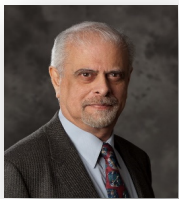# Welcome to 15th Annual Conference on Systems Engineering Research

## Disciplinary Convergence: Implications for Systems Engineering Research

### USC Viterbi School of Engineering Welcomes CSER 2017 Attendees

**Azad M. Madni, Professor, Systems Architecting and Engineering**

**Barry W. Boehm, Professor, Software Engineering**

We are delighted that you have chosen to attend CSER 2017. This is a special year for CSER. It is its 15th anniversary! Our CSER team has worked diligently to make your experience at the conference memorable and enjoyable. You will have an opportunity to mix and mingle, renew old acquaintances, and make new ones. You will meet researchers from all walks of life – academia, industry, and government. Over 80 presentations from ten different countries will be made at the conference.

Systems engineering is undergoing a fundamental transformation to meet the challenges posed by complex systems of the 21st century. In large part, this transformation is being fueled by technology-enabled disciplinary convergence. Accordingly, we chose the theme of CSER 2017 to be "Disciplinary Convergence: Implications for Systems Engineering Research."

According to a 2014 report by the National Research Council, "*Convergence…integrates knowledge, tools and ways of thinking from life and health sciences, physical, mathematical, and computational sciences, engineering disciplines, and beyond to form a comprehensive synthetic framework for tackling scientific and societal challenges that exist at the interfaces of multiple fields.*" - 2014 National Research Council Report.

The ongoing convergence of engineering with other disciplines is opening up a whole new frontier that systems engineering in particular can exploit. We hope to explore these new frontiers in CSER 2017.

"*…The central idea of disciplinary convergence is that of bringing together concepts, thinking, and approaches from diverse disciplines in conjunction with technologies to solve complex problems … Systems engineering research today is beginning to exploit disciplinary convergence to address problems that appear intractable when viewed through the lens of a single discipline.*" - Azad M. Madni, "Transdisciplinary Systems Engineering: Exploiting Convergence in a Hyper-Connected World" (Springer, 2017)

We have a stellar lineup of keynote speakers, banquet speaker, and panels including our flagship executive leadership panel on Saturday that leads into the closing reception.

Let us make CSER 2017 into a rewarding experience for our research community. Thank you all for coming and have an enjoyable and stimulating conference.

*Dr. Azad M. Madni & Dr. Barry Boehm, CSER 2017 General Co-Chairs*

**USC Viterbi**
School of Engineering

**Dear CSER 2017 Attendees,**

Welcome to the 15th annual CSER event, which offer researchers in academia, industry, and government a common forum to present, discuss, and influence systems engineering research. The 2-day technical program for CSER features over 80 presentations across 25 sessions. The technical papers, which have been carefully selected through a formal peer review process, demonstrate depth and breadth to be of interest for all conference attendees.

In this 15th year of CSER, we are offering tutorials on key forward-looking topics such as Cyber-Physical Systems, Data Analytics, Systems Thinking, and Model-Based Systems Engineering.

The Technical Committee worked diligently to ensure the conference represents forward-thinking research from across the globe, from renowned academicians, senior industry and government representatives, and graduate students. We have invited top researchers from these organizations to serve as technical session chairs across a broad range of research topics.

Sincerely,

*Dr. Daniel Erwin,*
*Dr. Roger Ghanem,*
*Ms. Marilee Wheaton,*
*CSER 2017 Technical Co-Chairs*

Daniel Erwin,
Professor, Astronautical Engineering, USC

Roger Ghanem,
Professor, Mechanical Engineering, USC

Marilee Wheaton,
Systems Engineering Fellow,
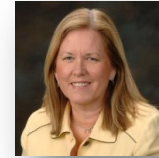The Aerospace Corp.

**Dear CSER 2017 Attendees,**

Let us add our warm welcome! We have a full agenda planned for the next three days, so please take some time to read through the program information. We encourage you to take advantage of the opening reception on Thursday night to meet and greet colleagues from across the globe. Breakfasts, coffee breaks, lunches, pre-banquet reception, the banquet Friday night, and closing reception on Saturday should provide ample opportunity to converse with colleagues and exchange ideas – ideas that likely will have been stimulated by conference presentations. In addition, please spend time with our sponsors and exhibitors in the Exhibition Hall in the Redondo Ballroom to thank them for their sponsorship and to learn about their products and services.

Warm Regards,

*Terry Rector and Marilee Wheaton*
*CSER 2017 Conference Management Co-Chairs*

Terry Rector,
Senior Project Engineer,
The Aerospace Corp.

Marilee Wheaton,
Systems Engineering Fellow,
The Aerospace Corp.

On behalf of INCOSE-LA, welcome to the 15th Annual Conference on Systems Engineering Research. We are honored to have you attending our conference, visiting our beautiful city, and participating in Redondo Beach's most popular conference. The INCOSE-LA Conference Management Committee has left no stone unturned to ensure your stay is worthwhile, pleasant and educational. We look forward to spending this time with you in the Los Angeles area. If we can do anything to make your stay more pleasant, please let us know. Thank you for joining us.

Welcome to CSER 2017!
*Phyllis Marbach, President, INCOSE-LA Chapter*

WHAT'S IMPOSSIBLE TODAY
WON'T BE TOMORROW.

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## CSER 2017 Hosts

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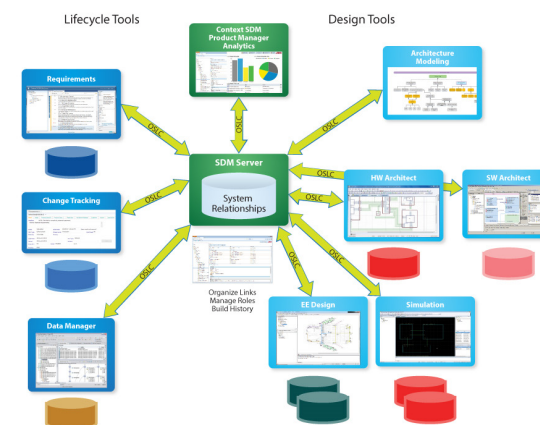LOS ANGELES CHAPTER

