Design of Low-Cost Space Missions
5-Day Short Course List of Topics

Note: This course assumes that participants are working in space technology or are broadly familiar with the material contained in the traditional Space Mission Analysis and Design (SMAD) course.

What's the Problem? — the Dramatic Need for Space Mission Cost Reduction

- The need for cost reduction
- Nobody starts out to create a high cost, over-run, overdue, failure-prone mission
- The benefits to society and aerospace of mission cost reduction

Overview of Mission Cost Reduction

- The traditional approach to reduced budgets
- Is cost reduction real?
- Current examples of dramatically lower cost missions
- Range of cost options
- The need to talk about real cost
- Advantages of small and large organizations
- Low Cost does not mean Low Reliability
- Why reducing cost is hard to do and how to overcome that
- Creating a Proactive Program to Reduce Mission Cost
- The key litmus tests for whether a change intended to control cost will be counterproductive and, instead, increase cost and schedule
- Summary of cost reduction approaches

Process Changes to Reduce Cost

- The government perspective on reducing cost
- Design-to-cost
- Radical techniques to reduce cost

Mission, System, and Business Changes to Reduce Cost

- Mission and system engineering are critical
- Key technology changes to reduce cost
- Business and procurement changes to reduce cost

Technology for Reduced Cost

- Hardware
- Software

Reducing Mission Cost

- Spacecraft
- Payload
- Ground segment and operations
- Launch

Cost and Schedule Overruns

- Why do they occur?
- What can be done to avoid or minimize them?
  - Technical solutions
  - Programmatic solutions
  - Government solutions
- Counterproductive approaches

Other Topics

- Cost Modeling
- Reliability
- Case study experiences

Implementation Strategies and Problems

- Techniques applicable to all programs
- Reducing cost in new missions
- Reducing cost in ongoing programs
- Problem areas in implementing dramatic cost reduction
- Counterproductive approaches to system acquisition

Responsive Space

Summary — The Two Broad Approaches to Reducing Mission Cost

Supplements (used throughout the course)

- Money
  - Inflation
  - The time value of money
  - Amortization
  - Learning Curves
- The Iridium experience
- Computational spherical geometry
- Earth geometry viewed from space
- Mapping and pointing errors
  - Trading on error budgets to minimize cost
- Cost model of reusable vs. expendable launch vehicles
- Methods for reducing launch cost
- Advantages and limits of cubesats and nanosats