

# DoD VV&A Overview

for

# FAA V&V Summit 2011

Mr. Fred Hartman, IDA  
Ms. Simone Youngblood JHU/APL

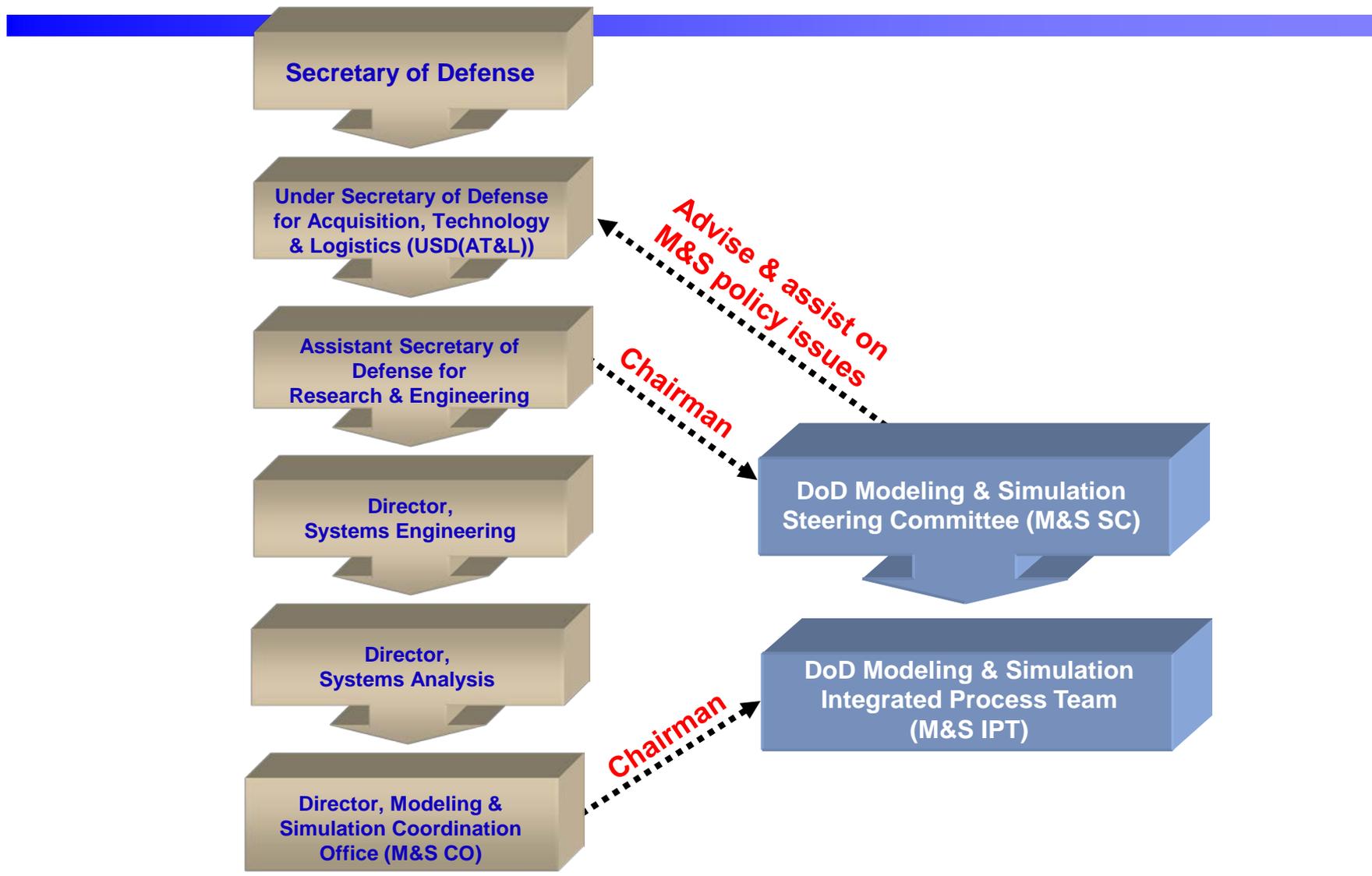
October 19, 2011

# VVA Topics

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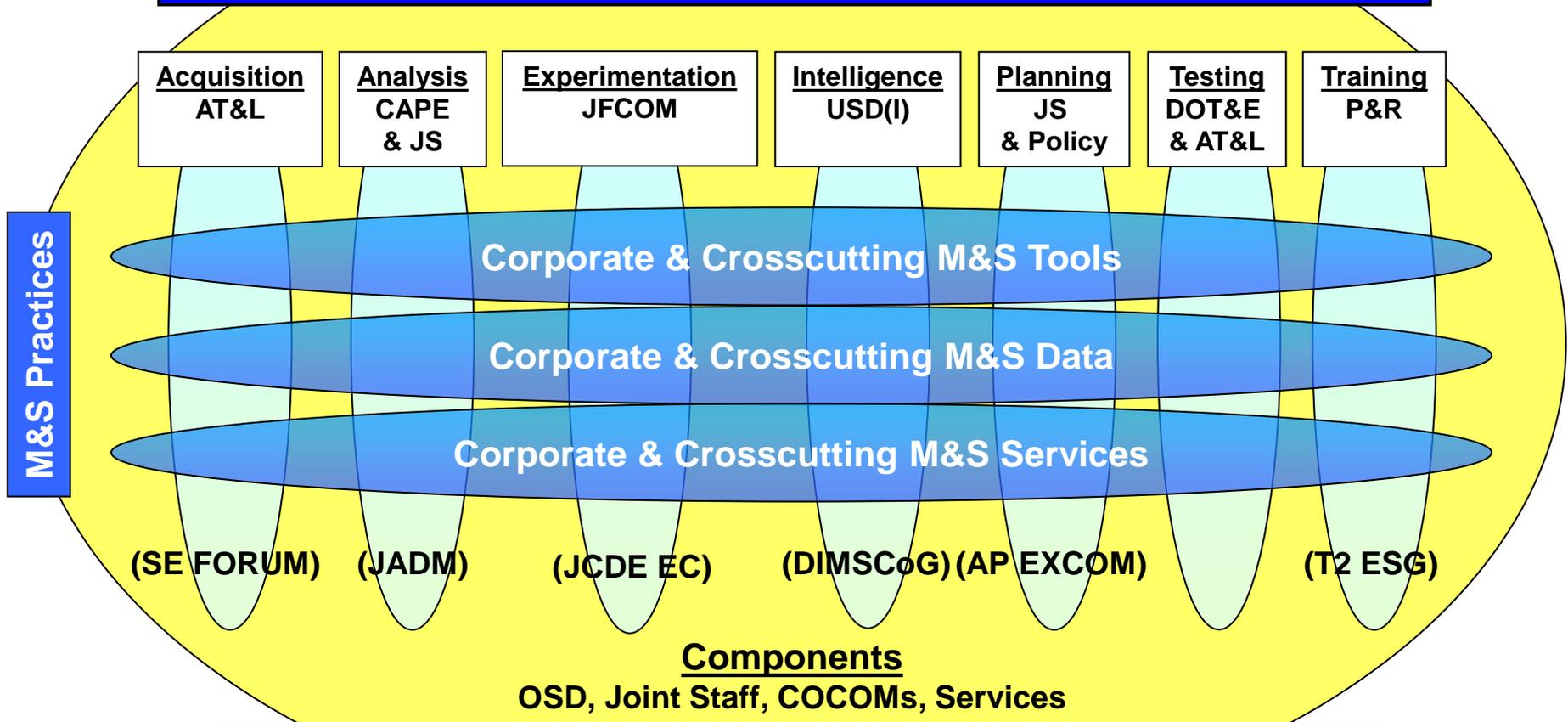
- DoD Modeling & Simulation Management
  - Observations
  - DoD & Services VV&A Policy and Guidance
  - VV&A Recommended Practices Guide
  - Risk Based VV&A Project
  - VV&A Standards
  - Questions
-

