SMS—Space Mission Structures: From Concept to Launch

Short Course

Testimonials

Ball Aerospace

"The reference book for this class was (and still is) incredibly helpful to me when I began my career as a structural analyst in the aerospace industry. The subject matter included in the book and in the class is both applicable and comprehensive. Probably what I learned from this course that will be the most beneficial for my career is the concept of an engineer taking responsibility or ownership for a problem, rather than assuming someone else will."

"Excellent exposure for new employee."

"Tom is a great instructor. He addressed all the questions and shared a lot of his experience in each topic, which was really helpful for a young engineer like me."

"The example problems were good thought problems and drove home key points discussed in class."

"I think this course should be required for all junior (< 5 yrs experience) structural analysts."

"The instructor's lessons from person experience were extremely useful in helping me to retain key principles."

"I found the risk/(negative) margin of safety analysis very helpful."

Most interesting or useful:

- "Hand calculations for preliminary design."
- "The section on preliminary design."
- "Examples of design/analysis mistakes & what to do to avoid them."
- "Rules of thumb, course materials, and the instructor's enthusiasm and knowledge."

Boeing

"I have been using your text for several years and find it the most valuable in my collection!"

"I would recommend new hires to take this course."

"This course explains everything starting from the basic definition which is very helpful when people are not familiar with that subject. Overall this is a great course. More people should have a chance to take it."

"I enjoyed the course. It is just the right kickoff for a designer looking to do some analysis—it puts the process into perspective."

"High quality/value. Some of the thought process has already been put to use at work."

SMS Testimonials

"Excellent eye opener for all aspects of womb-to-tomb spacecraft design."

"Very practical, relevant and insightful."

"Time well spent, lots of good examples and class participation helped disseminate ideas and experiences."

"Great course. As a new aerospace industry engineer, this is the first formal presentation of integration I have had and feel Mr. Sarafin has done an outstanding job."

"Best d___ course I've ever had."

"I really enjoyed! I feel I am a better engineer because of this course."

"This course has been an eye opener. As a new engineer this course is very valuable in showing what is important in doing my job."

"Tom, you're an excellent speaker/presenter. The class was very entertaining."

"Preliminary sizing and load estimations using simple spring-mass models was extremely informative. Also strain energy methods used to optimize structures were extremely powerful."

"The best course I've taken since I've been out of college! As a stress analyst, this course has summarized the key points for analyzing structures. In addition, the course summarized 'the big picture' in structural design/analysis."

"A very good course."

"Excellent course for overall overview."

"Excellent presenter."

"High quality course. Well taught."

"Excellent slides/underscored important points."

"Clear viewgraphs and excellent materials. Well organized course."

"It is a very valuable course. A lot of practical examples that are very helpful to work."

"Knowledge of subject matter facilitated his (the instructor's) ability to explain complex topics in simple terms."

"The instructor was very well organized and prepared. He also had good analogies and examples."

"This course should be required of all new hires after 6 – 8 months on the job."

"High quality. Very valuable overview of all areas that affect me as a design engineer."

"Best work related course I've ever had."

"Course was extremely helpful to me. I wish I would have been exposed to this information earlier in my career."

"Mr. Sarafin possesses an amazing amount of knowledge and experience, very impressive. Old school knowledge with modern ideas is what he brings to the class room. I don't think any design engineer, manufacturing engineer, or stress analyst could not benefit from this course."

"This is a great course for young engineers. It helps build a foundation which keeps an engineer thinking about the 'big picture'."

SMS Testimonials

Bristol Aerospace

"Excellent session. Very informative. Great presentation skills. I very much appreciated the wealth of experience that was shared."

"The value of acquiring the wisdom learned from over 50 years of engineering experience during the golden age of space travel is simply priceless."

"Very interesting and engaging presentations. The war stories (were) effective examples of lessons learned."

"Highly valuable course."

"Best training course that I've taken to date. I will be pushing to have more courses in the future."

"Well done. I think you guys have found your calling!"

"I feel the knowledge and resources I've gained are valuable and will serve me well as I develop throughout my career."

"I found the stories and anecdotes told throughout to be very interesting and felt that they really added to the course."

"The course was an excellent refresher for some of the items I personally need to brush up on having not been exposed to this for some time. For someone new to the industry it gives them a taste of what to expect during their career. I enjoyed the personal experiences that (were) shared relating to the topic at hand."

"The course was very well presented - probably the best I've been to and I anticipate the reference materials will be very useful."

Canadian Space Agency

"A great overview of the different aspects behind structural design and how it is done within the industry with real examples and practical information."

"Really excellent class on space mission structures with a very clear material and a lot of very interesting and instructive lessons learned and anecdotes!"

"Super course, learn't a lot and highly recommend it."

"Excellent basis of knowledge to know where to focus energies and efforts throughout the design and project process."

"Really good, experienced teacher with lots of experienced-based stories and examples."

"Excellent course, excellent teacher!"

"Tom is extremely effective in his teaching. His way to explain complex topics and make them simple is impressive."

"Excellent mechanical engineering (structural, stress) course for an electrical engineer."

"For a S/W telecom engineer specialized in payloads, it is the best way to understand the overall aspect of your ride to space other than this course. Personally can't imagine any other course."

SMS Testimonials

"Solid presentation with practical examples."

"I consider myself incredibly lucky to be offered the opportunity of attending this course."

"Offers a unique perspective on the applicability of FEA vs. testing."

"Great exposure to spacecraft structure topics for someone with a background in another field."

"Very knowledgeable and engaging instructor. Very useful and directly applicable material."

"Even if the subject of the course is a bit far from my field, I learned a lot from the course. I really appreciated the 'lessons' on what's engineering really about. Most of your examples can be applied to other fields and I think will help me become a better engineer. Thanks!"

