DoD Modeling and Simulation Support to Acquisition

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Office of the Deputy Assistant Secretary of Defense for Systems Engineering (ODASD(SE))
NDIA Modeling & Simulation Committee
February 11, 2014
Agenda

• Modeling and Simulation within ODASD(SE)
• Modeling, Simulation & Analysis (MS&A) and Acquisition Modeling & Simulation Working Group (AMSWG) Progress
• MS&A and AMSWG Plans for 2014

• Additional related activities:
  – NDIA M&S Committee:
    – Acquisition activities supported by modeling and simulation
    – Essential Elements of the System Model**
  – Engineered Resilient Systems / CREATE
  – SISO Acquisition Standards Profile
  – INCOSE MBSE Workshops
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
Vacant

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

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, Producibility, Human Systems Integration)
Counterfeit Prevention
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
“I believe we are on the threshold of seeing … integrated design tool suites for complex electromechanical systems. I believe we will begin to see simulation become a more integrated part of the design process rather than something that is engaged separately. I believe we will see the ability to affordably explore much more complex design spaces, with the opportunity to better understand how the implication of design changes downstream ripples back across an entire product design.”

Remarks at 23rd Annual INCOSE International Symposium, June 25, 2013, Philadelphia, PA

Model-based systems engineering plays a key role in making this vision possible

Mr. Stephen P. Welby
DASD, Systems Engineering
Prior to 2012: Observations: AMSWG and NDIA

AMSWG Call for Action:
- Modeling and simulation is not consistently applied in the acquisition life cycle
- Models and simulations are never used as a continuum of tools, or as a supplier of rationale and justification for analysis, evaluations, and assessments across the acquisition life cycle
- Modeling and simulation has a long-standing strategy, but it does not have a current roadmap for improvement in application

NDIA Model Based Engineering (MBE) Final Report (draft) Gaps that Must be Closed:
- Policy
- Processes/Methods
- Tools/Technologies/Standards
- People
- Infrastructure/Environment
- The Business case for MBE
At the Time: The Acquisition Life Cycle

(borrowed from NavMSMO)

2012: Among a variety of activities, the AMSWG spent time examining the use of models and simulations across the acquisition life cycle.
MS&A Fundamentals
(now updated bi-annually)

- **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


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Distribution Statement A – Approved for public release by OSR on 2/5/14, SR Case # 14-S-818 applies.
Defense Acquisition Guidebook (DAG)
Ch 4 – System Engineering
(prior to release of Interim DoDI 5000.02)

• Section 4.1 Introduction
• Section 4.2 Systems Engineering Activities in the Life Cycle
• Section 4.3 Systems Engineering Processes provides a description of each process and contains the design considerations including specialty engineering.
  – 4.3.19 Tools, Techniques, and Lessons Learned - SE tools and techniques support the Program Manager and Systems Engineer in performing and managing the SE activities and processes to improve productivity and system cost, schedule, capabilities, and adaptability. The program should begin applying SE tools and techniques during the early stages of program definition to improve efficiency and traceability and to provide a technical framework for managing the weapon system development.
  – 4.3.19.1 Modeling and Simulation - Models and simulations are SE tools used by multiple functional area disciplines during all life-cycle phases. Modeling is essential to aid in understanding complex systems and system interdependencies, and to communicate among team members and stakeholders. Simulation provides a means to explore concepts, system characteristics, and alternatives; open up the trade space; facilitate informed decisions and assess overall system performance. Ref: https://acc.dau.mil/dag4
2013: Systems Modeling Use in Acquisition

- 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.

The concept is still maturing
- In far more use than recognized!
- Has proven to be powerful when used
- Is not perfected, and requires intelligent use
- Sporadic adoption; gaining momentum
In Particular, the ‘System Model’

**Data**

- **Technical Data**: Recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include computer software or data incidental to contract administration, such as financial or management information. Source: DFARS 252.227.7013

- **Product Data**: All data created as a consequence of defining (requirements), designing, testing, producing, packaging, storing, distributing, operating, maintaining, modifying and disposing of a product. Source: Army PEWG, based on ANSI/EIA-649-B-2011

**Product Data**

- **Product Definition Info**
  - Reqs Info
  - Design Info
  - Mfg Info

- **Product Associated Info**
  - Configuration Control Info
  - Verification Info

- **Product Operational Info**
  - Logistics Mgt Info
  - In-Service Info

**Technical Data Package**

- Includes:
  * Drawings / Models
  * Lists – Inspection / Test Equipment
  * Software Documentation
  * Interface Control Documents
  * Engineering Product Structure

**TDP** - A technical description of an item adequate for supporting an acquisition strategy, production, and engineering and logistics support. The description defines the required design configuration or performance requirements, and procedures required to ensure adequacy of item performance. It consists of applicable technical data such as models, drawings, associated lists, specifications, standards, performance requirements, quality assurance requirements, software documentation and packaging details. Source: MIL-STD-31000
Enclosure 3: Systems Engineering

- **Section 9. MODELING AND SIMULATION:** The Program Manager will integrate modeling and simulation activities into program planning and engineering efforts. These activities will support consistent analyses and decisions throughout the program’s life cycle. Models, data, and artifacts will be integrated, managed, and controlled to ensure that the products maintain consistency with the system and external program dependencies, provide a comprehensive view of the program, and increase efficiency and confidence throughout the program’s life cycle.

AMSWG 2014 – Policy and Guidance

• **January 2014:**
  – Examined Component Policy/Guidance regarding documentation of support planning of modeling and simulation in support to Programs of Record
  – Identified 4 existing candidate options:
    – Component Modeling and Simulation Support Plans (MSSP)
    – Existing required documentation
  – Identified 4 additional candidate areas of discussion:
    – Validation, verification and accreditation challenges in engineering/physics-based models, data models – for use in acquisition
    – MSSP content
    – Linkage with existing documentation

• **Remainder of 2014:**
  – Provide support to DoD 5000 and guidance updates
  – Review Defense Acquisition Program Support (DAPS) methodology to provide background on review possibilities
  – Identify and justify MSSP content – which will lead to:
    – Validation, verification, accreditation needs and information
    – Linkage to existing documentation
  – Share Best Practices, Lessons Learned from exemplar programs
Endstate: Greater Engineering Use of Models and Simulations?

- **Diffusion of Innovation**: “The process by which an innovation is communicated through certain channels over time among members of a social system” (innovation, social system, communication channels, time). IOW: What do we want to say, and how do we want to say it

- **Identifying exemplars**: Learning from the ‘doers’
  - Engineered Resilient Systems
  - Service/Agency successes in Programs of Record, and support activities

- **Establishing/modifying guidance (and policy?)** for model-centric activities
  - What already exists that we can leverage – even if not model or simulation specific?

- **Continue outreach and collaboration**
Questions?

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ODASD(SE) MS&A Activities

• **Program Engagement:**
  – Continue to support Programs of Record reviews within ODASD(SE)
  – Refresh DAPS query statements

• **Continue development of model-based framework**
  – Continue engagement with external societies
  – Develop business case for ‘System Model’ usage
  – Identify/review system model uses prototypes (e.g. USAF Digital Thread) and exemplars (e.g. USN DDG-1000 IDE, USA ISEC). Others?
  – Maintain connectivity with ongoing data identification efforts within AT&L

• **Integrate common approaches for using models and simulations in education and outreach**
  – DAU SyS 30x, CLE023, CLE011

• **Continue AMSWG**
  – Modeling and simulation support planning and documentation
  – Support to the AMSWG Core as needed

• **Provide technical exchange and updates through professional societies (e.g., INCOSE, MORS, NDIA, SISO)**