# DoD Modeling & Simulation Management



# 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.

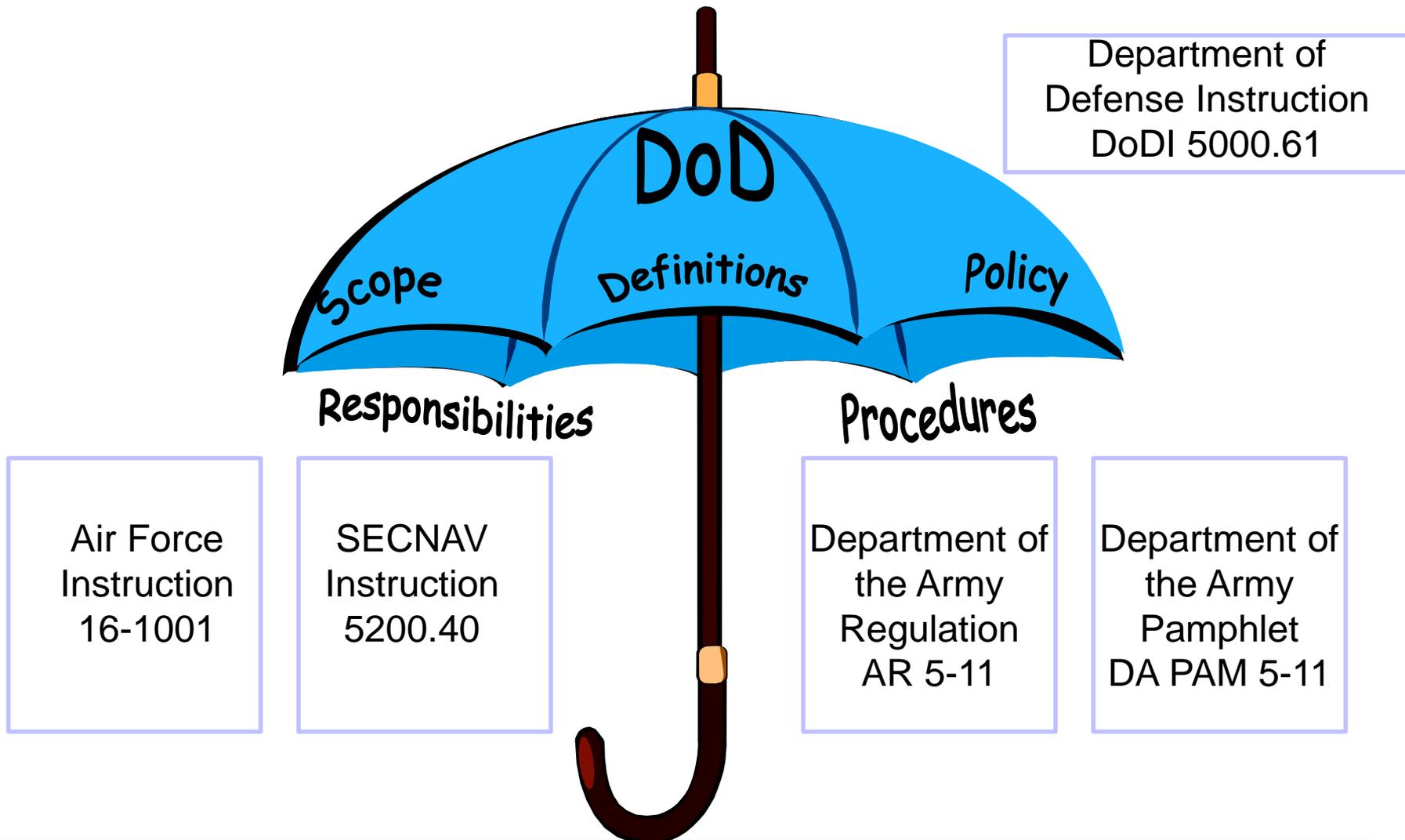
# Observations

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- 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



# Relevant DoD and Service VV&A Policy and Guidance

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## 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**)
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# DoDI 5000.61 Historical Overview

