DoD VV&A Overview

for

FAA V&V Summit 2011

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VVA Topics

- DoD Modeling & Simulation Management
- Observations
- DoD & Services VV&A Policy and Guidance
- VV&A Recommended Practices Guide
- Risk Based VV&A Project
- VV&A Standards
- Questions
DoD Modeling & Simulation Management

Secretary of Defense

Under Secretary of Defense for Acquisition, Technology & Logistics (USD(AT&L))

Assistant Secretary of Defense for Research & Engineering

Director, Systems Engineering

Director, Systems Analysis

Director, Modeling & Simulation Coordination Office (M&S CO)

DoD Modeling & Simulation Steering Committee (M&S SC)

Chairman

Advise & assist on M&S policy issues

DoD Modeling & Simulation Integrated Process Team (M&S IPT)

Chairman
DoD Modeling & Simulation Management

M&S Management Structure Organized by Communities.
Designed to Support & Integrate M&S Activities across the Department.
Led by a 1 to 2 Star M&S Steering Committee (M&S SC) to provide governance.

Goal: Establish corporate M&S management to address DoD goals:
Leads/guides/shepherds the $Bs in DoD M&S investments; adds value thru metrics & ROI-driven priorities; and seeks to provide transparency.

Components
OSD, Joint Staff, COCOMs, Services
Observations

- Definitions of Verification and Validation across DoD, Services, DOE, NASA, AIAA, AMSE, and International Policy have only minor variations.
- Where applicable, the definition of Accreditation are consistent.
- V&V Processes are similar, but authority identification/implementation responsibilities vary with organization.
- VV&A Documentation Processes, as defined in MIL-STD 3022, have been adopted by multiple V&V Communities.

V&V Communities are converging on Standard Terminology, Processes, and Documentation.
DoD/Service Policy Relationship

Department of Defense Instruction
DoDI 5000.61

- **Scope**: Air Force Instruction 16-1001
- **Definitions**: SECNAV Instruction 5200.40
- **Responsibilities**: Department of the Army Regulation AR 5-11
- **Procedures**: Department of the Army Pamphlet DA PAM 5-11
Relevant DoD and Service VV&A Policy and Guidance

DoD Policy and Guidance Documents

- DoD Directive 5000.59 (M&S Management), 8 August 2007
- DoD Instruction 5000.61 (VV&A), December 9, 2009
- RPG Build 3.0 (vva.msco.mil), September 2006

Department of the Army Policy and Guidance

- Army AR5-11 (M&S Management), February 2005 (Draft Update in Process)
- DA Pam 5-11 (VV&A), 30 Sept 1999 (Draft Update in Process)

Department of the Navy Policy and Guidance

- SECNAVINST 5200.40, April 1999
- DON M&S VV&A Implementation Handbook (Volume 1 VV&A Framework), March 2004

Air Force Policy and Guidance

- AFI 16-1002 (M&S Support to Acquisition), 1 June 2000
- AFI 16-1001, 1 Jun 1996 (Draft Update in Process)
• Implements policy, assigns responsibilities, prescribes procedures, and establishes common terminology
• DODI 5000.61 version history:
  • Original instruction dated April 29, 1996
  • Second version dated May 13, 2003
  • Current version dated December 9, 2009

DoDI 5000.61 dated 9 December 2009 available at
DoD VV&A
Recommended Practices Guide

- RPG promotes the effective application of VV&A methodology
  - Defines philosophy, principles and methodologies
  - Developed by subject matter experts
  - Built to address diverse audiences, situation and applications
- Web-based format intended to:
  - Provide the foundation for multi-tiered, multi-dimensional information at various levels of depth and detail
  - Be extensible to allow for the addition of information over time
  - Allow the reader to build guidance tailored to a situation or application

Available at vva.msc.dla.mil
Scope of RPG Update

- The Recommended Practices Guide (RPG) was recently updated to address issues of:
  - Content: The information contained in the website
  - Presentation and Structure: Organization and navigation
  - Technology: Web-based features

- RPG Update Status
  - All internal and external hyperlinks reviewed and updated
  - New Navigation Features Added
  - Updates made to all Core and Special Topics Documents
  - New Special Topics Documents on Acceptability Criteria and the Validation Referent added

- Additional RPG Updates in Process
  - Techniques Catalog updated
  - Use Cases representing examples of VV&A Implementation in Development
Risk Based VV&A Project

The DoD M&S Steering Committee funded the Risk Based VV&A effort to support more efficient and effective VV&A implementation. This methodology provides a means to:

