Lean Aircraft Initiative
Plenary Workshop
Implementation IPT

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Overview

- Core themes, design overview and key considerations
- IPPD in the Lean Enterprise Model (LEM)
- Five dimensions of IPPD
- Lessons across three case studies
- Recommendations in five topic areas:
  - Rewards and incentives
  - Leadership and integration
  - Performance measurement
  - Functional roles and career development
  - Dynamics across product and team lifecycles
- Keynote address and industry presentation
- Products and next steps
Core Themes

- There is not just one type of IPPD context
  - No one “cookie cutter” IPT model that applies in all settings
  - Five elements of the IPPD context to consider:
    Customers, Products, IPTs, Suppliers, Time

- Implementation of IPTs is not a one-time event
  - The challenge of managing an ongoing process
  - Key implementation recommendations are deceptively simple

- Implementing IPTs in an IPPD context requires fundamental changes in the flow of information, authority, rewards and expertise in organizations
Teams of 3-5 representatives from 14 organizations

Day One
- Morning case study: Rockwell Avionics and Communications
- Afternoon case study: Northrop Grumman -- GATS/GAM
- Five breakout groups meeting in morning and afternoon
- Keynote lunch speaker -- Anne Donnellon, F.W. Olin Graduate School of Management at Babson College

Day Two
- Morning case study: F-22 (Lockheed Martin and Boeing)
- Opportunity to examine diversity of IPPD elements
- Featured industry presentation -- David Roggenkamp, Ford Motor Company
- Afternoon recommendations from breakout groups
The Learning Cycle

Data → Knowledge → Action → Data
Key Considerations

- The purpose of the workshop
  - *Data collection and shared learning for the benefit of the entire consortium*
  - *Individual/organizational learning and linkages*

- The workshop featured:
  - *Customers and Suppliers*
  - *Competitors*
  - *Newly merged partners*
  - *Multiple organizational levels and functions*
    - The highest quality knowledge generation depends on appreciation of this diversity
Key Considerations (cont.)

- Case studies selected for diversity and potential to stimulate learning

- Defining terms:
  - **Context/Strategy/Structure:**
    - **IPPD:** Integrated Product and Process Design
  - **Process/Structure:**
    - **IPT:** Integrated Product Team
Lean Enterprise Model (LEM)

- **Overarching Practices**
  - 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
Five elements surfaced from diversity of cases:

- Customers
- Products
- IPTs
- Suppliers
- Time

First four elements vary along two dimensions:

- Scale -- (few, moderate, many)
- Adaptation/Innovation Required -- (little, moderate, extensive)

Dimensions of time:

- Bounded, Periodic, and Continuous

Still preliminary -- grounded research
Case Study Highlights

- **Rockwell Avionics and Communications**
  - IPPD/IPT process focusing on 1) reducing variation in manufacturing, 2) transferring of accountability from design to manufacturing and 3) design robustness/readiness assessment measurement tool

- **Northrop Grumman Corporation**
  - IPT implementation adding GPS aided targeting system for B-2A advanced technology bomber with a focus on Quick Reaction Capability (QRC) to streamline the program design approval and development process.
F-22 Team

- **System Program Office (SPO)** -- Background on the F-22 Air Dominance Fighter Program, including mission, requirements, contract structure, and how the Air Force SPO has been structured to manage an industry IPT/IPPD approach.

- **Program Overview** -- Program-level IPPD experiences with a focus on the use of Analysis and Integration (A&I) teams to achieve major systems integration. Integrated Product Team successes and difficulties will be highlighted.

- **Boeing Defense and Space Group** -- Lessons from integrated team leadership assignments across multiple phases of the product development process

- **Lockheed Martin Aeronautical Systems Sector** -- Integrating the F-22 structure (forward, mid, aft fuselage and wings) using common graphical design systems and common design/manufacturing methodologies among multiple, widely dispersed partners. Major changes in aircraft design and manufacturing practices such as the elimination of master tooling and mockup will be discussed.
Classification of the Cases

- A preliminary analysis -- designed to be illustrative, not definitive

- Classification by scale is relatively straightforward

- Classification by required adaptation/innovation involves more interpretation

- Potential value for self-assessment and strategic planning
## Case Studies Compared

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<th>Elements</th>
<th>Rockwell Collins</th>
<th>Northrop Grumman</th>
<th>F-22</th>
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<td>Customers</td>
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**Key for Scale:** Few, Moderate, Many

