



# Space Mission Operations

## Planning, Executing, Supporting

### Course Description:

This course explores the challenge of designing and implementing space mission operations in a practical, cost-effective way in the real-world. Taking a functional approach, the course provides an in-depth view of the entirety of space mission operations, including the concept of operations and all functions that are performed in support of a space mission. Interactive discussions focus on initial requirements definition, operations concept development, functional allocation among spacecraft, payload, ground system and operators. Students get extensive hands-on experience with a variety of mission operations modeling tools to understand physical constraints and appreciate the impact of programmatic trade-offs. Case studies of ongoing NASA, DoD and commercial missions are examined.

### Course Objectives:

At the end of this course the student should be able to...

- Define and explain the critical activities of space mission operations
- Develop a mission concept of operations (ConOps) and be able to critically analyze one of these key documents
- Describe the elements that contribute to mission operations complexity and perform trade-off analyses to reduce that complexity
- Apply principles of orbital mechanics to plan and implement key operations activities
- Describe and analyze key elements of mission ground systems including communication link budgets
- Compare and contrast operations concepts for military, civil, scientific and human space missions
- Develop the planning, execution and support requirements for real-time space mission operations

### Who Should Attend

- Systems engineers, payload principle investigators, subsystem engineers or project managers who are responsible for the detailed design and operation of space systems.

### Course Materials

Each participant will receive:

- An electronic copy of all slides used in the presentations
- Copy of text book *Cost Effective Mission Operations* (edited by Boden and Larson)

## Course Agenda

- **Course Introduction and Overview**
  - Course Introduction
  - Mission Operations Overview
- **Mission Operations Planning**
  - Concept of Operations (ConOps) Development
  - Operations Complexity
- **Tracking and Navigation**
  - Understanding and Using Orbits
  - Predicting Orbits
- **Mission Data Receipt and Delivery**
  - Introduction to Telemetry, Tracking and Commanding (TT&C)
  - Ground Systems and Communication Architectures
- **Spacecraft Support and Analysis**
  - Environmental Effects and Spacecraft Design
  - Contingency Planning and Anomalies
- **Flight Control and Training**
  - Activities, Roles and Responsibilities
  - Organization and Training

## Approach

- **Guided Lectures and Discussion**
- **Historical Documentaries**
- **Hands-on Exercises**
- **Current Mission Case Studies in Operations**
  - FalconSAT
  - ISS
  - Cygnus
  - Kratos quantumCMD ground hardware/software
  - EchoStar
  - LRO
  - Others

