

## Space Systems Cost Estimating Workshop

### Overview

This three-day domain-focused workshop will provide attendees with the knowledge and skills necessary to perform cost estimation in the space sciences. Students will be given an overview of the different methods of estimation being used today, including grass-roots and bottom-up estimates, analogy-based estimates, and parametric models. They will also be led through a discussion of the differences between parametric system level models, such as the NASA Instrument Cost Model (NICM), and component level parametric models, such as SEER-H. Using the SEER-H estimating methodology, students will learn the differences between modeling various spacecraft subsystems and instrument types, and how to handle estimating new technology developments. Students will be introduced to the newly created “Space Estimation” knowledge bases, developed through multiple NASA sponsored validation studies. They will become familiar with how to assess cost and schedule risk and how to build a defensible estimate. At the end of this course, students will be able to produce a cost estimate for Phases A-D of a space mission project and become familiarized with other methodologies for estimating Phase E-F. Students will also gain insight into the risks, uncertainty and cost drivers associated with space hardware development, acquisition and integration.

For convenience, this workshop can be taught at a requested on-site location or at our headquarters in El Segundo, CA. At our offices, we will provide a comfortable and highly effective learning environment, utilizing only the most up-to-date technologies. This specialized workshop pulls from the extensive experience base of our staff and consultants in the space science cost estimation domain. Our instructors don't just teach—they've been extensively involved with the application of SEER-H, NICM, MOCET, and CER development at NASA and the DoD. Our instructors will augment the training with “lessons learned” from their experience in cost estimation in the space domain and share their tips for developing and presenting a good estimate. Upon completion of the three-day Space Systems cost estimating workshop, students will have gathered valuable perspective on how to use the SEER models for space systems cost estimates, and how to compliment and augment these estimates with other available tools.

### Audience

#### **This course is designed for:**

- Cost estimators
- Business analysts
- Project/Team leads
- Engineers

**Course Prerequisites** It is highly recommended that students are familiar with SEER-H, SEER-EOS, SEER-IC, and SEER-SEM prior to taking this course.

**Course Objectives:**

- Students will become familiar with the common approaches to cost estimating in the Space domain, including:
  - In what situations are the different approaches most appropriate?
  - What makes a good estimate?
  - How do parametrics fit into cost estimation?
- Students will be given an overview of parametrics and its applications to space cost estimation.
- Students will be given the understanding on how to estimate all phases of a space mission life cycle:
  - Pre-Systems Acquisition (Formulation, Technology Development, etc.)
  - Systems Acquisition (Design & Fabrication, System AI&T)
  - Operations, Support & Sustainment (Overview only)
- Students will become familiar with strategies on how to assess cost risks using SEER models.
- Students will become familiar with the standard NASA and DoD Work Breakdown Structures (WBS) and what tasks can be estimated using the SEER models.
- Students will become familiar with techniques to model different spacecraft subsystems, including:
  - Thermal
  - Electrical Power & Distribution
  - Propulsion
  - Telecommunications
  - Attitude Determination & Control
  - Command & Data Handling
  - Structures & Mechanisms
- Students will become familiar with techniques to model different instrument types, include:
  - Remote-sensing
  - Direct-sensing
  - Active
  - Passive
- Students will become familiar with how to estimate instruments with significant new technology development
- Students will become familiar with how to develop credible software estimates
- Students will learn how to estimate the various levels of program management, systems engineering, and safety & mission assurance inherent in space missions
- Students will learn how to present a credible and defensible cost estimate

## SEER for Space Systems Course Outline

### Day One

- I. Introduction & Background
  - a. Schedule, course objective, introductions
  - b. Space Guidance document, validation studies
- II. Estimation and Parametrics
  - a. Cost estimating approaches
  - b. CER development
  - c. Types of parametric models
    - i. System/ Subsystem
    - ii. Component level
- III. Cost Risk
  - a. Cost Risk in the context of SEER
- IV. SEER Overview
  - a. SEER H, SEER IC, SEER EOS, and SEER SEM familiarization
    - i. Interface
    - ii. Parameters and most commonly used element types
- V. Heritage
  - a. Relation between heritage and TRL
  - b. Heritage in the context of SEER

### Day Two

- I. Spacecraft Bus
  - a. Estimating subsystems
  - b. Flight software
- II. Payloads
  - a. Estimating common instrument types
    - i. Active, passive, direct-sensing, and remote-sensing instruments
    - ii. FPGAs, ASICs, detectors
  - b. Estimating instruments with significant new technology development
- III. Project Management, Systems Engineering, and Mission Assurance (PM/SE/MA)
  - a. Mission level
  - b. Spacecraft bus
  - c. Payload and instruments
  - d. ATLO and AI&T

### Day Three

- I. Refresh Spacecraft Bus, Payloads, and PM/SE/MA
- II. Capstone Project Example File
- III. Summary & Conclusion