TenP—Ten Principles for Successful Space Programs

Course Overview: This two-day course addresses the most challenging problem in the space industry: How do we reduce cost and schedule time while also trying to ensure a successful mission? After examining the driving issues in space-system development, the instructor introduces ten principles for successful space programs.

1. Invest in knowledge and understanding.
2. Adopt the right attitude: quality and mission success first.
3. Instill ownership and responsibility.
4. Constantly strive to improve communication and teamwork.
5. Follow a sound engineering approach.
6. Reduce cost through good engineering and good management, not by compromising quality.
7. Think ahead to avoid problems, and keep everything as simple as possible.
8. Establish an effective quality system that involves everyone.
9. Be willing to accept risks, but only those you and the other stakeholders understand.
10. Make sure you—and everyone else—have enough time, resources, and freedom to do things right.

The course then explores key aspects of leadership, management, and engineering within the framework of those principles. The instructor shares many examples, case histories, and personal experiences to drive home the key points. The objectives are to provide a fresh focus on quality and mission success, build understanding, spur thought, and help your program improve efficiency of its organization and processes—from the top level of management on down to how every engineer or technician approaches his or her job.

Target Audience: All leaders, managers, supervisors, systems engineers, and consultants involved in procuring, specifying, designing, producing, or testing spacecraft, launch vehicles, or vehicle components.

Course Developer and Teacher:

Tom Sarafin is President and founder of Instar Engineering and Consulting, Inc. He has worked in the space industry since 1979 as a structural engineer, a mechanical systems engineer, a project manager, and a consultant. Since founding Instar in 1993, he's consulted for NASA, DARPA, the DOD Space Test Program, Lockheed Martin, DigitalGlobe (Maxar), Sierra Nevada Corp (Sierra Space), and many other organizations. He was a key member of the team that developed NASA-STD-5020, "Requirements for Threaded Fastening Systems in Spaceflight Hardware" (March 2012). He is the editor and principal author of *Spacecraft Structures and Mechanisms: From Concept to Launch* and is a contributing author to *Space Mission Analysis and Design*. Since 1995, he has taught well over 300 courses to more than 6000 engineers and managers in the aerospace industry. He teaches the following courses: Space Mission Structures, from Concept to Launch (SMS), Design and Analysis of Bolted Joints (DABJ), Structural Design and Analysis for Aerospace Engineers (SDA), Structural Test Design and Interpretation (STDI), Vibration Testing of Small Satellites (VTSS), Notching and Force Limiting Workshop (NFLW), and Ten Principles for Successful Space Programs (TenP).

Testimonials

"One of the best classes I have taken. All engineers, project managers, engineering management, chief engineers, and quality would benefit from this class to assist in looking at right practices in conducting programs."

"A great, focused overview that challenges a status quo."

"Enjoyed the outside perspective on how to deal with overall engineering processes. Also enjoyed the different real life examples/stories."

"Highly recommended for engineers and managers involved in the design and development of aerospace systems."

"After this course, I am more aware that 'ownership' needs to shift between customers and contractors depending on where you are in the hardware development phase."

"This was a very thought provoking course." "Great course!!"

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Course Outline

Introduction

What constitutes a "successful space program?"

1. **Why Are Space Missions So Challenging?**
   - How do we reduce cost and ensure a successful mission?
   - A wake-up call
   - Taking time to understand the problem
   - Recurring problems in space programs
   - How cost builds up on a space program
   - What makes space missions so hard?
   - Typical causes of problems
2. **Finding Solutions: Ten Principles**
   - Faster, better, cheaper: can we get all three?
   - Establishing a vision
   - Adapting what Deming taught us
   - The key to cost-effective, successful space programs
   - Ten principles for successful space programs
   - The principles adapted for engineers
3. **Building a Mission-Success Culture and an Effective Team**
   - What business are you in?
   - What it should mean to have a "commercial mentality"
   - What "quality" means in the space industry
   - Root causes of poor quality
   - Whose job is this?
   - Quality starts with the right attitude
   - Fostering the right attitude
   - Striving for "profound knowledge"
4. **Instilling Ownership and Responsibility in Contractors**
   - What "verification" means in the space industry
   - Distinguishing between requirements and verification
   - Recognizing customer and contractor responsibilities
   - You can't specify quality and mission success!
   - Understanding verification
   - Using standards without taking away responsibility
5. **Overview of System Development**
   - What is "systems engineering"?
   - A process for system development
   - The role of requirements documents
   - Characterizing requirements
   - Allocating requirements
   - Controlling interfaces
   - Requirements validation
   - Verification planning
   - Proactive versus reactive verification
   - Testing
6. **Reducing Cost and Risk By Design**
   - Strategies for reducing cost while improving quality
   - Dispelling some myths
   - Keeping it simple!
   - Reducing the number of parts
   - Accommodating likely growth
   - Standardizing
7. **Managing Risk with a Quality System**
   - What is a quality system?
   - Keys to an effective quality system
   - Examples of quality systems at multiple levels
   - Attending to details
   - Controlling the configuration
   - Philosophies for product inspection
   - Responding to discrepancies
   - Managing weight growth
   - Designing and establishing a quality system
8. **Responsibly Accepting Risk**
   - What it means to understand a risk
   - Common risk rating systems
   - Removing subjectivity with expected cost of failure
   - Hypothetical examples
   - Making the launch decision

Summary

- What about the tenth principle?
- Key points from this course
- Using the principles as a compass

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