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- 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**

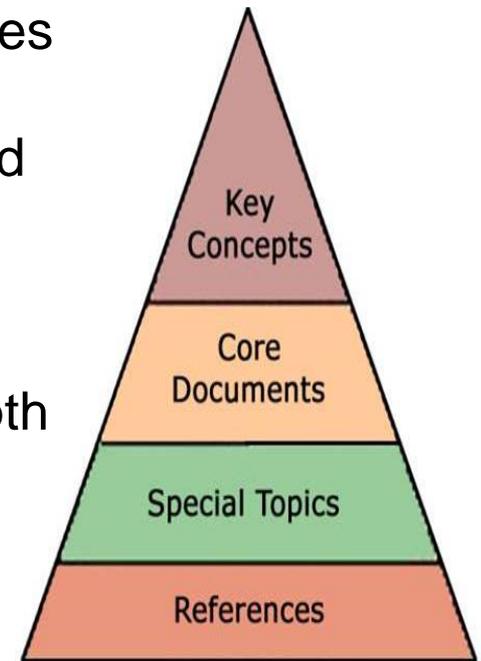
**<http://www.dtic.mil/whs/directives/corres/pdf/500061p.pdf>**

# DoD VV&A

## Recommended Practices Guide

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- **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.msco.mil](http://vva.msco.mil)**

# Scope of RPG Update

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- 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

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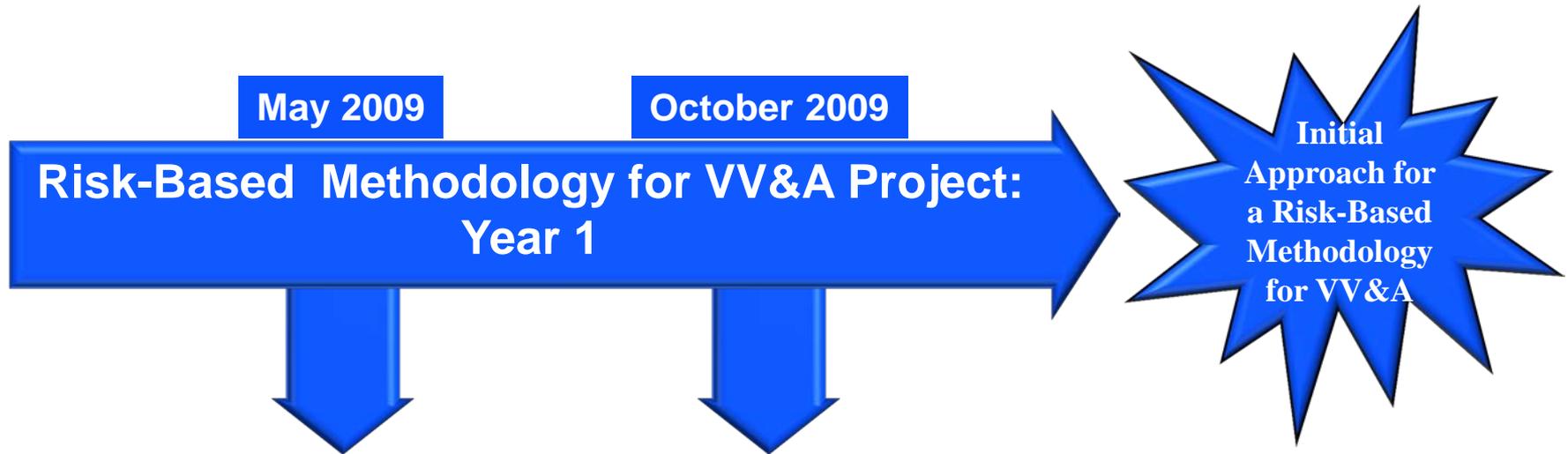
The DoD M&S Steering Committee funded the Risk Based VV&A effort to support **more efficient and effective VV&A implementation**. This methodology provides a means to:

- 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)

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## Literature Survey

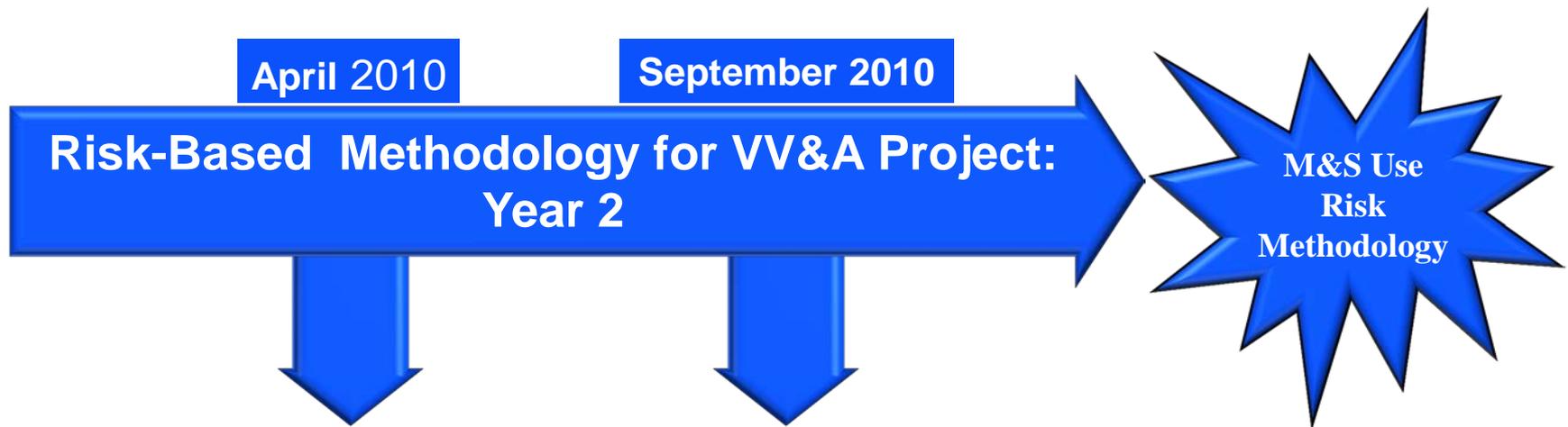
- Collected > 350 references
- Organized references into 6 categories:
  - Decision making
  - Risk management
  - Risk assessment
  - Uncertainty analysis
  - VV&A
  - General techniques

