

## Building Lean Supply Chains

*Lean Shipbuilding & Repair Forum 3*

*Tom Phelps, Altarum*

*Teri Hoenes, Boeing Integrated Defense Systems*

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### Presentation Topics

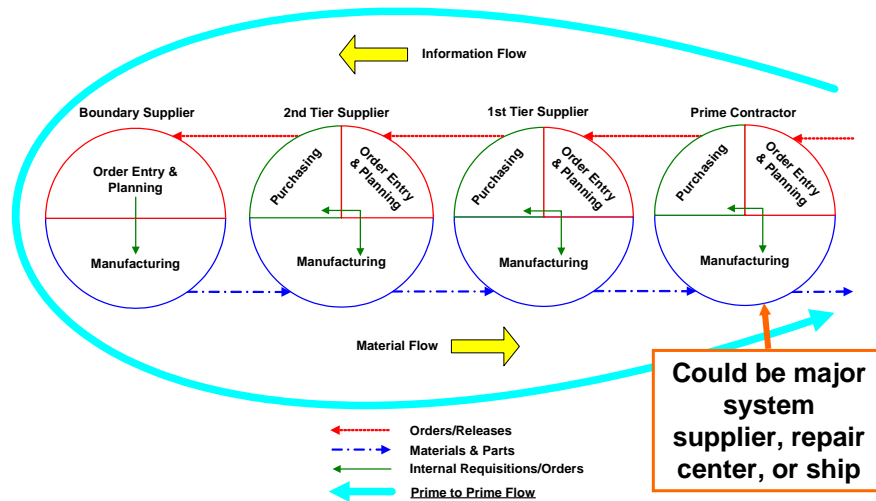
- ♦ Lean supply chain concept
- ♦ The process and methods
  - Illustrated by new construction example
  - Overview of repair example
- ♦ Closing thoughts

## Why Lean Supply Chains?

- ♦ A supply chain is a complex system
- ♦ The lean philosophy focuses on performance optimization
  - Local optimization rarely results in global optimization
- ♦ The lean supply chain approach recognizes and addresses the complex supply chain system

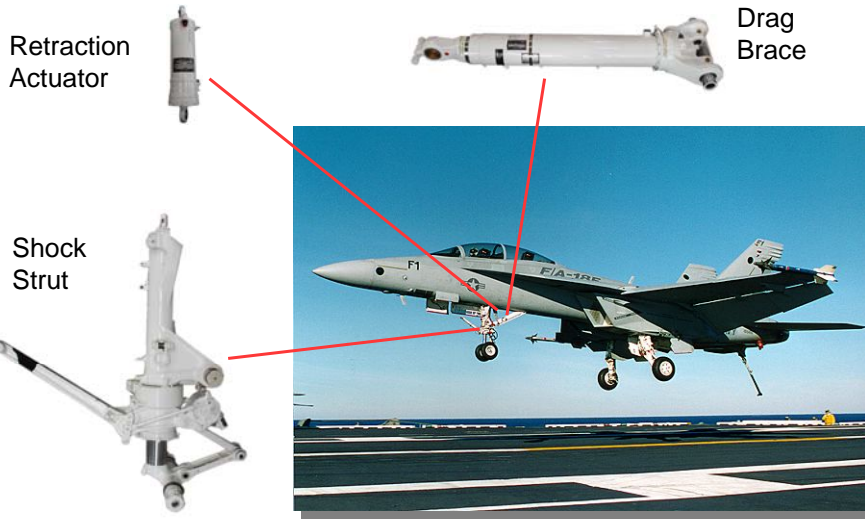
*This concept is very different from what is commonly called "Supply Chain Management," which addresses how a company uses its suppliers not what the suppliers do or how they work together.*

## Lean Supply Chain Concept



**Apply lean methods to supply chain as a system**

## Example System: F/A-18 E/F Nose Landing Gear



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## Supply Chain Value Stream Management Project



