DoD Modeling and Simulation Support to Acquisition

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ODASD(SE)/System Analysis

NDIA Modeling & Simulation Committee
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Agenda

• Modeling and Simulation within ODASD(SE)
• Modeling and Simulation Observations
• Modeling and Simulation Fundamentals
• System Modeling and DoD Acquisition
• Engineered Resilient Systems
DASD, Systems Engineering Mission

Systems Engineering focuses on engineering excellence – the creative application of scientific principles:

– To design, develop, construct and operate complex systems
– To forecast their behavior under specific operating conditions
– To deliver their intended function while addressing economic efficiency, environmental stewardship and safety of life and property.

**DASD(SE) Mission:** Develop and grow the Systems Engineering capability of the Department of Defense – through engineering policy, continuous engagement with component Systems Engineering organizations and through substantive technical engagement throughout the acquisition life cycle with major and selected acquisition programs.

A Robust Systems Engineering Capability Across the Department Requires Attention to Policy, People and Practice
DASD, Systems Engineering

Stephen Welby
Principal Deputy Kristen Baldwin

Systems Analysis
Kristen Baldwin (Acting)

Major Program Support
James Thompson

Mission Assurance
Nicholas Torelli

Addressing Emerging Challenges on the Frontiers of Systems Engineering
Analysis of Complex Systems/Systems of Systems
Program Protection/Acquisition Cyber Security
University and Industry Engineering Research
Modeling and Simulation
Systems Engineering FFRDC Oversight

Supporting USD(AT&L) Decisions with Independent Engineering Expertise
Engineering Assessment / Mentoring of Major Defense Programs
Program Support Reviews
OIPT / DAB / ITAB Support
Systems Engineering Plans
Systemic Root Cause Analysis

Leading Systems Engineering Practice in DoD and Industry
Systems Engineering Policy & Guidance
Development Planning/Early SE
Specialty Engineering (System Safety, Reliability and Maintainability Engineering, Quality, Manufacturing, Productivity, Human Systems Integration (HSI))
Technical Workforce Development Standardization

Providing technical support and systems engineering leadership and oversight to USD(AT&L) in support of planned and ongoing acquisition programs
Observations: Call for Action

- **Modeling and Simulation is not consistently applied in the acquisition lifecycle**
  - It is not consistently recognized as a component or enabler of Systems Engineering
  - It is not consistently productive for the program management team
  - It is inconsistently applied in phases of the acquisition lifecycle

- **They are never used as a continuum of tools, or as a supplier of rationale and justification for analysis, evaluations, and assessments across the acquisition lifecycle**
  - It is not consistently represented in Service and component organizations
  - It is not, as a community, organized to answer questions, fill SE gaps, or share best practices

- **Modeling and simulation has a long-standing strategy, but it does not have a current roadmap for improvement in application**
  - Acquisition modeling and simulation needs, capabilities, messages from PEO, PM not reaching OSD; and vice versa

- **Contemporary challenge: Mr. Kendall’s remarks at CSIS, 6 Feb 2012**
**Purpose:** One page that conveys a high-level, concise, and comprehensive set of truths for Mod/Sim usage in Systems Engineering support to programs

**Key Areas Emphasized:**
- Program Systems Engineer is responsible for Mod/Sim planning and coordination
- Mod/Sim is included in key schedule and programmatic plans
- SE uses models to define, understand, and communicate technical artifacts
- Models are continually updated throughout program life-cycle
- Project success is dependent on appropriate Mod/Sim training of team

Using the Modeling and Simulation Fundamentals

The M&S Fundamentals support the consideration of modeling and simulation as a tool for systems engineers to use in support to Acquisition activities

- The Fundamentals connect the M&S community to the acquisition use of M&S
- The Fundamentals suggest how M&S should be incorporated into the SE position on the program, but do not dictate how
- The Fundamentals assist both OSD and the programs maintain a common understanding of M&S use for acquisition program support

The M&S Fundamentals provide the modeling and simulation basis of support for programs, posturing modeling and simulation as a part of systems engineering, not separate from it.
AMSWG in 2012

- **Cost Modeling**
  - MORS Affordability Workshop
  - Service Mod/Sim in Acquisition and SE

- **Services and System Engineering**
  - Defense Acquisition Guidebook (DAG) Chapter 4 (Systems Engineering)
  - Defense Acquisition University (DAU)

- **Activities within Lifecycle Supported by Mod/Sim**
  - Materiel Solutions Analysis
  - NDIA Interim Results
  - Manufacturing

- **The Case for Model-based “x”**

- **System Model Development**
Systems Modeling Use in Acquisition
A 10,000 Ft View of the Practice

- The use of models and the insights gained from their use, aid in the conceptualization, resource estimation, design, deployment and sustainment of systems

- It is not limited to engineering; it enables engineering rigor across all acquisition functions

- The tools and processes for systems modeling use enable acquisition functions to be more efficient

- “Modeling” refers to a wide range of artifacts, to include physical and computer based

- Application of models supports reduction of program uncertainties, at any point in time, in cost, schedule, and performance

Model-based acquisition does not diminish the importance of simulations; it increases the relevance of simulation output through consistent use of complete models.
Acquisition Life Cycle Framework
“Weapon System Development”

Enabling S&T

Pre-acquisition Concepts, Experimentation and Prototyping
AOA

MDD

Material Solution Analysis

ICD

Pre-EMD

Review

Technology Development

Post-PDR

Assessment

SE Tradeoff Analyses

PDR

Pre-EMD

CDD

Engineering and Manufacturing Development

Post-CDR

Assessment

CDD

MDD

Production and Deployment

CPD

Operations and Support

Disposal

FRP

IDC

CDD

SEP

ASS

Temp

PPP

LCSP

AS

Sep

Temp

PPP

LCSP

AS

Sep

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Sep

Temp

PPP

LCSP

Additional documentation requirements, may be approved below MDA

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Why? Engineered Resilient Systems Key Technical Areas

Systems Representation and Modeling
- Physical, logical structure, behavior, interactions, interoperability…

Characterizing Changing Operational Contexts
- Deep understanding of warfighter needs, impacts of alternative designs

Cross-Domain Coupling
- Model interchange & composition across scales, disciplines

Data-driven Tradespace Exploration and Analysis
- Multi-dimensional generation/evaluation of alternative designs

Collaborative Design and Decision Support
- Enabling well-informed, low-overhead discussion, analysis, and assessment among engineers and decision-makers
Summary

- The Modeling & Simulation Fundamentals are one of the Keystones (NOT POLICY) of consistent modeling and simulation support to programs
  - Established by the Acquisition Modeling and Simulation Working Group as a simple way to bridge the M&S community with the acquisition community.

- Prove the best practices (real and expected) before applying the System Model
  - Discover/Identify best practices based on examples from the Services/Agencies
  - Develop definition, build business case by studying elements in existence today

- Develop the System Model from elements and artifacts of acquisition activities which already exist
  - Do not invent anything new; instead, use ‘aim points’ from that which already exists
  - Population of the system model should not require separate contract clauses
Questions?

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