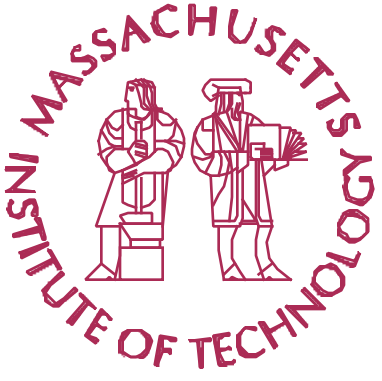
Lean Aircraft Initiative
Plenary Workshop

Implementation IPT



October 8 -9, 1997

Presented By: Joel Cutcher-Gershenfeld
Sloan School of Management, MIT

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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**

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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**

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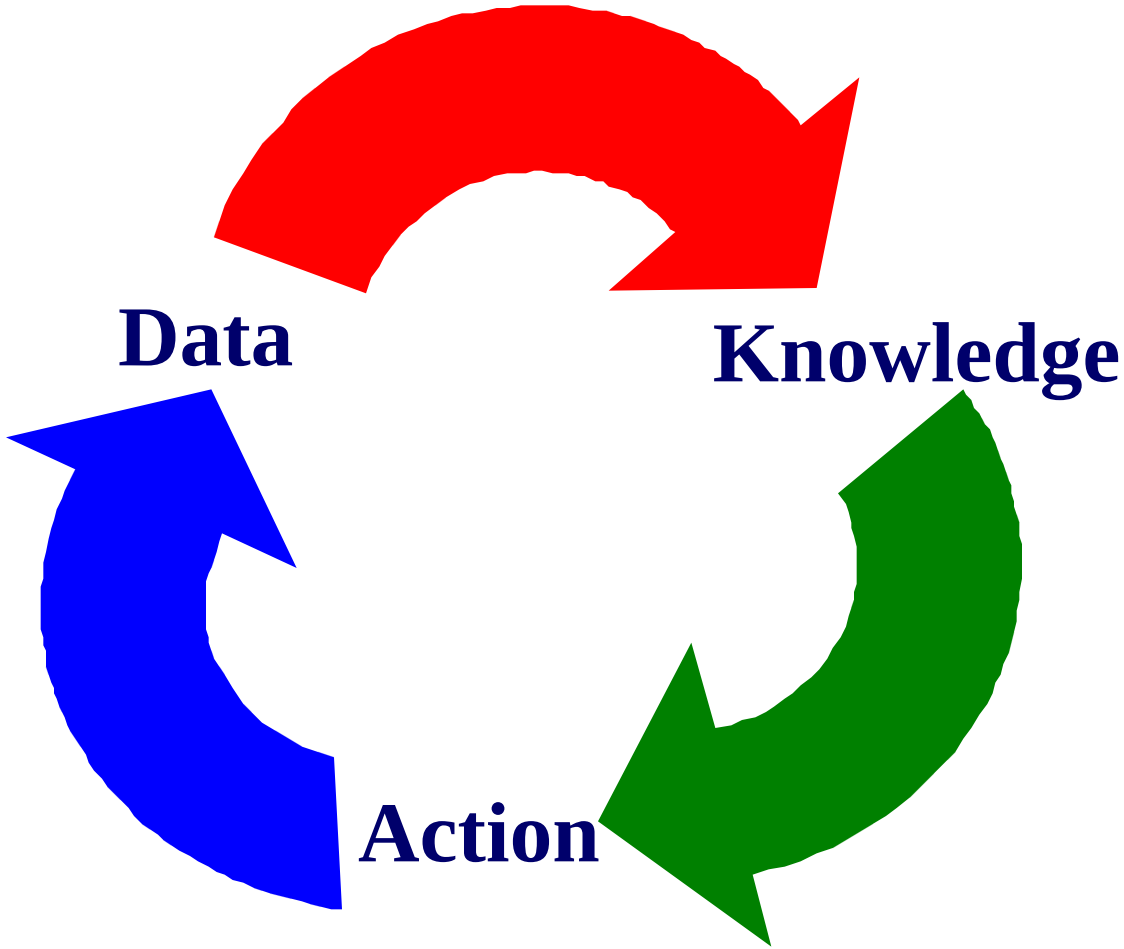
Design Overview

- **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 (Lockeed 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



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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

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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

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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*

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Emergent IPPD Framework

- **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**

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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
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- **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.
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Case Study Highlights (cont.)