## 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)

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## Risk Based VV&A Concepts Presented to:

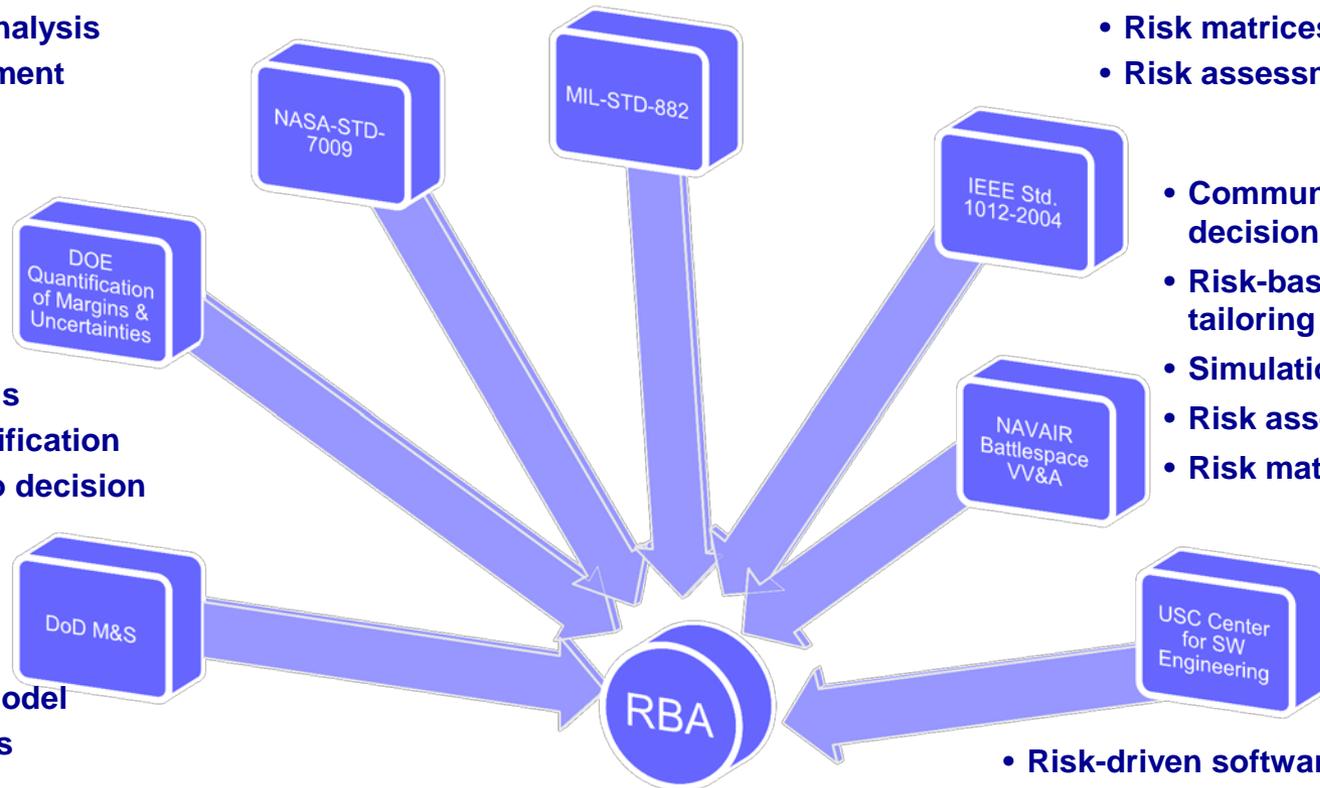
- The Simulation Interoperability Workshop VV&A Forum
- The Acquisition Modeling and Simulation Working Group (AMSWG)
- The Technical Cooperation Program Action Area 12 (VV&A) Task Group
- The AMSWG VV&A Sub-Committee
- The NDIA Systems Engineering M&S Committee Meeting
- The Military Operations Research 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



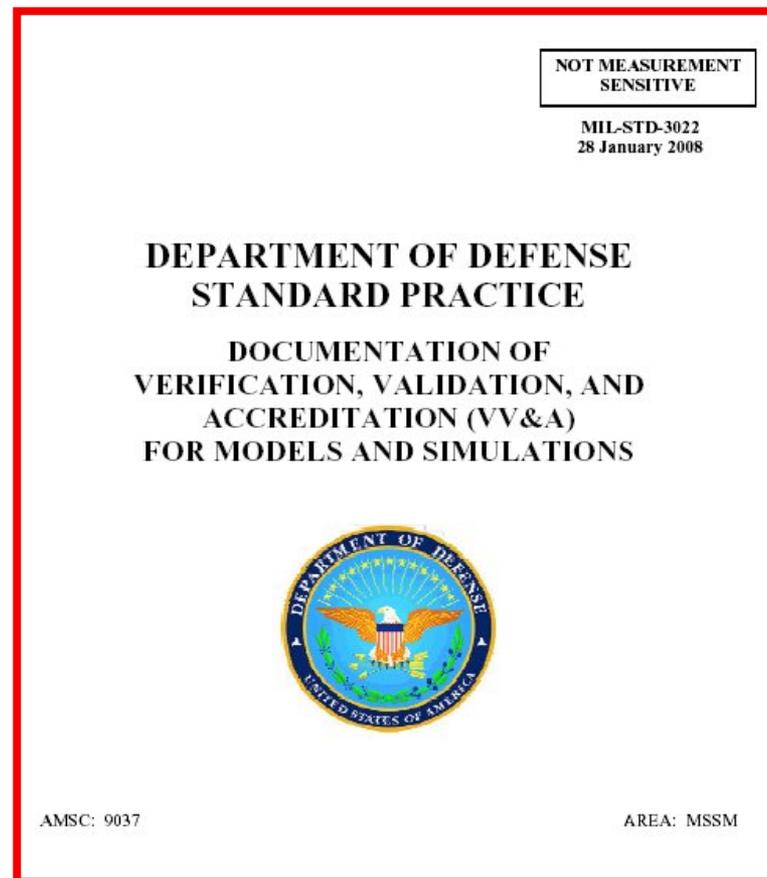
- Communication to decision makers
- Risk-based VV&A tailoring
- Simulation importance
- Risk assessment
- Risk matrices

