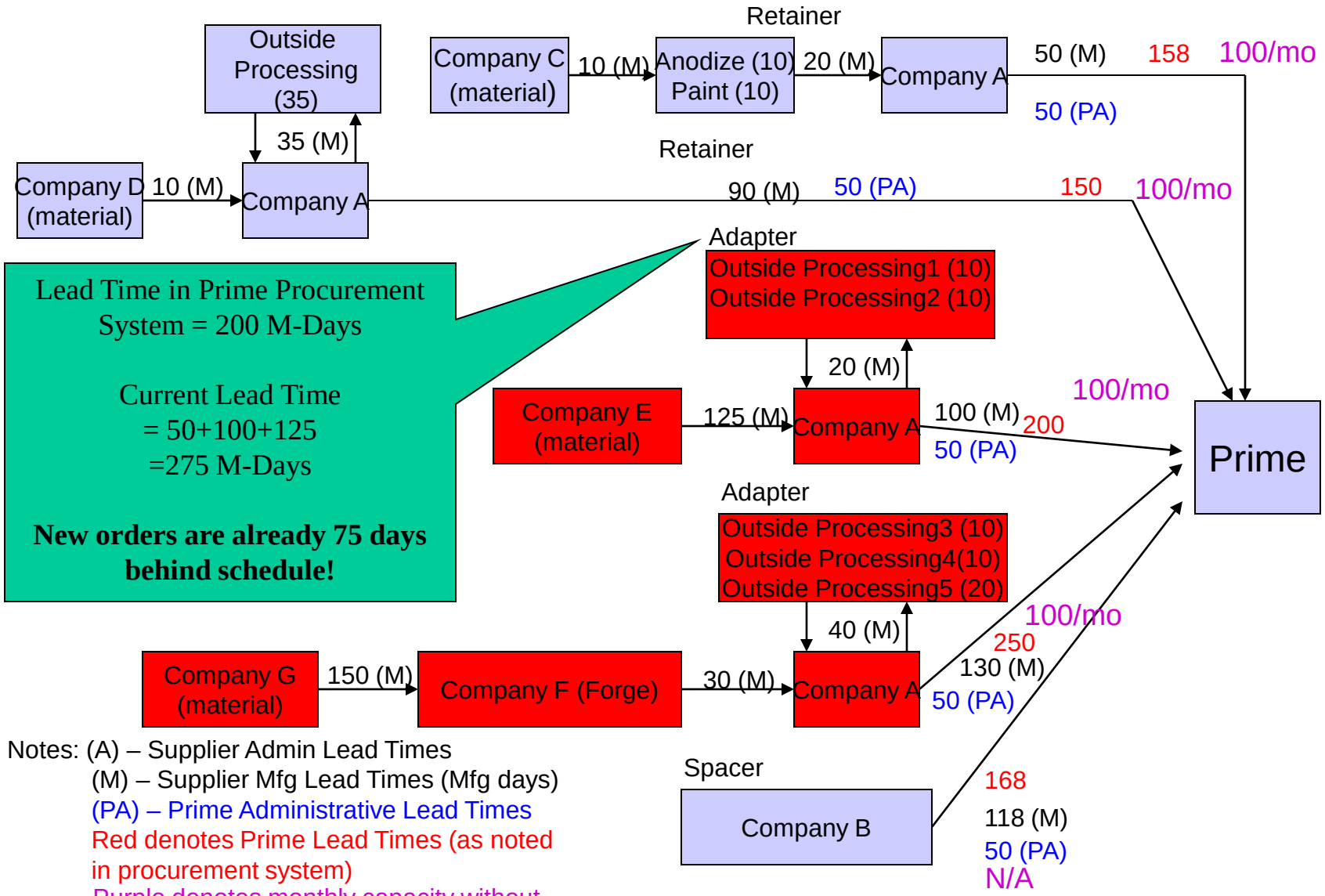
Company EE
XA 120 Days

Company FF
A

Company GG
A 080 Days

Company HH
A

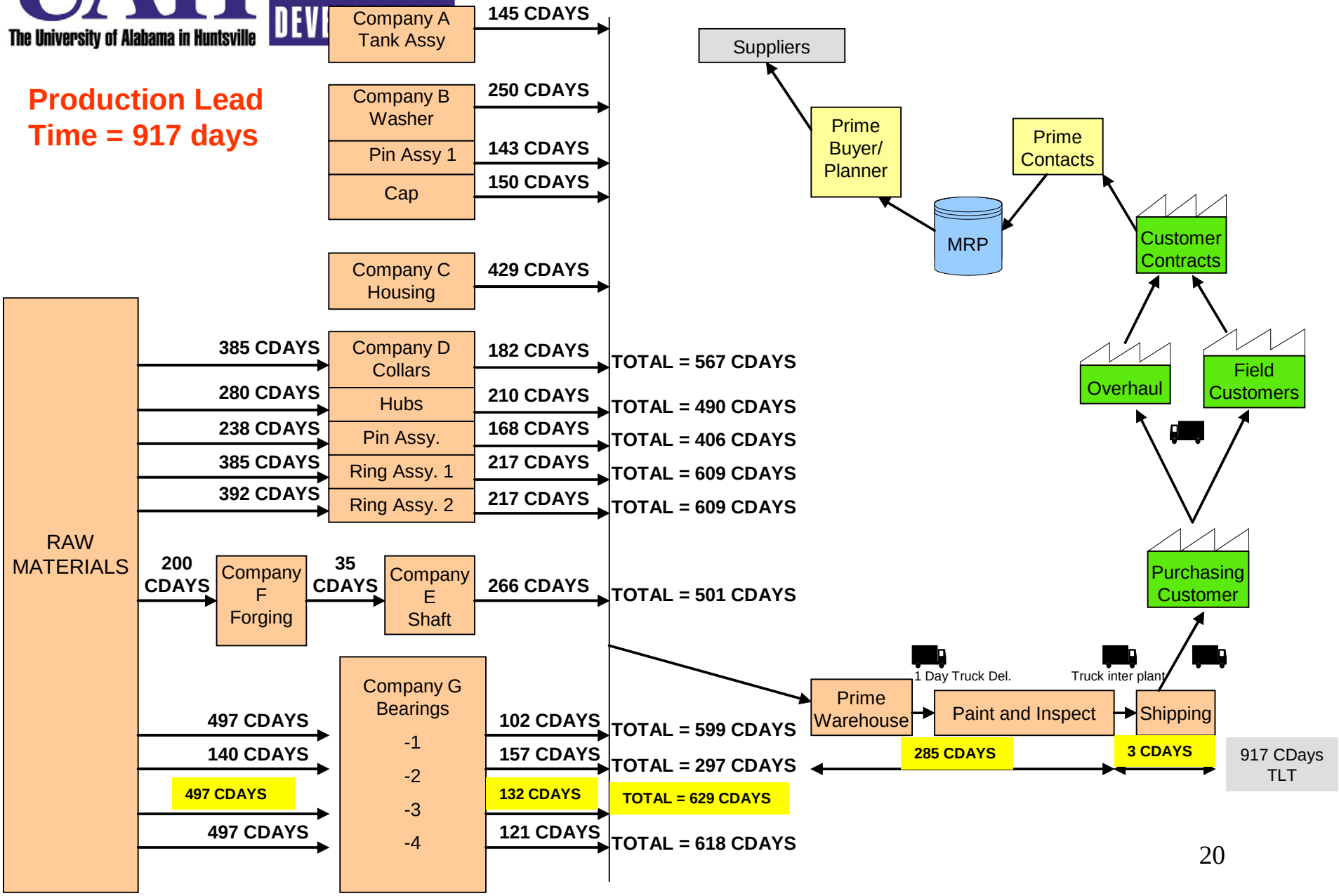
