

## **Welcome to Vancouver for the 2015 IEEE International Systems Conference**

It gives me great pleasure to welcome our attendees to the 9<sup>th</sup> Annual IEEE International Systems Conference here in the beautiful, cosmopolitan city of Vancouver, one of the most beautiful and elegant cities of British Columbia, Canada. Among our attendee ranks are engineers and practitioners, academics and researchers, government folks and students from multiple countries around the globe, all with the common interest of systems engineering for complex systems.

We have a very full and varied program on tap for you, covering all aspects of complex systems and systems of systems and the highly specialized systems engineering skills that accompany such systems, and I must give special thanks to our Technical Program Chair, Dr. Sidney Givigi, of the Royal Military College of Canada, who has put in countless hours of his valuable time to select the most appropriate content from the truly outstanding candidate material submitted for presentation this week.

Our world is growing more complex by the day, and the systems we must design, build, put in service and maintain are ever increasing in complexity, not only because of the huge scope of our complex systems but also the ever-advancing technology that beckons to us with its promise of increased functionality and cleverness. From our communication systems to our entertainment systems, from energy generation and delivery systems to transportation systems, from exploration systems to manufacturing and production systems, from health care systems to safety and security systems, and from weapon systems to defense systems, all of these demand competent and effective engineering solutions, using the best minds in systems engineering that the world can produce.

And this is what this conference is all about, the exploration and exchange of information relative to such complex and all-encompassing systems and the transfer of knowledge that we hope will enhance your job, your function, your contributions to these complex systems that are for the general benefit of humanity, which a key focus of the Institute of Electrical Engineers or IEEE today. And speaking of IEEE, we are pleased to have in attendance this week the Vice President of Technical Activities, Dr. Vincenzo Piuri, and I am sure he would enjoy engaging in conversation with attendees.

So please enjoy your visit and partake of the technical content that we offer you. We hope you enjoy not only this conference but your stay in Canada, and if there is anything we can do to make your visit more comfortable, please do not hesitate to contact one of our helpful staff.

Bob Rassa  
Conference Chair  
President, IEEE Systems Council

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## Tutorials - Monday, April 13

### *Cyber Security Tutorial*

**Time:** 8:00 AM - 12:00 PM

**Instructor:** Robert Swarz, Worcester Polytechnic Institute

**Abstract:** This tutorial will describe the basic techniques and technologies that can be used to assure the confidentiality, integrity, and availability of information exchanged across networks. After an overview of basic information security concepts, we will motivate the need for cyber security by outlining the threats impacting government, infrastructure, and industry and by describing case studies of some actual cyber attacks. Selected concepts will be expanded upon, such as TCP/IP-based network security principles, encryption, public key infrastructure, and authentication protocols. An overview of the legal, policy, and regulatory environment will be presented. We will conclude with a summary of common controls, as well as a discussion of principal sources of up-to-date information and guidance on cyber security threats.

### *Department of Defense's Transformational Changes in "Big A" Acquisition*

**Time:** 8:00 AM - 12:00 PM

**Instructor:** Mrs. Yvette Rodriguez, Defense Acquisition University

**Abstract:** The Department of Defense acquires defense systems by implementing the Big "A" Concept, which is comprised of the Defense Acquisition System (DAS), the Joint Capabilities Integration and Development System (JCIDS), and the Planning, Programming, Budgeting, and Execution (PPBE) Process. The DAS, JCIDS, and PPBE process provide the necessary tool set to understand the needs of the warfighter and strategically implement programmatic, technical, and financial management to successfully deliver defense systems. Transitioning from 2014 to 2015, the DoD embarked on novel measures advancing the methodologies of the Big "A" Concept and its supporting systems. Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) released Better Buying Power (BBP) 3.0 in September 2014 communicating the need to do more without more, while focusing on program affordability, controlling cost, rewarding contractors, eliminating unnecessary and low-value added processes, promoting effective competition, improving tradecraft in service acquisition, and improving the total acquisition workforce professionalism. Strengthening the DoD's buying power requires innovative perspectives and inventive practices. USD(AT&L) continues to promote DoD's buying power through the modernized releases of the Interim DoD Risk Management Guide for Defense Acquisition Programs in December 2014, the DoD Instruction 5000.02 Operation of the Defense Acquisition System in January 2015 and the Manual for the Operation of the JCIDS in February 2015. This tutorial will provide the audience with an overall perspective of the generalized DoD acquisition process in the "big A" concept with an emphasis on the DAS. It will also explore the modernization of DoD policy and guidance in "big A" acquisition, Better Buying Power 3.0, and their integrated role in engineering systems using the DAS.

