

Lean Aerospace Initiative Plenary Workshop

Implementation Workshop Highlights: Customer and Supplier Integration Across the Supply Chain



Sponsored by LAI

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Presentation Overview

- **Customer and Supplier Integration Across the Supply Chain**
 - Workshop design overview and key considerations
 - Customer-supplier integration and the Lean Enterprise Model (LEM)
 - Core Insights
 - Highlights across three case studies
 - Small group analysis of supplier roles in transition from engineering to manufacturing
 - Lessons from sub-tier supplier panel
 - Presentation by the Toyota Supplier Support Center
 - Recommendations in six topic areas
 - Next steps and research implications



Work Group Recommendation Topics

- **Communication and Trust Across the Supply Chain**
- **Supplier Integration in Engineering and Design**
- **Supplier Integration in Production and Sustainment**
- **Strategic Partnerships**
- **Centralization and Strategic Planning in the Procurement/Materials Function**
- **Supplier Certification, Development and Diffusion of Innovation**



Workshop Design Overview

- **Teams of 3-5 representatives from 14 organizations**
- **Day One**
 - Morning case study: Long-term agreements (Textron)
 - Afternoon case study: Centralized procurement (Lockheed Martin)
 - Five breakout groups meeting in morning and afternoon
 - Keynote lunch presentation -- Toyota Supplier Support Center
- **Day Two**
 - “The Supplier Game” simulation
 - Morning case study: Transition from engineering to manufacturing (JDAM -- Boeing/McDonnell Douglas)
 - Small group analysis
 - Sub-tier supplier panel
 - Afternoon recommendations from breakout groups



Key Considerations

- **The purpose of the workshop**
 - Data collection and shared learning for the benefit of the entire consortium -- driven by Implementation IPT
 - Individual/organizational learning and linkages
- **Case studies selected for diversity and potential to stimulate learning**
- **The workshop featured:**
 - Customers and Suppliers
 - Competitors
 - Newly merged partners
 - Union and management representatives
 - Multiple organizational levels and functions



Lean Enterprise Model (LEM)

- **Which of the overarching practices in the LEM are relevant to customer/supply integration?**
 - *Identify and Optimize Enterprise Flow*
 - *Assure Seamless Information Flow*
 - *Optimize Capability and Utilization of People*
 - *Make Decisions at Lowest Possible Level*
 - *Implement Integrated Product and Process Development*
 - *Develop Relationships Based on Mutual Trust and Commitment*
 - *Continuously Focus on the Customer*
 - *Promote Lean Leadership at All Levels*
 - *Maintain Challenge of Existing Processes*
 - *Nurture a Learning Environment*
 - *Ensure Process Capability and Maturation*
 - *Maximize Stability in a Changing Environment*



Core Insights

- **Supply chain integration involves virtually all lean principles and practices**
- **Overall industry trend towards increased interdependency between customers and suppliers**
 - IPT Membership
 - Integrated electronic communication, CAD/CAM, and other functions
 - Shift from certification to development
 - Use of commercial standards
 - Direct worker to worker contacts
 - Risk/reward sharing arrangements
 - Long-term agreements



Core Insights

- **Strategic implications**
 - Make-buy decisions
 - Reduced supply base
 - Shared design and engineering
- **Re-examing basic assumptions**
 - Importance of flexibility and competition
 - Low cost versus high value
 - Tangible incentives versus intangible relationships and learning
 - Customer preferences and Industry capability
 - Potential for “reverse diffusion”
- **Workshop participants -- a powerful sounding board**



Case Study Highlights

- **Textron -- Long-term agreements with suppliers, based on lean principles**

1) Process mapping; 2) Best value concept (cross-functional teams); and 3) Long-term agreements

- **Lockheed Martin -- Sector-wide materials management and process improvement, with supplier comments by Allied Signal**

Phase 1: Restructuring and “War Room” for process mapping/ improvement; Phase 2: Lean principles training, kaizen events and extension to 2nd/ 3rd tiers



Case Study Highlights

- **Boeing JDAM -- Challenges and opportunities with respect to supplier roles in the transition from design to production**

