



OFFICE OF THE DEPUTY ASSISTANT SECRETARY OF DEFENSE SYSTEMS ENGINEERING

System of Systems Engineering Collaborators Information Exchange (SoSECIE)

September 20, 2016
11:00 a.m. to Noon Eastern Time

Challenges of Verification, Validation, and Accreditation (VV&A) in a Complex System-of-Systems Federated Environment

Presenter: Dr. Anamaria Dent, nou Systems, Inc.

*Coauthor: Mr. Doug Parsons, Army Aviation and Missile Research,
Development and Engineering Center (AMRDEC)*

Abstract

The mission of the Ballistic Missile Defense System (BMDS) Operational Test Agency (OTA) is to provide an independent Operational Assessment (OA) of the BMDS. With the increased emphasis on Models and Simulations (M&S) usage for performance assessment, confidence in the ability of the M&S to accurately represent the operational system performance and support fielding assessments is crucial. Verification, validation, and accreditation (VV&A) are essential steps in M&S development, systems engineering, and data output usability and credibility. Many challenges on the road to V&V of the M&S, and ultimately M&S accreditation, require the adaptation of classical methods with respect to VV&A activities.

These challenges are multiplied by the complexity of the system that the M&S is representing. The BMDS is a joint, integrated, multi-layered, and globally deployed system-of-systems delivered to defend the United States, deployed forces, allies and friends against ballistic missiles of all ranges by engaging them in all phases of flight: boost, ascent, midcourse and terminal. Thus, the BMDS is a collection of autonomously designed systems (BMDS elements or components) integrated to form a system (system-of-systems or federation) in its own right. Additionally, the integration of the BMDS capabilities into NATO's new policy to develop a BMD system will continue to challenge the VV&A activities. As more nations develop missile defense capabilities, the U.S. industry and the BMDS OTA needs to extend the knowledge and experience to our allies. In collaboration with our partners and allies, new and innovative ways will have to be developed to ensure that we have confidence in our models' ability to represent the performance of the tactical system.

For the BMDS, one needs to demonstrate that this extremely complex weapon system will perform its intended missions without ever being able to exercise it in more than a very small percentage of its intended operating conditions. This unusual limitation is endemic to the very nature of the system due to cost, safety, and political constraints. The reality is that it is simply

not possible to exercise the operational system in but a very limited range of its intended operational configurations, scenarios and environments. To meet this challenge a strategy of capability demonstration through simulation has to be implemented. However, in order to be successful in this approach, one must have very high confidence that the models and simulations being used for this activity faithfully represent what the operational system will do in the entire myriad of operational conditions in which its performance must be demonstrated and assessed. Building this confidence is a multifaceted endeavor in which the BMDS OTA is centrally involved. This brief will discuss the VV&A challenges and address some possible solutions that the BMDS OTA Team has implemented.

Biography

Dr. Anamaria Dent is currently an engineer with nou Systems, Inc. supporting the Ballistic Missile Defense System (BMDS) Operational Test Agency (OTA) and is the contractor lead for the modeling and simulation (M&S) accreditation assessment efforts. She has over 15 years of mathematical analysis, verification, validation, and performance assessment, as well as other Department of Defense experience. She has extensive knowledge of BMDS modeling and simulation with in-depth understanding of systems engineering of complex systems. Dr. Dent has over 7 years' experience in the verification, validation, and accreditation of the BMDS M&S, with particular emphasis on federation simulations. Dr. Dent received her doctoral degree in mathematics, with an emphasis in Algebraic Geometry. She served as a lieutenant in the U.S. Navy specializing in training and researching the effects of ionizing radiation.

Mr. Doug Parsons is a systems engineer with the Army Aviation and Missile Research, Development and Engineering Center (AMRDEC) supporting the BMDS OTA team. In his career spanning more than 30 years with the Department of Army Mr. Parsons has served in leadership roles in software development, as well as developmental and operational test and evaluation (T&E), of both constructive and virtual simulations. His current role supporting the BMDS OTA is the lead for Ground Test (GT) Hardware-in-the-Loop (HWIL) modeling & simulation accreditation. Mr. Parsons has a B.S. in Mechanical Engineering, a M.S. in Systems Management/Operations Research and a M.S. in Industrial Engineering/Interactive Simulation and Training.