

# Understanding Space

## The Why, What and How of Space Missions and Systems

### Course Description

Space is hard. Getting into space, operating and delivering essential space services such as communication and remote sensing requires a complex orchestration of physics, technology, people, processes and things. Missions sometimes fail when early assumptions go unchallenged, constraints are misunderstood, or decisions are made without a clear picture of how things actually work (or don't) in space. Understanding Space gives you the knowledge, insight and context to manage this complexity and better contribute to the space enterprise.

This course frames your understanding of space around missions, orbits and systems to learn how fundamental space concepts influence success or failure. Throughout the course, you'll explore why we use space, how the space environment and orbital mechanics enable and constrain what we can and can't do. Examine how space payloads, human spaceflight, spacecraft subsystems, rocket science, and launch vehicles work in real missions. Gain an appreciation for how technical decisions throughout a project are interconnected. Hands-on exercises build capability and confidence that you can apply directly to actual programs.

### Who Should Attend

New to space? Finding the jargon and concepts confusing? This course helps you see the big picture quickly—without getting lost in technical detail. It's for newcomers, as well as experienced practitioners looking to reconnect fundamentals to real mission outcomes. Whether you're part of a new project, or supporting missions already in operation, this course is for you.

### Course Objectives

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

- ◆ **Gain Core Space Knowledge**
  - Define and describe important astronautics terms and concepts
- ◆ **Comprehend space mission Capabilities, Trade-offs and Limitations**
  - Explain how and why space is used to provide capabilities on Earth
- ◆ **Apply Space Concepts to real-world problems**
  - Calculate basic orbit and system parameters that drive mission scope and cost
- ◆ **Analyze Typical Space Problems**
  - Compare and contrast different technical approaches for space missions
- ◆ **Synthesize concepts to Design a Space Mission**
  - Design a space mission given some basic goals and objectives, and develop a top-level project plan for it
- ◆ **Evaluate basic technical and programmatic space issues**
  - Assess the technical merits of various space mission architectures

### Course Materials

Each participant will receive:

- An e-copy of the course text *Understanding Space: An Introduction to Astronautics*
- A complete set of course notes with copies of all slides used in the presentations

### Course Topics

- ◆ **Space in Our Lives**
  - Space in Our Lives
  - Elements of a Space Mission
  - A Brief History of Space
  - The Space Enterprise
  - Space Systems Engineering
  - Mission Management, Space Operations
  - Down to Earth Issues Exploring Space
- ◆ **Orbits & Trajectories**
  - The Space Environment
  - Understanding Orbits
  - Describing & Using Orbits
  - Orbit Design
  - Orbit Maneuvering
  - Ascent and Re-entry
- ◆ **Space Systems**
  - Payload and Spacecraft Design
  - Human Spaceflight
  - Spacecraft Subsystems
  - Rocket Science
  - Launch Vehicles

### Testimonials

*"Best course I've ever taken!"* - Boeing Engineer

*"I finally understand the big picture of what we do."* - NASA Scientist

*"Everyone in the space business should take this course."* - Lockheed Martin Engineer

*"[The course] covered a large number of complex subjects in an approachable way in a short period of time."* - JPL Engineer