



2007-10-24

Standardized Documentation for Verification, Validation, and Accreditation - A Status Report to the Systems Engineering Community (presentation)



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National Defense Industrial Association
10th Annual
Systems Engineering Conference
Track 5 M&S Session 3B5
10:15 am - 12:00 pm

**Standardized Documentation for
Verification, Validation, and
Accreditation -
A Status Report to the Systems
Engineering Community**

Presented by
DoD M&S Project (DMSP)
Project Management Team (PMT)
October 24, 2007



Outline

- Introduction
- Background
- DoD M&S Project
- Concept of Operations
- Policy, Guidance & Standards
- DoD VV&A Documentation Tool
- Structured VV&A Data
- Summary



A Word from Our Sponsor

“Because M&S is a fundamental and essential tool for acquisition programs, planning for use of M&S throughout developmental test and evaluation must be an early consideration in test planning. Just as **M&S planning should be integral to** program acquisition plans and **systems engineering plans**, it should also be integral to the program Test and Evaluation Strategy and T&E Master Plan. **Important planning considerations include:** the use and reuse of M&S applications and data for T&E across the program lifecycle, **establishing credibility of M&S tools and data**, using M&S to predict live test results, and using live test results to improve the credibility of M&S.”

Chris DiPetto, Deputy Director
OUSD(AT&L)A&T/SSE/DT&E

March 26, 2007



Introduction

- Modeling and Simulation (M&S) is a key enabler in the acquisition process for systems engineers.
- Using M&S that provide credible results is crucial to fielding defense weapon systems to the warfighter.
- Credibility and confidence in the use of M&S results are achieved through implementation of Verification, Validation, and Accreditation (VV&A) processes.
- VV&A is critical for ensuring M&S is correct, is used correctly, and can produce results a systems engineer can trust.



DoD Directive 5000.59

- DoD Directive 5000.59, DoD M&S Management, 8 Aug 2007
- Sec 4.3: It is DoD policy that M&S management shall ... pursue common and cross-cutting M&S tools, data, and services to achieve DoD's goals
- Sec 5.1.3.5: The M&S SC shall ...
Oversee ... the implementation of best practices of how models and simulations are effectively acquired, developed, managed, and used by DoD Components (e.g., verification, validation, and accreditation; standards; and protocols).



Department of Defense DIRECTIVE

NUMBER 5000.59
August 8, 2007

USD(AT&L)

SUBJECT: DoD Modeling and Simulation (M&S) Management

References: (a) DoD Directive 5000.59, "DoD Modeling and Simulation (M&S) Management," January 4, 1994 (hereby canceled)
(b) Program Decision Memorandum (PDM), December 14, 2005¹
(c) DoD Directive 5105.18, "DoD Committee Management Program," February 8, 1999
(d) DoD 5000.59-M, "DoD Modeling and Simulation (M&S) Glossary," January 1998
(e) through (j), see Enclosure 1

1. REISSUANCE AND PURPOSE

This Directive:

- 1.1. Reissues Reference (a) to update policy and responsibilities for DoD M&S management, per Reference (b).
- 1.2. Establishes the DoD M&S Steering Committee (M&S SC) under the provisions of Reference (c).
- 1.3. Authorizes the development of DoD Publications as needed and continues to authorize Reference (d), consistent with DoD 5025.1-M (Reference (e)).

2. APPLICABILITY

2.1. This Directive applies to the Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Joint Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within the Department of Defense (hereafter referred to collectively as the "DoD Components").

¹ Available from the Director, Program Analysis and Evaluation



DoD Instruction 5000.61

- DoD Instruction 5000.61, DoD M&S VV&A, 13 May 2003
- Sec 4.1: It is DoD policy that ... Models and simulations used to support major DoD decision-making organizations and processes ... shall be accredited for that specific purpose
- Sec 6.4: VV&A information shall be documented



Department of Defense INSTRUCTION

NUMBER 5000.61
May 13, 2003

USD(A&L)

SUBJECT: DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)

- References: (a) DoD Instruction 5000.61, "DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)," April 29, 1996 (hereby canceled)
- (b) [DoD Directive 5000.59](#), "DoD Modeling and Simulation (M&S) Management," January 4, 1994
- (c) [DoD 5025.1-M](#), "Department of Defense Directives System Procedures," March 5, 2003
- (d) [DoD Directive 5141.2](#), "Director of Operational Test and Evaluation (DOT&E)," May 25, 2000
- (e) through (p), see enclosure 1

1. REISSUANCE AND PURPOSE

This Instruction:

- 1.1. Reissues reference (a) to implement policy, assign responsibilities, and prescribe procedures under reference (b) for the verification, validation, and accreditation (VV&A) of DoD models and simulations and their associated data.
- 1.2. Authorizes publication of DoD 5000.61-G, "DoD Verification, Validation, and Accreditation Guide," consistent with DoD 5025.1-M (reference (c)).

