

# Space Mission Operations

## From Concept to Implementation

### Course Description

Space Mission Operations explores the challenge of designing and implementing sustainable mission support in a practical, cost-effective way.

This 3 or 4 day course takes a functional approach to provide an in-depth view of the entirety of space mission operations. This includes 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. Constraints imposed by the space environment, orbital mechanics, communication architectures and other mission systems are also evaluated.

Participants gain 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 in detail.

### 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 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

### 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 *Cost Effective Mission Operations* (edited by Boden and Larson) textbook

### Course Topics

- ◆ **Course Introduction and Overview**
  - Course Introduction
  - Mission Operations Overview
- ◆ **Mission Operations Planning**
  - ConOps Development
  - Operations Complexity
- ◆ **Tracking and Navigation**
  - Understanding and Using Orbits
  - Predicting Orbits
- ◆ **Mission Data Receipt and Delivery**
  - Introduction to 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
- ◆ **Numerous case studies and exercises throughout the course**

### Testimonials

*"I have a new appreciation for the scope of mission ops, and appreciate [the] importance of planning, tools, and training."*

*"I now have a much greater understanding of the context for some of the things we do in daily space mission operations."*

*"The most valuable lessons were real-life experiences, solutions to anomalies, and the SMAD sheet and how to work with it."*