**Key for Adaptation/Innovation:** Low, Moderate, Extensive
Insights from IPT Launch Analysis

- **Common to all IPTs**
  
  A. Specify product requirements (features, timing, links to other products)
  
  B. Establish mechanisms for communication and coordination
  
  C. Clarify resources (budget, training, facilities, software platform, senior champion)
  
  D. Ensure leadership
  
  E. Need to re-align organizational culture

- **Distinctions among IPTs**
  
  A. Variation in tolerance for requirements creep and expected changes in other products
  
  B. Variation in importance of horizontal and vertical coordination of activities
  
  C. Contrast between co-location and electronic coordination
  
  D. Contrast between leader as “coordinator” and leader as “champion”
  
  E. With scale, culture challenge is larger, but lower risk of being marginalized
Recommendations

- Rewards and incentives
- Leadership and integration
- Performance measurement
- Functional roles and career development
- Dynamics across product and team lifecycles
Rewards and Incentives

- **Team based**
  - *Rewards*
    - Financial
    - Tangible Benefits ($)
      - Cash Awards
    - Career Path
      - Educational Opportunities
      - Promotion - Career enhancing assignments
      - Separate IPT career path

- **Non-Financial**
  - *Recognition*
    - Medals, Letters of appreciation, etc.
  - *Underlying assumptions about motivation*
Leadership and Integration

Within an organization

- Senior executive management must advocate and enable the IPT philosophy
  - Use industry-wide definitions as a baseline
    - IPT definition
    - Role of IPT leaders
  - Develop robust company-wide process for selecting, developing, and maintaining IPT leadership

Industry-wide

- Develop a “Capability Maturity Model” which delineates the characteristics of an IPT
  - Recognize and support people when they are executing and acting like an IPT
Performance Measurement

- Set clear enterprise “big picture” metrics and synchronise at every level
  - New programs can then look upward to corporate metrics and flow downward
  - Anticipate feedback and adjustment in both directions

- Fewest possible measures
  - Driven by product and program requirements

- Shift with phases of implementation
  - Early on, focus on the right management system (including metrics feedback process)
  - Over time, focus increasingly on outcomes

- Fundamental culture shift in finance, other functions
  - From downward control to both control and support
• **Balance specialists and generalists**
  - *Clearly define roles/responsibilities of functional groups*
  - *Identify skill needs and share responsibility for training*
    - Functional groups: Assure a pool of specialists
    - IPTs: Mentoring, coaching, and OJT
  - *Clear staffing process*

• **Motivate/maintain expertise within IPT environment**
  - *Career planning opportunities*
    - Rotation, technical sabbaticals, promotions (within and across functions), functional leads selected from both functions and IPTs
    - Shared training -- organization and individual

• **Career development/path for IPT leaders**
  - *Senior management recognition of IPT leadership as a discipline*
  - *Compensation and defined skill sets at each tier*
Dynamics Across Product and Team Life Cycles

- Top level recognition that you don’t have the right team in place for tomorrow
  - No static solutions

- Team composition/development strategy wired to product life cycle
  - IPPD/IPT valid process
  - Requires change strategy

- Recognize there are some things IPTs cannot impact
  - Overhead, capacity utilization, etc.
Four Challenges

1. The environment that creates the need for teams is often inhospitable to team work.
2. Teams are expected to produce revolutionary change but are rarely seen as revolutionary themselves.
3. The more integrated the team becomes, the less differentiated the team members become.
4. Structuring team work is critical but threatening to the team process.

Four recommendations

A. Leadership specifies ends, not means.
B. Training and coaching are critical.
C. Evaluating and rewarding teams requires complex tradeoffs of many variables.
D. Adapt career paths to new strategic and work requirements.
Product development process leadership at Ford

- **Ford Product Development System (FPDS)**
  - Linked to Ford Production System (FPS) and systems for “order to delivery” and “after sales service”

- **Three places to take time out of the development process -- focus on the first two**
  1) Defining the product, 2) Design and Analytical Verification, and 3) Development, Tooling and Launch

- **Themes of: People, process and technology**
  - Systems engineering, Product development factory, Reusability, Voice of the customer, Job #1-like commitment, Teamwork

- **Results**

  **Individual Programs:** Time-to-market (25-45%), Warranty (25-30%), Resources (30-40%), Investment (25-30%)

  **Total System:** More new programs, Improved cash flow, more employee pride
Products and Next Steps

- Workshop Notes Distribution
- Back Home Assignment -- Executive Board Member Briefing
- Benchmarking and Networking
- LAI Plenary Workshop and Executive Briefing
- Workshop Final Report
- LEM Data Sheets
- New Research Initiatives
- Upcoming Implementation Team Workshop
  - Potential Topic: Integration Across the Supply Chain