"This is the first time in many years that I want to read and go through the course manual at night to try to catch whatever I have missed. Thank you for a great course."

"Probably the best technical course I have taken in the last 5 years. Should be mandatory … for all systems engineers."

"I appreciated that the instructor modified his style and what to teach to a higher-level audience instead of doing the stress calcs instruction."

Goodrich ISR Systems

"Large breadth of material covered, with adequate detail, both theoretical and practical."

"Tom was very knowledgeable, both academically (theory) and practical (hands-on, real world). Style was engaging and comfortable. He injected humor and kept the interest high."

"Lots of new information; topics often missed by most."

"A very good overview of the structural design and analysis process."

"Topics are relevant to our need. Excellent."

"Very broad scope—very informative. This will have an immediate impact on the way I approach engineering problems."

"Very knowledgeable. I admire Tom's engineering knowledge."

"Excellent compilation of engineering 'by laws' that if followed can avoid design faults and failures."

"Good content on joints, verification and requirements and criteria. Good real life examples."

"Very engaging speaker. Great job."

"Good coverage of a wide area of topics."

"Instructor is very knowledgeable and presents information clearly and effectively."

"Very enlightening—good introduction into the system level overview of spacecraft design challenges."

"Broad experience, practical knowledge."

"Broad range of topics covered with appropriate level of detail."

"Impressive scope of knowledge. Excellent presentation skills."

SMS Testimonials

"Very comprehensive. Excellent knowledge of course material and presented very well."

"Knowledgeable instructor, interesting presentations, helpful ideas. Very good."

"A very good course for an engineer working in the aerospace field."

"Very well versed and knowledgeable in the field."

"Real-life applications and experience. One of the best I've seen. Held attention for four days."

"Excellent. Loved videos to break up seriousness."

"Detailed and solid knowledge base, clear and concise explanations."

"I am very picky and usually don't give all 5's, but this class was well worth my time."

"A good lecture. Some are more familiar than others. Comprehensive outline that could be used in designing a better product."

"Good overview of mechanics. I like the 'homework' philosophy."

"There was a good mix of lecture and stories."

"Very good presentation style. Covers a broad range of topics. Very good at keeping attention."

"Much real world experience, emphasis on remembering 'the basics.' Very knowledgeable, good presentation style."

"Comprehensive, practical and very well presented."

"Sparked my interest in further first hand analysis."

Instar

"I wish every class I take was as valuable and well-structured as this one."

"The dynamics section was a great technical summary."

"My greatest take-aways throughout were "philosophies" of approaching the various challenges."

"The examples of application of engineering theory were the best part."

Jet Propulsion Laboratory

"Excellent course!"

"This course provides an end-to-end overview of how to approach spacecraft engineering, with a focus on structures."

"Excellent big picture course for all engineers."

"Great course for all mechanical or systems engineers."

"A must for aerospace systems engineers."

SMS Testimonials

"Really good course and content for anyone participating in spacecraft design and delivery in the aerospace industry."

"Good insight into stress analysis."

"Great course content. Easy to understand, even with limited mechanical engineering training in the past, but informative for those with much more experience as well."

"Very good review of key engineering concepts. All hardware/designs I've worked on were touched on in some way. All new engineers should have this class."

"Excellent overview of commonly overlooked aspects of structure design."

"Engaging and enlightening."

"This course is a "must take" for every engineer and analyst involved with space hardware/systems, especially freshouts."

"Very good introduction or review class for mechanical engineers."

"Excellent high-level course for people interested in spacecraft structure design with forays into useful techniques for design and analysis."

"With a wealth of knowledge, Thomas Sarafin provides a comprehensive overview of the life cycle of space structures."

"Outstanding course as both a refresher and "gap-filler" – relevant for all mechanical cognizant engineers."

"Great focus on commonly misunderstood areas of structural engineering and frequent pitfalls."

"This course offers a comprehensive, simple discussion of the best practices and philosophies that all structures engineers should follow in order to become better engineers in general, and systems engineers overall."

"Every topic is engaging and refreshing. Challenges not only your memory but current methodology and approach to design, reviews, and fabrication and test."

"As an engineer fresh out of college, this class was a great introduction to all the aspects of mechanical design and analysis that I will be using in the future. The textbook will be a very valuable resource as I start my first real structural design projects."

"Everything that isn't taught in school or learned in the workplace. Great philosophy and methods to think as an engineer."

"This is the class I wish I'd found when I started in the aerospace business. Every mechanical engineer should take this class not once, but twice."

"Great class, I've been in engineering over 20 years. This is the first class offered thru work that coverec information all engineers should know."

"I think this course is essential for giving relatively new engineers the guidance so they don't have to learn the hard way, and is great for experienced engineers, as well, to get a bigger picture."

"Great in depth information directly related to work coming from somebody who has worked in the industry and seen it all."

SMS Testimonials

"S lot of real world examples discussed during the class that made the course interesting and understandable!"

"It was a great overview of all the issues concerning space structures."

"This course opened a lot of doors for me; I know a great deal more that I don't know."

"This class does a great job defining and explaining space environments and expected loads."

"This three day course covered many of the subjects I have had to learn slowly over the seven years that I have been in my current organization. I wish I had been offered this course some time in the first year!"

"This course was a great overview for the "big picture" for spacecraft design, It linked formulas and mathematical concepts learned in school to real applications in an easy-to-understand way. Great examples were given as well. Would highly recommend this course. It sparks that excitement of how we build actual spacecraft in the real world!"

"The best structures course I've taken so far."

"This is an excellent and useful class for mechanical engineers, stress analysts, dynamics and load engineers. The material is well thought out and presented. The presenter, Tom Sarafin, is very knowledgeable and experienced."

