Honourcode, Inc.
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Applied Systems Engineering

A 4-Day Practical Workshop

Planned and Controlled Methods are Essential to Successful Systems.

Today's complex systems present difficult challenges to develop. From military systems to aircraft to environmental and electronic control systems, development teams must face the challenges with an arsenal of proven methods. Individual systems are more complex, and systems operate in much closer relationship, requiring a system-of-systems approach to the overall design.

This workshop is a review of the latest principles for systems engineering in context of standard development cycles, with realistic practice on how to apply them.

Participants in this course practice the skills by designing and building interoperating robots that solve a larger problem.

The challenges today are changing, because systems are changing. Rather than separate, well-defined functions, systems today interact in complex ways to perform operational missions. Many interoperating systems are essential to normal operations, and seemingly minor design errors can cost lives.

The challenges today are changing, because acquisition methods are changing. Interoperability of systems is driving new iterative approaches that displace the older "waterfall" acquisition models. New developments require more integrated information quicker.

***You should attend this course if you are*:**

- A leader or a key member of a complex system development team
- Concerned about the team's technical success
- Interested in how to fit your system into its system environment
- Looking for practical methods to use

The course is aimed at

- Program/project managers,
- Systems engineers,
- Technical team leaders,
- Logistic support leaders, and
- Others who participate in defining and developing complex systems.

Error Cost Found in Phases

PHASE	COST
Definition	1
System Design	3
Prelim Design	10
Detail Design	50
Production	200
Use	500

The discipline and concepts of systems engineering provide ways to manage this complexity. By following systems engineering practices, teams organize their thought processes in such a way as to bring order out of chaos. Studies of complex programs have shown that the proper application of up-front thinking can reduce the cost impact of errors by as much as five hundredfold.

In this workshop, you will learn the latest systems principles, processes, products, and methods. This is a practical course, in which students apply the methods to build real, interacting systems during the workshop. You can use the results now in your work.

Topics Covered in the Course

How do We Work With Complexity? – Basic definitions and concepts. Problem-solving approaches; system thinking; how complexity shapes systems and system development.

- Reductionist and system-level approaches
- Complexity theory, emergent properties, complex behavior
- Conceptual development and chunking
- System thinking principles

Systems Engineering Model – An underlying process model, compatible with ISO-15288 and the INCOSE Systems Engineering Handbook, that ties together all the concepts and methods. Overview of the systems engineering model; description of the processes defined in the model.

- Model overview
- Incremental, concurrent processes from Stakeholder Requirements Definition through Requirements Definition, System Architecting, System Integration, Verification, Validation, Operation, Maintenance and Disposal

A System Challenge Application – Practical application of the systems engineering model against an interesting and entertaining system development. ***Small groups build actual interoperating robots to solve a larger problem.*** Small group development of system requirements, design, integration, and testing, with presentations for mutual learning.

3/02 Cart System carries one ball down the track, then turns around to go back for another

Operational Definition – How to focus on and agree on the need for a system. Defining the problem in stakeholder terms.

- Stating the need from an operational view
- Interoperability impacts
- Quantifying the need

Requirements Definition – Requirements as the primary method of measurement and control for systems development. How to translate a need into effective requirements.

- Introduction to requirements, including definitions of types of requirements
- Analyzing missions and environments
- Definition of requirements through operational analysis
- Documenting good technical requirements
- Methods for requirements analysis, both functional and object-oriented including SysML
- Requirements specifications and use of language; informal requirements methods such as Agile and Lean

System Architecting – Designing a system using the best methods known today. System architecting processes; alternate sources for solutions; how to allocate requirements to the system components; how to develop, analyze, and test alternatives; how to trade off results and make decisions.

- The concept of an architecture; the elements of architecture
- Architecting methods including scoping, partitioning, aggregating and certifying
- Decision analysis using trade-off methods
- Simulation and modeling to prove an architecture and support decisions
- Interfaces and interface control
- Architecting with patterns, a powerful way to create architectures
- Architectural frameworks and how they support architecting; examples from DoDAF

- Creating product-level requirements

Product Design and Implementation – The role of systems engineering during the design of product-level components; protecting the objective

- Preliminary design and detailed design phases; review and monitoring of the detail work
- Production planning and management
- Unit test methods; the system responsibility for acceptance

System Integration and Test – Building in quality during the development, and then checking it frequently. The relationship between systems engineering and systems testing.

- System integration concepts; the purpose of system integration
- Planning for integration and how it affects production and testing
- Integration management
- Verification at multiple levels: architecture, design, product
- Validation at multiple levels; requirements, operations design, product
- Transitioning the system into use

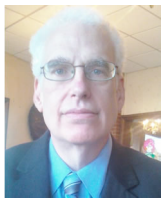
Project Technical Leadership – How to successfully manage the technical aspects of the system development; virtual, collaborative teams; design reviews; technical performance measurement; technical baselines and configuration management.