Extending acquisition reform lessons during engineering through continued integration of suppliers in a lean, demand/pull production operation



Supplier roles in transition from engineering to manufacturing

- **Don't tie supplier's hands in use of products and capabilities with competitors**
- **Information flow and team membership to ensure control and alignment among sub-tier suppliers**
 - *Design changes*
 - *Leadership changes*
 - *Diffusion of innovation*
- **Team level decision making**
- **System-wide metrics, including production forecasts and cost/schedule/quality performance**
- **Continued active government role, including feedback and assistance**



Lessons from sub-tier supplier panel

- **Overall value -- not just cost**
- **Constant communications -- often betting the business, so no surprises**
- **Importance of personal relations -- huge impact of restructuring**
- **Standardize on information and CAD/CAM technologies**
- **Design allowance -- everything need not be requalified**
- **Integrated suppliers -- a key source of competitive advantage**



Toyota Supplier Support Center

- **Why establish a supplier support center?**
 - The thinking behind the system
 - Applying the thinking
- **Appliation of the Toyota Production System in conditions of low volume and variable demand**
 - The concept of “True North”
 - What is wrong with batch production?
 - High volume and low variety versus other conditions
 - A deceptively simple question -- what do your customers (government and airlines) want?
 - “Customers in this industry behave the way they do within the constraints that the industry has set for them. If the industry had different capabilities, then the customers would behave differently.”



Communications and Trust

- **Selected recommendations:**
 - **Adopt/implement/invest in aerospace sector electronic commerce with appropriate security to support entire supply chains**
 - **Streamline sharing of protected information with suppliers -- place legal and contracts representatives on IPT's**
 - **Develop reward sharing across the supply chain -- incentives flow directly to individuals based on improvements in cost, quality, on-time delivery**
 - **Implement frequent, personal communications between top executives and team members to achieve positive reinforcement of corporate commitments.**



Supplier Integration in Design and Engineering

- **Selected recommendations:**

- **Make a conscious decision to implement, advocate, nurture, and support a long term commitment to supplier integration**
- **Provide significant compensation and rewards at all levels to support total team success (Rewards and Punishments?)**
- **Leadership provides necessary resources to support supplier integration**
- **Establish and uphold business relationships with suppliers that incentivize their commitment and support (hard guarantees)**
- **Implement a process or group to facilitate and assure supplier integration**



Supplier Integration in Production and Sustainment

- **Selected recommendations:**

- Establish regular meetings of executive IPT (see LEM) and include the supply chain
- Set and support the vision of the value stream
 - Quantifiable goals with incentives
 - Active information flow
- Enable change during production and sustainment through:
 - Business practices
 - Tools
 - Culture
 - Organization
 - Education and Training
- Respond to and anticipate change throughout the value chain



Strategic Partnerships

- **Selected recommendations:**

- **Get senior management buy-in, commitment, and support -- develop methods, process, and specific procedures for strategic partnerships**
- **Develop business case and plan, including exit Criteria**
- **Develop “win-win” strategies and mechanisms that maximize benefits while minimizing associate liabilities; i.e., “don’t tie me up”**
- **Seek out opportunities for reward and recognition -- “Nurture” relationships**



Centralization and Strategic Planning in the Procurement/Materials Function

- **Selected recommendations:**

- Enable procurement/material management functions to be a strategic partner through training and development
- During the restructuring of business operations, coordinate in real time the implications for purchasing, procurement, and material management
- Balance pressure to centralize or decentralize based on system/people capabilities, nature of operations, nature of materials -- for example: Centralize commodity items, decentralize custom and subcontract items.