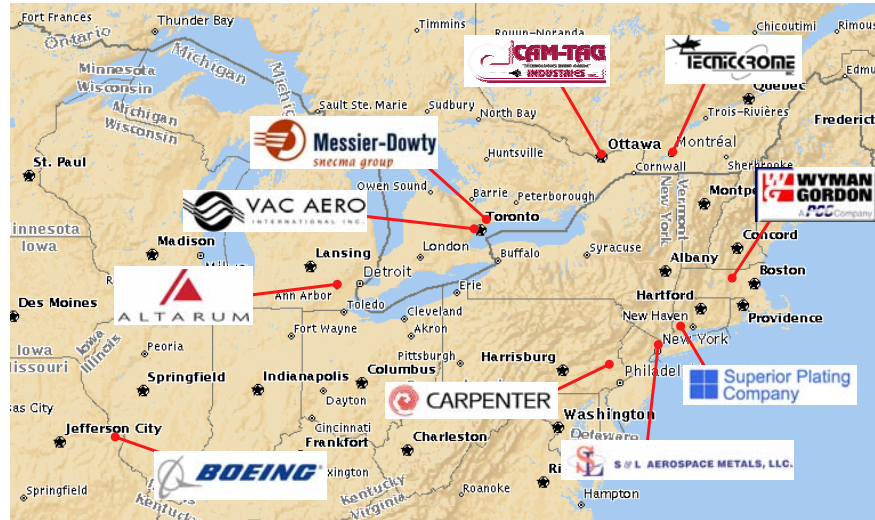
- ♦ A project within the SPANS program (Supply Chain Practices for Affordable Navy Systems)
- ♦ Project funding from Navy MANTECH at Office of Naval Research
- ♦ Project management support from Advanced Technology Institute



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## SCVSM Project Team



Teri Hoenes, Boeing

Mike Smith, Messier-Dowty

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## Overall Process

- ◆ Define Supply Chain
- ◆ Assess Current State
- ◆ Develop Macro Future State
- ◆ Select Improvement Projects and Participants
- ◆ Implement Change
- ◆ Measure Improvement

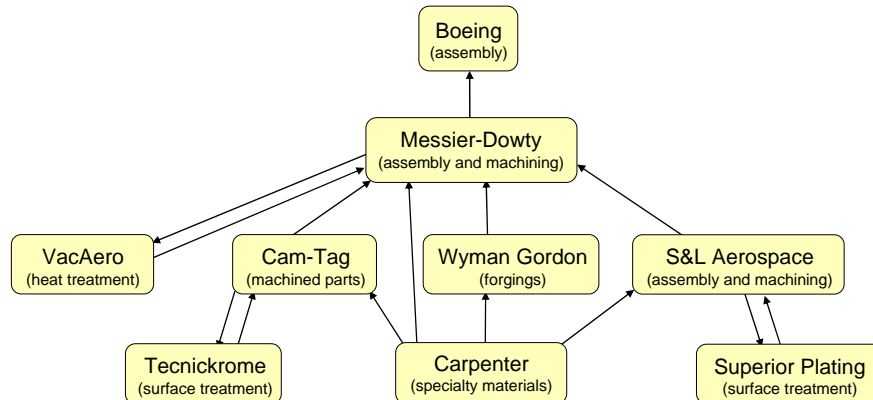
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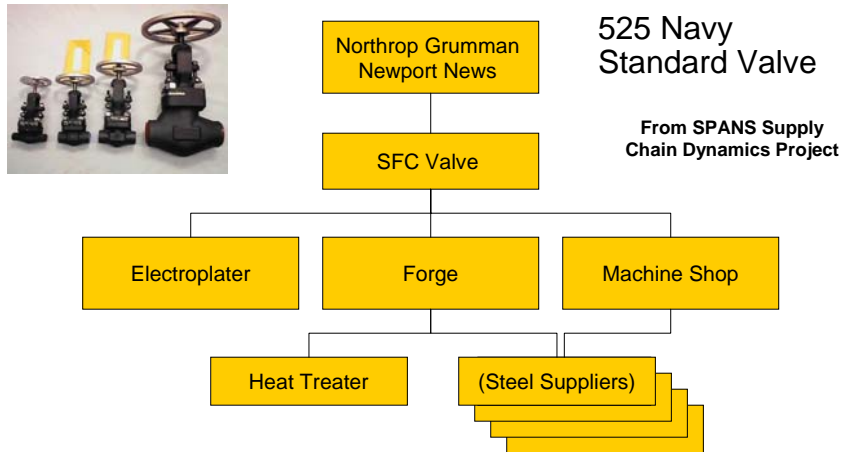
## Define Supply Chain