**Mentor Graphics®**

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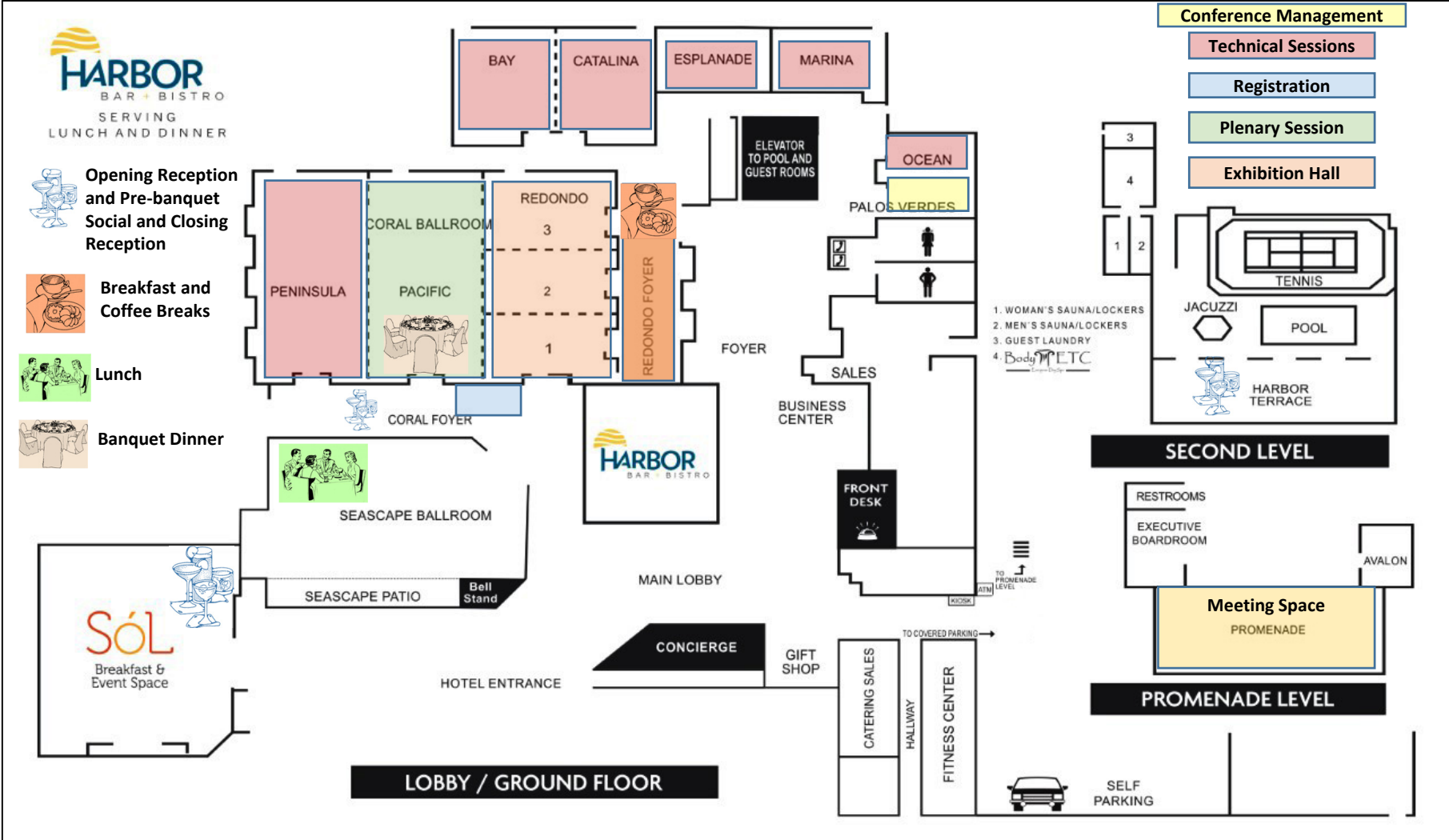
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# Conference Map



**Legend:**

- Opening Reception and Pre-banquet Social and Closing Reception
- Breakfast and Coffee Breaks
- Lunch
- Banquet Dinner

**Color key:**
- Conference Management
- Technical Sessions
- Registration
- Plenary Session
- Exhibition Hall

**HARBOR BAR • BISTRO** — SERVING LUNCH AND DINNER

**SóL** Breakfast & Event Space

**LOBBY / GROUND FLOOR**

Rooms: BAY, CATALINA, ESPLANADE, MARINA, OCEAN, PALOS VERDES, REDONDO 3 / 2 / 1, REDONDO FOYER, CORAL BALLROOM, PACIFIC, PENINSULA, CORAL FOYER, SEASCAPE BALLROOM, SEASCAPE PATIO, Bell Stand

ELEVATOR TO POOL AND GUEST ROOMS

FOYER, SALES, BUSINESS CENTER, FRONT DESK, MAIN LOBBY, CONCIERGE, GIFT SHOP, HOTEL ENTRANCE, CATERING SALES, HALLWAY, FITNESS CENTER, SELF PARKING, TO COVERED PARKING, TO PROMENADE LEVEL, ATM, KIOSK

1. WOMAN'S SAUNA/LOCKERS
2. MEN'S SAUNA/LOCKERS
3. GUEST LAUNDRY
4. Body ETC

**SECOND LEVEL**
TENNIS, JACUZZI, POOL, HARBOR TERRACE

**PROMENADE LEVEL**
RESTROOMS, EXECUTIVE BOARDROOM, AVALON, Meeting Space PROMENADE

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To access meeting internet connection, please launch a website using any search engine; cnn.com or msn.com. You will be asked to connect to internet, select Crowne Plaza Meetings. Then select "I have an access code." Connect to your session as follows: Access Crowne Plaza Redondo Beach Meetings, Access Code: CSER2017

## Cyber-Physical Systems, *8:00 AM – 12:00 PM*

Cyber-physical systems (CPSs) comprise a tightly integrated network of mechanisms, sensors, computers, and software each operating in their own temporal and spatial world. CPSs ingest inputs from the physical world which when blended with system goals direct mechanisms that modify the physical environment for achieving those goals. The physical world though is messy. Sensors do not always produce perfect measurements and mechanisms do not always perfectly perform as intended. Kalman and other filters are traditionally employed to clean up physical world noise but these filters have limited noise assumptions and system operation that do not always apply. This tutorial begins by reviewing CPS fundamentals and then progresses through examples that illustrate increasing system complexity and the need for system resiliency. We conclude by exploring state-space modeling and other current research.

**Dr. Azad M. Madni** is a Professor of Astronautical Engineering and the Technical Director of the Systems Architecting and Engineering Program in University of Southern California's Viterbi School of Engineering. He is also a Professor (by courtesy) in USC's Schools of Medicine and Education. He is the founder and Chairman of Intelligent Systems Technology, Inc., a high tech R&D company specializing in game-based educational simulations, and methods, processes, and tools for complex systems engineering. He received his BS, MS and PhD degrees from the University of California, Los Angeles. His research has been sponsored by both government research organizations such as DARPA, OSD, ARL, RDECOM, ONR, AFOSR, DHS S&T, DTRA, NIST, DOE and NASA, and aerospace and automotive companies such as Boeing, Northrop Grumman, Raytheon and General Motors.

**Dr. Michael Sievers** is a Senior Systems Engineer at Caltech's Jet Propulsion Laboratory and a Lecturer in the System Architecting and Engineering Program at the University of Southern California. He teaches SAE 547 (Model Based Systems Engineering) and SAE 548 (Systems/SoS Integration). He conducts research in model-based systems engineering and is a principal investigator on a number of harsh environment, fault-tolerant, high-performance computing research projects. He holds a Ph.D. in Computer Science from the University of California, Los Angeles.
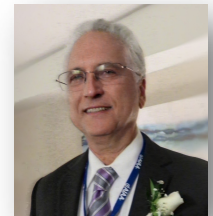
## Model-Based Systems Engineering, *1:00 PM – 5:00 PM*

Model-based systems engineering (MBSE) formalizes the practice of systems engineering through the use of models. This tutorial introduces the fundamental principles of modeling and its application to system engineering. This tutorial is intended to give students a basic understanding of MBSE and its applications by describing what a system model is, how it is used to enable systems engineering in real-world applications, and explore the role of tools in MBSE. The tutorial format is a slide presentation with some class exercises.

