



## **ESSI—Engineering for Success in the Space Industry**

### **Short Course**

### **Testimonials**

**Ball Aerospace** (commenting on an earlier version with a different title)

“The breadth of the material was great to establish the frame for the discussion of verification and risk management.”

“Tom has tremendous knowledge and conveys his points in a very animated way that makes you want to pay attention.”

“Good instructor; course materials presented effectively.”

“Very enjoyable and applicable to the job. I will refer to the course book frequently.”

“Make everyone ... take this! This is a great course!”

“Good breadth. Gets people thinking ‘outside the box’.”

“Time spent talking about developing requirements was very well spent—that’s what I wanted to get from this course.”

“Extremely valuable. Better than (other) instructors because Tom has been teaching the issues and communicating them for years.”

“ ‘Must take’ course for all disciplines.”

“Good overview and re-emphasis of what it takes to have high confidence your product will work.”

“Fantastic!”

“Tom has interesting ideas about how to improve the space industry.”

“It gave a new perspective on how projects come along. Going into how to do things right in detail was very useful. Thoroughly enjoyed taking this class.”

“This is a powerful philosophy that can have a tremendous impact on the industry as a whole. Well done!!”

“This was a great course for me because I just came back into a systems engineering role. A good dose of how to do things right this early in the game should serve me well.”

“I liked how I could relate everything to what I see going on.”

“Excellent education for a ‘new’ aerospace systems engineer.”

“This needs to be offered to new systems engineers within a few months of their start date. This class would have helped me a lot when I started (it still helps a lot now!).”

## ESSI Testimonials

“Great instructor-class interaction. Good class exercises.”

“Good principle-based development approach.”

“The class instructor displayed great presentation acumen.”

“Excellent, real-world examples to help remember the principles of good engineering in aerospace. More managers need to take this course!!”

“Lots of food for thought—many good points to take away and implement in everyday work.”

“Good instructor; effective communicator.”

“The team exercises were very beneficial.”

“A ‘must’ for all systems engineers (and managers, too!).”

“This is an excellent course with an excellent instructor.”

“Offer it to everyone!! We all need this!!!”

Strongest point of the course:

- “Emphasis on improving the process of developing useful requirements.”
- “The instructor’s ability to convey his message and provide examples from experience.”
- “The ‘real life’ examples and group discussion of the ideas presented in the course.”
- “Relating all phases of a program to the challenge of doing things right.”
- “Tom’s strong background & knowledge in the industry. Perfect presentation.”
- “Risk discussion, communicating effectively, understanding verification.”
- “Quality is everyone’s responsibility. Focus on ‘better’ vs. ‘faster and cheaper’.”
- “The emphasis on quality throughout the organization and how it ripples through the chain to create cost efficiency and a fun work environment.”
- “Inclusion of real-life anecdotes to drive important points home.”
- “Tom’s knowledge and experience.”
- “Broad vision of doing things right in aerospace.”

### Canadian Space Agency

“Anyone working in the space industry will benefit in the perspective provided by this course.”

“This course is a good summary and refresher for the systems engineer. It provides many good pointers and tips when appraising space systems design.”

## ESSI Testimonials

“As a young engineer, this course was the perfect detailed overview of each important subject (not only technical) that I could imagine.”

“If only I could make taking this course a requirement for some companies!”

“It is evident that the lecturers have tremendous experience and make the course very interesting by interspersing very applicable lessons learned stories with the course notes.”

“As a program manager responsible for the scientific output of satellite projects, I found this course was tremendously valuable to understand the industry best practices to design, build, and test spacecraft, including a basic understanding of its components with realistic hands-on problems and exercises to enhance the learning experience.”

“In *Engineering for Success in the Space Industry*, Thomas Sarafin and Poti Doukas share their extensive experience and lessons learned in a multitude of programs in both an enlightening and entertaining course.”

“Very interesting and insightful.”

Very comprehensive. Good ideas to improve reliability. Lots of practical examples. Challenges the status quo.”