"A course for ALL Engineers."

"Thomas, you need to offer this course 2 to 3 times per year to JPL over the next 2 to 3 years."

"Excellent course for both new and senior engineers that encompasses a broad yet practical perspective of spacecraft structures from concept to launch."

"The best class I have ever taken at JPL. It is 100% applicable to all Mechanical CogE's and Analysts."

"Great course."

This is a good, complete and useful overview … the lifecycle of space structures development."

"Come for the learning, stay for the funny videos!"

Lockheed Martin

"This is a great course. Slides and book will be great reference material. Both instructors are very knowledgeable."

"With a mechanical engineering background and being in the liaison stress group, I liked the review of every topic. I found the class to be very useful, and I was able to relate to all of the subject matter to my brief space industry experience."

"This is a very comprehensive and informative course. Though it does not directly impact my job, it gives someone who is not an engineer in the space industry an overall understanding."

"Excellent…provides broad explanation of things that must be considered, activities that are going on. Many of us would not otherwise be aware of these things."

"I truly appreciated the opportunity to begin an understanding of the concept to launch process with such detail. It has given me clarification of many areas of technical operations that I was previously unaware of what the different groups did."

SMS Testimonials

"This class was absolutely FANTASTIC. I learned so much about a discipline I've never really been exposed to in my work. If I want to go into this area in greater detail (and I plan to) the text book is perfect. Tom's instruction is top-notch."

"Examples from personal experiences/anecdotes helped to drive points home."

"From an aircraft background, I found course very valuable."

"I learned a lot about the space industry which will help in my career at LM. I enjoyed it. Thanks!"

"The dynamics discussion was very helpful and I enjoyed the review of mechanics of materials and strength analysis."

"Stories are great."

"Should be required to give young engineers an overall understanding of space structures."

"Excellent practical examples. Lots of content. Good mix between theory and practical applications."

"This course gave a very good overview of space structures. It provided me with lessons learned and a better understanding of design process."

"The instructors presented the material very well and didn't read from the slides. The course covered everything in perfect detail."

"Great introduction to many applicable topics. Should be required for Level 1 and 2 (at least) engineers."

"Great course. Very applicable to our current work."

"Well worth the time and money. One of the best."

"Good content, good presentation, a lot of info in a condensed time frame."

"Great class—very informative, provides a good overview of the entire design process."

"Good emphasis on fundamentals."

"Several meaningful real-world examples presented."

"Very real world focused. I was able to easily relate class information to my job."

"Well organized with plenty of useful examples."

"Good course—interesting general overview of engineering statics, materials and stress."

"Excellent. Good teachers, good examples."

"Excellent practical examples, lots of content, good mix between theory and practical applications."

"Excellent course. You are both very sharp guys and presented material well. Also answered questions efficiently and obviously very knowledgeable. Thank you."

"This is a great course. It gave me a lot of insight into my job and the decisions I make everyday."

"Excellent presentations! Fantastic identification for a needed course to teach engineers spacecraft design from concept to launch. Could definitely use more courses like this!"

"I enjoyed the broad overview of the different aspects influencing structural design. I particularly appreciated the specific examples and citation of related documentation."

SMS Testimonials

"Excellent course, very useful and informative."

"Very well organized, great value—lots of good info that is hard to find elsewhere."

"Really enjoyed the various topics. Some was review, while other information cleared up some questions. The instructors made it interesting with real world application."

"Great course full of a lot of useful information. Easy to glean how useful some of the ideas could be in everyday life."

"Great exposure to disciplines surrounding design. Great emphasis on how to design an excellent part."

"Emphasis on the sense of ownership to the parts we design."

"Excellent knowledgeable instructors. Applicable topic, just enough class participation. It should be required for all structures and mechanisms designers and analysts."

"This was a great overview of engineering for newer engineers (<5 years)."

"Brings the spacecraft design perspective into a grasped understanding for young engineers. Highly recommended to other mechanical and structural engineers and stress analysts!"

"Extremely useful and informative. Touched on key issues which motivated me to do independent thinking about past/current design work. Opened my eyes to a much wider perspective of structural design."

"Great course. Very worthwhile for design engineers as well as other disciplines. Should definitely be taught again … to more of our engineers!!"

"Very well structured. Incredibly useful examples from industry to relate concepts."

"Very interesting. Gives a good idea of the 'bigger picture' in space missions and structures."

"Very organized, right amount of information in different areas—wasn't too general or too deep in inappropriate areas; good information that is hard to find in other places."

"I really enjoyed this course and found it very informative and interesting."

"I like Tom's stories that relate to topics covered in class."

"I highly recommend this course to my peers."

"The instructors had many years of experience in the industry. This added to the course with real-life examples and stories of experiences from other people."

"Very good course for all, but especially young engineers like myself."

"Great examples; very relevant and timely. Kept course content fresh and engaging with stories. Resource material will be very helpful in the future. Great knowledge of subject and presentation material."

"2 thumbs up. Learned some things, and it refreshed my memory on a lot more things."

"The outline was clear, the step-by-step approach was effective, the chapters were organized well. Student activities helped to keep attention/ involvement."

"Great course—covered many topics I hadn't expected but hoped for."

SMS Testimonials

"An excellent course full of actual case studies from the aerospace industry. The instructor related the material presented to practical examples from his considerable career in the industry."

"A very good course giving information on space mission structures design, providing designers with information on why it is important to think of analysis, test, producibility, and verification when designing."

"Great overview on design and the importance in thinking about it at a systems level."

"Great overall course. Recommended for new design/stress engineers. I would recommend it to many of my peers."

"Great course, very relevant to what is done at LM.