**Dr. Mark L. McKelvin, Jr.** is an Engineering Specialist in systems and software engineering at the Aerospace Corporation. In this role, Dr. McKelvin advises customers on model-based engineering techniques and develops solutions to architecture design challenges in cyber-physical and software-intensive systems. He is also a Lecturer in the System Architecting and Engineering Program at the University of Southern California, Viterbi School of Engineering. His interests are in the application of modeling, analysis, and design of engineered systems, including cyber-physical, embedded, and software systems. He holds a Ph.D. in Electrical Engineering and Computer Sciences from the University of California, Berkeley with an emphasis in Electronic Design Automation.

## Data Analytics, *8:00 AM – 12:00 PM*

Data analysis has long been an integral part of understanding and updating systems, but with recent advances in the size and scope of data collection, analysis has become more complex than ever before. Systems engineers face a critical dilemma: how can such large-scale data be evaluated and visualized to provide key insights? This tutorial is designed to introduce participants to some of the analytics tools available to systems engineers to solve that dilemma. Topics include using recent GUI-driven statistical software to identify crucial data variables, visualizing large data sets through easy mapping software, and making individualized data analysis apps available across organizations and research groups. This tutorial will demonstrate these topics using real data to show how researchers can use these cutting edge methods in a real-life modeling situation. In addition, while the tutorial focuses on familiarizing participants in-depth with a few of the many data analytics tools available, discussion includes overviews for software and tools helpful for more specific analysis considerations, with useful resources for further exploration.

**Dr. Courtney Paulson** is an Assistant Professor in the Department of Decision, Operations and Information Technologies at the Robert H. Smith School of Business at the University of Maryland. She received her B.S. in Statistics from the University of Central Florida in 2011 and her Ph.D. in Business Administration (Statistics) from the University of Southern California in 2016. Due to her research focus in interdisciplinary data analytics, she has worked with researchers across many domains, including marketing, operations, and systems analysis. Her work has been selected for awards from organizations ranging from the American Statistical Association to the INFORMS Society of Marketing Science, who recently honored her with the 2015-2016 ISMS Doctoral Dissertation Award. In additional, she serves as a Business Analytics faculty member for the DOIT department, specializing in teaching data modeling and data analytics.

## Systems Thinking, *1:00 PM – 5:00 PM*

Systems thinking has been touted as the "Fifth Discipline" in Peter Senge's famous book by that name. However, this is usually limited to the use of systems coupling diagrams and system archetypes to help understand the nature of feedback and complex system behavior. You will need more than these tools to fully appreciate how to think clearly about systems in a truly holistic manner. This tutorial will teach you some essential principles and concepts of systems and how to use these in a "systemic" fashion to improve your ability to think about systems in a holistic manner. You will learn about the PICARD Theory and the Seven Samurai Framework. You will see how the Knowledge Pyramid helps you understand how systems convert data into information that is used for the discovery of knowledge to be used in making better decisions.

**Dr. James Martin** is an enterprise architect and systems engineer working for The Aerospace Corporation developing solutions for information systems and space systems. He was a key author on the BKCASE project in development of the SE Body of Knowledge (SEBOK). His main SEBOK contribution was the articles on Enterprise Systems Engineering. Dr. Martin led the working group responsible for developing ANSI/EIA 632, a US national standard that defines the processes for engineering a system. He previously worked for Raytheon Systems Company as a lead systems engineer and architect on airborne and satellite communications networks. He has also worked at AT&T Bell Labs on wireless telecommunications products and underwater fiber optic transmission products. His book, Systems Engineering Guidebook, was published by CRC Press in 1996. Dr. Martin is an INCOSE Fellow and was leader of the Standards Technical Committee. He received from INCOSE the Founders Award for his long and distinguished achievements in the field. He is founder and current leader of the Systems Science Working Group for INCOSE.

# CSER 2017 Keynote Speakers

## Friday, March 24

**Yannis Yortsos**
*Dean, Viterbi School of Engineering, University of Southern California*

**Dr. Yannis C. Yortsos** is the Dean of University of Southern California's Viterbi School of Engineering. He has served in this capacity since June 2005. He holds the Chester F. Dolley Professor of Chemical and Petroleum Engineering, and the Zohrab A. Kaprielian Dean's Chair in Engineering. He joined the USC faculty in 1978 and chaired the department of chemical engineering from 1991 to 1997. Yortsos has been part of the senior leadership team at USC Viterbi since July 2001, and served as interim dean for a year before his permanent appointment to the position. He is well known for his work on fluid flow, transport and reaction processes in porous and fractured media with applications to the recovery of subsurface fluids and soil remediation. He has been actively involved in the peer review of the Yucca Mountain Project for the disposal of high-level radio-active waste. Dr. Yortsos was elected in 2008 to the National Academy of Engineering for fundamental advances in fluid flow, transport, and reactions in porous media applied to the recovery of subsurface resources. He serves as chair of the Earth Resources Engineering Section, and of the Section 11 Executive Committee. Previously, he served as secretary and vice chair of the Earth Resources Engineering Section, as chair of the NAE Section 11 Liaison Members, and as a member of the NAE Nominating Committee. Dr. Yortsos coined the term Engineering+, a concept promoting interdisciplinary research, programs and faculty appointments that enable engineering's powerful role for innovation in the sciences and the professions. He received a B.S. degree in chemical engineering from the National Technical University of Athens in 1973, and M.S. and Ph.D. degrees from the California Institute of Technology, in 1974 and 1979 respectively, both in chemical engineering.

**Dr. Paul D. Nielsen** is the Director and CEO of Carnegie Mellon University's Software Engineering Institute. The Software Engineering Institute is a federally funded research and development center (FFRDC) sponsored by the U.S. Department of Defense. SEI develops and transitions technologies in software architecture, integration and interoperability, cybersecurity, process improvement, real-time systems, data analytics, formal methods, V&V and systems engineering related to software. SEI works with the global software engineering and cybersecurity communities. Prior to joining the Software Engineering Institute in 2004, Nielsen served in the US Air Force, retiring as a major general. He served primarily in research and development assignments. In his final assignment, Dr. Nielsen was the commander of the Air Force Research Laboratory and the Technology Executive Officer for the Air Force. Nielsen received a B.S. from the U.S. Air Force Academy; an M.S. and Ph.D. from the University of California, Davis, and an M.B.A. from the University of New Mexico. In 2010, Nielsen was elected as a member of the National Academy of Engineering (NAE). He is a Fellow of both the American Institute of Aeronautics and Astronautics (AIAA) and the Institute for Electrical and Electronics Engineers (IEEE). He is a past president of AIAA and serves on the board of the Armed Forces Communications and Electronics Association (AFCEA). Currently he is a member of the Defense Science Board and co-chaired the DSB's 2015 Summer Study on Autonomy. Previously, he served on the AF Scientific Advisory Board, the Board of Directors for PAR Technology Corporation and the Hertz Foundation.

