Lean Aircraft Initiative
Plenary Workshop
Program Instability

March 5, 1997

Presented by:
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Outline

- Background
- Executive Board actions
- Data sources
- Policy recommendation topics
- Supporting data
- Summary
Background

- Program Instability research objectives:
  - Identify primary sources of instability
  - Measure instability-related cost premium
  - Investigate strategies to avoid instability or mitigate its impact
- Focus to date at program and project level
- Data collected from government and contractor sources
November 1996 Executive Board Actions

- Validate survey findings
  - PEO/PM briefings
  - Accuracy of cost growth segregation

- Compare findings with previous CBO research

- Develop policy change recommendations and present at April 1997 LAI Executive Board
General Response From PEOs and PMs

- Program Instability research presented to PEOs, PMs
  - 2 USAF PEOs (BG Reiter, Mr. Schulte)
  - 26 PMs in 22 programs/projects at ASC, ESC, Redstone

- Positive response overall

- Value in multi-service perspective
Survey Data Sources

Government Survey

- 500 surveys distributed
  - ASC, ESC, NAVAIR, ATCOM, Redstone
  - Distribution complete
- 153 returned to date
  - 55 SPO/PMOs represented

Contractor Survey

- 300 surveys distributed:
  - 53 programs identified in SPO survey
  - Additional programs in LAI member companies
- 106 returned to date
  - Prime and subcontractors contractors
Government PM Ratings of Program Instability Sources

Source: 1996 Government PM survey.
Source: 1996 Contractor PM survey.

Contractor PM Ratings of Program Instability Sources

- Technical Challenges in This Program
- Budget Changes
- Changing User Requirements
- Cooperation with Other Organizations
- Poor Supplier Performance
- Long Acquisition Cycle
- Changing Customer Acquisition Priorities
- Staffing Turnover in Own Program
- Production Buy Changes
- Staffing Turnover at Customer
- Technical Challenges from Other Programs

Source: 1996 Contractor PM survey.
Government PM Ratings of Instability Avoidance Strategies

- User Involved in Developing Requirements
- Aggressively Advocate Support for your Program
- Contractor Involved in Developing Requirements
- Contractor Involved in Developing Schedule
- Design Contracts for Flexibility
- Designs Validated Using Prototypes
- Design Validated Using Simulation and Modeling
- Design Based on Incremental Technology Steps
- Use Multi-year Procurement
- Short Overall Acquisition Cycle
- High-risk Developments Scheduled off Critical Path
- Independent Experts Assess Program Plan
- Schedule Interdependent Activities in Same Year

Source: 1996 Government PM survey.
Contractor PM Ratings of Instability Avoidance Strategies

Source: 1996 Contractor PM survey.
Government PM Ratings of Instability Mitigation Strategies

- Manage all Major Subsystems in one SPO
- Involve Users in Decision-making
- Use IPTs
- Management Reserve in Program Plan
- Unused Funding from Prior Years
- Use TEMs Personnel as Needed
- Involve Oversight Community in Decision-making
- Use CAM
- Use 3-D Modeling
- Use Staff From Other Offices or Labs as Needed
- Use Computer-Aided Scheduling Tools
- Use Flexible Assembly
- Major Subsystems Managed in Different SPOs

Source: 1996 Government PM survey.
Contractor PM Ratings of Instability Mitigation Strategies

Source: 1996 Contractor PM survey.

1 2 3 4 5 6 7
Not Effective
Very Effective

Use IPTs
Management Reserve in Program Plan
Use Computer-Aided Scheduling Tools
Use 3-D Modeling
Use CAM
Use Staff From Other Programs as Needed
Use Rapid Prototyping Tools
Use Knowledge-based Design Tools
In- and Out-source Work
Use Temporary Personnel as Needed
Unused Funding from Prior Years
Use Firm's Own Resources as Funding Bridge
Develop "Fallbacks" with Parallel R&D Projects
Use Flexible or Tool-less Assembly
Use Manufacturing Process Simulation Tools
Instability Sources Summary

SPO and Contractor survey similarities:

Same 3 sources of program instability in top tier grouping:
  – Budget changes
  – Technical problems
  – Requirements changes

Common sources of instability in second tier grouping:
  – Problems with other organizations
  – Long acquisition cycle
  – Changing acquisition priorities
Elements of Cost Growth

Preliminary - For Discussion Only

- Cost growth (average annual)
  - Budget changes: Government 2.2%  Contractor 1.8%
  - Technical difficulties: Government 2.4%  Contractor 2.7%
  - Changes in user requirements: Government 2.5%  Contractor 2.7%
  - Other sources: Government 0.3%  Contractor 0.8%
  - Total: Government 7.4%  Contractor 8.0%

- Case studies of government programs underway to validate cost growth estimates.

