**OFFICE OF THE DEPUTY ASSISTANT SECRETARY OF DEFENSE**
*SYSTEMS ENGINEERING*

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

**Tuesday, December 2, 2014**
**11:00 a.m. to Noon Eastern Time**

## Designing Resiliency into a System of Systems

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**Abstract**
As today's System of Systems (SoS) become more complex and interconnected, the probability of widespread and prolonged service disruptions increase. One has to look no further than envisioning the loss of communications due to a catastrophic event to our space-based or terrestrial infrastructure, or consider the impacts of programmatic delays for systems that are going to replace aging systems within a SoS. Often these critical SoS are assembled without considering fragility from the outset, thus allowing only antidotal consideration to be given to resiliency as an emergent behavior.

Resiliency is defined as the ability to adapt to changing conditions (natural or man-made) through planning to absorb (withstand) and rapidly recover from adverse events and disruptions. Resilient architectures are able to support mission functions at a higher degree of probability, with shorter disruptions in mission capabilities after a disturbance is introduced. However, to achieve a higher degree of SoS resiliency, design attributes for avoidance, robustness, recovery, and reconstitution must be defined as early as practical in the planning process.

This presentation explores resiliency as an emergent behavior of a system from architectural design and performance perspectives. As a result, system performance can be evaluated as disturbances are introduced, and forecast how the SoS will recover to a steady-state. Furthermore, this paper introduces a methodological approach that will identify the key architectural nodes and parameters that can be changed during through design or policy changes that will increase critical system capabilities through increased resiliency.

**Biography**

Dr. Warren Vaneman is a Professor of Practice in the Department of Systems Engineering at the Naval Postgraduate School, Monterey, CA. He has more than 25 years of experience in systems engineering and systems architecture in various government organizations. His research interests include system of systems engineering and integration, systems architecture and design, and model-based system engineering. In addition to his civilian experience, Dr. Vaneman is a surface warfare and space cadre officer in the U.S. Navy Reserve. He has a Ph.D. and M.S. in Industrial and Systems Engineering from Virginia Tech, and a B.S. from the State University of New York Maritime College.