### ***Principles and Practice of Operational Resilience***

**Time:** 13:00 - 17:00

**Instructor:** Nader Mehravari, *Software Engineering Institute & Carnegie Mellon University*

**Abstract:** Organizations large or small, public or private, civilian or federal, continue to invest in a variety of independent operational risk management activities including cybersecurity, IT disaster recovery, business continuity, incident management, information security, etc. However, given the extreme complexity of today's business processes, a disjointed stovepipe approach to operational risk management is no longer viable. Successful protection and sustainment of one's enterprise missions now requires a fully integrated approach that incorporates unification, standardization, automation, and training while balancing affordability and risk management. In addition, organizations are increasingly shifting preparedness planning philosophy from "recovery" to "resilience" with the ability to "absorb" disruptive events (including cyber-attacks). Operational resilience is the emergent property of an entity that can continue to carry out its mission in the presence of operational stress and disruption that does not exceed its limit and allows the organization to protect and sustain high-value services and their associated assets. This tutorial is intended to provide the audience with a comprehensive overview of system and business resilience, operational resilience management, and associated concepts and challenges.

### ***Safety Issues in Complex Engineered Systems***

**Time:** 13:00 - 17:00

**Instructor:** Shrisha Rao, *International Institute of Information Technology, Bangalore*

**Abstract:** This tutorial aims to give a broad introduction to the study and practice of safety in the design and operation of complex systems. The field is obviously too vast to be covered in a single tutorial session, but an attempt will be made to give a representative overview of the many issues concerning safety, and to highlight some of the important aspects that an attendee may consider to be worth further study. The tutorial may be of interest to practitioners as well as theoreticians new to safety-critical systems: software developers and architects, system engineers and operators of industrial plants, computer scientists and graduate students who know program analysis and temporal logic but wish to understand how safety concerns play out in practice, etc.

## Featured Speakers

### Keynote Speaker

#### *Systems Engineering Can Make or Break a Program*

**Mr. Robert Lyons, Jr.**  
**President,**  
**IEEE Aerospace and Electronic Systems Society**

#### **Abstract:**

This talk is one engineer and program manager's retrospective analysis of systems engineering issues and their programmatic impacts. The programs in question span more than 40 years and cover small to very large avionics, command and control, space, and weapons systems. As each system is discussed, its technical problems -- most of which are systems engineering related, the linkage to program outcomes, and the lessons that would have been good to have been learned 40 years ago are summarized.

#### **Bio:**

Mr. Lyons is the former United States Air Force Director, HQ Air Force Materiel Command Acquisition Center of Excellence. He has worked on nuclear instrumentation, solid-state electron devices, and microwave systems in 3 USAF laboratories. He also led many diverse projects, including serving as the Avionics and Software Integrated Product Team Leader for the F-22, the Deputy Program Director for the F-15, and the Program Director for the X-32 Joint Strike Fighter. Currently, Mr. Lyons lectures on project, program, and risk management classes, specifically on the Digital Avionics Architectures and Software Management at the University of California at Los Angeles Extension.

### Tuesday Luncheon Speaker

#### *NSF Program Overview: Engineering and Systems Design (ESD) and Systems Science (SYS)*

**Chris Paredis**  
**Program Director,**  
**ENG/CMMI ESD & SYS,**  
**National Science Foundation**

#### **Abstract:**

This presentation provides an overview of the Engineering and Systems Design (ESD) and Systems Science (SYS) programs at the National Science Foundation. I will start by presenting my conceptual model of systems engineering and design, identifying what I believe are the core issues in our research area. From there the two programs will be introduced and differentiated from each other. For each program, the role and scope of the program are defined, and several examples and possible directions for future research are provided. The presentation will end with some logistical details about the programs and an opportunity for Q&A. The overall goal is to increase the success of principal investigators when submitting proposals to the ESD or SYS programs.

<b>PROGRAM SCHEDULE - Monday, April 13, 2015</b>		
<b>07:30 - 17:00</b>	<b>REGISTRATION - Prefunction Area</b>	
<b>Room</b>	<b>Shaughnessy I</b>	<b>Shaughnessy II</b>
<b>08:00 - 10:00</b>	1A1 - Cyber Security	1A2 - Department of Defense's Transformational Changes in "Big A" Acquisition
<b>10:00 - 10:15</b>	<b>COFFEE BREAK - Prefunction Area</b>	
<b>10:15 - 12:00</b>	1B1 - Cyber Security (Continued)	1B2 - Department of Defense's Transformational Changes in "Big A" Acquisition (Continued)
<b>12:00 - 13:00</b>	<b>LUNCH - Pinnacle III</b>	
<b>13:00 - 15:00</b>	1C1 - Safety Issues in Complex Engineered Systems	1C2 - Principles and Practice of Operational Resilience
<b>15:00 - 15:15</b>	<b>COFFEE BREAK - Prefunction Area</b>	
<b>15:15 - 17:00</b>	1D1 - Safety Issues in Complex Engineered Systems (Continued)	1D2 - Principles and Practice of Operational Resilience (Continued)