- Risk-driven software development
- Spiral development model

- Confidence ratios
- Sensitivity analysis
- Uncertainty quantification
- Communication to decision makers
- V&V Composite Model
- Validation Process Maturity

# 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



**Free: Available from the Acquisition Streamlining and Standardization Information System (ASSIST)**

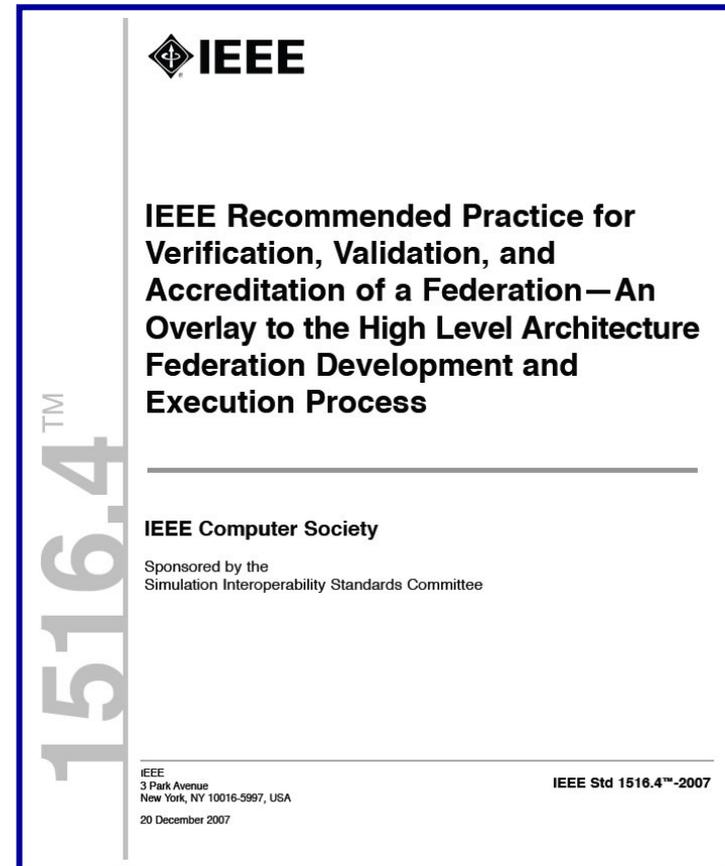
# Standard Intended Use & Tailoring

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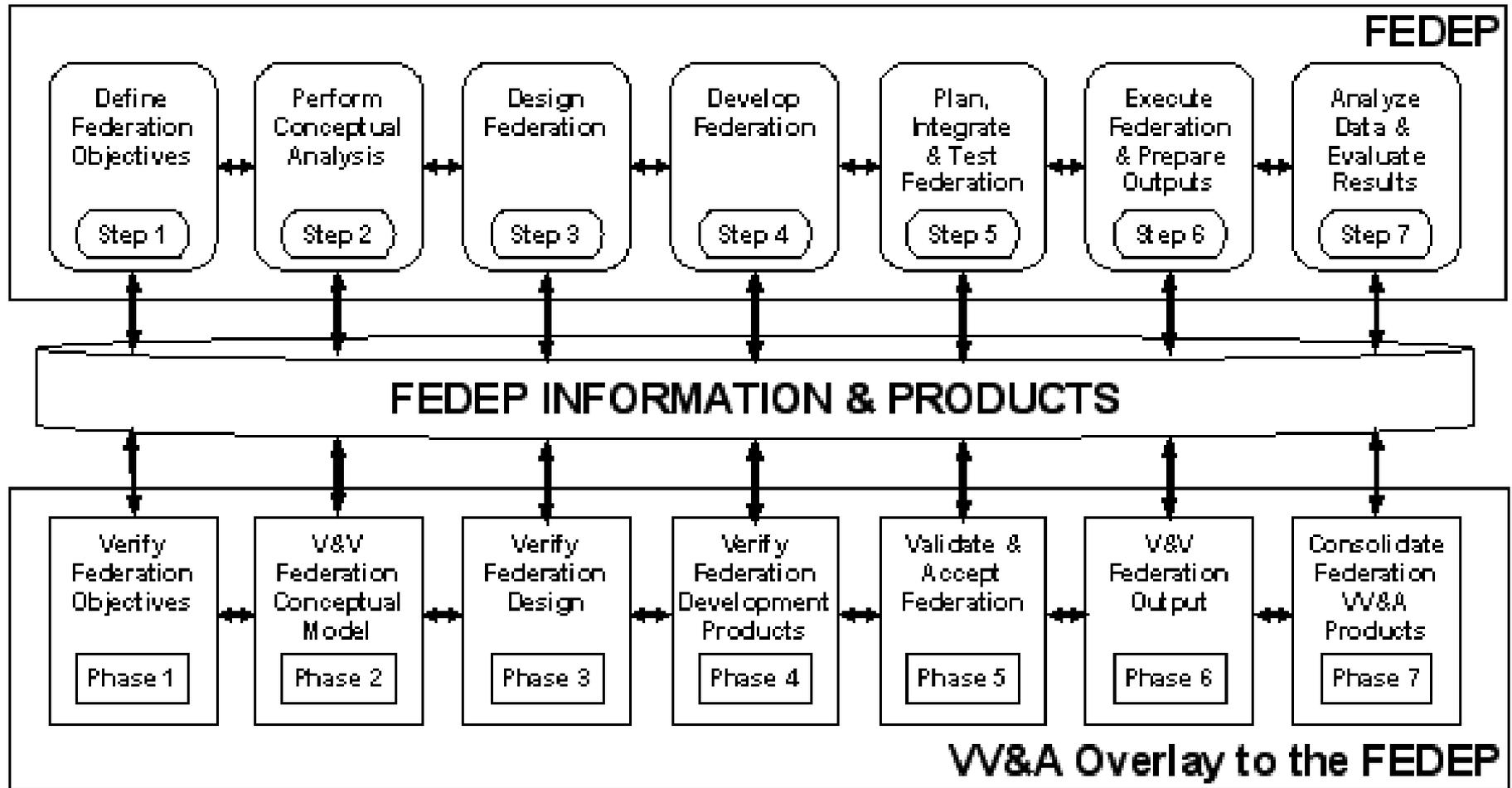
- Intended to support VV&A of DoD models, simulations, federations, and other types of distributed simulations by providing a common framework for documenting information produced during the VV&A processes.
- Specifies procedures on documenting information obtained through implementing the VV&A processes 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

