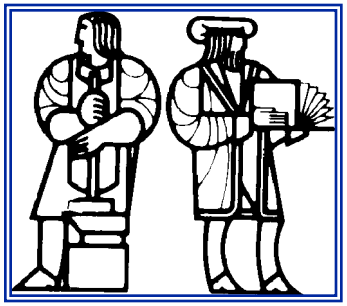
Lean Aircraft Initiative
Plenary Workshop

Product Development Focus Team



March 5, 1997

presented by

John Deyst
MIT

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Agenda

Product Development **Phase 1/Phase 2 Research**	**Deyst**
Example of Key Characteristics Application in Industry	**Ramkumar**
Key Characteristics Research	**Thornton**

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Phase 1 / Phase 2 Research Topics

- Software Factory Process
- Database Commonality
- Design Change Metrics
- Design Structure Matrices
- Reducing DoD Product Development Cycle Time

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Software Factories

- **Phase 1 Results: Case Studies indicate**
  - **40% increases in productivity**
  - **80% decreases in errors**
- **Fundamental Idea:**
  - **A systematic, controlled, and highly automated approach to software development can significantly decrease cost and cycle time**
  - **Facilitation of software re-use is the key factor in these improvements**

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Software Factories (cont.)

- **Supporting Evidence: Corresponding results reported from commercial and foreign organizations**
- **Phase 2: None currently planned, report available on the World Wide Web**

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Database Commonality

- **Phase 1 Results: Survey with follow-up interviews and case studies indicate**
  - **Correlation between database commonality and team interaction**
  - **Earlier design/cost tradeoffs**
  - **60% reductions in cost overruns**
  - **50% reductions in schedule overruns**
- **Fundamental Idea: Seamless information flow**

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Database Commonality (cont.)

- **Supporting Evidence :**
  - **Earlier research results in commercial product development**
  - **Architectural innovation enabled by supplier participation in conceptual design contributing to 65% projected cost reductions**
- **Phase 2 Research: Technology supply chain management (joint with SR)**
  - **Role of suppliers in product innovation**
  - **Supply chain development**
  - **Policy issues/incentives**

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Design Changes

- **Phase 1 Results: Interviews and before/ after case studies indicate**
  - **Introduction of IPTs, CAD and training reduced design changes by factors of 2 to 4**
  - **The design change ratio is a consistent normalized metric across organizations**
- **Fundamental Idea:**
  - **Design changes are indicators of the quality of product development processes**

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Design Changes (cont.)

- **Supporting Evidence: A dynamic model of design change processes, recently implemented at a major airframe organization, provides direct indications of IPT effectiveness**
- **Phase 2 Research: System dynamics modeling of design changes (joint with SR)**
  - **Develop a methodology for design change modeling applicable across LAI**

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Design Structure Matrices (DSM)

- **Phase 1 Results: A case study using DSMs identified numerous information transfer inconsistencies between IPTs working on a major airframe development**
- **Fundamental Idea: The complexity of product development processes can be effectively managed using the DSM methodology**

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Design Structure Matrices (DSM) (cont.)

- **Supporting Evidence: Recent results indicating the utility of DSMs as a tool for managing iteration in product development**
- **Phase 2 Research: Models and tools, design structure matrices**
  - **Analyze information flow between IPTs**
  - **Establishing priorities under resource constraints**
  - **Risk management**

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Reducing DoD Product Development Cycle Time

- **Phase 1 Tentative Findings: Preliminary evidence suggests**
  - **DoD controlling influence on schedules**
  - **Product requirements, technology development, and process development appear to have lesser influence on schedules than funding profiles**

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Reducing DoD Product Development Cycle Time (cont.)

- **Fundamental Idea:**
  - **Product development schedule performance can be improved by better matching resource availability with requirements, and product and process technology**
- **Supporting Evidence:**
  - **Broad range of information used for creating product development schedules in commercial practice**

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Reducing DoD Product Development Cycle Time (cont.)

- **Phase 2 Research:**
  - **Surveys of industry program managers (~106)**
  - **Survey of Program Element Monitors and Requirements Officers (35 returned to date)**
  - **Detailed analysis and documentation**
  - **Policy recommendation developed with Policy Focus Group**

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Phase 1 Summary

Effort	Findings
Software Factories	40% productivity increases 80% error reductions Reuse of proven software modules
Database Commonality	60% reductions in cost overruns 50% reductions in schedule overruns Seamless information flow
Design Changes	Factor of 2-4 decrease (IPTs, CAD, training) Dynamic model
Design Structure Matrices	Identified information transfer inconsistencies (preliminary)
DoD Cycle Time	Identified key role of resource availability (preliminary)

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Phase 2 Research Topic Summary

- Architectural innovation enabled through supply management
- System dynamics modeling of design changes
- Design structure matrices
- Reducing DoD product development cycle time
- Key Characteristics

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