"Covered a large variety of topics—great!"

"Great instructor, good presentation of content."

"Instructor relates to how LM does business well. Examples are practical, coursework very relevant. Good presentation skills; gave overview of areas I knew little about."

"Awesome. It was very well taught."

"Great course. Instructor was an incredible speaker. His material was real life examples. I can use all of these examples to help in my career."

"Course was very informative and beneficial."

"Great course, well taught. I highly recommend it."

"I like that the instructor (Tom) has been in the field and knows what issues we have in the real world. Please, offer this again."

"I enjoyed hearing the real life examples that help relate the engineering principles that were presented. I found the Falconsat-2 case study to be the most interesting."

"Instruction and presentation material were excellent."

"Useful course. Based on lessons learned from years of experience."

Johnson Space Center

"This course is a fantastic way to learn about the many things that fo into designing and analyzing a spacecraft."

"Mr. Sarafin provides an outstanding perspective on the entire field of aerospace structures."

"This course challenges engineers to look at their work and processes and find ways to improve."

"Excellent guidance for anyone involved in any phase of spacecraft development."

"Great instructor and excellent material."

"This is one of the best courses I have taken. It is detailed and thorough."

"Just in time for me to better understand vibe testing that is about to start on my project.

SMS Testimonials

"I am glad I took this course this early in my career."

"This is a great course to take to teach the fundamental principles of structural design to those not familiar, as well as, teach common design pit falls and methods to avoid them to seasoned designers."

"Outstanding use of personal experience to illustrate the penalties of not following sound engineering approaches."

"Class exemplifies importance of integrating analysis into design process to reduce time to complete and associated costs."

"The course has a lot of information that is applicable to engineering in general, and can be useful in other industries, as well."

"I recommend this course foe entry level stress analysts, all levels of design engineers, and managers who need a structures review."

"Opportunity to see the forest, not just the trees (structures discipline)."

MacDonald, Dettwiler and Associates (MDA)

"Well done. One of the best courses I have been in! Very focused and relevant."

"Very comprehensive with a good balance between theory and practice."

"The instructor was very knowledgeable and is very good at presenting the material and keeping it interesting."

"Thoroughly prepared and experienced instructor. Excellent and well-organized material."

"Tom has an excellent knowledge set and was a great presenter, giving many real-life examples to help get concepts across."

"Instructor has in-depth knowledge of topics and is genuinely interested in student understanding."

"Great overall 'big picture' presentation of how everything related to one another, being new to the industry it was really informative."

"Tom was great, presented material clearly and easily understandable. Real life examples really drove the points home."

"Providing overall background of key concepts needed to begin structural design and analysis. Provided a clear idea of attempting design and analysis—key for a young/new engineer."

"Very good spectrum of information that supports a systems-level understanding."

"I feel honored and grateful to have Tom Sarafin as the instructor—very knowledgeable."

"Overall, a very useful course. Excellent exercises. Good stories and anecdotes."

"This course is great. Every engineer should take this course."

"The course is very well organized and the content is very important for system engineers."

NASA Glenn Research Center

"I think this is an excellent course! I found all parts of the course useful and informative."

SMS Testimonials

"This class gave a good process to use for quick "back of the envelope" calculations to be done before FEA."

"The course helps remind us of the many simple tools at our disposal, that if not used, we slowly forget."

"This class provided someone without a structural background with a good foundation in structural design and analysis."

"Excellent class, excellent instructor. It is (an) inspiring class. It teaches you how to be an excellent system engineer."

"The instructor has excellent credentials and keeps the students engaged."

"I wish I had taken this class 20 years ago. Possibly the best course I've ever taken."

"Very informative overview of a flight project with problems that make you check your assumptions."

"This is the course you should take when starting a new aerospace project. This course offers insight, oversight, and wisdom of a space mission, from concept to launch."

"I was very pleased with the overall quality of the course. It keeps the students engaged and the presenter really had a lot of real world case studies and examples that we could all learn and relate to."

"Even though I'm not a structures guy, many of the lessons in the course are universally applicable. Learning to 'speak the language' … is very helpful."

"High quality and value."

"The example on FalconSAT-2 was great for tying the whole course together. I didn't previously know the entire process from start to finish."

"The most useful were the class problems & examples."

"The review of basic statics, dynamics, and mechanics is great even for someone young like me. I didn't know a lot about vibrations but the information in this course was easy enough to learn. It covers a lot of details that they just don't have the time to cover in college."

"I think this is a great course that really could (contribute) to my development (as) a good engineer."

What I found most interesting or useful: "The need to diversify and remove our blinders to become a smarter engineer. I also really liked the class exercises and problems. (They) helped drive home the point and get us thinking instead of just listening. The reviews every morning were also a very good approach."

"One of the best (most applicable) courses I've taken at NASA."

NASA Goddard Space Flight Center

"Excellent class. Very Informative! It encompasses all the important major aspects of space structures."

"The holistic discussion of the mechanical design and analysis process for an early career engineer was fantastic."

"The Space Mission Structures takes from all the concepts learned during the engineering school and shows how they apply to aerospace structures." The course also broadens understanding of the whole picture and how structures impact the whole mission."

SMS Testimonials

“Great class needed to make you thing outside of your engineering bubble.”

“As a younger engineer, this course has been a great experience to open my mind to important topics within the lifestyle of spacecraft structure design. Removing the blinders to broaden my understanding of the structural lifestyle will help me make better decisions as my career progresses.”

“Great course for all levels of experience.”

Very good and comprehensive course covering nearly all (if, not all) applicable techniques for a space structures engineer.”

“This course is useful for design engineers that want to be able to do more analysis and learn how to come at a design with a systematic approach.”

