

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

**January 22, 2019  
11:00 a.m. to Noon Eastern Time**

### **System of Systems Model Building and Acausal Simulation Environment**

***Presenter: Dr. Peter Menegay, Director of Funded R&D, SynaptiCAD***

#### **Abstract**

This effort represents ongoing work to provide a unique model building and simulation environment for the design of complex aerospace systems. The environment is based on three separate but interacting elements: 1) a powerful equation solver for model building, 2) a system-building tool where subsystems can be created and connected from the models described in 1, and 3) a time & event simulator based on SystemVerilog, which simulates the built system. The present work focuses on the addition of several new elements, chief among these being the ability to unite existing independent system representations into a system of systems (SoS). Other capabilities include trade studies and requirements enforcement across trade studies. The trade study in this case can be viewed as a set of multiple conditions over which a requirement is to be satisfied. Of particular note is the development of acausal SoS models which are solved through the equation solver. Thus an entire SoS simulation can be seen as a system of simultaneous equations in which the user can input various combinations of knowns/unknowns. For example, instead of solving for efficacy of a weapons system given its design, we can input the desired efficacy and solve for a design parameter. A simple example is created to illustrate these capabilities featuring an MQ-9 Reaper aircraft with sensors, a ground control station and a communications satellite. These three systems are merged into an interoperating SoS from which further analysis can take place along the lines mentioned above. Technical challenges associated with scale-up of the environment and links to system architecture tools (e.g. AADL) are discussed.

#### **Biography**

Peter Menegay leads the funded research and services team at SynaptiCAD. As such he is responsible for R&D project management, proposal development, and consulting. He has over 20 years of experience developing (and using) engineering modeling and simulation software. He has led numerous SBIR and consulting projects at SynaptiCAD and Phoenix Integration. He has previous experience as a turbomachinery aerodynamicist with GE and Dresser-Rand. He has a PhD in mechanical engineering from Virginia Tech.