TEACHING SCIENCE AND TECHNOLOGY, INC.

Designing Space Missions and Systems

A Practical Approach to Achieving Technical Baselines

Course Description

Space projects often succeed—or fail—because of a small number of early design decisions. Those decisions are frequently made when information is incomplete, options are still open, but trade-offs are poorly understood. This course prepares you to navigate that moment—when ambition meets reality.

This course focuses on how laws of physics, technology and other constraints shape mission and system design, and how disciplined systems engineering translates mission needs into coherent, buildable architectures. You'll learn how early choices about mission concepts, architectures, and trades propagate into cost, schedule, performance, risk, and operational complexity—often in irreversible ways.

Using a structured, practical approach, the course begins with mission needs and objectives and walks through early system definition, requirements development, Concept of Operations, architecture formulation, and trade-space analysis. These decisions are then traced forward into payload design, spacecraft sizing, subsystem definition, verification, and mission operations to show how architecture choices ripple across a program.

You'll examine a realistic end-to-end case study that applies the tools and techniques learned in the course to develop a complete space mission. Experiential learning through hands-on exercises, together with lessons learned from historical missions, enable you to directly implement what you learned in your own projects.

Course Objectives

At the end of this course you will be able to apply the space mission analysis and design processes, principles, tools and techniques to develop a viable mission concept by:

- ✦ Defining high level mission goals and objectives
- ✦ Deriving system and subsystem requirements
- ✦ Identifying design solution options and drivers
- ✦ Applying design trade-off tools, techniques and methodologies to select specific solution options
- ✦ Describing the wider impact of design solutions across the rest of the mission architecture (cost, schedule, risk, integration and test, launch, and operations)

Who Should Attend

Are you defining mission concepts and architectures? Are you weighing payload, orbit, and system trade-offs? Are you supporting space mission or system design decisions that will shape a program for years to come? This course is designed for mission, system, and discipline engineers, principal investigators, and project managers who need to make—and defend—those decisions with confidence.

Course Materials

Each participant will receive:

- A complete set of course notes with copies of all slides used in the presentations
- An e-copy of the *Space Mission Analysis & Design-CORE* textbook

Course Topics

- ✦ **Module 1: Space Systems Engineering and Mission Design**
  - Introduction to Applied Space Systems Engineering
  - Designing Space Missions
- ✦ **Module 2: Mission Constraints and Enablers**
  - Space Environment
  - Orbit Design and Applications,
  - Launch System Services,
  - Technical Risk Management and TRL
  - Digital Engineering Tools and Techniques
- ✦ **Module 3: Spacecraft Design**
  - Payloads
  - Spacecraft Architecture
  - Spaceflight Software
- ✦ **Module 4: Subsystem Design**
  - EPS
  - ADCS/GNC
  - Propulsion
  - Comm
  - Thermal Control
  - Structures and Configuration
- ✦ **Module 5: Mission and System Implementation**
  - Quality/Product Assurance and Standards
  - Assembly, Integration and Verification (AIV)
  - Mission Operations and Ground Systems
  - Cost and Schedule Modeling
- ✦ **Threaded case study throughout**