- **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.**

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Classification of the Cases

- A preliminary analysis -- designed to be illustrative, not definitive
- Classification by scale is relatively straight-forward
- Classification by required adaptation/innovation involves more interpretation
- Potential value for self-assessment and strategic planning

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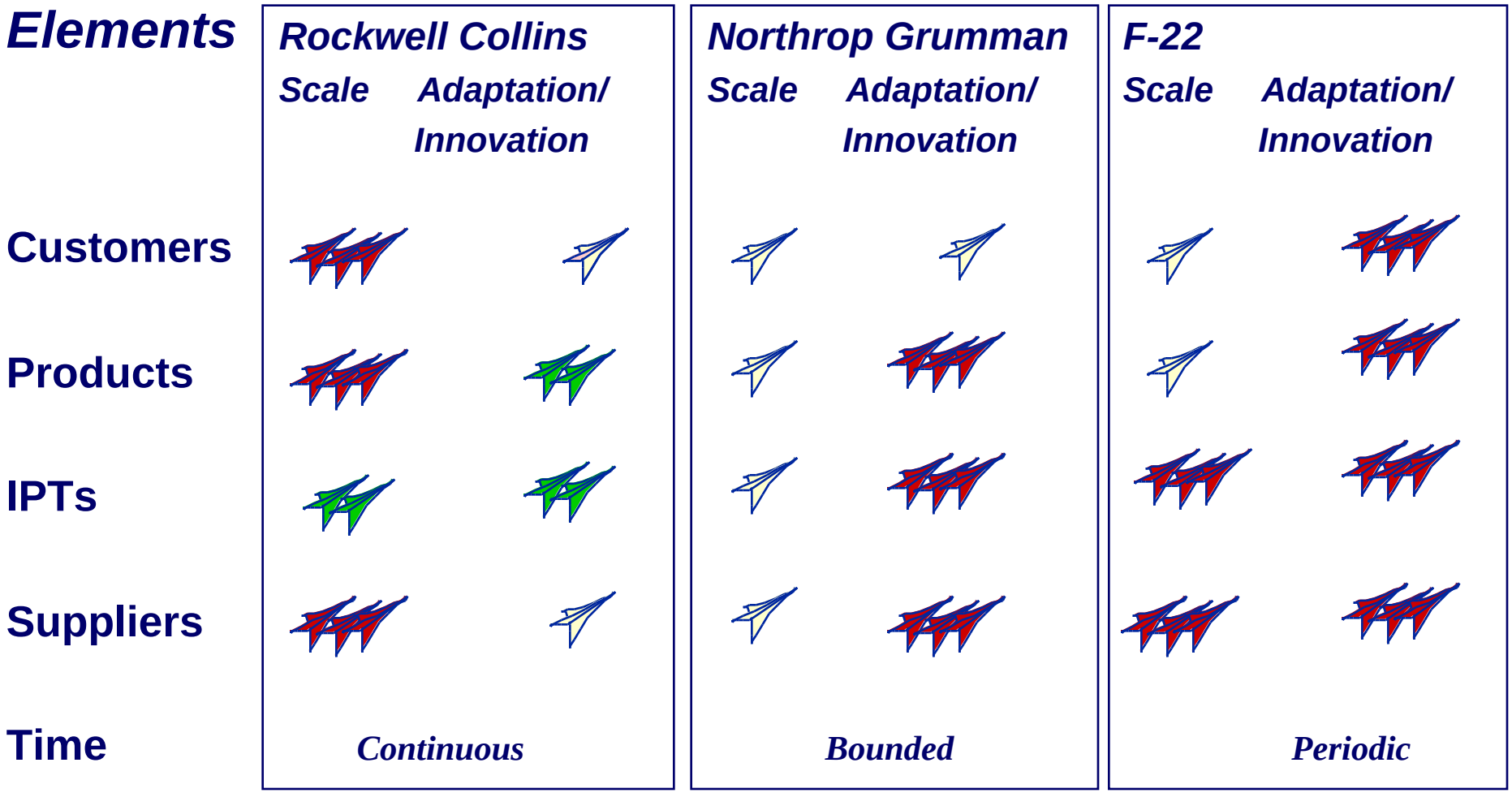
Case Studies Compared



Key for Scale: Few Moderate Many

Key for Adaptation/Innovation: Low Moderate Extensive

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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*

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Recommendations

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

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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*

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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

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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*

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Functional Roles and Career Development

- **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*

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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.*

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Keynote Address by Anne Donnellon

- **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.*

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Industry Presentation by David Roggenkamp

- **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

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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*

