Lean Aircraft Initiative
Plenary Workshop

The Role of the Schedule
Development Process

October 8, 1997

Capt Ross McNutt
MIT
Overview

- Structure Method and Objectives
- The Schedule Development Story
- Schedule Process
- Small Group Discussions
**Schedule Development Phases**

**Planning Phase**
- Develop Initial Project Schedule
- Project Approval

**Contracting Phase**
- Select Contractor and Develop Contract Schedule
- Contract Signed

**Development Phase**
- Actual Development Schedule
- First Production Item
Defense Product Development Processes

LEAN AIRCRAFT INITIATIVE

Users
- Resource Planning
- Modernization Planning Process
- Req Definition Process

Pentagon
- PPBS Process
- Acquisition Review Process
- Acquisition Oversight Process

Program Office
- Idea Generation Process
- Acquisition Planning Process
- Contracting Process
- Development Oversight Process

Contractors
- Marketing Process
- Proposal Generation Process
- Product and Process Development

Planning
Contracting
Development
Schedule Process
Research Methodology

- Objectives
  - Identify the important factors involved in the development of project schedules
  - Determine the effect of those factors on project outcomes

- Three Surveys - Different levels and roles in process
  - Contractor Program/Project Managers 104
  - Program Office Program/Project Managers 151
  - Pentagon Program Element Monitors 62
  - 317 Project Surveys Completed

- Case Study
  - Post Acquisition Reform Development Effort
  - Demonstration of Current Schedule Process
Initial Schedule Development in the Planning Phase

Planning Phase
- Develop Initial Project Schedule

Contracting Phase
- Select Contractor and Develop Contract Schedule
- Contract Signed

Development Phase
- Actual Development Schedule
- First Production Item
User’s Desired Date

Program Element Monitor Survey

“ASAP”  80%

Specified Future Date  20%
LEAN AIRCRAFT INITIATIVE

Operational Need Date

Current Operational Deficiency: 70%
Future or Projected Deficiency: 30%

Program Element Monitor Survey
Ranking of Program Objectives (1st to 4th)

**Superior Performance**

- First: 100
- Second: 80
- Third: 60
- Fourth: 40

**Low Acquisition Cost**

- First: 40
- Second: 60
- Third: 80
- Fourth: 100

**Low Operation Costs**

- First: 20
- Second: 40
- Third: 60
- Fourth: 80

**Shortened Schedule**

- First: 0
- Second: 20
- Third: 40
- Fourth: 60

PEM and SPO Surveys
# Program Objective Significance Table

<table>
<thead>
<tr>
<th>Mode Rank</th>
<th>Perf</th>
<th>Acq Cost</th>
<th>Ops Cost</th>
<th>Schd</th>
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<tbody>
<tr>
<td>Superior Performance</td>
<td>1st</td>
<td>X</td>
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<tr>
<td>Low Acquisition Cost</td>
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<td>.03</td>
<td>X</td>
<td></td>
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<tr>
<td>Low Operational Cost</td>
<td>3rd</td>
<td>&lt;.001</td>
<td>.05</td>
<td>X</td>
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<tr>
<td>Shortened Schedule</td>
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<td>&lt;.0001</td>
<td>&lt;.01</td>
<td>.36</td>
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* Using the Non-parametric Wilcoxon Rank-sign Test
* PEM and SPO Survey’s N=209
Factors Influencing the Projects’ Starting Date

<table>
<thead>
<tr>
<th>Program Element</th>
<th>No Impact</th>
<th>Some Impact</th>
<th>Defining Impact</th>
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<tbody>
<tr>
<td>User's Desires</td>
<td></td>
<td></td>
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<tr>
<td>Leadership Desires</td>
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<td></td>
<td></td>
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<tr>
<td>Expect Dev Funding</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>Expect Prod Funding</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>Service Planning</td>
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<tr>
<td>Technology Development</td>
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<tr>
<td>Dep on Another Program</td>
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<td>Engineering Development</td>
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<td>Testing Requirements</td>
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<tr>
<td>Manuf Process Develop</td>
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<tr>
<td>Support Requirements</td>
<td></td>
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</tbody>
</table>

Mean

1  2  3  4  5  6  7

Program Element Monitor Survey
## Factors Influencing the Length of the Initial Schedule

<table>
<thead>
<tr>
<th>Factor</th>
<th>No Impact</th>
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<th>Defining Impact</th>
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</thead>
<tbody>
<tr>
<td>User's Desired Schedule</td>
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<td>Expected Dev Funding</td>
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<td>Expected Prod Funding</td>
<td>4.4</td>
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<td>Testing Requirements</td>
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<tr>
<td>Engineering Development</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaderships Desires</td>
<td>3.6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Technology Development</td>
<td>3.6</td>
<td></td>
<td></td>
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<tr>
<td>Dep on Another Program</td>
<td>3.5</td>
<td>4</td>
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<tr>
<td>Service Force Planning</td>
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<td>Support Requirements</td>
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<tr>
<td>Manuf Process Dev</td>
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**Government Project Manager Survey**
Relative Order of Information Used for Initial Schedule