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- MIL-STD-3022, Documentation of Verification, Validation, and Accreditation for Models and Simulations, 28 Jan 2008
  - <https://assist.daps.dla.mil/quicksearch/>
- IEEE Std 1516.4™-2007, IEEE Recommended Practice for Verification, Validation, and Accreditation of a Federation—An Overlay to the High Level Architecture Federation Development and Execution Process, 20 December 2007
  - <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/>

# Contact Information

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For more information on DoD VV&A Efforts and the M&S Use Risk Methodology Contact :

Fred Hartman (IDA)

[Fhartman@ida.org](mailto:Fhartman@ida.org)

(703) 578-2776

Simone Youngblood (JHU/APL) at

[Simone.Youngblood@jhuapl.edu](mailto:Simone.Youngblood@jhuapl.edu)

(240) 228-7958

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# Questions?

# DoD VV&A Policy, Guidance and Standards Discussed

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- DoD VV&A Policy: DoDI 5000.61 “DoD M&S VV&A”
- DoD VV&A Guidance: The VV&A Recommended Practices Guide (RPG)
- 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

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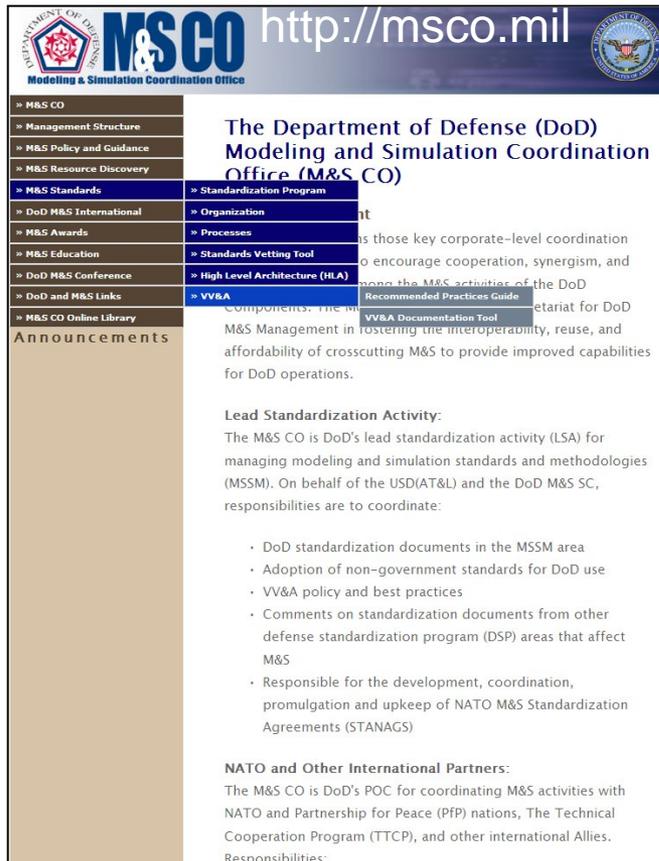
- **US Coast Guard, COMDTINST 5200.40, 22 Dec 2006**
- **NASA-STD-7009, July 11, 2008**
- **IEEE Std 1278.4-1997 DIS VV&A**
- **IEEE Std 1516.4-2007 HLA FEDEP VV&A Overlay**
- **AIAA G-077-1998, Computational Fluid Dynamics, January 14, 1998**
- **ASME PTC 60/V&V 10, Computational Solid Mechanics, July 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

