GSAW 2014 Tutorial A:

Introduction to Model-Based Systems Engineering (MBSE) and System Modeling

Length: Half day

Overview:
Other engineering disciplines (e.g., mechanical, electrical) have long used model-based tools and methods to help manage complexity and formalize how designs are represented and analyzed. Due to its wide scope, systems engineering has been harder to formalize, but now with the emergence of system modeling languages and tools, systems engineering is obtaining benefits in rigor and precision, similar to the benefits that mechanical and electrical engineering achieved through computer-aided design (CAD) decades ago.

This tutorial is intended to give students a basic understanding of MBSE from both a technical and programmatic viewpoint.

The tutorial describes what a system model is, the role that it plays in a project, the relationships that it has with respect to other discipline models, and principles for well-structured system models that can support a wide range of analyses.

Part 1: Introduction to Model-Based Systems Engineering
1. What is model-based systems engineering (MBSE)?
2. Systems engineering problems that MBSE addresses
3. The role of a system model and how it relates to other discipline models
4. Case study in MBSE
5. Comparison of MBSE to traditional SE
6. Management issues:
   - Implications for projects, infusion strategy, lessons learned
7. Summary

Part 2: Introduction to System Modeling
1. System Models
2. Good System Models
3. SysML Basics and Customization
4. Methodologies and NASA Systems Engineering Process
5. Summary

This tutorial provides helpful background for the tutorial "MBSE for Ground Systems", but is not a prerequisite for that tutorial.

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Biographies:
Daniel Dvorak is a Principal Engineer in the Systems Engineering and Formulation Division at the Jet Propulsion Laboratory, California Institute of Technology. Dan supports JPL's initiative on model-centric engineering and leads NASA's software architecture review board. His interests include model-based systems engineering, fault management, system control architectures, and goal-driven mission operations. Dan is a 2013 recipient of the NASA Systems Engineering Excellence Award. He holds a Ph.D. in computer science from The University of Texas at Austin, a M.S. in computer engineering from Stanford University, and a B.S. in electrical engineering from Rose-Hulman Institute of Technology.

J. Steven Jenkins is Principal Engineer in the Systems Engineering and Formulation Division at the Jet Propulsion Laboratory, California Institute of Technology, currently supporting JPL's Integrated Model-Centric Engineering Initiative. His primary focus is the application of model-based systems engineering to space mission formulation, implementation, and operations. Jenkins served on the system engineering teams for Project Constellation and Project Prometheus. He also managed the System Engineering and Architecture Office and the Enterprise Information System Project in the Institutional Computing and Information Systems Office. Dr. Jenkins holds a B.S. in Mathematics from Millsaps College, an M.S. in Applied Mathematics from Southern Methodist University, and a Ph.D. in Electrical Engineering (Control Systems) from UCLA.

Description of Intended Students and Prerequisites:
Intended students are systems engineers, discipline engineers, and engineering managers seeking an introduction to model-based systems engineering (MBSE), with an emphasis on the value of a system model in the practice of systems engineering. Attendees should have some knowledge of systems engineering. Knowledge of SysML™, the systems modeling language, is not required.

What can Attendees Expect to Learn:
Attendees will learn what MBSE is, what motivates it, what benefits are claimed for it, and how it compares to traditional systems engineering. The tutorial will emphasize the role that a system model plays and principles for building good models. The tutorial will also examine management issues including implications for projects, infusion strategy, and lessons learned.