- ♦ Select target component
  - First-tier supplier willingness to play
    - Start with those already implementing lean internally
  - Criticality of target component to overall system
    - Lead time, cost, quality
- ♦ Document basic supply chain relationships
  - Identify sub-tier suppliers
  - Capture impact on target component
- ♦ Select key suppliers
  - Major sub-components
  - Criticality to target component

## Nose Gear Supply Chain



## Compare: Shipbuilding Supply Chain



*Also similar to deck machinery, gearboxes, hydraulics*

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## Assess Current State

- ♦ Build baseline process map for the material flow
  - Initial receiving through final shipment
- ♦ Build baseline process map for the supporting business processes
  - Order entry
  - Estimation
  - Shop floor scheduling
  - Purchasing
  - Shipping
- ♦ Focus on activities that affect overall lead time
  - If you can reduce lead time through better processes, costs inevitably come down and quality improves
- ♦ Identify opportunities for improvement

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## Building a Value Stream Map

- ♦ Develop the value stream map by walking the process
  - Designate one person to be the part or piece of paper traveling through the process
- ♦ Capture data for each process on the shop floor or in office, always looking for relationships with customers and suppliers
- ♦ Document process and review with operators/support teams
- ♦ Identify quick-hitter and longer-term opportunities for improvement
  - Internal to company
  - Between companies
- ♦ Involve “customer chain” in assessment at every supplier



## Example Quick Hitter Opportunities

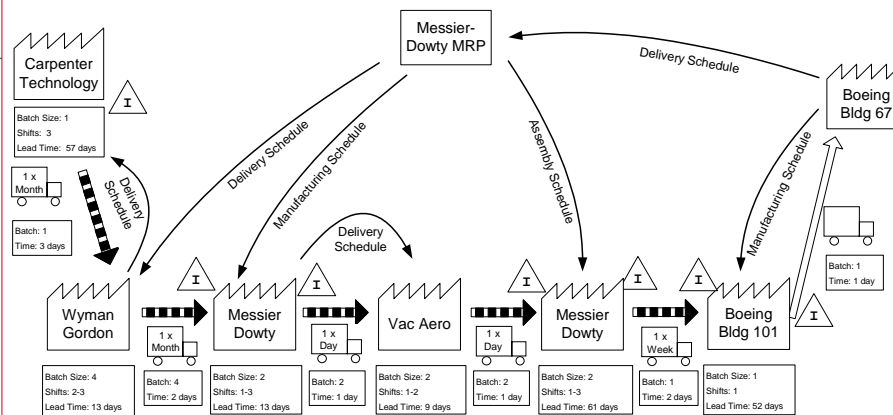
- ♦ Shorten Boeing/Messier-Dowty negotiation time by supplier providing information up front
  - Removed 1-2 weeks of lead time from Boeing business process
  - Reduced two people traveling to Messier-Dowty from (1-2 weeks to a few days, savings estimated at 2 person-weeks plus associated travel)
- ♦ Messier-Dowty assembly work being undone and redone by Boeing
  - Removed 2 hours of labor and lead time from assembly process, \$12,000/year savings
- ♦ Machine shop supplier found new ultrasonic inspection provider
  - Removed 2 weeks of lead time on part, \$5,000/year savings just in transportation & customs agent fees

# Top-Level Macro-VSM



- ♦ Built from condensed versions of individual value stream maps
  - No benefit to showing entire map at level of detail used within companies (too complex to grasp)
- ♦ Top level version very simple, helps people understand what you are talking about
  - legible on 8.5 by 11 paper
- ♦ Shows info flow propagating from end facility to third-tier suppliers and material/parts/assemblies moving from suppliers to the end facility
- ♦ Used for both current and future states