2. APPLICABILITY AND SCOPE

This Instruction applies to:



Need

- Since 1996 organizations DoD-wide have been implementing VV&A processes and capturing VV&A information
- Plethora of DoD-, Service-, and organization-level documentation guidance
 - No consistency in formats and content descriptions
- No easy method to identify published VV&A information



Importance of VV&A Information

- Documenting VV&A information consistently across DoD yields many returns including the capability to share that information with future users of M&S.
- VV&A information tells a potential user about
 - M&S assumptions (simplifications and potential failure points)
 - M&S capabilities (what the M&S can be used to do)
 - M&S limitations (what it should not be used to do)
- VV&A information saves potential users time and money finding an M&S that satisfies or partially satisfies their needs to use M&S.



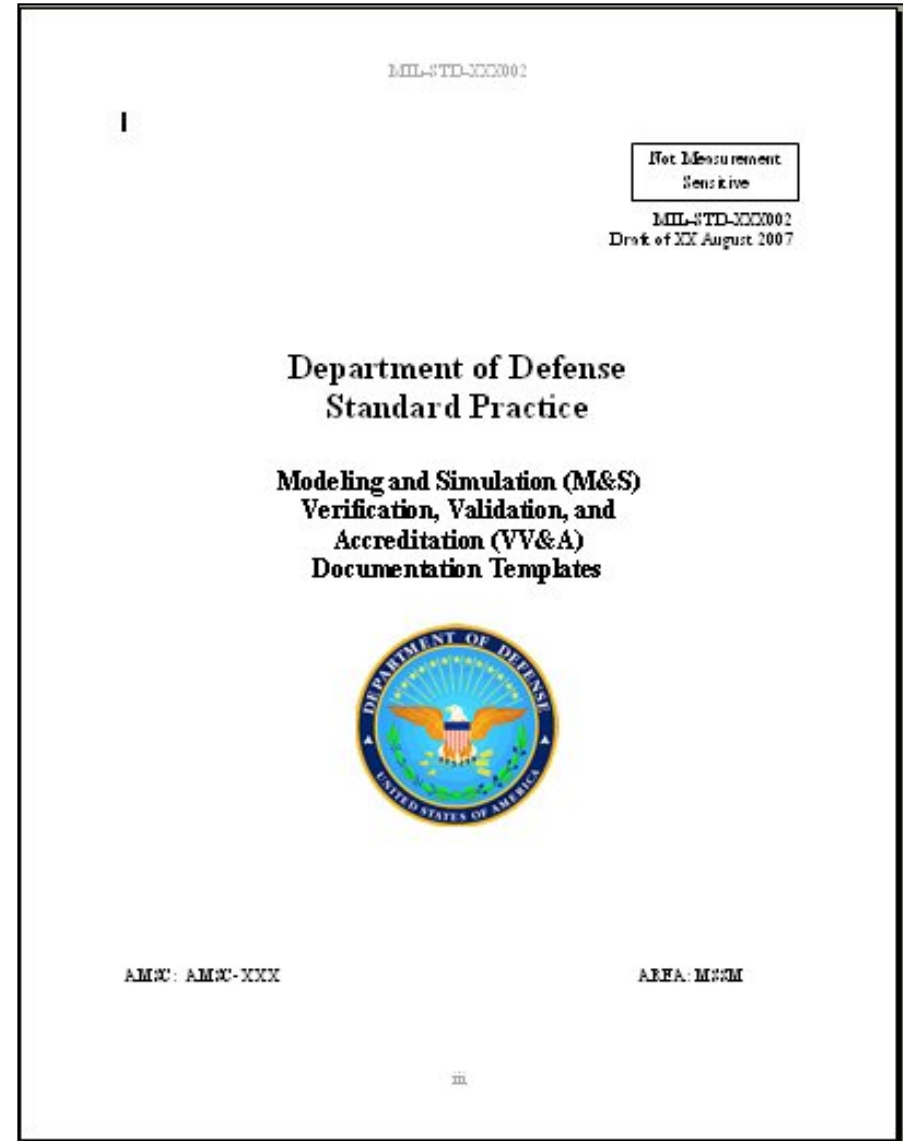
Background

- In 2005, a 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
- Purpose was to enable expanded M&S reuse by building foundation for consistent V&V information to support accreditation decisions.
- Templates resulted in draft DoD Standard Practice
 - M&S VV&A Documentation Templates (MIL-STD-XXX002)
 - provides common framework for sharing information throughout VV&A processes
 - using templates helps users better understand if M&S can meet their needs
 - templates make it easy to know
 - what kind of information is available
 - where to look in the document for that information
- Templates automated by DoD VV&A Documentation Tool (DVDT)



MIL-STD-XXX002 (draft)

- MIL-STD-XXX002 (draft) DoD Standard Practice “M&S VV&A Documentation Templates”
- Specifies procedures on documenting information obtained through implementing the VV&A processes for M&S when their outputs will be used to supplement decision making in DoD.
- May be cited as solicitation requirements.
- Guidance should be applied in accordance with the scope of the specific purpose for using M&S.