Centralization and Strategic Planning in the Procurement/Materials Function

- **Additional finding – a recommended curriculum for training and development in the procurement/materials function:**
 - Negotiating partnerships, not just contracts
 - Knowledge of products, commodities
 - Knowledge of engineering and manufacturing processes
 - Cost accounting and forecasting principles
 - IPT membership and capability to coach
 - Citizenship in industry
 - Principles of “supply chain management”
 - Principles of system integration technology



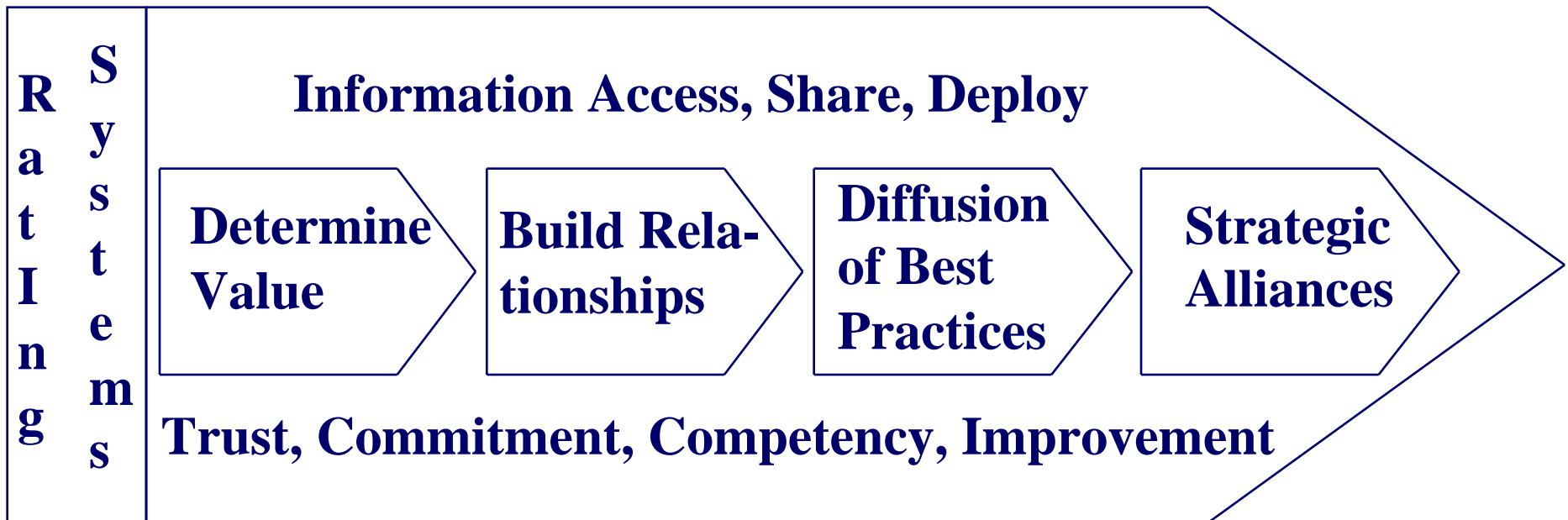
Supplier Certification, Development and Diffusion of Innovation

- **Selected recommendations:**

- ***Re-orient/clarify values and metrics***
 - From: Measuring your suppliers -- To: Measuring total system effectiveness
- ***Commission values clarification team (by CEO)***
 - Characterize emerging and strategic business priorities; Translate to values and operating principles/ behaviors; Simple articulation for enterprise alignment -- 'True North'
 - Commission and empower deployment team
 - Values and metrics agreement across (vertical and horizontal) extended enterprise; Develop deployment toolset -- 'War Room'
- ***Aggressively Implement - Just Do It!!!***
 - Stop analyzing; Deploy accountable teams; Provide experienced implementation expertise; Adjust deployment details at lowest level, as required



Supplier Certification, Development and Diffusion of Innovation





Next Steps

- **Workshop notes distribution and back home assignment -- Executive board member briefing**
- **Benchmarking and Networking**
- **LAI plenary workshop and parallel executive briefing**
- **Workshop final report and LEM data sheets**
- **Next Implementation Team workshop**



Selected Research Implications

- **Understand dynamics when values and assumptions are revealed -- such as in make-buy decisions or restructuring of supplier contracts**
- **Anticipate system implications of increased interdependency**
- **Assess performance implications more integrated supplier arrangements**
- **Look further upstream to assess supplier and lean implications at initial program establishment -- explore assumptions about customer preferences and industry capability**



