Lean Aircraft Initiative
Plenary Workshop

Product Development Focus Team

March 5, 1997
presented by
John Deyst
MIT
Agenda

Product Development
Phase 1/Phase 2 Research  Deyst

Example of Key Characteristics
Application in Industry  Ramkumar

Key Characteristics Research  Thornton
Phase 1 / Phase 2
Research Topics

● Software Factory Process
● Database Commonality
● Design Change Metrics
● Design Structure Matrices
● Reducing DoD Product Development Cycle Time
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
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
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
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
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
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.
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.
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
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
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
Reduction of 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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<tr>
<th>Effort</th>
<th>Findings</th>
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<tr>
<td>Software Factories</td>
<td>40% productivity increases</td>
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<td>80% error reductions</td>
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<td>Reuse of proven software modules</td>
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<td>Seamless information flow</td>
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<td>Design Changes</td>
<td>Factor of 2-4 decrease (IPTs, CAD, training)</td>
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<td>Dynamic model</td>
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<td>Design Structure Matrices</td>
<td>Identified information transfer inconsistencies (preliminary)</td>
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<td>DoD Cycle Time</td>
<td>Identified key role of resource availability (preliminary)</td>
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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