GSAW 2024 Tutorial F: Half Day

Digital Engineering for Enterprise Ground Systems

Overview:
Modern ground systems are evolving. The changing ground systems landscape is driven by disruptive and nondisruptive evolutionary and revolutionary changes in both on-orbit capabilities and on-ground solutions. Traditional approaches where ground systems consist of a small number of stovepiped solutions supporting a single mission or constellation are being replaced by enterprise systems that support multiple missions comprised of a heterogeneous portfolio of disaggregated platforms developed and flown by a mix of government, federal partner, and commercial providers. In addition, the last several years has seen a significant the expansion of commercial services across all aspects of satellite operations from launch and mission operations to data downlink and mission data processing, and end-user delivery.

These changes provide great opportunity and challenges for government systems' owners to leverage the rapid pace of innovation that industry enables for both flight and ground system acquisition. Transitioning from highly specified front-end loaded requirements-driven development of custom solutions built and operated by the government to a needs-based service integration approach with significant commercial operator involvement provides greater agility and expandability, but assumes additional acquisition risk and requires a new set of acquisition skills capable of balancing priorities across a portfolio of capabilities and an ability to react to rapidly emerging threats and opportunities.

Digital Engineering (DE) offers the prospect of providing discipline to what could become a chaotic future. As an integrated digital approach that uses authoritative sources of truth (ASOT) data and models as a continuum across disciplines to support lifecycle activities from concept through disposal, DE provides methods and tools to address increasing system and enterprise complexity, the increasing need for speed and agility in engineering processes and increasing need for efficiency and effectiveness in engineering solutions. For ground systems in particular, DE enables enterprise portfolio knowledge management, accelerating fact-based decision-making across the system lifecycle, and providing the flexibility to adapt to new service capabilities or changes in mission objectives. Integrating cost models into the DE environment supports accelerated, data-informed acquisition decision-making at any point in the lifecycle by leveraging the ASOTs and models with which they coexist.

This tutorial provides an overview of DE, to include what it is, how it's used, and what benefits it is expected to provide to the space enterprise. This will be followed by discussing how to implement DE into acquisition lifecycle management processes including the use of descriptive models to communicate system definition characteristics such as requirements, V&V activities, architecture, interfaces, and ConOps. A discussion of cost estimating and analysis support to an acquisition lifecycle management process in a digital engineering environment will illustrate the importance of cross-mission costs in portfolio management. Finally, we will review the potential of DE at the Enterprise level to coordinate and balance priorities across a portfolio of programs that depend on common capabilities in order to meet their mission unique goals.

Participants who take this course will gain a more comprehensive understanding of the core principles and nature of DE and will be better prepared for the massive and inevitable digital revolution that is underway across the community.

Instructors:
Stephen Marley, Fredda Lerner, Scott Schnee, and Mary Covert, The Aerospace Corporation

Biographies:
Stephen Marley – As a Ground Systems Enterprise Architect, Dr. Marley is focused on complex/scientific data information systems in support of environmental observation science and ground system operations. With nearly 30 years' experience of developing environmental satellite ground systems, he has successfully led and/or participated in the designing of satellite ground systems for the European Space Agency's European Remote Sensing satellites, NASA's Earth Observing System, USGS's Landsat program, and most recently NOAA's Geostationary and Polar satellite programs. Currently, working within the Ground Architecture team at NOAA, Dr. Marley is helping to establish Enterprise Architecture best practices and tools defining the technical framework for the realization of the future NOAA Ground Enterprise. Dr. Marley is a graduate in Infrared Astronomy from the University of Leeds. He is also a Certified Enterprise Architect and a proud alum of the International Space University.

Fredda Lerner – As a systems of systems (SoS) engineer, Ms. Lerner is focused on systems development, engineering, integration, and lifecycle management in the context of and used for digital engineering (DE). Ms. Lerner has long been a DE practitioner and evangelist: 7 years ago, she was an integral part of the team that simulated one of the first successful DE ecosystems that interconnected disparate authoritative source of truth (ASOT) data sources through models at a US government agency. Ms. Lerner supports, develops, leads, and enables US Department of Defense, Intelligence Agencies, and other federal agencies to include NASA and NOAA, to cost effectively and efficiently develop, plan, implement, and transition their systems into the DE paradigm. Ms. Lerner received a Bachelor of Mechanical Engineering from Georgia Tech. In the 40+ years since then, Ms. Lerner has held mechanical, manufacturing, systems engineering, and program management positions of increasing authority and scope for leading private sector corporations, most of which were in support of US government programs. Recently, Ms. Lerner was a chapter co-author of Emerging Trends in Systems Engineering Leadership, published in 2022.

Scott Schnee – Dr. Schnee has led and supported a wide range of space and ground architecture trade studies over the last decade, bringing together teams to assess performance, estimate lifecycle cost, and set requirements. He primarily supports NOAA/NESDIS and NASA/GSFC with occasional support to other agencies. Dr. Schnee's current efforts are primarily focused on the definition and development of the ground enterprise for NOAA's Space Weather Next program. Dr. Schnee holds a Ph.D. and Masters in Astronomy from Harvard University and a Bachelor of Arts in Astrophysics from Columbia University.

Mary Covert – Ms. Covert has been developing unique, customized cost models for myriad estimating purposes and milestones for over 20 years. Known as "the estimator of odd things", her area of expertise is cost estimating challenges that require specialized analyses. She has developed custom ground cost models for NOAA/NESDIS, USGS Landsat, Intelligence Agencies, NSF, NASA, and others, ranging from iROMs and ICEs for programs, to architectural trade studies at the enterprise level. Ms. Covert holds a triple major Bachelor of Science degree from the University of Miami, and a Master's Degree in Economic Geography from Florida Atlantic University.

Description of Intended Audience and Recommended Prerequisites:
Engineering/Requirements Managers, Enterprise Architects, and Technical Review Leads. Familiarity with MBSE concepts is desirable, but not necessary.

What can Attendees Expect to Learn:
Attendees will learn how to apply Digital Engineering (DE) and Model-Based systems Engineering (MBSE) concepts for the efficient and coordinated development of enterprise ground systems.