“ I wish I had this course 7, 8, or 10 years ago! So many concepts and rational methodology that we all ought to follow to develop flawless flight structures at minimum cost.”

“Whenever you’re convinced you know your job, well, take this course and I’ll guarantee you’re missing something. I think it takes many years and mistakes to become an expert. This course will provide guidance in doing my job better.”

“I wish I had this course when I started my career and every 5 years after that. So much good material that I need a reminder on a regular basis.”

“Great back to the roots mech engineering class!”

“Class teaches you to think, perform basic engineering before you jump in too deep with specifics!”

“Hey, Mr. Focused Mechanical Engineer, look at the big picture!”

“Presenter was great.”

“Very valuable to ‘Fresh-outs’! Relates classroom knowledge to factual experiences in the spacecraft industry.”

“Great job with the course. Your advice and pointers really have changed how I approach FEA and will make me a better engineer.”

“Definitely helped me see the bigger picture. It was good to see other analysts’ approaches. It helped me put a lot of things, as an analyst, into perspective.”

“The systems approach information is quite helpful for new engineers to think about.”

“I enjoyed it thoroughly. Every day I learned something. I especially liked the fact that the course challenges the ‘old school,’ why do you do this or that?”

“For me the entire course was an excellent high-level review.”

“I wish I had taken this class 10 years ago! This is a great class.”

“I learned a lot of simple calculations to quickly baseline a structure. It was useful (and humbling) to do the in class assignments.”

“Very interesting real life examples. This is probably the most useful and practical short course I’ve taken.”

SMS Testimonials

"I am happy with the process you are promoting. Hopefully, this will show the compartmentalized outfits how to better engineer."

"I learned a lot about the correct way to approach design and why it's so important to have a wide scope of the project, so that you can anticipate and avoid conflicts before they require large amounts of time and money."

"Great engineering mind set—you made me think about things."

"Great job! Excellent information that I know will come in handy. Thanks!"

"This is an excellent class for structural/mechanical leads who wish to be a lead engineer. Also, good for systems engineers."

"Very good course. Would highly recommend."

"Real life professional experiences given by instructors."

"Looking forward to taking the bolted joints course and other courses from Instar."

"Enjoyable course! Good for a new engineer."

"Practical experience…things they don't teach in school were useful."

"Love the experience of the teachers, real-life examples help reinforce the key concepts of the course. Great getting a lesson from someone from industry for a change."

"Great review with anecdotal accounts for rusty engineers."

NASA Johnson Space Center

"Will recommend this to other engineers in the structures division. Good balance of theory and practical application. Excellent job!"

"Was succinct and complete."

"Excellent course—very informative. Good instruction, I like the real-world examples."

"Excellent instructor and material!"

"As a structures engineer, I found the course to be very useful and will encourage others in my division to take advantage of the course."

"A lot of what was discussed, I can apply during SR&QA activities that I am involved in. Great class!"

"Good use of hardware props. Excellent sharing of lessons learned stories. Good no-nonsense, to-the-point approaches!"

"I appreciate the matter of fact, keep it simple approach to the subject—it makes sense to me."

"The instructor is very knowledgeable about the course material and that shows."

"I really enjoyed the chapter on design from scratch. It's a lecture I never had in college and something I always really wanted."

"I really enjoyed experience-related stories and anecdotes. I also really liked the risk analysis in the last chapter."

SMS Testimonials

"As a mechanical engineer, I can definitely see the value of these topics for designers. In fact, I have recommended it for a design engineer friend of mine…"

"Your overall insight on how to avoid problems during design, fabrication, testing, etc. is the best I've seen. Thanks."

"Liked learning a little bit about dynamics, etc. Helped me understand some factors that may influence my designs. Excellent, thought-provoking course over-all!"

"I think that the information I learned will be very useful in managing the structural component of my project."

"This course has been extremely valuable. I hope that I can take away half of the information presented and learn how to use it well."

"The stories and examples are very effective in illustrating your points."

"Excellent. Very helpful as a refresher on engineering fundamentals in several disciplines, plus helpful to me as a manager trying to ramrod design/analysis tasks as part of projects."

"Served as a good refresher for several topics. Clarified vague areas and introduced good topics of discussion."

"Great overview. Good technical detail and level."

"High value to new engineers. Good review for experienced engineers. The course should be material that all project engineers know."

"The examples were highly relevant to our work. I have a much better understanding of structure design issues, especially modeling and its limits and appropriate uses. The instructor clearly understands and is effective at communicating."

"Very informative. Good reference material to deal with problems."

"Great course, great instructor."

"Gave me an excellent foundation to start building on."

"Excellent course. Should be a part of mandatory training for personnel before they are assigned to more than entry level GS 7-9 jobs."

NASA Langley Research Center

"I'm new to flight projects and mechanical design team leadership. This course was an excellent introduction to me of the mechanical and structural world of space flight projects and has provided me with better tools to lead my design teams."

"I recommend young engineers take this course earlier."

"The course filled in several holes and provided points of view that (I) haven't been exposed to regularly."

"A great overview of spacecraft development. This should be a required course for all new aerospace engineers and managers."

SMS Testimonials

"All design engineers should take this course – it is a great reminder al all the additional factors (stress, analysis, manufacturing, quality, etc.) that go into the design other than its creation. Will definitely help you create a better/cheaper/more efficient final product."

"I recommend this course be held for other NASA employees more frequently."

"More people at Langley should take this, especially design engineers to remind them of the stress analysis/manufacturing that goes into their design."

"Good class and instructor."

NASA Marshall Space Flight Center

"Quality? The best of any class I've had."

"Very good course. Good content and well presented."

"Best course I've taken. Got me excited about design again."

"Excellent course. Best one I've had so far."

