Updating DoD Policy and Guidance for Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)

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Abstract

The Department of Defense (DoD) and the military services recognize the value of modeling and simulation for many aspects of their operations and have prepared directives and guidelines to provide general instructions on how, when, and under what circumstances to employ formal Verification, Validation, and Accreditation (VV&A) procedures. VV&A incorporates three interrelated processes to gather and evaluate evidence to determine whether the capabilities, accuracy, correctness, and usability of a model or simulation are sufficient to support its intended uses. An accreditation recommendation reflects the degree to which the verification and validation (V&V) evidence supports using the model or simulation.

The Department's instruction for DoD Modeling and Simulation (M&S) VV&A (DoDI 5000.61) establishes policy, assigns responsibilities, and prescribes procedures for the VV&A of models, simulations (including distributed simulations), and their associated data. The current policy was approved December 9, 2009, with an interim change approved October 15, 2018. Supplemental guidance exists to support DoD- and Service-level M&S Communities in the effective and efficient implementation of VV&A Policy.

The Policy and Guidance for M&S VV&A are undergoing a comprehensive review and revision that reflect a decade's worth of changes in expanded use and consideration of models and simulations. The purpose of this VV&A Policy update is much more than the simple reissuance of a DoDI. The goal is to enhance the state of practice of modeling and simulation VV&A and establish a comprehensive framework for modeling and simulation credibility that operates within a suitable DoD Policy and the best practices and documentation standards that facilitate its implementation.

The review scope includes the VV&A processes as captured in the current policy; the notion of risk of use and the potential for policy and guidance to improve applications of risk-based concepts; current terminology and the need to address modern concepts such as trustworthiness and credibility; and the possible expansion of VV&A techniques in either policy or guidance. Consideration is also given to the position of the current policy as the basis for Service and Agency instructions, policy and guidance.

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What is VV&A?

Three interrelated processes

to gather and evaluate evidence

to determine whether the capabilities, accuracy, correctness, and usability

of a model or simulation

are sufficient to support its intended uses

- ➤ **Verification** – Did I build the thing right?
- ➤ **Validation** – Did I build the right thing?
- ➤ **Accreditation** – Is it believable enough to be used?

An accreditation recommendation reflects the degree to which the V&V evidence supports *using* a model or simulation

- OUSD(R&E) is responsible for the Department's Policy for DoD Modeling and Simulation VV&A

  - DoD Instruction (DoDI) 5000.61

  - Associated guidance on best practices

  - Documentation standards

VV&A Website
(https://vva.msco.mil)
- VV&A Templates
- MIL-STD-3022
- Recommended Practices Guide

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VV&A Policy and Guidance

> *"Policy" relates to DoD Issuances (e.g., Directives & Instructions)*
>
> *"Guidance" is about technical implementation*

Policy

- DoDI 5000.61 – DoD Modeling & Simulation VV&A

Guidance

- Mil-STD-3022 – Documentation of VV&A for Models and Simulations

- Recommended Practices Guide

Key Features of DoDI 5000.61

- Establishes DoD policy for VV&A of M&S
  - Requires VV&A of models, simulations and data used to support DoD processes, products and decisions
  - Directs VV&A results be documented and made accessible
  - Assigns Components and PAS* Officials as final validation authority for representations in their areas of responsibility
- Establishes standards for documentation and accessibility of VV&A results

* OSD Presidentially Appointed, Senate-confirmed (PAS)

# DoDI 5000.61 Sets Overarching VV&A Policy

"***Heads of the DoD Components and OSD Presidentially Appointed, Senate-confirmed (PAS) officials*** *are authorized to provide, within their areas of responsibility, VV&A procedures and guidance as appropriate and in accordance with this Instruction.*" (DoDI 5000.61 draft, para 1.2.e.)

"*The Heads of the DoD Components and the OSD Presidentially Appointed, Senate-confirmed (PAS) Officials shall…* **Establish VV&A policies, practices, and procedures for models, simulations, and associated data**, *within their areas of responsibility.*" (DoDI 5000.61 draft, para 2.4.)