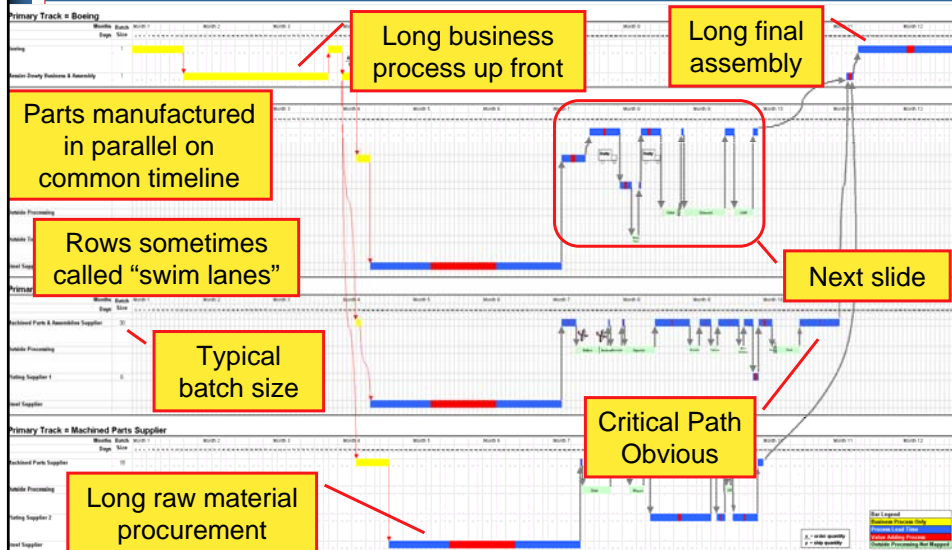
## Example Top Level View – Current State



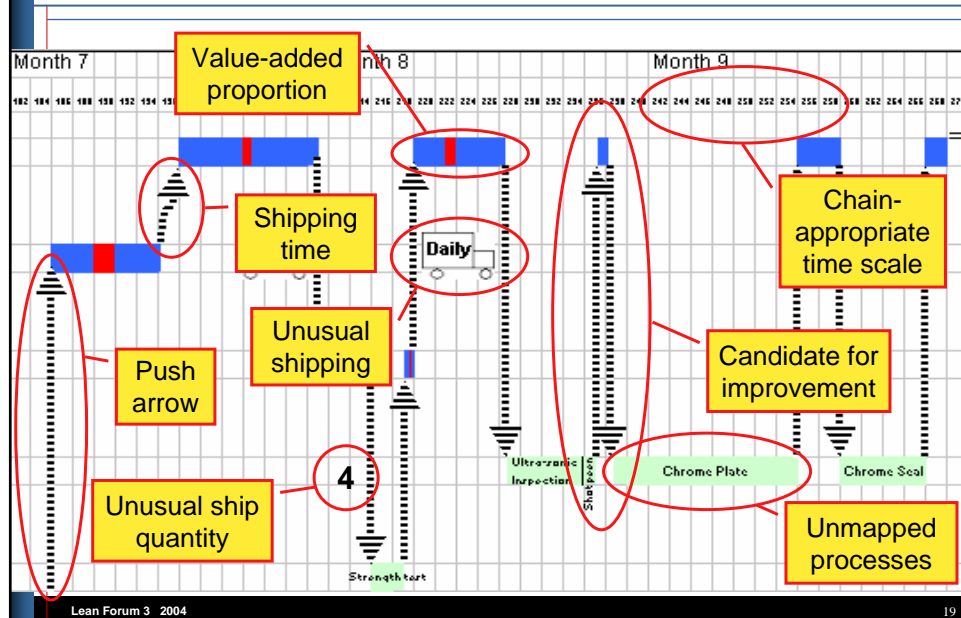
## Macro Timeline Chart

- ♦ Shows:
  - What time is spent where and proportion of that time the companies are adding value
  - Where the handoffs are in the process and to whom
  - Who has responsibility when
- ♦ Highlights a wide variety of opportunities
- ♦ Also used for both current and future states