- Weigh VV&A investments against the risk of making a bad decision due to unreliable M&S results
- Tailor the V&V and Accreditation Efforts based on risk
- Perform Methods/Technique/Resource Trade-offs

The Risk Based VV&A project was a two year effort and has resulted in the M&S Use Risk Methodology
Steps in Building the Risk-Based Methodology for VV&A Approach (Year 1)

**Literature Survey**
- Collected > 350 references
- Organized references into 6 categories:
  - Decision making
  - Risk management
  - Risk assessment
  - Uncertainty analysis
  - VV&A
  - General techniques

**Method Assessment**
- Identified & evaluated over 60 methods from the literature survey
- Combined with a previous V&V technique assessment to build a technique ontology with > 200 methods
- Discovered no significant technological gaps in realizing a Risk-Based methodology for VV&A
- Identified several opportunities to apply techniques from other domains to VV&A
Steps in Building the Risk-Based Methodology for VV&A Approach (Year 2)

Risk-Based Methodology for VV&A Project: Year 2

Risk Based VV&A Concepts Presented to:
- The Simulation Interoperability Workshop VV&A Forum
- The Acquisition Modeling and Simulation Working Group (AMSWG)
- The Technical Cooperation Program Action Area 12 (VV&A) Task Group
- The AMSWG VV&A Sub-Committee
- The NDIA Systems Engineering M&S Committee Meeting
- The Military Operations Research Society (MORS)
- Software Engineering Institute
- ITEA LVC Conference
The Risk Based VV&A Methodology Leverages Existing Concepts

- Communication to decision makers
- Uncertainty quantification
- Credibility assessment
- Sensitivity analysis
- Risk assessment

- Severity categories
- Probability levels
- Risk assessment values
- Risk acceptance levels

- Risk-based V&V tailoring
- Software integrity level
- Risk matrices
- Risk assessment

- Confidence ratios
- Sensitivity analysis
- Uncertainty quantification
- Communication to decision makers

- V&V Composite Model
- Validation Process Maturity

- Communication to decision makers
- Risk-based VV&A tailoring
- Simulation importance
- Risk assessment
- Risk matrices

- Severity categories
- Probability levels
- Risk assessment values
- Risk acceptance levels

- Risk-driven software development
- Spiral development model
MIL-STD-3022

- 2005-2006: DoD-sponsored Tri-Service VV&A Templates Tiger Team developed templates for four core VV&A documents
  - Accreditation Plan, V&V Plan
  - V&V Report, Accreditation Report
- 2007: Processed through DoD M&S management system and Defense Standardization Program
- 2008: Approved as a DoD Standard Practice
- May be cited as a solicitation requirement and Data Item Descriptions (DIDs) included on Contract Data Requirements List (CDRL)
  - DI-MSSM-81750 DoD M&S Accreditation Plan
  - DI-MSSM-81751 DoD M&S V&V Plan
  - DI-MSSM-81752 DoD M&S V&V Report
  - DI-MSSM-81753 DoD M&S Accreditation Report
- 2009: DoD Instruction 5000.61, DoD M&S VV&A, references MIL-STD-3022
Standard Intended Use & Tailoring

- Intended to support VV&A of DoD models, simulations, federations, and other types of distributed simulations by providing a common framework for documenting information produced during the VV&A processes.
- Specifies procedures on documenting information obtained through implementing the VV&A processes when the outputs will be used to supplement decisionmaking in the DoD.
- These types of information, at least some of the time, are obtained via contract from commercial firms.
- Tailoring guidance for contractual applications. Invitation for bids, request for proposals, and contractual statements should tailor Appendices A through D in accordance with the scope of the contractual effort.
IEEE Std 1516.4

- Defines processes and procedures to implement VV&A for federations being developed using the HLA Federation Development and Execution Process (FEDEP) (IEEE Std 1516.3™-2003)
- Focuses on unique aspects of VV&A of federations as a higher-level framework into which VV&A practices can be integrated and tailored for specific uses.
- Provides implementation-level guidance to VV&A practitioners.
IEEE 1516.4 Top-Level Process View
Where to Obtain VV&A Standards

- MIL-STD-3022, Documentation of Verification, Validation, and Accreditation for Models and Simulations, 28 Jan 2008
  - [https://assist.daps.dla.mil/quicksearch/](https://assist.daps.dla.mil/quicksearch/)

  - [https://sbwsweb.ieee.org/](https://sbwsweb.ieee.org/)