"One of the most practical courses I've taken."

"Valuable for young engineers and experienced engineers. Helps present the industry from a different perspective."

"I thought the complete coverage of the product cycle and all the disciplines involved, and methods of integrating these together, was very good."

"I wish they would require this course for all new hires so when someone mentions the 'random vibe test,' for example, everybody would know or have a general idea what is being talked about."

"A great or required course for most NASA engineers, including just out of school and experienced engineers. I wish I took this shortly after I was hired."

"I think managers should take this course, and the people we call 'systems engineers.' They need to understand limitations of analysis as well as we do."

"Course is great. I enjoyed Tom's enthusiasm and energy level."

"I enjoyed it. A great refresher in areas I knew and deeper understanding in areas where I am weak. Thank you!"

"Very well done notes and presentation."

"Very good and informative course content. It will help me if I decide to go into manufacturing."

"The course as a whole was informative and very practical. Class examples and case studies were very helpful."

This course will help me tremendously in my current design assignment and future work."

"This course was very valuable for me because it gave me a general overview of the entire process to create space structures."

"Bring Tom back to teach this again and encourage more engineers to take it."

"The verification flow will help greatly with integrated analysis I perform."

SMS Testimonials

"This course is the best I have taken because it gives me an overview of the entire process to create space structures."

NASA Wallops Flight Facility

"Courses like SMS help engineers focus on their design objectives in light of pressure from schedules and managers hell-bent on "checking the box" and not fulfilling requirements."

"This is a beneficial course for new engineers lacking experience as well as those that have been in the aerospace industry for some time and may have lost sight of many of these core ideas and principals."

"The views shared in this class (if taken to heart) will save the space industry from drowning in red tape and paper work."

"Great course. Helps to produce a different, more valuable perspective on the engineering process."

"Great course. Knowledgeable instructor. Highly recommended."

"Great course. Love the viewpoint from a practical, practicing engineer, far often lacking in courses I've taken from other instructors."

"Well-structured, well-presented, covers very useful topics, good quantitative methods as well as qualitative methods."

"Very knowledgeable, engaging presentation style; gets the class involved."

"Great examples, great insight into 'the way things really work.' Technique over theory!! Kept class attention with stories and problems for the class."

"Very knowledgeable great resource, presentation was interesting and kept attention."

"Very good. Plenty of real world experience."

"Excellent knowledge and background."

"Makes you stop and think about failure modes and analysis before jumping to conclusions."

"I liked the example problems, really helped a new engineer understand the real world problems."

"It was excellent. He was well prepared and extremely knowledgeable."

"Clear, organized, great industry stories connected to lessons."

"Real world examples and study cases, interactive."

"Lot of valuable material. Excellent reference text. Very good examples."

"Extremely knowledgeable. Does a good job of livening up dry material!"

"Tom knows this stuff very well."

Northrop Grumman Aerospace Systems

"This has been a great refresher of general mechanical engineering concepts."

"This will absolutely change the way I think and progress through my designs at NGC in the future."

SMS Testimonials

"A very valuable course that will positively effect all aspects of my future designs and analysis."

"This course was full of relevant examples, taught in an engaging manner by an obviously experienced teacher."

"Interesting and effective course!"

"This course (Space Mission Structures) helped me understand more of what is required of me as a designer and as an analyst."

"This class is a fantastic course for stress structures, loads, analysts."

"Thank you for a very thorough class."

"It revealed some weak spots I need to strengthen in my knowledge."

"This course was a great reminder to step back from our narrow looking glasses and see the entire picture…think like a systems engineer."

"Tom's experience in the industry make his courses very relevant to our daily challenges, providing valuable insight into avoiding common pitfalls."

"Enlightening."

"Excellent, broad exposure to all aspects of getting a structure from concept to launch."

"It is a refreshment course. We often so focus and specialize what we do, and it is great to be reminded of other aspects of engineering. This helps us to be better engineers."

"Great course…refreshes memory and helps better understand structures."

"This course provided detail analysis as well as valuable guidelines for the design of parts and assemblies."

"Excellent class, better than my other classes I took in my past. Excellent instructor and course contents."

"Really enjoy the stories told in the class."

"Great course on the basics of designing space structures."

"In your day to day tasks, it is easy to get stuck in the weeds. It is very helpful to step back and look at the system/requirements as a whole."

"I just finished reading through the course feedback notes and it looks like you put on another fantastic class. I really appreciate you coming to our campus and sharing your knowledge with our employees. You and the GD&T course instructor get the highest ratings from our employees when it comes to on site instruction."—(Manger of Mechanical Design Engineering)

"Excellent course, gave me good insight into areas that I had limited knowledge of and also a good overall picture of how dynamics influences and fits in with the other areas covered. One thing I thought was good about effectiveness of presentation is that the instructor emphasized key points on each chart rather than dwelling on details or formulas too much."

"I liked the analysis portion of the lecture the best. Other parts of the course were equally informative and interesting. All the 'lesson-learned' stories really made the points clear. Overall, an excellent class!"

"Excellent course. This helped tie together the 'big picture'."

SMS Testimonials

"I found the course to be very useful and informative. I feel this course gave me a much better understanding of spacecraft design. It provided me with information that was not offered in my college coursework."

"The course is unusually good!"

"Everything was well presented and very relevant to spacecraft design. I learned a lot!"

"I would recommend it to anyone. Excellent presentation."

"Should be a required course for engineers out of school and leads/management should follow recommendations in the course."

"I will suggest this be taught here again soon since I know others who would benefit also."

"Excellent multi-disciplinary exposure. Problems really make me think. Examples of experiences help others avoid pitfalls."

"I found this an excellent course, well worth the time."