Additional Detail on Workshop Events

- **Case study summaries**
- **Small group analysis of supplier role in transition from engineering to production**
- **Sub-tier supplier panel**



Long-Term Agreements -- Textron

“In the past, if you talked to an engineer about a problem, it was always the supplier’s fault. That attitude has really changed”

Background

- 10x Lean Initiative at Textron
- Use of Lean Enterprise Model (LEM)

● Implementation -- Step 1

- *Procurement process flow*
 - *Process mapping -- Example: time to get requisitions out*
 - *Identification of “low hanging fruit”*
 - *50% reduction in size of procurement manual*

● Implementation -- Step 2

- *Best value concept*
 - *Overall quality, delivery and affordability*
 - *Cross-functional supplier evaluation teams*



Long-Term Agreements -- Textron

- **Implementation -- Step 3**

- *Long-term agreements*

- *Best-value selection and supplier management process*

1. Understand baseline and define scope
2. Selection criteria to meet objectives
3. Develop terms and conditions
4. Execute procurement process
5. Supply chain continuous improvement and metrics

- **Results to date**

- 25 LTAs covering 118 parts (most are 5 year agreements) -- accounting for 75% of procurement dollars
- 50/50 split on continuous improvement gains (50% to supplier and 50% to end customer)
- “We get, you get” contracts
- Reduction in supply base, increased long-term planning capability, extension of lean principles



Centralized Procurement -- Lockheed Martin

- **Main objectives**

- Reduce cost, improve quality, reduce inventory, reduce the supplier base, and reduce span time

- **Background**

- Study found materials cost account for 47% of total costs
- Of 14,000 suppliers, 2% (230) account for 75% of expenditures
- Documentation of current processes

- **Implementation -- Phase 1**

- Restructuring with Central Operations and two Site Operations
- Suppliers with high leverage -- lean principles, non-value added processes/requirements eliminated, alternative materials and sources, commercial practices
- “War Room” focused on process improvement



Centralized Procurement -- Lockheed Martin

- **Implementation -- Phase 2**

- Team training in lean principles -- kaizen and six sigma
- “Kaizen events”
- Extension to second and third tier suppliers

- **Results to date**

- 9 suppliers, 200 identified projects (6 complete; 126 in process)
- From six complete projects -- \$550,000 current contract savings and \$1.6 million future savings
- Identified savings of \$56.6 million in hardware and \$148.3 million in logistics

- **Supplier comment -- Allied Signal**

- Suppliers brought in early and given training
- “Exceptionally well managed communication”
- Linkage from AMMC to other groups in Lockheed Martin -- especially engineering



Transition from Engineering to Production -- Boeing JDAM

● **Vision**

- “To be recognized as the first, and premier, acquisition reform program to deliver an affordable system that meets all system requirements and user needs ahead of schedule and under cost, with a fair and reasonable profit for all our partners.”
- Importance of suppliers
- Procured material over 90% of JDAM cost -- 22 suppliers
- No Boeing fabrication
- Annual rates up to 20,000
- Over 100 turns in five years
- “Gold” and “Silver” certification levels required to achieve cost and schedule targets
- Long-term agreements
- Demand/pull system



Transition from Engineering to Production -- Boeing JDAM

- **9 key issues identified in transition from engineering to production**
- **Supplier and government participants**
 - JDAM SPO
 - Rockwell Collins
 - Stremel Manufacturing
 - Lambda Advance Analog



Supplier Issues in Transition from Engineering to Production

- *Suppliers use of products and capability with competitors*
 - *Recommendation:*
 - Don't tie suppliers hands
 - Ensure advance notice on future competitions
- *Ensuring control and alignment with sub-tier suppliers on design changes*
 - *Recommendation:*
 - *Cross-supplier IPT to define clear / "real" requirements*
 - *Continuous improvement of communication / information flow*
- **Hand off within supplier as JDAM goes from design to manufacturing**
 - *Recommendation:*
 - Designs should not be "handed off" to manufacturing. They should be jointly developed by design and manufacturing functions.
 - IPT focus will place greater emphasis on manufacturing, freeze/block changes
- **Turnover at executive level in both organizations:**
 - *Recommendation:*
 - Refocus meetings on a regular basis throughout a program's life cycle.