<b>PROGRAM SCHEDULE - Tuesday, April 14, 2015</b>					
<b>07:00 - 17:00</b>	<b>REGISTRATION - Prefunction Area</b>				
<b>08:15 - 08:30</b>	<b>Opening Remarks - Pinnacle I &amp; II</b>				
<b>08:30 - 09:30</b>	<b>Keynote:</b> Robert Lyons, President, IEEE Aerospace & Electronic Systems Society				
<b>09:30 - 10:00</b>	<b>COFFEE BREAK - Prefunction Area</b>				
<b>10:00 - 12:00</b>	<b>Panel:</b> Systems Engineering Body of Knowledge  <b>Panelists:</b> Dick Fairley, IEEE Computer Society; Art Pyster, Stevens Institute of Technology; Rick Adcock, Cranfield University; David Olwell, Naval Postgraduate School; Garry Roedler, Lockheed Martin				
<b>12:00 - 13:30</b>	<b>LUNCH - Pinnacle III</b>				
<b>Room</b>	<b>Pinnacle I</b>	<b>Pinnacle II</b>	<b>Shaughnessy I</b>	<b>Shaughnessy II</b>	<b>Dundarave</b>
<b>13:30 - 15:15</b>	2C1 - Cyber Security	2C2 - Complex Systems Issues I	2C3 - Research in Systems Engineering I	2C4 - Model-Based Systems Engineering I	2C5 - Systems Verification and Validation
<b>15:15 - 15:30</b>	<b>COFFEE BREAK - Prefunction Area</b>				
<b>15:30 - 17:45</b>	2D1 - Modeling and Simulation I	2D2 - Complex Systems Issues II	2D3 - Decision Making Systems I	2D4 - Model-Based Systems Engineering II	2D5 - Medical Systems
<b>18:00 - 19:00</b>	<b>Welcome Reception - Prefunction Area</b>				
<b>19:00 - 20:00</b>	<b>Young Professionals Networking Event - Prefunction Area</b>				
<b>20:00 - 21:00</b>	<b>Analytics and Risk Technical Committee Meeting</b>				

<b>PROGRAM SCHEDULE - Wednesday, April 15, 2015</b>						
<b>08:30 - 17:00</b>	<b>REGISTRATION - Prefunction Area</b>					
	Panel: Theory of Systems Engineering					
<b>09:00 - 09:45</b>	<b>Panelists:</b> Anna-Maria R McGowan, NASA Langley Research Center & Aeronautics Research Directorate; Paul Collopy, University of Alabama in Huntsville; Christiaan Paredis, National Science Foundation; Masood Towhidnejad, Embry Riddle Aeronautical University; Timothy Simpson, Pennsylvania State University					
<b>09:45 - 10:00</b>	<b>COFFEE BREAK - Prefunction Area</b>					
<b>Room</b>	<b>Pinnacle I</b>	<b>Pinnacle II</b>	<b>Shaughnessy I</b>	<b>Shaughnessy II</b>	<b>Ambleside II</b>	<b>Dundarave</b>
<b>10:00 - 11:00</b>	3A1 - Modeling and Simulation II	3A2 - Complex Systems Issues III	3A3 - Decision Making Systems II	3A4 - Systems Engineering Issues I		3A5 - Research in Systems Engineering II
<b>11:00 - 12:00</b>	3B1 - Modeling and Simulation III	3B2 - Engineering Systems-of-Systems I	3B3 - Decision Making Systems III	3B4 - Technologies and Systems for Automated Border Control Gates		3B5 - Research In Systems Engineering III
<b>12:00 - 13:30</b>	<b>LUNCH &amp; Best Paper Awards - Pinnacle III</b>					
<b>13:30 - 15:15</b>	3C1 - Energy Management and Sustainability	3C2 - System Architecture I	3C3- Systems Engineering Theory	3C4 - Autonomous Systems I	3C5 - Sensors Integration and Applications I	3C6 - Cloud Computing
<b>15:15 - 15:30</b>	<b>COFFEE BREAK - Prefunction Area</b>					
<b>15:30 - 17:45</b>	3D1 - Modeling and Simulation IV	3D2 - Engineering Systems-of-Systems II	3D3 - Theoretical Foundations on Systems Engineering	3D4 - Autonomous Systems II	3D5 - Defense Systems	3D6 - Systems Engineering Issues II
<b>18:00 - 19:00</b>	<b>IEEE Technical Activities Volunteer Training</b>					

<b>PROGRAM SCHEDULE - Thursday, April 16, 2015</b>						
<b>REGISTRATION - Prefunction Area</b>						
<b>07:30 – 12:00</b>	<b>Room</b>	<b>Pinnacle I</b>	<b>Pinnacle II</b>	<b>Shaughnessy I</b>	<b>Shaughnessy II</b>	<b>Pinnacle III</b>
<b>08:00 - 09:45</b>		4A1 - Modeling and Simulation V	4A2 - Network Issues	4A3 - Space and Communication Systems I	4A4 - Transportation Systems	4A5 - Sensors Integration and Applications II
<b>09:45 - 10:00</b>		<b>COFFEE BREAK - Prefunction Area</b>				
<b>10:00 - 12:00</b>		4B1 - Robotic Systems	4B2 - Complex Systems Issues IV	4B3 - Space and Communication Systems II	4B4 - System Architecture II	4B5 - System Modeling and Integration
<b>12:00</b>		<b>Closing Remarks - Pinnacle I &amp; II</b>				