**Paul Nielsen**
*Director and CEO, Software Engineering Institute*

# CSER 2017 Keynote Speakers



**Greg Hyslop**
*CTO and Senior Vice President, Engineering, Test and Technology, The Boeing Company*

**Dr. Greg Hyslop** is the chief technology officer of The Boeing Company and senior vice president of Boeing Engineering, Test & Technology. Hyslop oversees the development and implementation of the enterprise technology investment strategy, and his portfolio of responsibilities includes the companywide Boeing Engineering function; Boeing Research & Technology (BR&T), the company's advanced central research and development organization; and Boeing Test & Evaluation (BT&E), the team that verifies and validates Boeing's commercial and defense products. In his role leading the Engineering function, which includes more than 50,000 engineers around the world, Hyslop partners with the Engineering leaders for Boeing business units to ensure One Boeing solutions that support programs across the enterprise. He also plays a key role in decisions that affect the technical integrity of Boeing products, services and processes. Hyslop reports to Boeing Chairman, President and CEO Dennis Muilenburg and is a member of the company's Executive Council. Hyslop is a member of the Aeronautics Committee of the NASA Advisory Council. He has also been named an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and is a member of the Board of Trustees of the AIAA Foundation. Hyslop has a Bachelor of Science degree in electrical engineering and a Master of Science degree in mathematics from the University of Nebraska, where he currently serves as a member of the university's Engineering College Advisory Board. He also has a Doctor of Science degree in systems science and mathematics from Washington University in St. Louis, where he served as an adjunct professor.

## Saturday, March 25

**Ms. Kristen J. Baldwin** was appointed the Acting Deputy Assistant Secretary of Defense for Systems Engineering in January 2016 while continuing as Principal Deputy, SE.  She is the principal systems engineering advisor to the Secretary of Defense and is responsible for establishing and executing engineering policy and oversight across the Department. Ms. Baldwin also serves as the acting Defense Standardization Executive.  She oversees the DoD strategy for Trusted Systems Design. A member of the Senior Executive Service (SES), Ms. Baldwin leads modeling and simulation, system security engineering, program protection, system of systems engineering, and systems engineering research and development initiatives.  She oversees the DoD Systems Engineering Research Center, a university-affiliated research center dedicated to advancing systems engineering methods, processes, and tools, and the MITRE National Security Engineering Center, a DoD federally funded research and development center. Ms. Baldwin was a recipient of the Meritorious Presidential Rank award in 2014, in recognition of exemplary service. Ms. Baldwin received a bachelor's degree in mechanical engineering from Virginia Tech and a master's degree in systems management from the Florida Institute of Technology.



**Kristen Baldwin**
*Acting DASD, Systems Engineering, Office of Secretary of Defense*

# CSER 2017 Keynote Speakers

**John Doyle**
*Professor,*
*California Institute of Technology*

**Dr. John Doyle** is the Jean-Lou Chameau Professor of Control and Dynamical Systems, Electrical Engineer, and BioEngineering at Caltech, and received the BS&MS in EE, MIT (1977), and PhD in Math, UC Berkeley (1984). His research is on mathematical foundations for complex networks with applications in biology, technology, medicine, ecology, neuroscience, and multiscale physics that integrates theory from control, computation, communication, optimization, statistics. An emphasis on universal laws and architectures, robustness/efficiency and speed/accuracy tradeoffs, adaptability, and evolvability and large scale systems with sparse, saturating, delayed, quantized, uncertain sensing, communications, computing, and actuation. Early work was on robustness of feedback control systems with applications to aerospace and process control. His students and research group developed software packages such as Matlab Robust Control Toolbox and the Systems Biology Markup Language (SBML). Paper prizes include the 1990 IEEE Baker Prize (for all IEEE publications), also listed in the world top 10 "most important" papers in mathematics 1981-1993, IEEE Automatic Control Transactions Award (twice 1998, 1999), 1994 AACC American Control Conference Schuck Award, 2004 ACM Sigcomm Paper Prize and 2017 "test of time" award, and inclusion in Best Writing on Mathematics 2010. Individual awards include 1977 IEEE Power Hickernell, 1983 AACC Eckman, 1984 UC Berkeley Friedman, 1984 IEEE Centennial Outstanding Young Engineer (a one-time award for IEEE 100th anniversary) , and 2004 IEEE Control Systems Field Award. Best known for fabulous partners, friends, colleagues, and students, with 16 of his advisees (mostly PhDs, some postdocs) now professors at "THE world top 10" universities (Berkeley(x3), MIT(x2), ETHZ (x2), Imperial (x2), Harvard, Stanford, Oxford, Cambridge, Hopkins, UCLA, Caltech). Has held world and national records and championships in various sports, but is otherwise extremely fragile.

## Invited Talk by Prof. Mike Gruntman
### *"Intercept 1961: From SA-1 Air Defense System to the Birth of Soviet Missile Defense"*
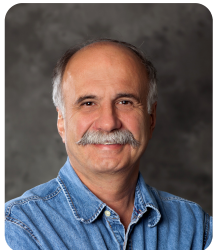
**Mike Gruntman**
*Professor,*
*University of Southern California*

Air defense and missile defense belong to exceptionally complicated systems. USC professor and award-winning author Mike Gruntman will discuss the most important and consequential, technologically and geopolitically, but little known development of a system that accomplished the first IRBM intercept in 1961 and led to the birth of Soviet missile defense.

**Dr. Mike Gruntman** is professor of astronautics and the founder of a space engineering program at the University of Southern California (USC). He is an accomplished physicist and engineer specializing in space science, space technology, and rocketry. Mike authored and co-authored nearly 300 scholarly publications, including four books.

***Thursday, March 23***
***5:00 PM – 6:00 PM***

# CSER 2017 Banquet Speaker

**Dr. John Slaughter**
*Professor,*
*University of Southern California*

A former director of the National Science Foundation, chancellor of the University of Maryland, College Park, and president of Occidental College, Dr. Slaughter has served for many years as a leader in the education, engineering and scientific communities.  He is known for his commitment to increasing diversity in higher education with a special focus on the STEM disciplines.

A member of the National Academy of Engineering — where he served on the Committee on Minorities in Engineering, co-chaired its Action Forum on Engineering Workforce Diversity and served two terms on the NAE Council — he is also the recipient of the Academy's Arthur M. Bueche Award in 2004. A Fellow of the American Association for the Advancement of Science, the Institute of Electrical and Electronic Engineers (IEEE), and the American Academy of Arts and Sciences, he was elected to the Tau Beta Pi honorary engineering society and was named Eminent Member of the Eta Kappa Nu honorary electrical engineering association. He is a member of Phi Beta Kappa and in 1993, Dr. Slaughter was named to the American Society for Engineering Education Hall of Fame and was the recipient of the society's Centennial Medal. He received the UCLA Medal of Excellence in 1989, was elected to the Kansas State University Engineering Hall of Fame in 1990, received the Roger Revelle Award from the University of California, San Diego in 1991and was named that institution's Alumnus of the Year in 1982.

Dr. Slaughter, a licensed professional engineer, began his career as an electronics engineer at General Dynamics and, later, served for 15 years at the U.S. Navy Electronics Laboratory in San Diego, where he became head of the Information Systems Technology Department. He has also been director of the Applied Physics Laboratory and professor of electrical engineering at the University of Washington, academic vice president and provost at Washington State University, the Irving R. Melbo Professor of Leadership in Education at the University of Southern California and president and CEO of the National Action Council for Minorities in Engineering, Inc. (NACME).