"This class gave me a more solid understanding of how every aspect of spacecraft design is inter-related and codependent, and each is critical towards creating a quality product."

"Course conveys a general optimism which was refreshing, technical and practical. Very well done."

"Space Mission Structures: From Concept to Launch is one of the most efficient and effective courses I've taken and is relevant for all types of engineers in the Aerospace workforce."

"Class was great, learned a lot of new things, and new ways to think about old problems. The stories shared by Tom and the other class participants (were) my favorite part. The course offered a fantastic mix of breadth and depth. I will be turning to the course notes/textbook as my first point of reference from this point on. Thanks Tom!"

"Must take."

"Excellent course with direct impact to daily work."

"Sarafin makes engineering exciting. I wish I had this course earlier in my career. I now have a better understanding of loads analysis, verification, producibility and testing. Great war stories!"

"This class helps stress analysts to better understand their role and think like a systems engineer."

"This class is a must for any engineer wishing to understand how different disciplines of engineers work together to take a spacecraft from the concept phase to launch."

"I found this class to be very valuable. It helped me understand my role as a stress analyst at a more fundamental level."

"One of the best courses I had a chance to take. Extremely well thought through."

"Great overall design and basic analysis class."

"I think every engineer working a space program should have some length of this class before we design or analyze anything."

"Good course, lets me know what is going on and understand mistakes early in my career."

SMS Testimonials

"I liked the personal examples which only an engineer with year of actual program experience can share. It's this kind of sharing of knowledge and history which can prevent the younger guys like myself from making the same mistakes."

"This course is really good. I'm sure you could teach a course on each chapter in this manual, and if you did, I'd love to take them."

"Presentation of good, solid, engineering approach to many different, but related tasks."

"I may be a MAGE designer, but I believe this all applies. Its mechanical design, its success is based on a sound engineering method/process, and it's all great information!! Keep it up, Tom. Thanks."

"Excellent course for all levels of engineering experience; good lessons for both the new graduate, the experienced engineer, and the manager."

"As a new engineer, this class in invaluable as a platform of future methods and applications and how I will make future decisions."

"I benefited tremendously from this course. I already use the fastened joints handout at least once a month and will probably use this handout equally as much."

"This course has given me a better understanding of my role and responsibility in regards to the overall quality and success of the program I am working on. Very valuable, especially 2 months into my professional career."

"I enjoyed the incorporation of real world examples into the course. The course is an excellent overview of SMS. The parts on strength analysis, design and final verification were the most fun."

"Overall course was excellent—very applicable to the work we do here."

"'What would you do' examples are great. I'm glad I know what margin of safety means now. Great course! Thanks a lot."

"Great course. Very useful. Excellent instructor, did a very good job of keeping my attention for a 5 hour lecture."

"Great material. Will prove to be very useful in design work."

"Should be recommended for any newbie in the space industry."

"This course was outstanding. It was a great overview of various functions and I got a lot out of it. I look forward to studying up on certain aspects of analysis based on what I've learned in this class. I hope to take more classes such as this one."

"This course was everything and more than I hoped it would be. I am taking away much information I can use in my work ... Excellent presentation and content."

"I think this course is most beneficial to me because I'm learning these lessons early in my career. I would highly recommend it for all spacecraft mechanical engineers. Everyone needs to think like system engineers and quality assurance engineers."

"This course should be a required course for all engineers/managers who work on any spacecraft program. Also, the presentation of the course was exceptional and made the course very enjoyable. I was especially impressed with the technical thoroughness of the charts."

"I am going back to my department and recommending new engineers or new to this industry to consider this in the future."

SMS Testimonials

"Great course…I would recommend it to all the dynamics department."

"I can recommend this course, without reservation, for just about anyone in the mechanisms/structures/systems disciplines. Excellent course."

"Excellent course! It would take at least 15-20 years to understand, accumulate and digest all of this info in a work environment. Thank you for the opportunity."

"Thank you! Well worth it."

"Very useful, especially for non-stress analysts. Designers should be required to take it. Great presenter."

"This class gave me a more solid understanding of how every aspect of spacecraft design is inter-related and codependent, and each is critical towards creating a quality product."

"Class was great, learned a lot of new things, and new ways to think about old problems. The stories shared by Tom and the other class participants was my favorite part. The course offered a fantastic mix of breadth and depth. I will be turning to the course notes/textbook as my first point of reference from this point on. Thanks, Tom!"

Rocket Lab

"Great Course!"

"Very useful and interesting course."

"A valuable course with a good mix of theory and practical advice for structural analysts & engineers."

Sandia National Labs

"One of the best short courses that I have taken. Information was well presented and relevant."

"Great to see another opinion on and view of the aerospace world. Great class.

"Really nice balance between technical meat, philosophy, and experience (war stories)."

"Really enjoyed this course, very well prepared. Excellent experience base."

"Great practical examples. Great refresher of basic engineering methods/tools."

"The best review of mechanical-dynamics applied to space craft that I have seen."

Most interesting or useful:

- "The examples and case studies."
- "Mental exercise of walking through the load path."
- "Requirements and verification."
- "Real-world examples, lessons learned, war stories, etc."
- "Philosophy & perspective."
- "Class exercises, class participation."

SMS Testimonials

- "Assessing risk, making informed decision."

Scitor

"Every SETA supporting a spacecraft acquisition should take this class! Outstanding!"

"Good top level overview of many aspects of structural design. Very well prepared."

"Provides excellent background and examples to make key points. Provides sound engineering principles with examples. Excellent."

"Covered key material, good selection of topics. Presentation—superb, brought in personal experience, examples."

"Tom has provided the class with in depth understanding of the structures, environment, integrity, and analysis through practical examples. Tom is a most knowledgeable instructor and applies the topics to our programs."