Primary Program Instability Research Findings

- 6 principal themes
  - Budget stability
  - Technology risk management
  - Requirements generation and stability
  - Program staffing continuity
  - Stakeholder participation in program planning and execution
  - Training in avoiding/mitigating program instability
Budget Stability

- Funding instability accounts for ~1/3 of average annual cost growth (2.2%)
  - PEOs and PMs generally support findings
  - Interactions between budget stability, technical problems, and requirements changes may understate overall cost impact of budget changes

- Other issues:
  - Focus to date at program level
  - Acquisition community perspective on problem only
  - Potential additional research:
    - Budget build-up process
    - Other stakeholders’ contributions and perspectives
Technical Risk Management

● SPO Survey
  - Top-rated instability mitigation strategies:
    - Management reserve in program plan
  - On/under budget programs rate as more effective instability *mitigation* strategies:
    - Use 3-D modeling, CAM, computer-aided scheduling tools
  - On/under budget programs rate as more effective instability *avoidance* strategies:
    - Use incremental technology steps, plan high-risk developments off critical program path

● Contractor survey:
  - Top-rated instability mitigation strategies:
    - Management reserve in program plan
    - Use computer-aided scheduling tools, 3-D modeling, CAM
## Technical Risk and Program Performance

<table>
<thead>
<tr>
<th>Program Characteristic</th>
<th>Over Budget</th>
<th>On/under Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product technology advance</td>
<td>More revolutionary programs</td>
<td>More evolutionary programs</td>
</tr>
<tr>
<td>Technical advance required in key subsystems</td>
<td>More new development</td>
<td>More non-developmental</td>
</tr>
<tr>
<td>Character of key enabling technologies</td>
<td>More military-unique</td>
<td>More commercial</td>
</tr>
<tr>
<td>Advance in underlying enabling technologies</td>
<td>More change — less current</td>
<td>Less change — more current</td>
</tr>
<tr>
<td>OTS/NDI value content (%)</td>
<td>34%</td>
<td>51%</td>
</tr>
<tr>
<td>Total Development Time</td>
<td>65 months</td>
<td>42.5 months</td>
</tr>
<tr>
<td>“Fast Track” program status</td>
<td>—</td>
<td>4.7x more likely to be “fast track”</td>
</tr>
<tr>
<td>(Fast Track/Not Fast Track)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Program Budget ($M)</td>
<td>$4,447</td>
<td>$1,018</td>
</tr>
<tr>
<td>Impacted by Program Instability</td>
<td>More instability</td>
<td>Less instability</td>
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On/under budget programs represent “smaller, faster, cheaper” system approach

Source: 1996 Government PM survey.
Requirements changes the largest single source of cost growth overall (2.5%)
- Largest component of cost growth in programs with largest cost over-runs
- Requirements changes-related cost growth increases through system life cycle
- The source of greatest savings in on/under budget programs

User involvement universally cited as critical to program success by PEOs and PMs
- Potential additional research:
  - Role of user in requirements generation
  - Best practices from other industries on user involvement
On/under budget programs have (compared with cost overrunning programs):

- More staff continuity:
  - 43% vs. 17% original staff since program start
- Fewer program managers:
  - 2.5 vs. 3.8 program managers since program start
- Finding persists while controlling for differences in program length

PEOs/PMs support need for more staffing continuity at all levels
- Existing rules are often overridden
Stakeholder Participation

**SPO survey:**
- Top-rated instability avoidance strategies:
  - User involved in developing requirements
  - Aggressively advocate support for your program
  - Contractor involved in developing requirements
  - Contractor involved in developing schedule
- Top-rated instability mitigation strategies:
  - Users involved in decision-making

**Contractor survey:**
- Top-rated instability avoidance strategies:
  - Open, frequent communication with customer
  - Contractor involved in developing requirements
  - Aggressively advocate support for your program
  - User involved in developing requirements
Training in Instability Management Practices

- Instability avoidance and management a stated priority in program management guidelines
- Wide range in responses in PM evaluations of instability avoidance and mitigation strategies suggests potential uneven realization of goal
- No specific data from surveys to provide additional insight into training effectiveness or requirements
Survey data on program instability collected, validated through practitioner review

Policy focus team identified most promising areas for policy change recommendations