Among the corporate boards on which he has served are IBM, Northrop Grumman, Monsanto, Baltimore Gas and Electric, Sovran Bank, Union Bank, Avery Dennison, Atlantic Richfield (ARCO) and Solutia, Inc. In 1977, he was appointed by President Jimmy Carter as assistant director and, in 1980, as director of the National Science Foundation and, in 2006, by President George W. Bush to membership on the President's Council of Advisors on Science and Technology (PCAST).

Dr. Slaughter earned a Ph.D. in engineering science from the University of California, San Diego (UCSD), an M.S. in engineering from the University of California, Los Angeles (UCLA) and a B.S. in electrical engineering from Kansas State University. He holds honorary degrees from 31 colleges and universities.  Recipient of the first U.S. Black Engineer of the Year Award in 1987, Dr. Slaughter was awarded the Martin Luther King Jr. National Award in 1997.

He and his wife, Dr. Ida Bernice Slaughter, herself an educational leader, have two children: a son, John Brooks Slaughter II, D.V.M., and a daughter, Jacqueline Michelle Randall, a community college faculty member.

# Executive Leadership Panel

**Dr. Allen Adler**
*Vice President, Enterprise Technology Strategy, The Boeing Company*

**Dr. Wayne Goodman**
*Executive Vice President, The Aerospace Corporation*

**Lt Gen (Ret.) Larry James**
*Deputy Director, Jet Propulsion Lab*

**Dr. Allen Adler** is vice president of Enterprise Technology Strategy for The Boeing Company, the world's largest and most diversified aerospace company. In this role, Adler leads the company's advance planning and strategies around eight technical domains that ensure Boeing's competitive advantage in technology advancement. Adler is also executive sponsor of the Boeing Technical Fellowship, a group comprising the company's most accomplished scientists and engineers who promote technical excellence and innovation, as well as represent Boeing's top research, development and manufacturing capabilities. Additionally, Adler directs a research organization, called Strategy and Innovation, that identifies developing and transitioning business opportunities, as well as provides company modeling and simulation services. Before joining Boeing, Adler served at the Defense Advanced Research Projects Agency as director of the Tactical Technology Office. Adler earned a B.S. degree from the California Institute of Technology and a doctorate from Princeton, both in physics.

**Dr. Wayne Goodman** is the executive vice president of The Aerospace Corporation. He assumed this position on December 31, 2016. Previous positions include the senior vice president of the Operations and Support Group and the vice president of Space Program Operations, where he worked with the Air Force, government, and industry partners to develop military satellites and to advance national security space systems. Earlier in his career, he was the general manager of the Launch Vehicle Engineering and Analysis Division; the Launch and Satellite Division; and the MILSATCOM Division. Dr. Goodman earned a bachelor's degree in mechanical engineering from Drexel University, and a master's and doctorate in mechanical engineering, both from the University of California, Berkeley. Dr. Goodman received the Meritorious Civilian Service Award from the Department of the Air Force in 2010 and The Aerospace Corporation's President's Achievement Award in 1997.

**Lt Gen (Ret) Larry James** is the Deputy Director and Chief Operating Officer of the Jet Propulsion Laboratory. He was appointed Deputy Director of the Jet Propulsion Laboratory in August 2013. At JPL he is the Laboratory's Chief Operating Officer responsible to the Director for the day-to-day management of JPL's resources and activities. This includes managing the Laboratory's solar system exploration, Mars, astronomy, physics, Earth science, interplanetary network programs, and all business operations. These activities employ 5000 scientists, engineers, technicians, and business support personnel, generating $1.5 billion in annual revenues. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics and a member of the Board of Directors for United Way of Los Angeles. He received a B.S. in Astronautical Engineering from the Air Force Academy, Colorado Springs CO in 1978 and a M.S. degree in Aeronautics and Astronautics from the Massachusetts Institute of Technology, Cambridge MA in 1983.

# *Executive Leadership Panel*

**Dr. Sandra Magnus**
*Executive Director,*
*American Institute of*
*Aeronautics and Astronautics*

**Dr. Sandra "Sandy" H. Magnus** is the Executive Director of the American Institute of Aeronautics and Astronautics (AIAA), the world's largest aerospace professional society. Dr. Magnus attended the Missouri University of Science and Technology, graduating in 1986 with a degree in physics and in 1990 with a master's degree in electrical engineering. She also holds a Ph.D. from the School of Materials Science and Engineering at the Georgia Institute of Technology (1996). Selected to the NASA Astronaut Corps in April 1996, Dr. Magnus flew in space on the STS-112 shuttle mission in 2002, and on the final shuttle flight, STS-135, in 2011. In addition, she flew to the International Space Station on STS-126 in November 2008, served as flight engineer and science officer on Expedition 18, and returned home on STS-119 after four and a half months on board. Following her assignment on Station, she served at NASA Headquarters in the Exploration Systems Mission Directorate. Her last duty at NASA, after STS-135, was as the deputy chief of the Astronaut Office.

**Mr. Marcus Nance**
*Director, Boeing*
*Defense Systems,*
*The Boeing Company*

**Mr. Marc Nance** is the Boeing Defense Space and Security (BDS) Director of Competitiveness & Integration, reporting to the BDS Chief Engineer. He is responsible for the engineering strategy and execution of key initiatives that enable Boeing's sustained future competitiveness. This includes leadership in engineering optimization, engineering excellence, enterprise engineering, program engagement and global engineering. Prior to this role Marc held a variety of program and functional roles. Most recently this included being the Boeing Enterprise Systems/Software Engineering & Analysis Technology Domain Leader. He was responsible for the strategic planning of Boeing's entire portfolio of Systems, Software and Test Engineering Technologies to enable the Company to design and build its world class systems. Marc has over 30 years engineering and project management experience with The Boeing Company. Marc holds a Bachelor and Masters Degree in Aeronautical & Astronautical Engineering from the University of Washington.

**Dr. Elliot I. Axelband**
*Senior Engineer,*
*RAND Corporation*

**Dr. Elliot Axelband** is a senior engineer and Consultant at the RAND Corporation since 1994, leading and contributing to projects addressing acquisition, execution and technical issues as they concern UAVs, Space Systems, Cyber Systems, Chemical Demilitarization, Ground Vehicle Development, The Future Combat System, The Joint Strike Fighter, Training, and Program Transfer and Realignment. From 1994 to 2004 he was a professor of Electrical Engineering, Associate Dean for Research Development, and director of the Graduate Program in Systems Architecting and Engineering at USC. Before that, he was employed at the Hughes Aircraft Company, retiring as a vice president and general manager in 1994. He is an IEEE Life Fellow and Centennial Medal Recipient, an INCOSE Fellow, and was awarded the Distinguished Service Medal by the Air Force. His Ph.D. in Engineering was awarded by UCLA, his Master's degree in Electrical Engineering by USC, and his Bachelor's degree in Electrical Engineering by The Cooper Union.

# Invited Panels

### Systems Engineering:  A Foundation for Technical Leadership

This panel is composed of senior managers and engineers from nationally recognized organizations. They will provide their perspectives on why technical leadership is so critical to the success of complex engineering projects, and how the practice of effective systems engineering enhances and enables such leadership.  Systems Engineers acting as technical leaders are the first line of defense in making sure that projects are set up properly, and that uncertainty and risk are addressed. They will discuss how Systems Engineers and Project Managers can work together to bring a project to completion more efficiently through cooperation between these two disciplines.