"*VV&A Recommended Practices Guide (RPG). The RPG is intended to* **facilitate the application of DoD-specified directives and guidelines, and to promote the effective application of VV&A**. *The guidance contained within this RPG is generally applicable to the full spectrum of M&S products employed for military and defense applications.*" (DoDI 5000.61 draft, para 3.2.b.)
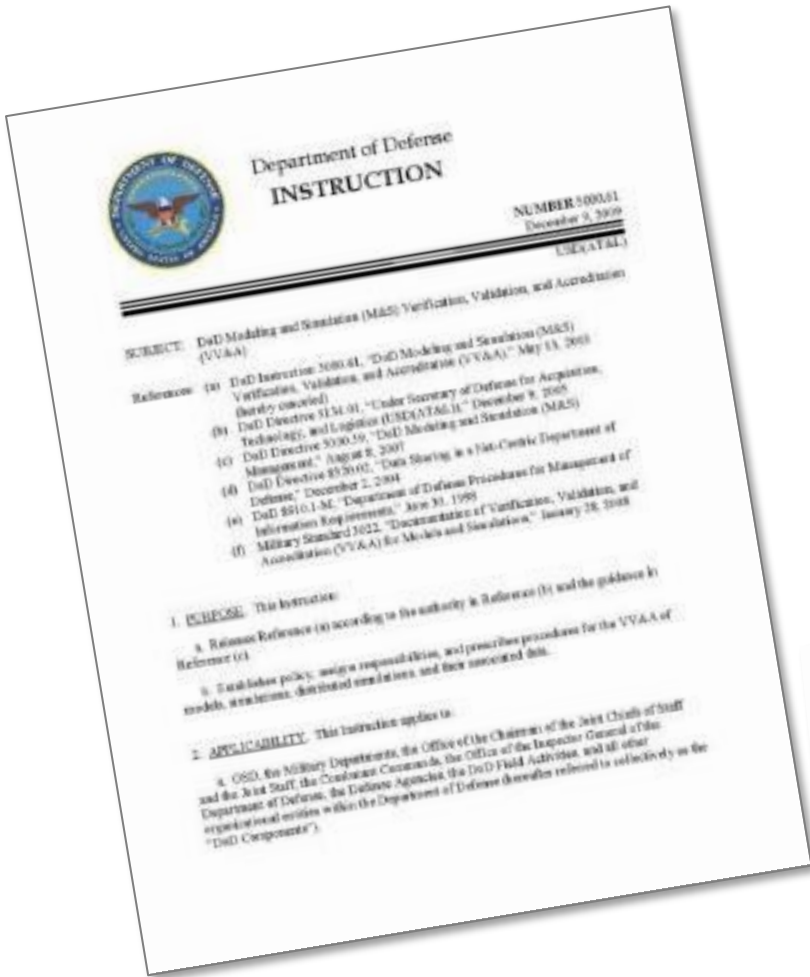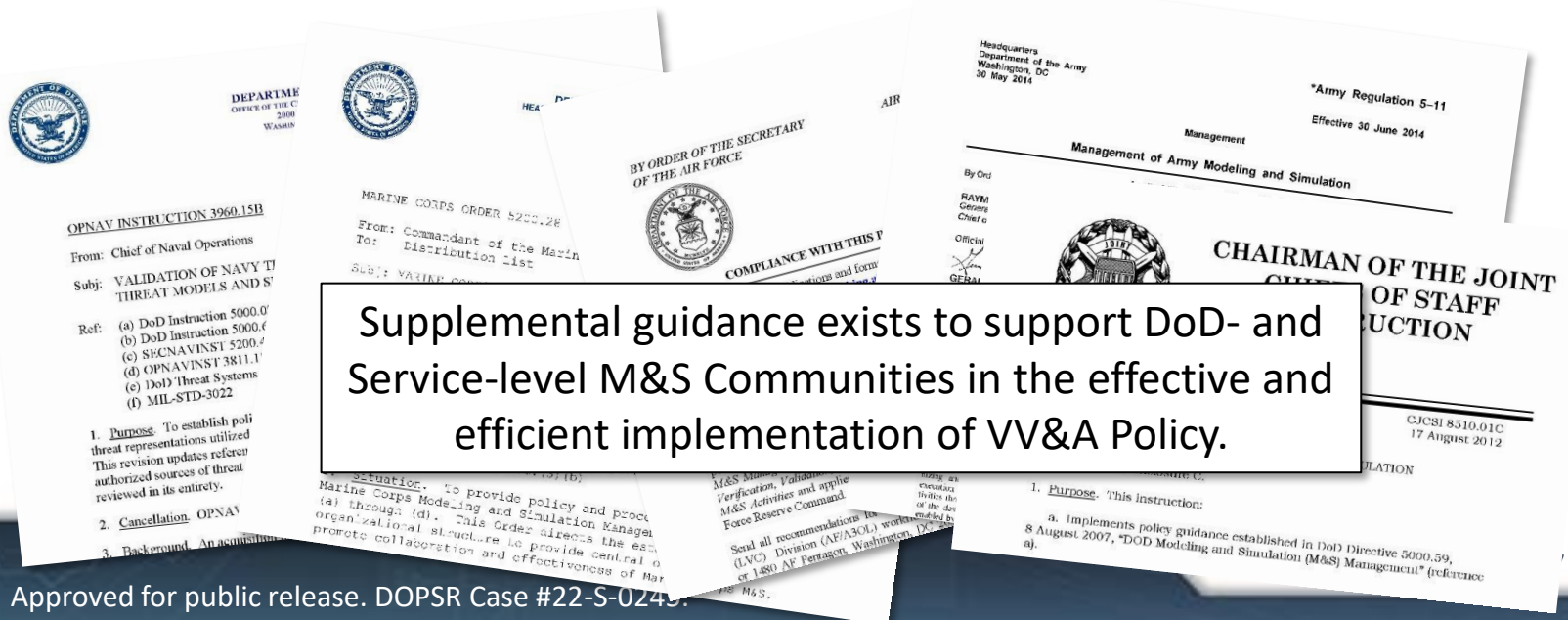
DoDI 5000.61, DoD M&S VV&A