## Example Timeline View



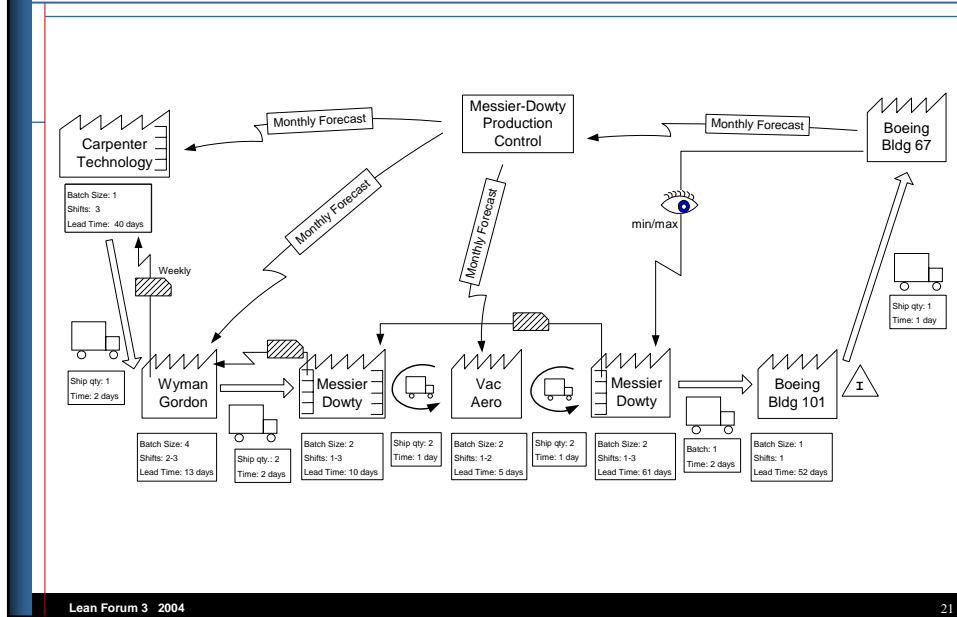
## Timeline View Up Close



## Move Toward the Future State

- ♦ Bring the companies together to
  - Compare future state to current state, determining the gaps between the two
  - Identify a set of multi-company collaborative improvement projects that will move the supply chain towards the future state
  - Identify which companies are going to work on which projects
- ♦ Create detailed plans for each project
  - Set specific goals
  - Determine timelines
  - Assign responsibilities
- ♦ Get to work!
  - Be ready to address additional opportunities as they arise

## Example Top-Level View – Future State



## Nose Gear Improvement Projects

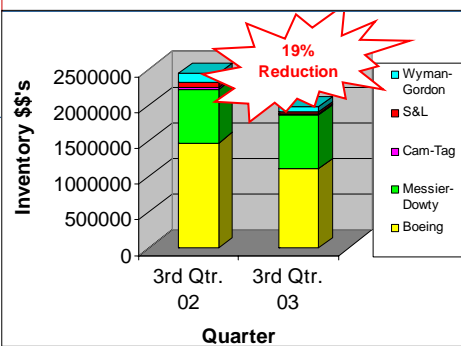
- ♦ Rationalize inspections: Streamline the manufacturing process by removing redundant and otherwise unnecessary inspections
- ♦ Rationalize batch sizes: Determine what the optimal batch sizes should be throughout the supply chain and do what's necessary to make them possible
- ♦ Fully dressed landing gear at Messier-Dowty: Shift assembly of electrical, hydraulics, and wheels from Boeing Material capability testing: Move material capability testing off the critical path
- ♦ Forecasting & Scheduling improvement: Goal of concentrating on improving forecast and actual purchasing data at steel supplier.

## Additional Activities

- ♦ Other cost and lead-time reduction activities spawned by the projects
  - Multi-company activities to reorganize/redesign manufacturing processes to eliminate process steps and part handoffs
    - Collaborative development of chrome-to-size process between Messier-Dowty, second-tier machine shop, and plating house
    - Messier-Dowty assembly process being substantially revised, with new floor organization, tools, methods, and supplier inspection, kitting, and packaging
  - Messier-Dowty recognized its spares quoting and contracting process was “broken,” has taken 6-month process to 10 days
    - Robust, personnel changes have not hurt the timing

*These unplanned activities may provide greater benefit than the planned ones*

## Nose Gear Supply Chain Improvements



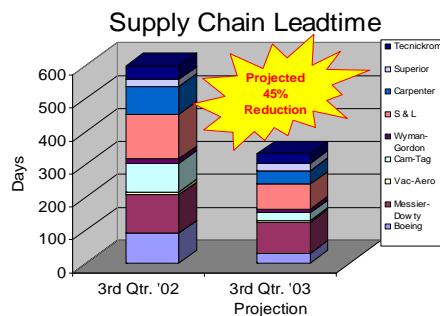
Supply chain inventory reduced

- Sum across chain = 19%
- Greater savings to come as more changes implemented and inventory bleeds off

Overall lead time has reached 48 week goal (from 62 weeks)