*Panel Moderator*:  Mr. Scott Lucero, Deputy Director, Strategic Initiatives, Office of the Secretary of Defense

*Panelists*: Ms. Christi Gau Pagnanelli, Director, Systems Engineering, The Boeing Company ; Mr. Paul Gill, Senior Manager, Aerojet Rocketdyne; Dr.Jairus Hihn, Principal Systems Engineer, Jet Propulsion Lab ; Ms. Rosalind Lewis, Principal Director, The Aerospace Corporation; Mr. Kenneth Cureton, Instructor, USC/ SAE Program

### Smart Manufacturing

Smart Manufacturing panel includes panelists from academia and industry. Panelists will discuss trending topics in smart manufacturing. These include: track, traceability and qualification of supply chain parts from a carbon footprint, material qualification performance standpoint; management and reduction of variations in supply chain  flow; interoperability with the tooling and a machine supply chain; qualification of parts and assemblies during manufacturing; dynamic energy management and management of grid and power quality for power sensitive processes; data aggregation and analytics for optimization and in situ qualification of processes; model management, adoption and incorporation of new technologies like 3D printing;  model-based qualification  of 3D printed parts; and advanced sensors and controls.

*Panel Co-Chairs*: Prof. Xiachoun Li, UCLA and Prof. Azad Madni, USC

*Panelists*: Dr. Jim Davis, UCLA; Dr. Kelly Dodds, Raytheon; Dr. G.P. Li, UC-Irvine; Dr. Satyandra K. Gupta USC; Dr. James P. Nokes, The Aerospace Corporation; Dr. Steve Wall, JPL

### The Power of Convergence through Diversity of Resources:
### Empowering Women as Leaders in Systems Engineering

The central idea of convergence is that bringing together diversity of concepts, thinking, and approaches is helpful for solving complex problems.  The Empowering Women as Leaders in Systems Engineering (EWLSE) vision is for men and women to work together as advocates for women as leaders in systems engineering by:  creating a systems engineering environment welcoming to all; promoting the demonstrated value of women as systems engineers and leaders; and enabling increased participation and retention of women in systems engineering.  Please attend this interactive panel discussion to hear more about this key INCOSE initiative and share your success stories of empowerment.

*Panel Moderator*: Ms. Rosalind Lewis, The Aerospace Corporation

*Panelists*: Dr. Cecilia Haskins, NTNU;  Ms. Stephanie Chiesi, Raytheon Company; Dr. Thomas McKendree, Raytheon Company; Dr. Shamsnaz Virani, WPI

# Technical Program: Thursday
## March 23

| | | |
|---|---|---|
| 7:00 - 8:00 | Breakfast | Redondo Foyer |
| | Registration | Coral Foyer |
| 9:00 - 16:00 | SEANET Doctoral Workshop | USC |
| 8:00 -10:00 | Cyber-Physical Systems Tutorial – Part 1 | Bay |
| 8:00 -10:00 | Data Analytics Tutorial - Part 1 | Catalina |
| 10:00-10:30 | Break | Redondo Foyer |
| 10:30-12:00 | Cyber Physical Systems Tutorial – Part 2 | Bay |
| 10:30-12:00 | Data Analytics Tutorial – Part 2 | Catalina |
| 12:00-13:00 | Lunch | SOL |
| 13:00-15:00 | Model-Based Systems Engineering Tutorial – Part 1 | Bay |
| 13:00-15:00 | Systems Thinking Tutorial - Part 1 | Catalina |
| 15:00-15:30 | Break | Redondo Foyer |
| 15:30-17:00 | Model-Based Systems Engineering Tutorial - Part 2 | Bay |
| 15:30-17:00 | Systems Thinking Tutorial – Part 2 | Catalina |
| 17:00-18:00 | Invited Talk by Prof. Mike Gruntman | Bay |
| 18:00-20:00 | SEANET Poster Session and Welcoming Reception | SOL |

| 7:00-8:00 | Breakfast | | | | | Redondo & Redondo Foyer |
|---|---|---|---|---|---|---|
| 7:00-17:00 | Registration | | | | | Coral Foyer |
| | Exhibits | | | | | Redondo |
| 8:00-10:00 | **Opening Remarks: Mr. Terry Rector**, Conference Co-Manager | | | | | Peninsula/Pacific |
| | **Plenary Session**<br>• **Dr. Azad M. Madni,** Conference General Co-Chair<br>• **Dr. Yannis C. Yortsos**, Dean of Viterbi School of Engineering<br>• **Dr. Paul Nielsen, Director**, Software Engineering Institute<br>• **Dr. Greg Hyslop,** CTO, The Boeing Company | | | | | |
| 10:00-10:30 | Coffee Break | | | | | Redondo & Redondo Foyer |
| | Morning Breakout Sessions | | | | | |

| | | **Agile Systems Engineering**<br>Phyllis Marbach & Alexey Tregubov<br>*Bay* | **System Architecture and Complexity**<br>David Broniatowski & Sebastian Herzig<br>*Catalina* | **Model-Based SE**<br>Michael Sievers & Mark McKelvin<br>*Esplanade* | **Infusion of System Science into SE**<br>James Martin & Len Troncale<br>*Marina* | **Advancing SE Education**<br>Cecilia Haskins & James Humann<br>*Ocean* |
|---|---|---|---|---|---|---|
| | *Peninsula/ Pacific* | | | | | |
| 10:30-11:00 | **Systems Engineering: A Foundation for Technical Leadership** | **Agile Fit Check Framework for Government Acquisition Programs**<br>(S. Mobasser) | **A facilitated expert-based approach to architecting "prizeable" complex systems**<br>*(Zoe Szajnfarber)* | **High Fidelity Simulation Surrogate Models For Systems Engineering**<br>*(A. Van der Velden)* | **Threshold Metric for Mapping Natural Language Relationships among Objects**<br>*(J. Simpson)* | **An architecture analysis of a cyber secondary school as a system of systems**<br>*(C. Emerson)* |
| 11:00-11:30 | | **The Agile Systems Framework: Enterprise Content Management Case**<br>*(J. Lockett)* | **A Framework for Measuring the Fit Between Product and Organizational Architectures**<br>*(Zoe Szajnfarber)* | **Validation and Verification of MBSE-compliant CubeSat Reference Model**<br>*(D. Kaslow)* | **On the Nature of Systems Thinking and Systems Science: Similarities, Differences, Potential Synergies**<br>*(L. Troncale)* | **Systems Engineering - making people talk**<br>*(C.Haskins )* |
| 11:30-12:00 | | **Quantifying the ilities: a literature review of robustness,interoperability,and agility**<br>*(A. Turner)* | **Cultural Worldviews on an Aerospace Standards Committee: a Preliminary Analysis**<br>*(John Park)* | **An Architecture Profile for Human System Integration**<br>*(D. Orellana)* | **Three General Systems Principles and their Derivation: Insights from the Philosophy of Science Applied to Systems Concepts**<br>*(D. Rousseau)* | **Development of a project-oriented and transnational master course for training the engineering competencies**<br>*(C.Haskins)* |

