TEACHING SCIENCE AND TECHNOLOGY, INC.

Human Space Flight Mission Analysis and Design

Designing Human Missions that Balance Safety, Performance, and Architecture

Course Description

Human missions raise the stakes. A single design decision can affect crew safety, mission success, operational complexity, and long-term sustainability. Human Spaceflight Mission Analysis and Design equips you to evaluate these trade-offs and develop mission architectures that protect lives while achieving mission objectives.

Using a structured, systems-based approach, the course covers conceptual human mission design from objectives and architecture definition through operational planning. You'll examine how decisions involving orbit, rendezvous, entry and landing, vehicle configuration, and key subsystems influence safety, mission assurance, and feasibility.

Designed for program managers, engineers, architects, and scientists, the course emphasizes safety and mission assurance as primary design drivers while exploring human factors, life support, propulsion, power, thermal control, EVA systems, and logistics through real-world case studies from the ISS, Commercial Crew, and future lunar and Mars 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

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.

Testimonials:

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

"Useful for just about anyone in the aerospace industry." – Kennedy Space Center 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**