



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

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

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## Intricacies of System of Systems Operational Availability and Logistics Modeling and Analysis

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### **Abstract**

In today's highly technological world, tasks are increasingly being accomplished by a system of systems (SoS) - a group of systems that function together to perform a task or sequence of tasks. Dependencies between systems present unique challenges to reliability, availability, and maintainability (RAM) analysts in the assessment of the SoS itself and in the evaluation of individual systems performance within the context of the SoS. At the SoS level, determination of operational availability is less straightforward than for individual systems. The mission profile often describes a coordinated effort involving several systems that are used intermittently over the course of a single mission. At the individual system level, interactions among systems operating within a SoS can lead to system performance that differs from what is observed when systems are operated independently. Often, the intricacies of assessing SoS RAM metrics can best be captured through modeling and simulation. This presentation will discuss various types of system interaction effects and present an example showing differences in system performance between systems assessed individually versus in the context of a SoS.

### **Author Biographies**

Charles M. Carter is a Senior Member of the Technical Staff at Sandia National Laboratories in Albuquerque, New Mexico, USA. For the past 20 years, he has worked exclusively in the reliability field and has conducted assessments of numerous large systems including many aircraft, space, naval, and petrochemical systems. He worked as an aeronautical engineer and a reliability analyst as an officer in the U.S. Air Force. He has also worked as a payload safety engineer at Johnson Space Center and as a software developer. Mr. Carter developed the simulation engine for the Raptor™ reliability engineering software tool and has written numerous papers on reliability and system of systems analysis. Mr. Carter received an M.S. in Systems Engineering from the Air Force Institute of Technology and a B.S. in Aeronautical and Astronautical Engineering from the University of Illinois.

Dennis J. Anderson is a Distinguished Member of the Technical Staff in the Military Systems Analysis Programs Department at Sandia National Laboratories in Albuquerque, New Mexico, USA where he has worked for 23 years. He is currently Principal Investigator for two large system-of-systems (SoS) logistics modeling and analysis projects for the U.S. Army and is



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technical consultant for SoS projects with the U.S. Marine Corps and the U.S. Air Force. Mr. Anderson received an M.A. in Mathematics (Applied Statistics option) from Arizona State University, Tempe, Arizona, and a B.A. in Mathematics, St. John's University, Collegeville, Minnesota.

Tamara Brown is Senior Member of the Technical Staff in the System Readiness and Sustainment Technologies Department at Sandia National Laboratories in Albuquerque, New Mexico, USA where she has worked for 7 years. She is currently Principal Investigator for a complex U.S. Navy System of Systems (SoS) acquisition program involving reliability and availability modeling, analysis, and optimization. Ms. Brown received an M.S. in Statistics from Iowa State University, Ames, Iowa, and a B.S. in Mathematics from University of Nevada, Reno, Nevada.