| 12:00-13:30 | Lunch Break | | | | | Seascape Ballroom |
|---|---|---|---|---|---|---|
| | Afternoon Breakout Sessions and Panels | | | | | |
| | **Systems Engineering and Decision Science** Ali Abbas & Rosalind Lewis *Peninsula/ Pacific* | **SERC Research** Jon Wade & Megan Clifford *Bay* | **System Architecture and complexity** David Broniatowski & Sebastian Herzig *Catalina* | **Resilience and Affordability** Edwin Ordoukhanian & Marilee Wheaton *Esplanade* | **Advancing SE Education** Heidi Davidz & James Humann *Marina* | **Systems Thinking and Complexity Management** Janet Singer & Robert Edson *Ocean* |
| 13:30-14:00 | **Using Bayesian Networks to Validate Technology Readiness Assessments of Systems** (D. York) | **Future Systems Engineering Research Directions** (J. Wade) | **System user pathways to change** (A. Cox) | **Engineering Resilience for Complex Systems** (C. Small) | **The Role of Decision Analysis in Industrial and Systems Engineering Education** (A.Abbas) | **Classifying Emergent Behavior to Reveal Design Patterns** (J. Reid) |
| 14:00-14:30 | **Adaptive and Automated Reasoning for Autonomous System Resilience in Uncertain Worlds** (C. Marshall) | **An Empirical Study of Technical Debt in Open-Source Software Systems** (R. Alfayez) | **The Flexibility of Generic Architectures: Lessons from the Human Nervous System** (D. Broniatowski) | **Using Decision Analysis and Agent Based Simulation to Examine the Operational Resiliency of a U.S. Army Company Team** (P. Beery) | **Strengthening systems engineering leadership curricula using competency-based assessment** (K. Duliba) | **Collective behaviors: Systemic view of distinct forces in a new framework** (A. Vesaghi) |
| 14:30-15:00 | **Model-centric decision-making: exploring decision-maker trust and perception of models** (E.German) | **SEEA: Accelerated Learning and Learning Assessment for Systems Engineering Education** (P. Zhang) | **Developing an Effective Optical Satellite Communications Architecture** (F. Skirlo) | **Early Lifecycle Cost Estimation: Fiscal Stewardship with Engineered Resilient Systems** (T. Moody) | **Integrating systems engineering students in capstones; a multi-spectrum characterization of interdisciplinary capstones** (C.Cooper) | **Generational Evolution in Complex Engineered Systems** (D. Thomas) |
| 15:00-15:30 | Coffee Break | | | | | Redondo & Redondo Foyer |

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|---|---|---|---|---|---|---|
| | | | **Afternoon Breakout Sessions and Panels** | | | |
| | **Systems Engineering and Decision Science**<br>**Ali Abbas & John Fujita**<br>*Peninsula/ Pacific* | **Using SE methods to protect electric power grid**<br>**Neil Siegel**<br>*Bay* | Catalina | **Cyber-Secure Resilient Systems**<br>**Ken Cureton & Wendy Leonard**<br>*Esplanade* | **Model-Based SE**<br>**Joe D'Ambrosio & Padma Sundaram**<br>*Marina* | **Systems and SoS Integration**<br>**Zoe Szajnfarber & Edwin Ordoukhanian**<br>*Ocean* |
| 15:30-16:00 | **Implementing Value-Driven Design in Modelica for a racing solar boat**<br>*(J. Sutherland)* | **Black Sky hazards: SE as a unique tool to prevent national catastrophe**<br>*(S. Avi)* | **Smart Manufacturing Panel** | **Applying the Cyber Security Game to a Point of Sale System**<br>*(A.Turner)* | **Model-Based Approach for Engineering Resilient SoS: Application to AV Networks**<br>*(A. Madni)* | **Resilience Concepts for Architecting an Autonomous Military Vehicle SoS**<br>*(K. Klingensmith)* |
| 16:00-16:30 | **A game theoretical perspective on incentivizing collaboration in system design**<br>*(S. Vermillion)* | **Interdependency effects on the electricity grid following a "Black Sky" hazard**<br>*(J. Monken)* | | **Resilient Cyber Secure Systems and System of Systems: Implications for the Department of Defense**<br>*(W. Leonard)* | **Discovering toxic policies using MBSE constructs**<br>*(R. Krishnan)* | **SoS Explorer: a tool for system-of-systems architecting**<br>*(D. Curry)* |
| 16:30-17:00 | | **A Systems Integration Framework for Inter-disciplinary Black Sky Operations**<br>*(E.Graedena)* | | **Architecting Cyber-Secure, Resilient System-of-Systems**<br>*(K. Klingensmith)* | **Model-based Engineering: Analysis of Alternatives for Optical Satellite Observation**<br>*(D. Shultz)* | **A Principles Framework to Inform Defence SoSE Methodologies**<br>*(J.Pratt)* |
| 17:00-17:30 | | **Using SE to create a survivable comm-unications system that will operate in the presence of "Black Sky" hazards**<br>*(N. Siegel)* | | **Inference Enterprise Multi-Modeling for Insider Threat Detection Systems**<br>*(E.Huang)* | **Model-Based Systems Engineering: Motivation, Current Status, and Needed Advances**<br>*(A. Madni)* | **Complex System Analysis and Verification: A Comprehensive Approach and Case Study**<br>*(H. Zhu)* |
| 18:00-19:00 | | | Pre-Banquet Social | | | Coral Foyer |
| 19:00-21:00 | | | Banquet Dinner | | | Peninsula/Pacific |

# Technical Program: Saturday
## March 25

| 7:00-8:00 | Breakfast | | | | | Redondo & Redondo Foyer |
|---|---|---|---|---|---|---|
| 7:00-17:00 | Registration | | | | | Coral Foyer |
| | Exhibits | | | | | Redondo |
| 8:00-10:00 | **Opening Remarks: Ms. Marilee Wheaton,** Conference Co-Manager | | | | | Peninsula/Pacific |
| | **Plenary Session**<br>• **Dr. Barry Boehm**, Conference General Co-Chair , Opening Remarks<br>• **Ms. Kristen Baldwin**, Acting Deputy Assistant Secretary of Defense for Systems Engineering , Keynote Address<br>• **Dr. John Doyle, Professor**, California Institute of Technology, Keynote Address | | | | | |
| 10:00-10:30 | Coffee Break | | | | | Redondo & Redondo Foyer |
| | Morning Breakout Sessions | | | | | |
| | *Peninsula/ Pacific* | **SERC Research**<br>Jon Wade &<br>Megan Clifford<br>*Bay* | **Tradespace and Visualization**<br>Simon Goerger<br>*Catalina* | **Infusion of System Science into SE**<br>Janet Singer &<br>Len Troncale<br>*Espalande* | **System Architecture and Complexity**<br>Michael Sievers &<br>John Fujita<br>*Marina* | **Systems Engineering Application**<br>Kurt Klingensmith &<br>Douglas Orellana<br>*Ocean* |
| 10:30-11:00 | **The Power of Convergence through Diversity of Resources: Empowering Women as Leaders in Systems Engineering** | **A robust portfolio optimization approach using parametric piecewise linear models of system dependencies**<br>*(N. Davendralingam)* | **Designing for System Value Sustainment using Interactive Epoch-Era Analysis: A Case Study from Commercial Offshore Ships**<br>*(M. Curry)* | **Systems Engineering Pathology: Leveraging Science to Characterize Dysfunction**<br>*(H. Davidz)* | **Preference Modeling for Government-Owned Large-Scale Complex Engineered Systems – A Satellite Case Study**<br>*(H. Kannan)* | **A Game Theory Perspective on Requirement-Based Engineering Design**<br>*(S. Yazdani)* |
| 11:00-11:30 | | **Interactive model trading for resilient systems decisions**<br>*(A. Ross)* | **Simulation-Based Air Mission Evaluation with Bayesian Threat Assessment for Opposing Forces**<br>*(A. Costa)* | **Evaluating how internal health assessment can trigger anticipatory intervention as part of a resilient system**<br>*(D. Lowe)* | **System safety data network: Architecture and Blueprint**<br>*(S. Shetty)* | **Understanding how social network analysis can provide insights into emergent networks of systems**<br>*(J. Enos)* |
| 11:30-12:00 | | **Formal Methods in Resilient Systems Design: Application to Multi-UAV System-of-Systems Control**<br>*(A. Madni)* | **Tradespace Exploration – Promise and Limits**<br>*(P. Collopy)* | **Agency and causal factors in social system behaviour: Advancing human systems engineering with general system theory**<br>*(S. Gabriele)* | **Scalability in self-organizing systems: an experimental case study on foraging systems**<br>*(J. Humann)* | **Structural Rules for Sound Business Process Implemented by UML Activity Diagram**<br>*(M. Ajina)* |
| 12:00-13:30 | Lunch Break | | | | | Seascape Ballroom |

