**System of Systems Engineering
Collaborators Information Exchange (SoSECIE)**

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Mission Engineering and Complexity

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Abstract
The fundamental purpose of Mission Engineering (ME) is to build the right thing based on a perceived operational need. Defining "the right thing" depends on the many interrelated elements of operational context, environment (operating, political, social) and available capabilities. It is inherently dynamic and complex. In this presentation the authors examine how complexity thinking can apply to Mission Engineering to illuminate hidden interdependencies that can have an inordinate impact on mission execution. There are several frameworks that help successful organizations identify ways to navigate inherent internal and external complexities. Applying complexity thinking can uncover which of a mission's system-of-systems components or mission external factors can have nonlinear impacts on operational mission outcomes.

Mission engineering examines the mission context, its effect on the enterprise, the capabilities of systems-of-systems, organizations and decision-making, mission threads, and external environmental factors. All of these taken together create complexity. The acquisition and system development processes that produce the capabilities to meet the defined mission need are in themselves complex and dynamic. With the Defense community pushing to move faster to develop and deploy advanced systems additional dynamic forces and rapid change are introduced that further increase complexity. The presentation will highlight examples of complexity in large systems and suggest ways to address complexity in various aspects of Mission Engineering.

Biographies

Dr. John Pourdehnad

John Pourdehnad is an educator/consultant/researcher in strategic management and change, using systems thinking as a worldview and design thinking as a methodology to dissolve complex interactive problems. He is a recognized thought leader in systems and design thinking with primary areas of interest in the implications of systems thinking in complex interactive problem formulation, systems redesign, and highly complex projects and mega programs. From 1979 until 2009, John Pourdehnad, first as a student and later as an associate of Russell Ackoff, worked as a consultant in a broad range of industries, helping management and leadership teams develop strategic plans and transformational roadmaps.

His career spans more than four decades in management, consulting, education and research. He has held senior global management positions in automotive, household appliances, and hi-tech industries. As a scholar-practitioner, he has consulted with large and small for-profit and not-for-profit organizations across many sectors and with government agencies helping management and leadership teams develop strategic plans and transformational roadmaps. Since 2016, he has been systems and design thinking professor in the Doctor of Management in Strategic Leadership and a Ph.D. in Complex Systems Leadership at Thomas Jefferson University. Before his appointments at Jefferson for 16 years, he held positions at the University of Pennsylvania in the School of Arts and Sciences and the School of Engineering and Applied Science, where he taught at the undergraduate and graduate levels and was a co-principal investigator for research programs. He also holds an appointment as Visiting Professor at the IESE Business School, the University of Navarra in Barcelona, Spain. He has published dozens of papers in various academic and trade journals and was a featured contributor to the BusinessWeek weblog. He is a member of several editorial boards, including the journal Systems Research and Behavioral Science (Wiley).

David E. Chesebrough

Dave is Vice President, Government Activity with Defined Business Solutions (DBS). He is engaged with technical and management support of DBS clients, including outreach, operations, and program development. He presently provides technical and outreach support to the Defense Microelectronics Activity. Prior to joining DBS, he was President of the Association for Enterprise Integration and Vice President of the National Defense Industrial Association, where he oversaw all 28 NDIA Divisions. While there started the Cybersecurity and Electronics Divisions and built a working group promoting agile software development for Government. He served in the U.S. Air Force as an astronautical engineering assigned to the forerunner of the Space and Missile Systems Center. Prior to that he was a mechanical design engineer in the Fuels Division of Babcock and Wilcox Commercial Nuclear Power Generation Group.