"Tom, I like your style and the excellent way you've interwoven real-life examples into your lecture. I'm mainly involved in software test, but many of the lessons and philosophies you've given directly apply!"

"Instructor—great knowledge and practical examples! Super!"

"Knowledgeable and practical instructor—understands aerospace industry. Excellent, good stories and applicability of material."

"Great leverage points to take back into my job!"

"Excellent knowledge with real-world experience. Kept interest level high with examples and mental challenges."

"Had everything I was interested in. Put pieces of my background in context of what we do. Many great examples. I can't say enough good things. It resonated with me."

Southwest Research Institute

"I thought the course was well composed and delivered. I learned a lot and am thankful for the refresher in topics I haven't used for a while."

"Excellent presentation and course material."

"Tom is a very engaging instructor."

"This course was on the money…"

"Very valuable for mechanical and systems engineers in technical details and also in promoting a philosophical framework for good design practices."

"Enjoyed seeing the big picture and the breakdown of the overall project."

Other organizations

SMS Testimonials

"I found this course to be extremely valuable. It filled in several gaps in my knowledge and I will "definitely" be able to use what I learned back in the program office. The technical problems and class examples really made me think."

"Course enlarges the vision to see the big picture, how important engineering philosophy from design to test a verification."

"This "education" (not training) improves my perspective and show the way to be an engineer properly."

"Tom educates on sound engineering techniques and principles."

"I recently became involved in the development of a qual test and now I have a much better understanding of the complexity of different project aspects and everything that should be considered to ensure mission success."

"The course was very insightful into understanding the derivation of mechanical requirements and the process of how to evaluate them."

"An important program level overview for all analysts and design engineers. A must take course."

"I never thought as much about the system perspective of my work as I will now going forward after taking this course."

"I found the course to be beneficial not only for space mission structures but also for my current role in the motor sport industry."

"This course combines multiple disciplines and engineering roles to teach engineers how to design better structures that will work."

"A great course and important subject matter for engineers both "young" and "old" proving that you can teach an old dog a new trick or two."

"All of Instar's courses, regardless of the nominal topic, are geared toward making the students better engineers – and it works! Tom passes on invaluable practical lessons learned to engineers who haven't yet made those mistakes and can now avoid them."

"This course will give insight to the larger picture that many overly specialized engineers need."

"Very good course!"

"A great overview of the entire structural design, analysis, and test process for a space mission. Both educational and interesting for experienced engineers and new graduates."

"I found the course a great resource for the fundamentals of engineering and a good overview of spacecraft structures."

"This course was a most beneficial use of time and provides mechanical engineers in the space industry with increased capability to perform structural design and analysis with the proper mindset."

"Excellent course. I wish I took this when I started in the space industry."

"I wish I would have had this education sooner."

"This course is exactly what I needed to help me understand how to proceed with my spacecraft structural design. It opened my eyes to many areas that I had forgotten to consider or didn't even realize I was missing. My design will be much better as a result of this class!"

"A great overview of the different aspects of space mission structures."

SMS Testimonials

"For non-mechanical engineering based systems engineers, this course is an excellent reintroduction and expansion to the black magic engineering behind structure and hardware content of design reviews."

"This course provided a good overview of concepts I hadn't used in a while. Tom Sarafin presented a refreshing view on spacecraft design/analysis that will directly improve my designs."

"I've taken a lot of short courses. Some of them were very good with great presentation, but this one tops them all."

"Essential for developing engineers in the space industry in order to see the overall picture."

"Excellent class. I will use this information starting tomorrow!"

"Very practical strategies and points of departure."

"I liked all the stories. They were applicable to the topic and will be helpful in understanding better what is going on at work."

"Stories from past experiences were very interesting."

"I found it all extremely useful. I especially enjoyed all the real life stories that backed the theory."

"This was a very good class."

"Highly recommended for anyone in the (aerospace) industry."

"In today's design environment that is becoming more cost constrained and where value needs to be demonstrated to customers, I can think of no better investment, especially for the younger engineers' crowd, than to take this course. It will really help connect their education to application in the Aerospace industry."

"A great refresher and real world situations, lessons learned type of course."

"Really enjoyed course."

"Make time to take this course, preferably early in your career. It is worth every minute."

"Tom is an energetic, effective instructor obviously very knowledgeable in his field."

"I feel the course was done extremely well. Thomas was great at maintaining my attention. Why limit yourself to the space industry? All engineers could benefit from your expertise."

"Excellent presentation in general. This course reminds me of many things. Great overview of the whole system. All managers should take this course!!!!"

"Excellent presentation. A reminder of how much fun engineering can be."

"This has been the best, most informative overview that I have seen. I would highly recommend this class to all engineers in space related fields, particularly, those engineers with limited experience in hardware design."

"First course taught by someone that has 'been in the trenches.' Most courses are taught by educators with 40 years teaching experience but no practical experience."

"Excellent course! The best I've ever taken as far as how it relates to my job."

"I recommend this course to new comers as well as seniors (including managers) to increase level of overall understanding of good engineering."

SMS Testimonials

"Instructor was excellent. Course and reference manual (especially) are to be a great help to me as a growing engineer. Thanks."

"The whole course had made me more aware of my shortcomings in regards to being rigorous. I need to devote more energy into approaching my strength analysis responsibilities with greater attention to detail and rigor."

"Great course! Good for new engineers because it shows the practical side of the business. I wish we had this in school."

"Enjoyed course—very technical subject, yet speaker was very approachable and created a comfortable learning atmosphere."

"Tom, I finally got to take the best course I've had a chance to take in 20 years."

"Great course!"—Retired Chief Engineer for USBI who helped develop the Saturn family of launch vehicles