“People in the industry may be seeing failures in their programs that baffle their common sense – this course provides the root cause, and an array of solutions to preventing those failures.”

“I have thoroughly enjoyed the course ... but I am not a system engineer! The insight it provided me into that world is fabulous.”

“Very well presented. I enjoyed the exercises and the interactions.”

“There was something ‘very’ interesting every hour!”

“Such a great, valuable course! Would love to do another!”

“This is the best course I have ever had! I will strongly recommend it to my colleagues’ either working for the government or private companies. Congratulations for your excellent work!”

“An entire organization or team should take the course. Tom and Poti deliver with emotion and heart. They own the course!”

“The summary slides at the end of each section are useful for reference.”

“Good use of practical experience.”

“Very good course. Thank you.”

Most interesting or useful:

- “Open discussions and experience shared. Real and valuable work related tips.”
- “Development of specifications/requirements.”
- “Verification and quality assurance.”

## ESSI Testimonials

- “Building an effective organization.”
- “The exercises. They make us realize that things that may seem obvious are often the mistakes that we do. Having the right attitude is the best example. Everyone thinks he has the right attitude ... and yet, it is the first mistake that we do!”
- “How to create an environment that leads to project success, and overview of the engineering process for system development.”

### LASP

“This course could potentially be called, “How to make good decisions in the aerospace industry.” Extremely helpful in this regard.”

“Greatly recommend it to beginning and moderately (10 yrs) experienced engineers.”

“This course is an excellent way to expand on textbook learning. Doukas and Sarafin draw on their extensive real-world experience to provide insight and wisdom for young aerospace engineers.”

“This course is a great foundation upon which young engineers can build as they learn more about designing and building a quality spacecraft.”

“I am only a sophomore in aerospace and computer science, but found this class very informative and useful for the future I may see in the aerospace company. It was a great introduction into the aerospace industry!”

“This class provided a great connection of technical information and practical advice on how to have a successful career in the aerospace industry.”

“Every engineer, from freshman in college to industry expert, can gain something from this course. All engineers from every field should understand the importance of a quality product as taught by this course.”

“This course provides insight into the engineering discipline in a holistic manner which is of benefit to any engineer. Be they a student or seasoned veteran, the course has something to offer.”

“I’m a software guy. Learning about the mechanical and system engineering aspects of spacecraft designs was a revelation.”

“Good industry overview that gives early engineers insight into how a space program is organized and structured.”

“Anyone in the space industry or even thinking about being in the space industry needs this class. There’s so much more information about how a spacecraft gets into space that just courses in school. I found this extremely helpful!”

“As an engineer with a few years of experience, I can look back and see things I have done correctly and incorrectly. From this, I can use the info in the class to improve my career.”

## ESSI Testimonials

“Being from a mechanical undergraduate program, this course introduced structural and systems concepts from the aerospace industry in an interesting and relatable manner.”

“This class makes engineers better. Take it if you can, even if travel is necessary.”

“This should be standard training...a must-have for all aerospace professionals.”

“This course gave me an understanding of what industry does and needs to be doing for project success and has more prepared me as I enter this new engineering world.”

“Tom and Poti produced a great course that drew on their numerous years of experience to help be more successful in the space industry.”

**MacDonald, Dettwiler and Associates (MDA)** (commenting on an earlier version with a different title)

“I liked the focus on ‘better’ and quality, and how that can be achieved in the system design & verification process.”

“Anecdotes were useful demonstrations.”

“Nice mix of videos, exercises, and slides to keep things interesting.”

“Pretty much everything was interesting and useful. Exercises were excellent! Overall a very useful course.”

“Touched on all important areas in system development and verification. Anecdotes were funny and memorable.”

“The entire course was very interesting and informing. The stories and experiences that were shared were very valuable.”

“The course is great. Every engineer should take this course.”

“The course is very well organized, and the content is very important for systems engineers.”