- **Issued: Dec 9, 2009 w/ Ch 1 Oct 15, 2018**
- **Currently undergoing review and update**
  - **Concepts and terminology consistent with current practices (e.g. Digital Engineering Strategy)**
  - **Templates for documentation**
  - **Additional guidance needed for effective, efficient implementation**

Supplemental guidance exists to support DoD- and Service-level M&S Communities in the effective and efficient implementation of VV&A Policy.

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ModSim Community of Practice & Pain Points

Lack of a current DoD strategy for simulation interoperabilty

Lack of adequate standards program

Lack of a common lexicon of technical, functional, programmatic, and acquisition terms related to DoD Enterprise modeling and simulation

Insufficient agile/responsive RMF process (permissions) to quickly stand up LVC simulation events

Insufficient Multi-Level Security guidance for simulation events

Pain Points nominated, consolidated, prioritized by MS CoP WG Core members

Lack of cyber / EMS / space models

Insufficient environmental representations

Lack of accurate human representations (digital human)

Insufficient understanding of human / machine interface

Insufficient threat representation

Inadequate V&V policy and guidance to support new rapid acquisition, test, analysis, and training capabilities

Inadequate support and correlation for Multifidelity Representation

Lack of V&V techniques for M&S supporting cloud environment, AI and Autonomy

Lack of cloud-enabled models and simulations

Insufficient authoritative data sources, insufficient ability to discover and share

Current simulations are not rapidly composable in containerized, modular methods from remote locations-M&S as a Service

Lack of simulations compatibility for distributed simulation in the cloud

Lack of automated V&V tools to speed process

Lack of guidance and tools to better integrate all M&S with Digital Engineering Infrastructure

Lack of validation methods for small data sets for T&E

Lack of an integrating infrastructure to facilitate Discovery, Accessibility, and Reuse of Models and Simulations to better support the M&S community

Insufficiently trained and knowledgeable M&S Workforce

Lack of modeling frameworks that enable rapid simulation composition to better support rapid combat capability development processes

Lack of a DoD-wide repository for models and simulations

Insufficient collaborative body for M&S resource decision making and problem solving

Lack of a resourced and empowered centralized organization that can make tangible decisions / develop interoperability solutions for implementation across the Services

Insufficient collaborative M&S environment for both US and International Partners

- **Policy and Guidance must reflect a decade's worth of changes**
  - VV&A concepts and terminology
  - Documentation templates for evolving VV&A responsibilities
  - Breadth and depth of recommended practices

- **R&E convened a workshop on April 14, 2021**
  - Reviewed the current policy and associated guidance
  - Presented VV&A challenges across Services and Communities
  - Identified common areas to address in DoD policy and guidance

Focus Areas for Review/Update

- ## Generality
  - Should the V&V process be more general to support uses beyond the original intended use?
 - If so, how do we capture them in policy and/or guidance?