| | Formal Methods in SE<br>**Donna Rhodes &<br>Bryan Mesmer**<br>*Peninsula/Pacific* | Resilience and<br>Affordability<br>**Eric Spero &<br>James Humann**<br>*Bay* | Systems Engineering<br>Application<br>**Heidi Davidz**<br>*Catalina* | Systems Thinking<br>and Complexity<br>Management<br>**James Martin &<br>Robert Edson**<br>*Esplanade* | Smart Manufacturing<br>**S.K. Gupta**<br>*Marina* | System Architecture and<br>Complexity<br>**Jairus Hihn &<br>Marilee Wheaton**<br>*Ocean* |
|---|---|---|---|---|---|---|
| | | | **Afternoon Breakout Sessions and Panels** | | | |
| 13:30 -<br>14:00 | **Improving LPDM Within<br>the US Army RDECOM**<br>*(T. Haduch)* | **Introducing Resilience<br>into Multi-UAV System-<br>of-Systems Network**<br>*(E. Ordoukhanian)* | **A Value Driven Approach to<br>Capture Unintened<br>Consequences Impacting<br>Mission Success**<br>*(D. Kis)* | **Using the PICARD<br>theory as a tool to<br>improve systems<br>thinking ability**<br>*(J. Martin)* | **Towards a Diagnostic and<br>Prognostic Method for<br>Knowledge-Driven Decision<br>Making in Smart<br>Manufacturing Technologies**<br>*(T. Hedberg)* | **A model framework for<br>determining dynamic<br>architecture goals in a<br>System-of-Systems**<br>*(M. Chavy-Macdonald)* |
| 14:00-<br>14:30 | **Verification and<br>validation of behavior<br>models using lightweight<br>formal methods**<br>*(K.Giammarco)* | **Considerations for<br>Engineered Resilience<br>from Examples of<br>Resilient Systems**<br>*(R. Lewis)* | **Survey of Four Uncertainty<br>Quantifications Methods in<br>Systems Engineering**<br>*(E. Salimi)* | **An Analysis of<br>Individual Systems<br>Thinking Elements**<br>*(S. Ferreira)* | **Patterns for modeling<br>operational control of discrete<br>event logistics systems (DELS)**<br>*(T. Sprock)* | **Evaluation of cross-project<br>multitasking in software<br>projects**<br>*(A.Tregubov)* |
| 14:30-<br>15:00 | **Categorical foundations<br>for systems engineering**<br>*(S. Breiner)* | **High Reliability<br>Imperative for<br>Autonomous Networked<br>Vehicles**<br>*(A. Adler)* | | **Is Systems Thinking<br>Effective? An Open<br>Discussion on Leading<br>Practices** | **Towards Automated<br>Generation of Multimodal<br>Assembly Instructions for<br>Humans Operators**<br>*(K. Kaipa)* | **Multi-objective optimization<br>of Geosynchronous Earth<br>Orbit space situational<br>awareness system<br>architectures**<br>*(J. Stern)* |
| 15:00-<br>15:30 | Coffee Break | | | | | Redondo &<br>Redondo Foyer |
| 15:30<br>-17:30 | Executive Leadership Panel<br><br>• **Ms. Marilee Wheaton,** Systems Engineering Fellow, The Aerospace Corporation *(moderator)*<br>• **Dr. Allen Adler**, Vice President, The Boeing Company<br>• **Dr. Wayne Goodman,** Executive Vice President, The Aerospace Corporation<br>• **Lt Gen (Ret.) Larry James**, Deputy Director, Jet Propulsion Lab<br>• **Dr. Sandra Magnus**, Executive Director, AIAA<br>• **Mr. Marcus Nance,** Director, Boeing Defense Systems, The Boeing Company<br>• **Dr. Elliot I. Axelband,** Senior Engineer, RAND Corporation | | | | | Peninsula/Pacific |
| 17:30-<br>19:00 | Closing Reception | | | | | Harbor Terrace |

# CSER 2017 Team

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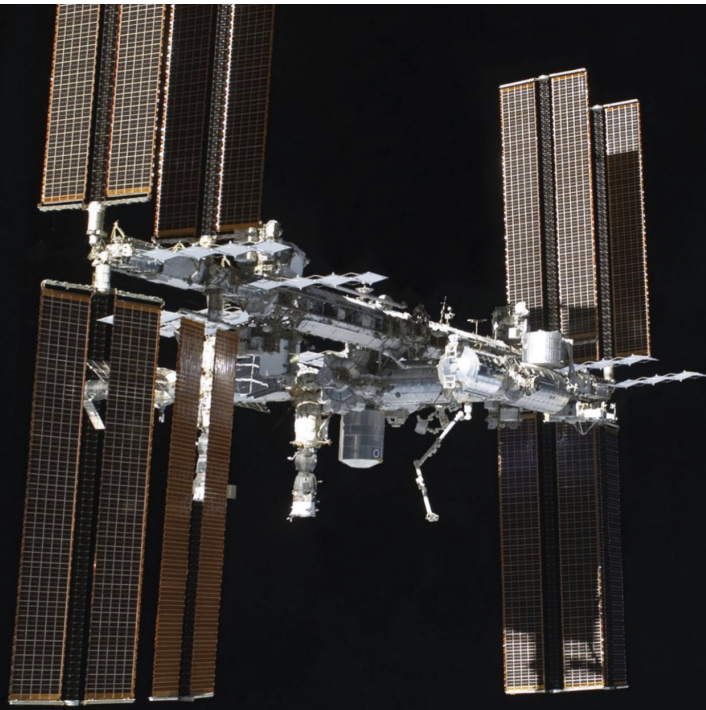
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