Accreditation Plan	V&V Plan	V&V Report	Accreditation Report
Executive Summary	Executive Summary	Executive Summary	Executive Summary
<i>1 Problem Statement</i>	<i>1 Problem Statement</i>	<i>1 Problem Statement</i>	<i>1 Problem Statement</i>
<i>2 M&amp;S Requirements and Acceptability Criteria</i>	<i>2 M&amp;S Requirements and Acceptability Criteria</i>	<i>2 M&amp;S Requirements and Acceptability Criteria</i>	<i>2 M&amp;S Requirements and Acceptability Criteria</i>
<i>3 M&amp;S Assumptions, Capabilities, Limitations &amp; Risks/Impacts</i>	<i>3 M&amp;S Assumptions, Capabilities, Limitations &amp; Risks/Impacts</i>	<i>3 M&amp;S Assumptions, Capabilities, Limitations &amp; Risks/Impacts</i>	<i>3 M&amp;S Assumptions, Capabilities, Limitations &amp; Risks/Impacts</i>
4 Accreditation Methodology	4 V&V Methodology	4 V&V Task Analysis	4 Accreditation Assessment
5 Accreditation Issues	5 V&V Issues	5 V&V Recommendations	5 Accreditation Recommendations
<i>6 Key Participants</i>	<i>6 Key Participants</i>	<i>6 Key Participants</i>	<i>6 Key Participants</i>
7 Planned Accreditation Resources	7 Planned V&V Resources	7 Actual V&V Resources Expended	7 Actual Accreditation Resources Expended
		8 V&V Lessons Learned	8 Accreditation Lessons Learned
<u>Suggested Appendices</u> <i>A M&amp;S Description</i> <i>B M&amp;S Requirements Traceability Matrix</i> <i>C Basis of Comparison</i> <i>D References</i> <i>E Acronyms</i> <i>F Glossary</i> G Accreditation Programmatic H Distribution List	<u>Suggested Appendices</u> <i>A M&amp;S Description</i> <i>B M&amp;S Requirements Traceability Matrix</i> <i>C Basis of Comparison</i> <i>D References</i> <i>E Acronyms</i> <i>F Glossary</i> G V&V Programmatic H Distribution List I Accreditation Plan	<u>Suggested Appendices</u> <i>A M&amp;S Description</i> <i>B M&amp;S Requirements Traceability Matrix</i> <i>C Basis of Comparison</i> <i>D References</i> <i>E Acronyms</i> <i>F Glossary</i> G V&V Programmatic H Distribution List I V&V Plan J Test Information	<u>Suggested Appendices</u> <i>A M&amp;S Description</i> <i>B M&amp;S Requirements Traceability Matrix</i> <i>C Basis of Comparison</i> <i>D References</i> <i>E Acronyms</i> <i>F Glossary</i> G Accreditation Programmatic H Distribution List I Accreditation Plan J V&V Report

*Information that is common and shared across the documents appears in italicized font in the table above*

# DoD VV&A Documentation Tool



The screenshot shows the M&SCO website home page. The header includes the M&SCO logo and the URL <http://msco.mil>. A navigation menu on the left lists various categories such as M&S CO, Management Structure, M&S Policy and Guidance, M&S Resource Discovery, M&S Standards, DoD M&S International, M&S Awards, M&S Education, DoD M&S Conference, DoD and M&S Links, and M&S CO Online Library. The main content area features the title "The Department of Defense (DoD) Modeling and Simulation Coordination Office (M&S CO)" and a list of key activities and responsibilities, including Standardization Program, Organization, Processes, Standards Vetting Tool, High Level Architecture (HLA), and VV&A. A section titled "Lead Standardization Activity:" describes the M&S CO's role in managing modeling and simulation standards and methodologies (MSSM). A bulleted list details responsibilities such as coordinating standardization documents, adopting non-government standards, and managing STANAGS. A section titled "NATO and Other International Partners:" describes the M&S CO's role in coordinating M&S activities with NATO and other international partners.



The screenshot shows the DoD VV&A Documentation Tool (DVDT) page. The header includes the M&SCO logo and the URL <http://msco.mil>. A navigation menu on the left lists various categories such as M&S CO, Management Structure, M&S Policy and Guidance, M&S Resource Discovery, M&S Standards, DoD M&S International, M&S Awards, M&S Education, DoD M&S Conference, DoD and M&S Links, and M&S CO Online Library. The main content area features the title "DoD VV&A Documentation Tool (DVDT)" and a detailed description of the tool's purpose and development. The text states that the DVDT is a Department of Defense (DoD) Modeling and Simulation (M&S) project sponsored by the M&S Steering Committee (M&S SC) and DoD Acquisition Community to provide consistent M&S VV&A documentation across DoD. The scope of the project includes three major tasks: recommend updates to associated policy, guidance, and standards documents; develop VV&A Extended Markup Language (XML) schemas and VV&A ontology for M&S; and develop DoD VV&A Documentation Tool (DVDT). The DVDT was developed by a Tiger Team, led by the Navy M&S Office (NMSO) to automate a set of standard templates based on Military Standard 3022 (MIL-STD-3022). These templates are the four core products of the M&S VV&A processes: Accreditation Plan, V&V Plan, V&V Report, and Accreditation Report. The DVDT consists of two parts: 1) Ability for users to register on the VV&A Documentation Tool website and obtain the templates and 2) The local use of the downloaded templates for completing the four documents that make up the VV&A documentation package. The DoD VV&A Documentation Tool (DVDT) is located [here](#).

Implements MIL-STD 3022 and Data Item Descriptions  
DI-MSSM-81750 - DI-MSSM-81751 - DI-MSSM-81752 - DI-MSSM-81753

# DoD VV&A Documentation tool

The screenshot shows the homepage of the DoD VV&A Documentation Tool (DVDT). The header features the DoD M&S logo and the title "VV&A Documentation Tool". A navigation menu on the left includes sections for "VV&A ASSISTANCE" (M&S Interview, DoD VV&A RPG, MIL-STD-3022, Data Item Descriptions, Supporting Resources) and "TOOL OPTIONS" (Register, Search, Log In, Help, Feedback). The main content area is titled "Welcome to the DoD VV&A Documentation Tool (DVDT)" and provides an overview of the tool's purpose: to capture VV&A information in a consistent form and content, supporting various DoD- and Service-level Communities by producing standardized VV&A documentation and meeting net-centric architecture requirements. It also describes how the DVDT automates the standardized DoD VV&A documentation templates formalized in the DoD Standard Practice Documentation of Verification, Validation, and Accreditation (VV&A) for Models and Simulations (MIL-STD-3022). A sidebar on the right displays the cover of the "DEPARTMENT OF DEFENSE STANDARD PRACTICE DOCUMENTATION OF VERIFICATION, VALIDATION, AND ACCREDITATION (VV&A) FOR MODELS AND SIMULATIONS" (MIL-STD-3022). The footer includes the URL <https://dvdn.nmso.navy.mil>, a row of military department logos, and the DoD M&S Tool Suite logo. A timestamp at the bottom left reads "Last Modified: 2/16/2010 7:59:01 AM Privacy & Security | Disclaimer | Freedom of Information | Webmaster".