<table>
<thead>
<tr>
<th>Information Source</th>
<th>No Impact</th>
<th>Some Impact</th>
<th>Defining Impact</th>
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<tbody>
<tr>
<td>Expected Dev Funding</td>
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<td>5.4</td>
<td>1</td>
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<td>Expert Judgment</td>
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<td>5.2</td>
<td></td>
</tr>
<tr>
<td>Contractor Proposed Sched</td>
<td></td>
<td>4.7</td>
<td>2</td>
</tr>
<tr>
<td>Historical Similar-Program</td>
<td></td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Bottom-Up Schedule Dev</td>
<td></td>
<td>4.2</td>
<td>3</td>
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<tr>
<td>Parametric Modeling</td>
<td></td>
<td>3.5</td>
<td>4</td>
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<tr>
<td>Comparable Commercial</td>
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<td>3.0</td>
<td>5</td>
</tr>
</tbody>
</table>

Government Project Manager Survey

1: No Impact
2: Some Impact
3: Defining Impact

Capt McNutt  PD100897- 13 ©1997 Massachusetts Institute of Technology
**Scheduling Tools Used**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Not Used</th>
<th>Occasionally Used</th>
<th>Extensively Used</th>
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</thead>
<tbody>
<tr>
<td>Milestone</td>
<td>5.2</td>
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<td>Gantt</td>
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<td></td>
<td>2</td>
</tr>
<tr>
<td>Critical Path Manage</td>
<td>4.2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PERT</td>
<td>3.2</td>
<td></td>
<td>4</td>
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<tr>
<td>Other Tools</td>
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<td>5</td>
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<tr>
<td>System Center-based</td>
<td>1.5</td>
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</tr>
</tbody>
</table>

**Government Project Manager Survey**
Same General Trend Occurs Across

- All Program Sizes
  - ACAT I, II, and III

- All Levels of Technological Advance
  - Revolutionary, New Generation, and Incremental Improvements

- All System Types
  - Aircraft, Spacecraft, Electronic Systems, Munitions
- Schedule is not seen as a high project priority

- Planned schedules determined by expected budget allocations - not development related requirements.
Schedules in the Contracting Phase

- Schedule is not seen as a high project priority
- Planned schedules determined by expected budget allocations - not development related requirements.

Planning Phase

Contracting Phase

Development Phase

Project Approval

Contract Signed

First Production Item

Select Contractor and Develop Contract Schedule

Actual Development Schedule
"Did the Government, through its RFP or other means, specify an expected project schedule to the contractors?"

- Specified Expected Schedule: 80%
- Schedule Not Specified: 20%

Program Element Monitor Survey
Factors Influencing Contractor Proposed Schedules

<table>
<thead>
<tr>
<th>Factors</th>
<th>No Impact</th>
<th>Moderate Impact</th>
<th>Sole Determinant</th>
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<tbody>
<tr>
<td>Customer’s Desired Schedule</td>
<td></td>
<td>5.6</td>
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<td>Expected Development Funding</td>
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<td>Expert Judgment/Bottom-up Analysis</td>
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<td>Historical Similar Programs</td>
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<td>3.7</td>
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<tr>
<td>Comparable Commercial Development</td>
<td>1.8</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Contractor Survey
Contractor Ability to Influence Program

- Program or Product Concept: No Impact = 4.6, Some Impact = 4.2, Very Large Impact = 3
- System Performance Requirements: No Impact = 4.6, Some Impact = 4.2, Very Large Impact = 2
- Program Schedule: No Impact = 3.7, Some Impact = 3.4, Very Large Impact = 3
- Overall Budget or Funding Profile: No Impact = 3.4, Some Impact = 3.4, Very Large Impact = 4
- Trade-offs between Perf, Cost, and Sched: No Impact = 3.1, Some Impact = 3.4, Very Large Impact = 4
- Acquisition Strategy: No Impact = 3.1, Some Impact = 3.4, Very Large Impact = 4

Contractor Survey
“Was development time a significant evaluation criteria during your source selection?”

Government Program Manager Survey

Mean = 3.6
Contractor Incentive to Bid a Different Schedule

Contractor Survey

![Bar chart showing the number of respondents with different incentives](chart.png)

- A Strong Disincentive: 4, 5, 5
- No Incentive: 56
- A Strong Incentive: 11, 7, 5
Contractor Bid Schedule
Vs Government Plan

Contractor Survey
Mean = 0.9
Schedules of Proposals
Received By Program Offices

Contractor Proposal Schedules Compared to Initial Government Estimate

<table>
<thead>
<tr>
<th>Number of Proposals Received</th>
<th>&gt;15% Shorter</th>
<th>5% to 15% Shorter</th>
<th>Within 5%</th>
<th>5% to 15% Longer</th>
<th>&gt;15% Longer</th>
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<tbody>
<tr>
<td>200</td>
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<td>25</td>
<td>125</td>
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<td>25</td>
<td>0</td>
<td>25</td>
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</tbody>
</table>

Program Managers Survey
Schedule Results of the Contracting Phase

- Schedule is not seen as a high project priority
- Planned schedules determined by expected budget allocations - not development related requirements.