Supplier Issues in Transition from Engineering to Production

- **Ensuring demand flow capability of suppliers.**

- Recommendations:
 - Recognize long term relationships
 - Understand capabilities on the team, and the opportunities
 - Product yield predictability
 - On-going validation of capacity management
 - Frequent visible two-way communication of schedule status and issues
 - Transportation planning and contingency

- **Ensuring reverse diffusion of innovation**

- Recommendations:
 - Effective means of communication
 - Electric systems that span the supply chain
 - Incentive program (individuals as well as companies)
 - Team management (manage turnover)
 - Early involvement in engineering changes
 - Performance based specifications



Supplier Issues in Transition from Engineering to Production

- **Team-level decision-making on supplier issues**
 - Recommendations:
 - Continue electronic communications
 - Bi-weekly teleconferences with each supplier
 - Document team decision process
 - Rebuild team working relationships
- **Metrics to share with suppliers – which ones, how frequently**
 - Recommendation:
 - Metrics –
 - Delivery
 - Cost
 - Quality (supplier defects)
 - System-wide (company-customer)
 - Metrics shared monthly
 - Other sharing besides Metrics –
 - Production forecasts
 - Cost performance



Supplier Issues in Transition from Engineering to Production

- **Continued government role in supplier certification and development**
 - *Recommendations:*
 - *Government funding directed at lean practices and the enablers of gold certification*
 - *front loaded investment*
 - *Continued economic incentives to meet or exceed improvement curves*
 - *Government as “user” to provide performance feedback to the team for improvement opportunities.*
 - *Government shouldn’t dictate terms, over-regulate teams, or fail to provide incentives.*
 - *Government is clearly a long-term member of the IPT*



Sub-Tier Supplier Panel

- **Initial questions for the Sub-Tier Supplier Panel:**

- *What is the recipe for trust?*
- *How do you want us to do business with you?*
- *How receptive are you to new ideas?*
- *Will you absorb hard costs or reduced lead times in exchange for assistance from OEMs?*
- *What is the motivation to be involved?*
- *How do you deal with multiple customers with different requirements and different certification programs?*
- *How much have you saved with lean principles?*
- *Is there a willingness to invest in exchange for long-term agreements?*



Sub-Tier Supplier Panel

- *To build trust, show it in your behavior – no surprises (even with bad news)*
- *Consider the following four combinations based on products and customers: 1) one product/ one customer; 2) many products/ one customer; 3) one product/ many customers, 4) many products many customers – don't treat them all the same*
- *For a small supplier, bidding on work may be betting the business – so give us advance notice, even when exploring options*
- *It comes down to personal relations with individuals in the customer's organization – so restructuring can have a big impact*
- *Long-term agreements enable business planning and job security for employees, but the rules are different*
- *We can't set up dedicated lines for each business on low volume contracts (is this a barrier to lean? No, but it makes it harder)*
- *Give sub-tier manufacturers a design allowance and build trust – so everything doesn't need to be requalified*
- *Focus on overall value, not just cost*
- *"Build to print" is a vague definition of responsibility and requires sensitivity*



Sub-Tier Supplier Panel

- ***Integrated teams with suppliers can be a key source of competitive advantage***
 - ***Customer focus on lean can help drive lean implementation in suppliers***
 - ***Don't just communicate around bad news/crises***
 - ***Manage trust at all levels***
 - ***Use of dedicated business unit for each customer to manage different certification***
 - ***Educate customers on "best value"***
 - ***Standardize on the information and CAD/CAM technologies – give us an interface that we can use***
- **Conclusions**
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 - *Communications is critical*
 - *Process improvement needs to be an integrated activity*
 - *Sharing metrics is essential*
 - *You can't force capability*
 - *It's clear we have shared destiny*
 - *Flexibility in changing with the environment – metrics, communication, etc.*