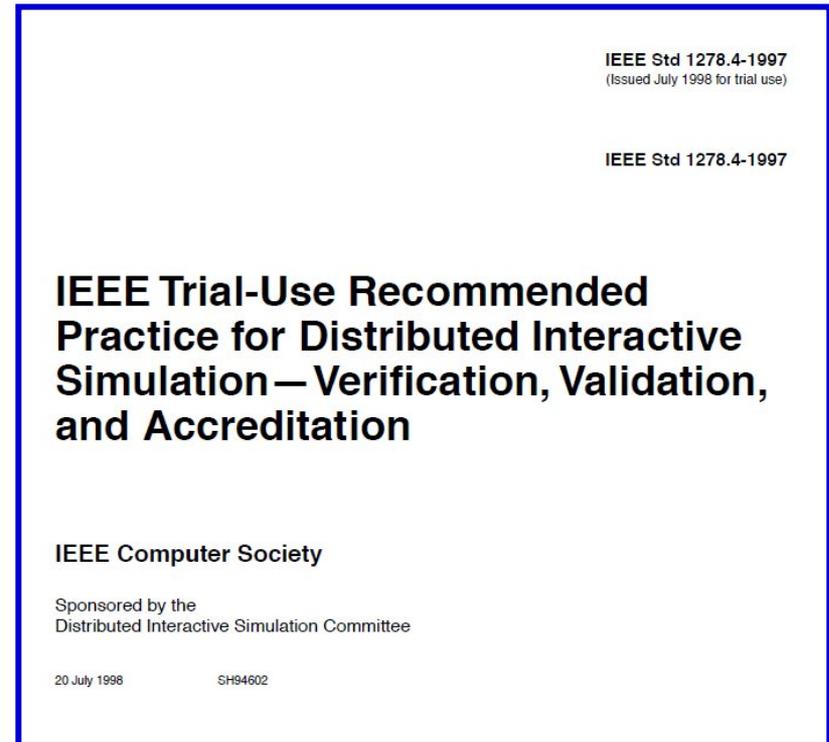
Producers register here or log in if already registered. There is online help for using the tool, as well as help for VV&A in general. The DVDT automates the MIL-STD-3022 documentation templates.

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.

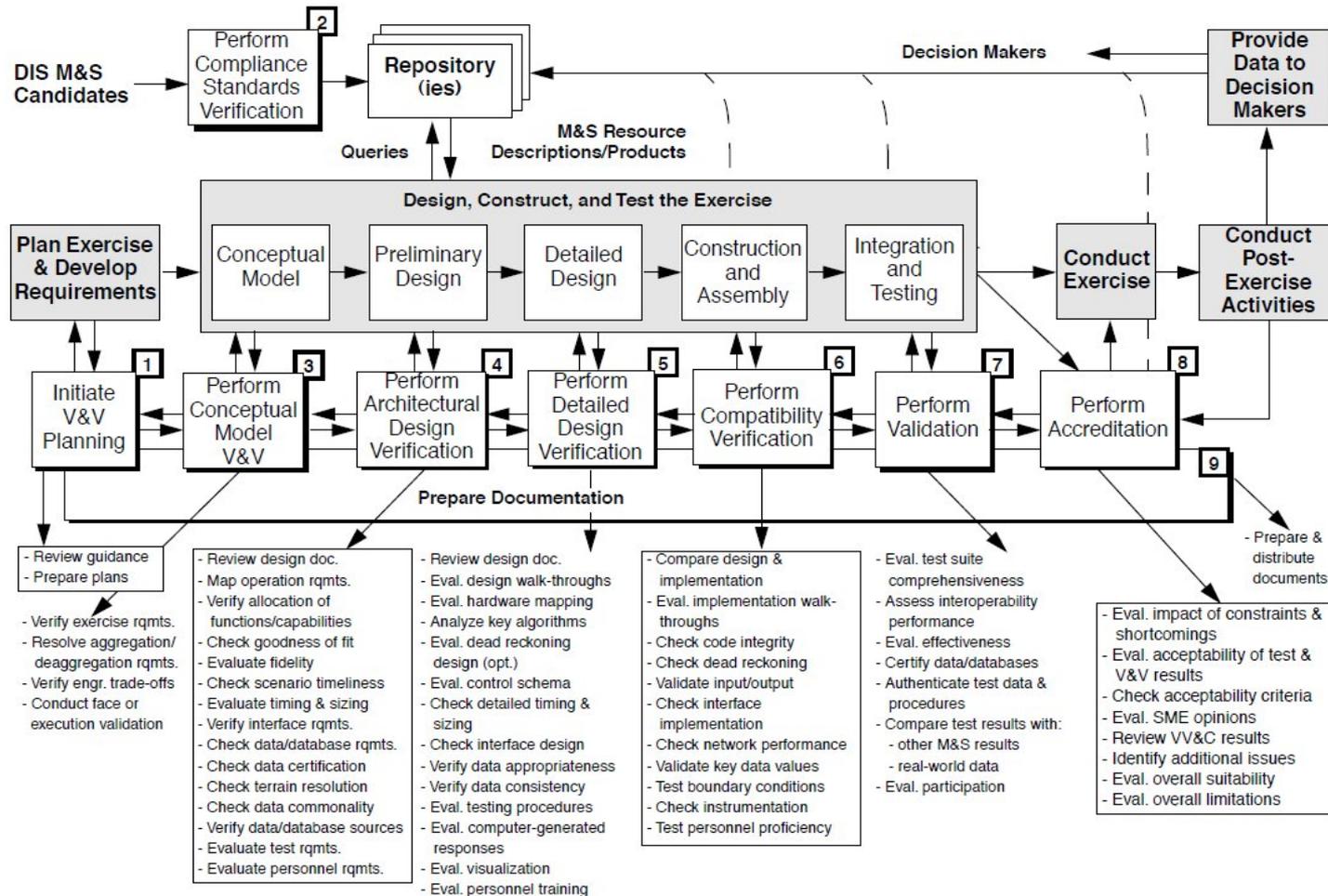
Register, log in, and create a project to download a set of XML-enabled document templates for local use. Compliant with DoD M&S Community of Interest Discovery Metadata Specification (MSC-DMS).

# 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

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