- Contracting phase incentives enforce expected schedule and eliminate possible alternatives.
Schedules in the Execution Phase

- Schedule is not seen as a high project priority
- Planned schedules determined by expected budget allocations - not development related requirements.
- Contracting phase incentives enforce expected schedule and eliminate possible alternatives.
Changes Due to Unforeseen Events

Government Program Manager Survey

<table>
<thead>
<tr>
<th></th>
<th>Least Likely To Change</th>
<th>Most Likely To Change</th>
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</thead>
<tbody>
<tr>
<td>Performance</td>
<td>3.4</td>
<td>1</td>
</tr>
<tr>
<td>Cost</td>
<td>4.3</td>
<td>2</td>
</tr>
<tr>
<td>Schedule</td>
<td>4.7</td>
<td>3</td>
</tr>
</tbody>
</table>
Government Program Manager Survey

Mean = 3.4

Ease of Lengthening Schedule

Mean = 5.6

Ease of Shortening Schedule
Available Schedule-Related Incentive Fees

Government Program Manager Survey

On Time Completion

- Mean = 3.0
- Percent of Contract

Early Completion

- Mean = 1.5
- Percent of Contract
Contractor View of Incentives

<table>
<thead>
<tr>
<th>Incentive</th>
<th>A Strong Disincentive</th>
<th>No Incentive</th>
<th>A Strong Incentive</th>
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</thead>
<tbody>
<tr>
<td>Reduce Total Program Cost</td>
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<tr>
<td>Reduce Unit Cost</td>
<td>4.4</td>
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<tr>
<td>Shorten Schedule</td>
<td>4.4</td>
<td></td>
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<tr>
<td>Exceed Performance Req.</td>
<td>4.4</td>
<td></td>
<td></td>
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<tr>
<td>Exceed Reliab/Maintenance</td>
<td>4.3</td>
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</table>
Program Slip

Schedule Slip (Months)

Government Program Manager Survey
Program Slip Per Year

Average Slip Per Year (Months per Year)

Government  Program  Manager  Survey
Program Slip
Major Acquisition Programs

Rand Database: All DoD Major Acquisition Programs since 1965
Execution Phase Schedule Results

- Schedule is not seen as a high project priority.
- Planned schedules determined by expected budget allocations - not development related requirements.
- Contracting phase incentives enforce expected schedule and eliminate possible alternatives.
- Development phase result - one way program slips.
Schedule Planning Inputs

Users
- Resource Planning
- Modernization Planning Process
- Req Definition Process

Proposed ORD

Program Office
- Idea Generation Process
- Acquisition Planning Process
- Contracting Process

MAJCOM POM Input

Pentagon
- PPBS Process
- Req Validation Process
- Acquisition Review Process
- Acquisition Oversight Process

ORD

Contractors
- Marketing Process
- Proposal Generation Process
- Product and Process Development

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Schedule Planning Outcomes

**Users**
- Modernization Planning Process
- Req Definition Process
- Resource Planning

**Pentagon**
- PPBS Process
- Acquisition Review Process
- Acquisition Oversight Process
- Req Validation Process
- Ord POM Process

**Program Office**
- Ord Plans
- Acq Plans
- Idea Generation Process
- Acquisition Planning Process
- Contracting Process
- Development Oversight Process

**Contractors**
- Marketing Process
- Proposal Generation Process
- Product and Process Development
- Marketing
Preliminary Conclusions

- **Schedule Process Outcomes**
  - Schedule is not seen as a high project priority
  - Planned schedules determined by expected budget allocations - not development related requirements.
  - Contracting phase incentives enforce schedule and eliminate possible alternative schedules.
  - Development phase result - one way program slips.
Other Schedule Related Research

- Areas Researched But Not Presented At This Time
  - Barriers to shortening schedules
  - Effects of schedule planning factors on schedule performance to plan
  - Causes and impacts of program instability on program schedules
  - Program example: Post-acquisition reform case study
Small Group Discussions

- Small Group Discussion 15 Minutes
  - Planning Phase
  - Contracting Phase
  - Development Phase
  - Overall Process

- Questions to be Discussed
  Do these data and conclusions match your experiences?
  What are the implications of these data on schedules and cycle time reduction?
  (If time permits: What can be done in each phase to change the results?)

- Report by Group Leaders 2-3 Min/each
  - One table from each phase with comments from others
  - Each table completes a written table report
“The most important way technology could enhance our military capability would be to cut the acquisition cycle in half.”

Chairman of the Joint Chiefs of Staff - Packard Commission 1986

“Even if one member makes a lot of progress in becoming lean, neither that member nor the stream as a whole will reap the full benefits if another member falls short”

James Womack and Dan Jones
Harvard Business Review March 1994