- Integrated Product Team (IPT) methodology
- Technical teamwork and leadership
- Project technical planning
- Technical monitoring, including Technical Performance Measurement (TPM) and reviews
- Technical control methods, including risk management, requirements management, configuration management
- Trends in SE management; how the Internet and complexity are affecting SE
- Small case studies on process management

Instructors. (Your course may be taught by any one of the following)

Dr. Eric Honour, **CSEP**, INCOSE Fellow, and former INCOSE President (1997), has been in international leadership of the engineering of systems for 20 years, part of a 45+ year career of complex systems development and operation. His energetic and informative presentation style actively involves class participants. He was the founding Chair of the INCOSE Technical Board in 1994, and served as Director of the Systems Engineering Center of Excellence (SECOE). He was selected in 2000 for Who's Who in Science and Technology and in 2004 as an INCOSE Founder. He is on the editorial board for *Systems Engineering*. He has been a successful entrepreneur, systems engineer, engineering manager, and program manager at Harris Information Systems, E-Systems Melpar, and Singer Link, preceded by nine years as a US Naval Officer flying P-3 aircraft. He has led or contributed to the development of 17 major systems, including the Air Combat Maneuvering Instrumentation systems, the Battle Group Passive Horizon Extension System, the National Crime Information Center, and the DDC1200 Digital Zone Control system for heating and air conditioning. Dr. Honour now heads Honourcode, Inc., a training and consulting firm offering effective methods in the development of system products. Dr. Honour has a BSSE (Systems Engineering) from the US Naval Academy, MSEE from the Naval Postgraduate School, and PhD from the University of South Australia based on his ground-breaking work to quantify the value of systems engineering.

Dr. Scott Workinger has led innovative technology development efforts in complex, risk-laden environments for 30 years in the fields of manufacturing (automotive, glass, optical fiber), engineering and construction (nuclear, pulp & paper), and information technology (expert systems, operations analysis, CAD, collaboration technology). He currently teaches courses on program management and engineering and consults on strategic management and technology issues. Scott has a B.S in Engineering Physics from Lehigh University, an M.S. in Systems Engineering from the University of Arizona, and a Ph.D. in Civil and Environment Engineering from Stanford University.



Mr. William "Bill" Fournier (CSEP) is a Senior Software Systems Engineer with 30 years experience, the last 11 for a major defense contractor. Mr. Fournier taught DoD Systems Engineering full time for over three years at DSMC/DAU as a Professor of Engineering Management. He has taught Systems Engineering at least part time for more than the last 20 years. Mr. Fournier holds a MBA and BS Industrial Engineering / Operations Research and is DOORS trained. He is a certified CSEP, CSEP-ACQ, and PMP. He is a contributor to DAU/DSMC, defense contractor internal Systems Engineering courses and process, and INCOSE publications.

Mr. Glen Francisco (CSEP, PMP) has over 17 years of experience developing new technologies, service, products, and applications for both private and government uses. He has a personable, engaging teaching style that keeps a class alive with information. He has worked as an engineer, Lead Systems Engineer, Project Engineer and Program Manager for a number of military & commercial companies to include Boeing (McDonnell Aircraft Company), Lockheed Martin (Martin Marietta), Texas Instruments, Raytheon, ELCAN Optical and DRS Technologies. His product systems have supported security surveillance, paramilitary (fire, police & EMS), automotive and industrial markets using passive thermal imaging technologies and other wavelength illuminated electo-optical imaging laser radar technologies. He was selected in the 2006 Marquis Publication of Who's Who in America. Glen has presented over a dozen papers at security & defense symposium. He holds multiple patents in active terminal guidance missile trajectory control and low cost plastic thermal management. He is a firefighter, emergency medic, firefighting instructor, and private pilot. He developed & introduced Thermal Imaging Cameras into the firefighting market in 2001, technology saving hundreds of lives and millions of dollars in property.

Mr. John Pratchios has over 40 years experience as a systems engineer designing, implementing and supporting complex hardware/software systems development. His work has included design and implementation of military command, communications, surveillance, and information systems, and also systems for weather imagery, publications control, and locomotive/train control. He is an engaging instructor with a warm, informal, knowledgeable presentation style. He has presented courses to military, Department of Energy, contractor, and college organizations. He is an expert in classical systems engineering including requirements management, system design, production liaison, hardware/software integration, program management, risk mitigation, and technical leadership. He is a specialist in architectural development of both centralized and distributed systems including DODAF and other types of analysis and model development for entire system performance/throughput estimation and validation. His experience includes Object Oriented software analysis & design using UML, Booch, Ellis RTOOSA, and other OOA/OOD methodologies. Working at Harris Corporation, E-Systems, and for the Navy, John has led or contributed to the development of over a dozen major systems including the Multi-Threat Emitter System (MUTES), the Transformational Satellite Management Operations System (TMOS), locomotive radio remote control systems, and the highest capacity and throughput system ever fielded by Harris Publishing Systems. John has a BSEE from the US Naval Academy, MSEE from the Naval Postgraduate School, and further post-graduate work.