Most interesting or useful:

- “War stories/lessons from history. Good course!”
- “How to write requirements.”
- “Systems engineering process, quality processes, testing philosophies and test flow.”
- “Good requirements vs. bad requirements.”
- “Cost reduction through better design, quality is everyone’s business, and requirements definition exercise/guidelines.”

**NASA Johnson Space Center** (commenting on an earlier version with a different title)

“Right amount of group activity vs. discussion!”

## ESSI Testimonials

“Everything was right on target for what I needed to learn. Great course. Enjoyed the stories.”

“This would be an excellent introductory ‘Systems engineering’ course to the subsystem engineers and other team members in a project development organization.”

“This was an excellent course. I would recommend this course to engineers from all disciplines to gain understanding of systems engineering and lessons learned. I learned something about the end-to-end product design, development, and certification. I wish I had been able to take this class 8-10 years ago.”

“This is a good course to refocus on the proper approach and good to review state of the art industry approaches.”

“Excellent course especially for those starting hardware/software projects.”

“Very useful course. More availability is needed for others in the organization.”

“I recommend that this course be taken whenever dealing with H/W deliveries.”

“Take it.”

“Good class!”

“I’ve already recommended this course for the remainder of my branch.”

“Most thorough system development course I’ve ever had. Very good sections on quality and verification as well as on guiding principles. Recommend many of the other Instar courses are offered. They appear to also be directly applicable to our organization.”

“The instructor was an excellent presenter and kept the class interested. He provided excellent examples of real-life applications.”

“Great examples, graphics—very useful. I didn’t have to take notes (hardly any).”

“Personal stories tied in very well with the course objectives.”

“Outstanding knowledge of the subject.”

“Excellent quality.”

“It was encouraging to hear someone known in the space industry advocating cradle-to-grave engineering. New engineers miss a lot focusing on one part of the design process.”

“Everyone should take this class—managers, engineers, customers and contractors, etc. There are lots of invaluable points/lessons learned that general people don’t know.”

“It’s a course for everyone. Even if you think you know it all, it’s a good refresher and could possibly give you a different perspective on how things should be done.”

“Take the course. Everyone involved in the space program needs to take this course, including project managers.”

“I might have been able to save NASA millions of dollars if I had taken this course a year ago.”

“Everyone involved in system development should take this course, including my supervisors.”

## ESSI Testimonials

“Great class with lots of real-world examples.”

“Using real-life examples was very useful in understanding engineering outside of NASA.”

“Sections 1, 2, and 3 were most interesting to me because I think understanding a problem and building a team are the most important aspects of accomplishing a task.”

“I enjoyed this course.”

“Really liked the reliability analysis material.”

“It was valuable to go over engineering principles that we don’t see on a daily basis.”

“Tom was clear and direct in presenting the material. I think having all of the different topics brought together into one course with one focus is really unique and useful. The specific examples and open class discussion were also valuable.”

“I think this is an excellent course and directly applicable to the start of the CEV program.”

“Time well spent. Really needed to hear about the probability risk process and will look to learn more in this area.”

“Great class. Useful info.”

“Exceeded my expectations.”

“It is not the classic ‘Systems Engineering’ course that you will find in textbooks; it is filled with lots of experience, lessons learned and practical applications.”

“A must for junior and mid-level engineers and those who have not certified hardware before.”

“All in all, a very good course.”

“Highly recommended for all employees at all grade levels.”

Most interesting or useful:

- “Pulling together the end-to-end process for product development.”
- “Real-life stories!”
- “Verification and quality assurance as confidence builders.”
- “Ensuring your contractor/product team retains ownership.”
- “Development of requirements and the class exercise that supported it.”
- “Emphasis on personal responsibility and ethical, sound engineering.”
- “All parts.”
- “Exercises to reinforce the presentation material.”

## ESSI Testimonials

- “Getting the participant to think about how things can be improved, how teamwork can be improved, instilling ownership and responsibility, etc.”
- “Requirements aren’t requirements if assumptions can be changed. I had never thought of this.”
- “Philosophy about quality and who are your customers.”
- “The 10 principles.”
- “The importance of understanding the problem.”
- “The class activities.”
- “Discussion on philosophy of verification.”
- “Lessons learned and horror stories in actual flight projects.”

