DoD Modeling and Simulation Support to Acquisition

Ms. Philomena “Phil” Zimmerman
ODASD(SE)/System Analysis

National Institute of Standards and Technology (NIST)
Model-Based Enterprise Summit
December 13, 2012
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

*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**

We apply best engineering practices to:

- Support and advocate for DoD Component initiatives
- Help program managers identify and mitigate risks
- Shape technical planning and management
- Provide technical insight to OSD stakeholders
- Identify systemic issues for resolution above the program level
DASD, Systems Engineering

Stephen Welby
Principal Deputy
Kristen Baldwin

Distribution Statement A – Cleared for public release by OSR Cases 13-S-0102, 13-S-0103, 12-S-1854.
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.
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

The concept is still maturing
- In far more use than often recognized
- Has proven to be powerful when used
- Is not perfected, and requires intelligent use
- Adoption has been uneven across DoD to date

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

Materiel Solution Analysis

Pre-acquisition Concepts, Experimentation and Prototyping

Pre-acquisition Concepts, Experimentation and Prototyping

ICD

Pre-EHS

Pre-EHS

Pre-EHS

Pre-EHS

Technology Development

SE Tradeoff Analyses

CDM

CDD

Engineering and Manufacturing Development

Post-PDR Assessment

Pre-CRC

Pre-CRC

Pre-CRC

Pre-CRC

CDD

CPD

Production and Deployment

Post-CDR Assessment

Post-CDR Assessment

Post-CDR Assessment

Post-CDR Assessment

CDD

CPD

Operations and Support

Disposal

FRP

IOC

FOC

= Additional documentation requirements, may be approved below MDA

NIST MBE Summit
2012/12/11 | Page-9
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
Richard Neal - The Integrated Manufacturing Technology Initiative

“Imperatives for Achieving Model-Based Product Realization”

Charlie Stirk - CostVision Inc

“Model standards interoperability across domains, the life cycle, and the supply chain”

Tom Hannon - Lockheed Martin Corporation

“The Lockheed Martin Model-Centric Digital Tapestry”