- ## Risk of use
  - The notion is implicit in policy and guidance, but is it understood?
  - How do we improve understanding and applications of risk-based concepts?

- ## Terminology
  - How do the ideas of Trustworthiness and Credibility differ from Accreditation?
  - Should we define those in policy or guidance?

- ## V&V techniques
  - Which acceptable/encouraged/preferred V&V techniques are captured/maintained by OSD?
  - Should DoD level policy or guidance address this?
  - Is this functional-area (community) or Service- specific?
  - Should subordinate policies and guidance be stored or referenced in a DoD-level repository?
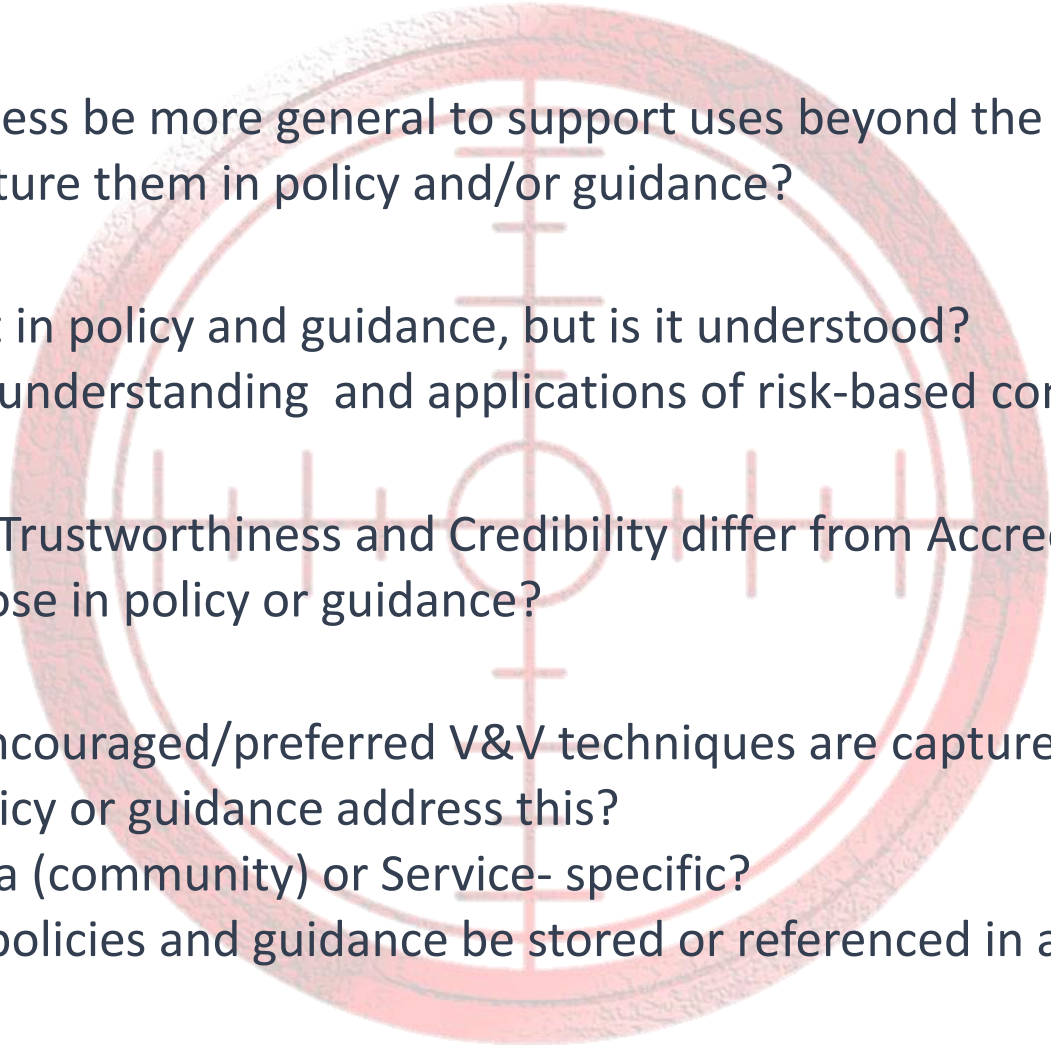
Initial Update Activities

