



## Executive Overview: Human Spaceflight

### Course Description:

This four day tailorable course provides the conceptual framework for developing human space missions starting from a blank sheet of paper. It describes and teaches the manned space mission design and analysis process. The entire course is process oriented to equip each participant with the practical tools to complete a conceptual design and analyze the impacts of evolving requirements.

### Course Objectives:

At the end of this course you will be better able to tie mission elements together to describe tradeoffs between human spaceflight system design and mission operations. You will examine human space mission design using a systems engineering approach to translating space mission objectives, requirements, and constraints into viable and cost-effective systems and operations concepts. At the end of this course, you will be able to...

- Interpret and convert space mission objectives, requirements, and constraints into visible and cost-effective operations concepts
- Understand the space environment and its impact on humans and hardware
- Explain the physiology of space flight, human factors, and psychological aspects
- Describe a process-oriented approach for creating cost-effective space missions
- Describe the key functions that must be performed for mission operations
- Apply effective methodology for translating space mission objectives, requirements, and designs into viable and cost-effective operations concepts
- Explain the interrelationships and tradeoffs between system design and mission operation

### Who Should Attend:

Program managers, engineers and scientists who need to understand the technical challenges involved in designing human space missions.

### Course Materials

Each participant will receive:

- A copy of the course text *Human Spaceflight* by Larson and Pranke
- A complete set of course notes with copies of all slides used in the presentations
- TSTI Alumni status allowing on-line access to course materials, including tools and videos through the Alumni Lounge

### Testimonials

"Every engineer could use this course and they should take it ASAP!" – Johnson Space Center Engineer

"... strongly recommended to people working with human spaceflight and possible all others" – ESTEC Engineer

## Course Topics

- **Module 1: Mission Design**
  - Designing Human Space Missions
  - Safety of Human Space Missions
  - Space Environments
- **Module 2: Crew**
  - Physiology of Human Spaceflight
  - Human Factors and Psychology
  - International Crewed Missions
- **Module 3: Orbits and Trajectories**
  - Understanding Orbits and Maneuvers
  - Describing and Using Orbits
  - Orbit Maneuvering and Rendezvous
  - Entry, Descent, Landing and Ascent
- **Module 4: The Space Element**
  - Designing and Sizing Space Elements
  - Designing and Sizing Transfer Vehicles
  - Cost Estimating
- **Module 5: Support Subsystems**
  - Thermal Control
  - Environmental Control and Life Support
  - Crew Accommodation
  - ADCS/GNC
  - Electrical Power
  - Data Handling
  - Structures
  - Space Propulsion
  - EVA systems
- **Module 6: Mission Operations Element**
  - Mission Operations
  - Command, Control and Communications (C3)
  - Logistics Support
  - In-Situ Resources
- **Case Studies**
  - Project: Mars
  - ISS
  - Commercial Crew
  - Lunar Outpost
- **Threaded Case Study and Hands-on Exercises**