Example Supply Chain Map



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 through put

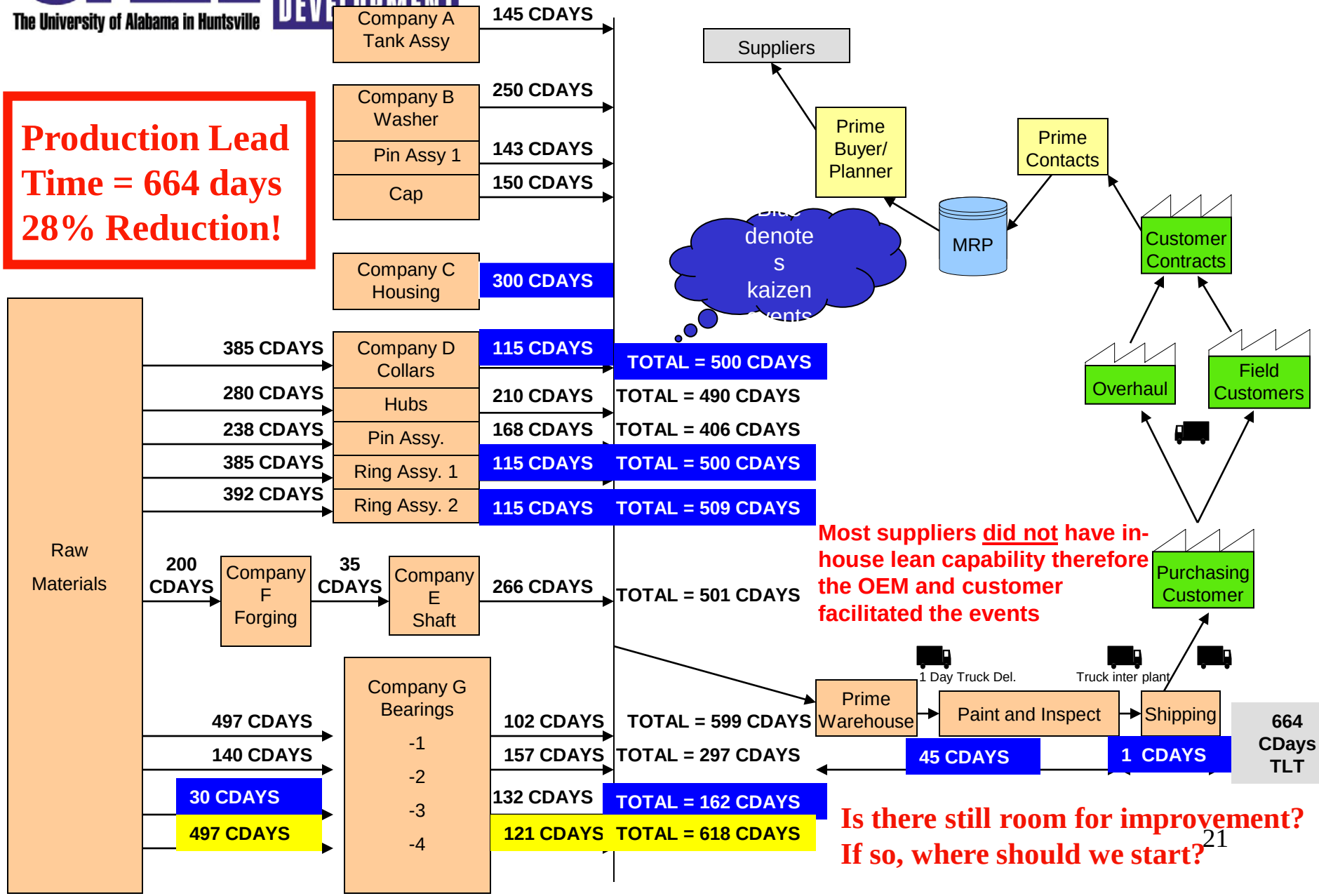
Current State Enterprise VSM

Production Lead Time = 917 days



Future State Enterprise VSM

Production Lead Time = 664 days
28% Reduction!



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