Lead time reductions off critical path

- reduce costs
- improve quality
- prevent new critical path



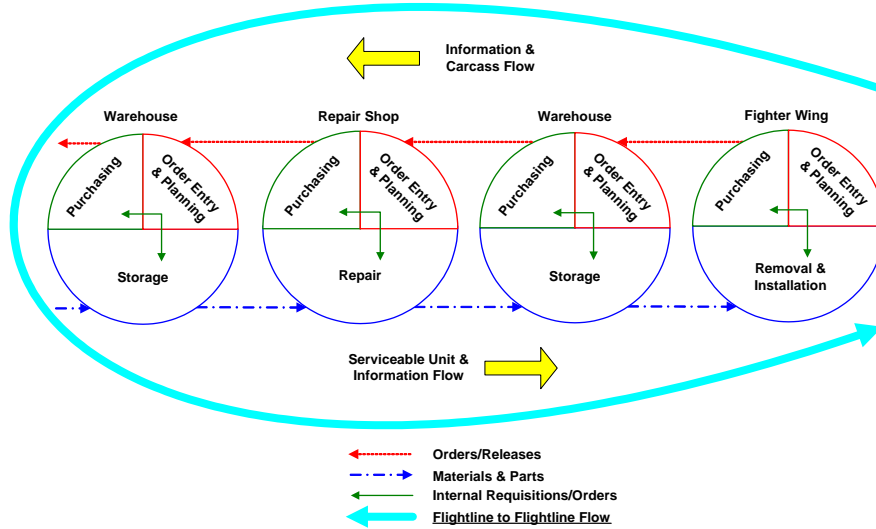
## Broad Supply Chain Benefits

- ♦ Greater understanding by all parties of each others' strengths and opportunities
  - Encouraging collaborative problem solving
  - Greater sense of shared goals
- ♦ Supply chain participation encourages management commitment
  - Joint Boeing/Messier-Dowty approach brought supplier managers on board
- ♦ Common tools, methods, and language across supply chain, improving cooperation and communication
  - Project training
  - Kaizen event (“Accelerated Improvement Workshop”) training at Boeing
- ♦ When Messier-Dowty recently warned its major suppliers to expect requests for a total of 25% in price reductions, only the two who were participating in this project responded with “We can do that”

## Broad Supply Chain Benefits (2)

- ♦ Suppliers moving forward with concepts
  - 3<sup>rd</sup>-tier steel supplier across 6000-person company, responded to Boeing
  - 2<sup>nd</sup>-tier machine shop both across its internal activities and working with additional suppliers on its own (will shift business away from those that don't undertake internal lean efforts)
- ♦ The improvements suppliers are making are not limited to focus parts
  - While Messier-Dowty is 15% of S&L's business, more than 50% of S&L's business eventually ends up at Boeing, Sikorsky is next largest customer

## Air Force Repair Supply Chain



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## New Air Force Project

- ♦ Mapping current state of supply chains for repaired F-16 parts
  - About 40% of mapping data collected
- ♦ Looking at two complex parts (multiple subcomponents)
  - Emergency power turbine (mechanical)
  - Radar component (electronic)
- ♦ Identifying opportunities across supply chains
  - Untracked wait time
  - Very complex information systems
  - Convoluted business processes
  - Many examples of “We’ve always done it that way”

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## Lean Supply Chains in Shipbuilding

- ♦ Lean supply chain approach is general
  - Not limited to aerospace, new construction, or DoD applications
- ♦ Supply chains provide many ship components, both new and repair
- ♦ Industry structure quite similar to aerospace
  - Low volumes
  - Limited selection of specialty suppliers
  - Limited number of shipyards
  - Spread across continent
- ♦ Suppliers with primary responsibility for major systems can apply lean to their supply chains
  - E.g., propulsion systems, control systems, accommodations

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## Beyond Traditional Lean

- ♦ The lean supply chain approach has 5 key elements that go beyond traditional lean:
  - Deliberately inclusive and broad-based thinking, from order to delivery
  - Macro (supply-chain level) metrics that drive the process
  - Macro level analysis tools and methods
  - Supplier teaming, collaboration, communication
  - Joint customer/supplier participation in assessment *and* implementation
- ♦ The result is greater benefit than can be achieved by individual-company lean alone

Guidebook: *Developing Lean Supply Chains* downloadable from:  
<http://www.altarum.org/altarum/publications/publications.asp>

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*Tom Phelps*

*734-302-4650*

*tom.phelps@altarum.org*

*www.altarum.org*

*Teri Hoenes*

*314-504-8419*

*teri.l.hoenes@boeing.com*

*www.boeing.com*