- **Service Coordination**
  - Service-led M&S VV&A Working Groups
  - Service reviews of policies and dependency to DoD issuance
- **Digital Engineering**
  - "Fit for use" – validation needs if not original intended use
  - Understanding data/info from a model or simulation, decision to trust and use it
  - Digital artifacts – explore specifications for use of metrics
  - Address critical areas like Cyber modeling and Digital Twins
- **Test & Evaluation**
  - M&S is critical to delivering relevant capabilities faster; V&V is vital to testing
  - Testing requires a consistent M&S framework, standards, best practices at different levels of modeling
  - Develop Use Case on (earlier) use of models & simulations, specify in T&E Master Plans
- **Threat Modeling**
  - Joint Threat Modeling Program – incorporating IC models, cost for developing trust
  - Variation in blue, threat behavior and rapidly emerging threats can invalidate the validation assessment
  - Maintain link to end users so IC gets useful feedback on models
  - Develop Use Case on how a threat representation is validated, quantification of uncertainty
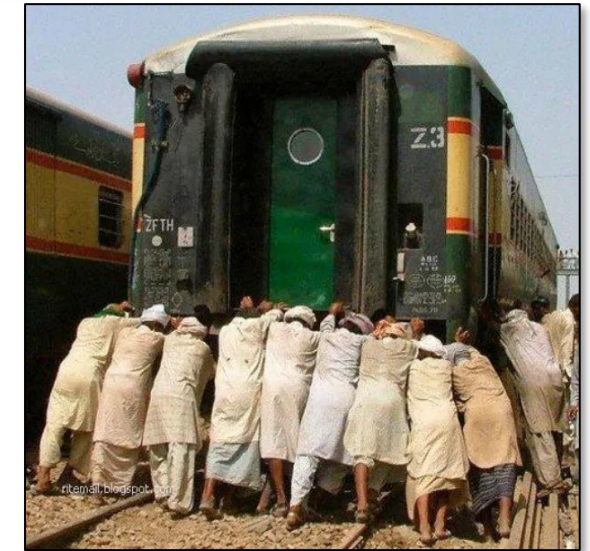
# Beyond DoD Policy and Guidance Updates

- Partnership with Simulation Interoperability Standards Organization
    - Product Steering/Development Group on VV&A
    - Paper review at the February 2022 Simulation Interoperability Workshop
    - Focus on Use Cases in the RPG and recommend changes, additions
    - Include international VV&A standards, particularly, consistent terminology

- DoD M&S VV&A Framework
    - Enhance the state of practice of modeling and simulation VV&A and establish a comprehensive framework for credibility
    - Common guidance to improve effectiveness and efficiency of joint and combined VV&A
    - Foster innovation in processes that improve credibility of models and simulations for proper use, enhanced interoperability, reuse, and trust
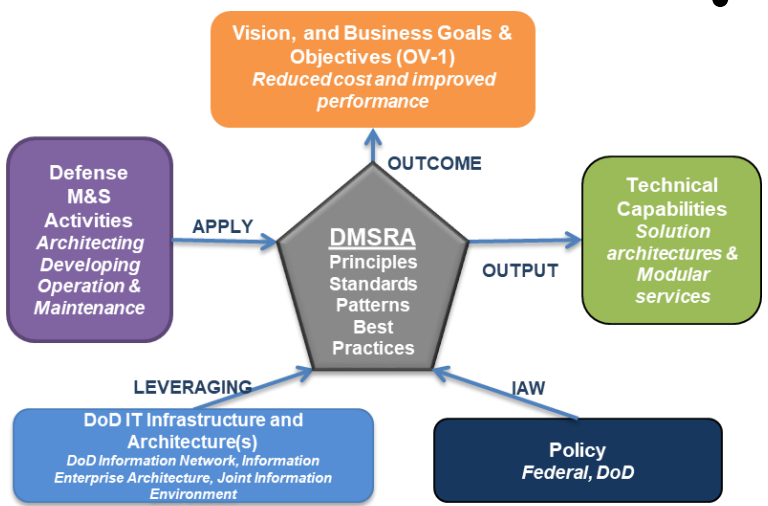
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