- IEEE Std 1278.4-1997, IEEE Trial-Use Recommended Practice for Distributed Interactive Simulation - Verification, Validation, and Accreditation, 20 July 1998 (reaffirmed June 2010)
  - [https://sbwsweb.ieee.org/](https://sbwsweb.ieee.org/)
For more information on DoD VV&A Efforts and the M&S Use Risk Methodology Contact:

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Questions?
DoD VV&A Policy, Guidance and Standards Discussed

- DoD VV&A Policy: DoDI 5000.61 “DoD M&S VV&A”
- The M&S Use Risk Methodology
- MIL-STD-3022 “Documentation of VV&A for M&S”
- IEEE 1516.4-2007 “IEEE Recommended Practice for VV&A of a HLA Federation”
- IEEE 1278.4-1997(R2002) “IEEE Recommended Practice for Distributed Interactive Simulation (DIS) VV&A”
Other Relevant Policy/Standards

- US Coast Guard, COMDTINST 5200.40, 22 Dec 2006
- IEEE Std 1278.4-1997 DIS VV&A
- IEEE Std 1516.4-2007 HLA FEDEP VV&A Overlay
- ASME PTC 60/V&V 10, Computational Solid Mechanics, July 2006
- DI(G) OPS 42-1 Defence Simulation Policy (Australia)
- DI(G) OPS 42-2 Defence Simulation Verification, Validation and Accreditation Policy (Australia)
- DEF STAN 03-44 Issue 2, 31 March 2008 (UK)
- DAOD 2010-2 Modeling and Simulation, DRAFT (Canada)
### MIL-STD-3022 Templates

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#### Suggested Appendices

- A M&S Description
- B M&S Requirements Traceability Matrix
- C Basis of Comparison
- D References
- E Acronyms
- F Glossary
- G Accreditation Programmatic
- H Distribution List

- I V&V Plan
- J Test Information

*Information that is common and shared across the documents appears in italicized font in the table above*
DoD VV&A Documentation Tool

http://msco.mil

Implements MIL-STD 3022 and Data Item Descriptions
DI-MSSM-81750 - DI-MSSM-81751 - DI-MSSM-81752 - DI-MSSM-81753
Producers register here or log in if already registered. There is online help for using the tool, as well as help for VV&A in general. The DVDT automates the MIL-STD-3022 documentation templates.

A benefit of using the tool is easier management of VV&A information. The tool is designed to walk the Producer through VV&A planning, implementation, and reporting.

Register, log in, and create a project to download a set of XML-enabled document templates for local use. Compliant with DoD M&S Community of Interest Discovery Metadata Specification (MSC-DMS).
IEEE Std. 1278.4

- Guidelines established for the VV&A of distributed interactive simulation (DIS) exercises.
- Provides "how-to" procedures for planning and conducting DIS exercise VV&A
- Intended for use in conjunction with IEEE Recommended Practice for DIS-Exercise Management and Feedback (IEEE Std 1278.3-1996)
- IEEE-SA approved reaffirmation of IEEE Std 1278.3-1996 and IEEE Std 1278.4-1997 in June 2010
- Presents data flow and connectivity for all proposed verification and validation activities and provides rationale and justification for each step.
- Provides VV&A guidance to exercise users/sponsors and developers.
DIS Exercise VV&A Process
Risk-Based VV&A Methodology
Product Overview

Risk-Based Methodology for Verification, Validation, and Accreditation (VV&A) Assessment
This report documented the initial assessment of the state of the art for risk methodologies focused on surveying resources and publications to identify existing applicable methods.

An Approach for Realizing a Risk-Based VV&A (RBA) Methodology Comments Summary
This report summarizes the comments and feedback received from reviewers of the initial methodology presented in NSAD-R-2010-020.

An Approach for Realizing a Risk-Based VV&A (RBA) Methodology
This report described an initial approach to defining an integrated methodology for planning, tailoring, and conducting VV&A to minimize the risk incurred when applying an M&S for an intended use.

The Risk-Based Methodology for Verification, Validation, and Accreditation (VV&A) Assessment of Applicable Methods
This report described the results of the assessment of methods documented in NSAD-R-2009-207 that were found applicable to Risk-Based VV&A.

M&S Use Risk Methodology (MURM)
This report provides a methodology and supporting mathematical logic for assessing risk attributed to M&S capabilities.

The Risk-Based Methodology for Verification, Validation, and Accreditation (VV&A) Literature Survey and Methods Bibliography
This report documented the initial assessment of the state of the art for risk methodologies focused on surveying resources and publications to identify existing applicable methods.