### NASA Marshall Space Flight Center

“An excellent course for system engineers.”

“This class provided a great understanding of the importance of systems engineering, and laid out good processes and theories on how it should be done.”

“This course still offered points which I can go back and use on my job immediately. I’ve been working in the space industry for nearly 30 years and believe all levels of engineers could benefit from this course.”

“A great thoughtful class that will help you survive the tough, mean streets of the space industry.”

“Terrific course. Highly recommended. Thank, Tom!”

“Course was great.”

“The principles and fundamentals covered in this course should be required for every person that has an investment in the success of their project – basically everybody!”

“Great material, presented very well!”

“Course is great.”

“This course does a good job of relaying that no process is going to work unless the people implementing it take pride/ownership in making it work.”

“Good overview of standard tests that provide confidence that a spacecraft meets requirements and will perform as intended.”

“Course notes are very good. Keeper!”

“Helped me in looking at the bigger picture of systems interaction versus the view from a specific discipline.”

## ESSI Testimonials

(Most interesting or useful) “Emphasis on sound engineering practices.”

“Good course!”

“This course would be helpful anytime, but was especially timely with my current responsibility to serve as technical liaison on SLI cryo-tanks.”

“This course is mature and well organized. Notes are excellent.”

**Northrop Grumman Aerospace Systems** (commenting on an earlier version with a different title)

“Lots of good examples and case studies.”

“Very valuable course.”

“The section on testing was very informative.”

“This course is a great course for me. I am new, so this course offered insight to my job and the bigger picture.”

“All sections were useful. I found the section on communication extremely helpful.”

“I liked the communication section and how you went over presentation tips. I also enjoyed the real life case studies.”

“The requirements group activity was helpful in fully developing the idea that requirements are critical and that a bad requirement can either over/under constrain your system, or in some cases allow a contractor to produce a useless part.”

“I think this class is very recommendable for young engineers (in 1<sup>st</sup> 5 years of career). Good advice given which they were never taught in school.”

“Very good class for all levels of experience but especially good for people with (at least) 5 years experience.”

“Very informative and useful. Hopefully management and customers are aware of these principles and embrace some of the content to improve space programs.”

“Very good discussion of communication—how to tell, what to tell. Excellent discussion of practical quality concerns & applications.”

“This is an excellent course for all levels of engineering and management. The more people who take it, the better our business can be. Keep it up!”

“Quite good. I’m glad I spent the time.”

Most interesting or useful:

- “Things to watch for when writing requirements.”
- “Instilling ownership and responsibility, (and) establishing effective quality systems.”

## ESSI Testimonials

- “Real, historical examples from within the aerospace industry. Young engineers are especially unaware of lessons learned on past programs and benefit from this knowledge.”
- “The importance of being responsible for quality every day, being profoundly knowledgeable, and taking ownership of what you are working on.”
- “Creating a quality system for yourself.”
- “Overall perspective of mission success.”
- “Open thinking about what a good verification plan should be. Testing to build confidence, but tailored to the system so you’re not spending budget on testing that doesn’t add value/reduce risk.”

### Other organizations

“Get it to as many people as possible!”

“I thought this class was very good and that everyone in our organization should take this course.”

“It gave me a better understanding of requirements and verification.”

“The instructor’s knowledge was broad and he taught very well—extremely motivating!”

“This course is highly relevant to the current (company) objective of increased quality at reduced cost.”

“This was the most relevant course/instructor I’ve had here. The practical experience made the examples ‘hit home’ harder.”

“Excellent. We need more of these courses. Require management to hear this.”

“This disciplined insight into what I do is very helpful in recapturing the reason why I’m in this business.”

“The instructor has a broad knowledge of the ingredients of engineering systems and the scope of effort that goes into assuring mission success through reasonable risk reduction.”

“Great class for young program managers in space acquisition, especially for young officers.” (USAF officer)