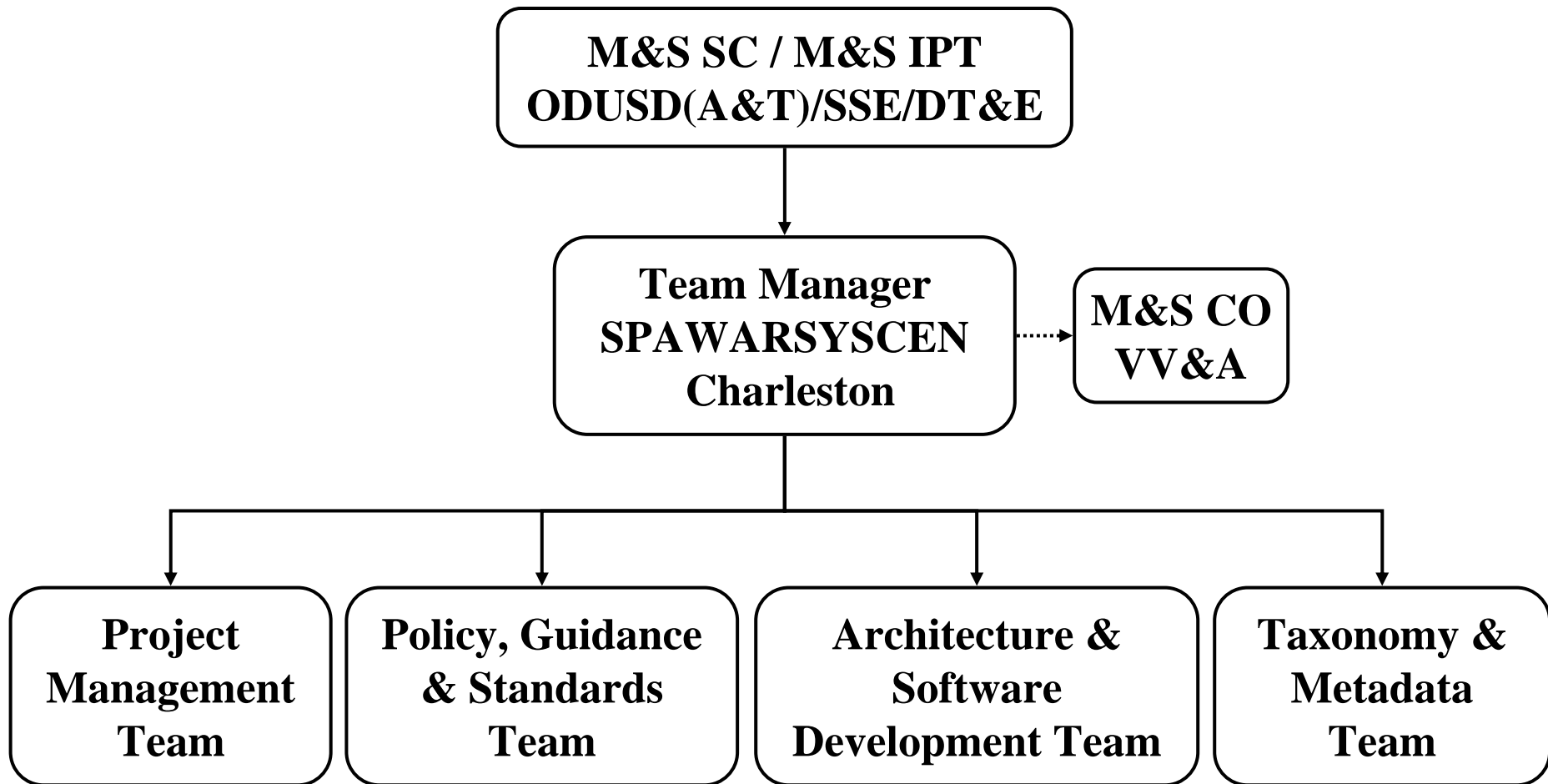


DoD M&S Project

- Sponsor: Department of Defense (DoD)
M&S Steering Committee
(M&S SC)
- Oversight: Acquisition Community Lead
- Project title: Standardized Documentation
for VV&A



Project Management Structure





Project Scope

- Three major tasks and associated deliverables:
 - recommend updates to associated policy, guidance, and standards documents
 - develop VV&A XML schema and VV&A ontology for M&S
 - produce DVDT



M&S Practices Gaps

- Address gaps documented in M&S SC Common and Cross-Cutting Business Plan
- **REUSE**
 - Potential users find it difficult to
 - locate, access, and assess M&S resources and to identify potential reuse candidates
 - clearly understand the capabilities of candidate model and simulation resources
 - assess the difference between the functionality of reuse candidates and the capabilities that are needed
- **VV&A**
 - There is no mature method for deriving VV&A costs
 - Standardized VV&A documentation templates are needed

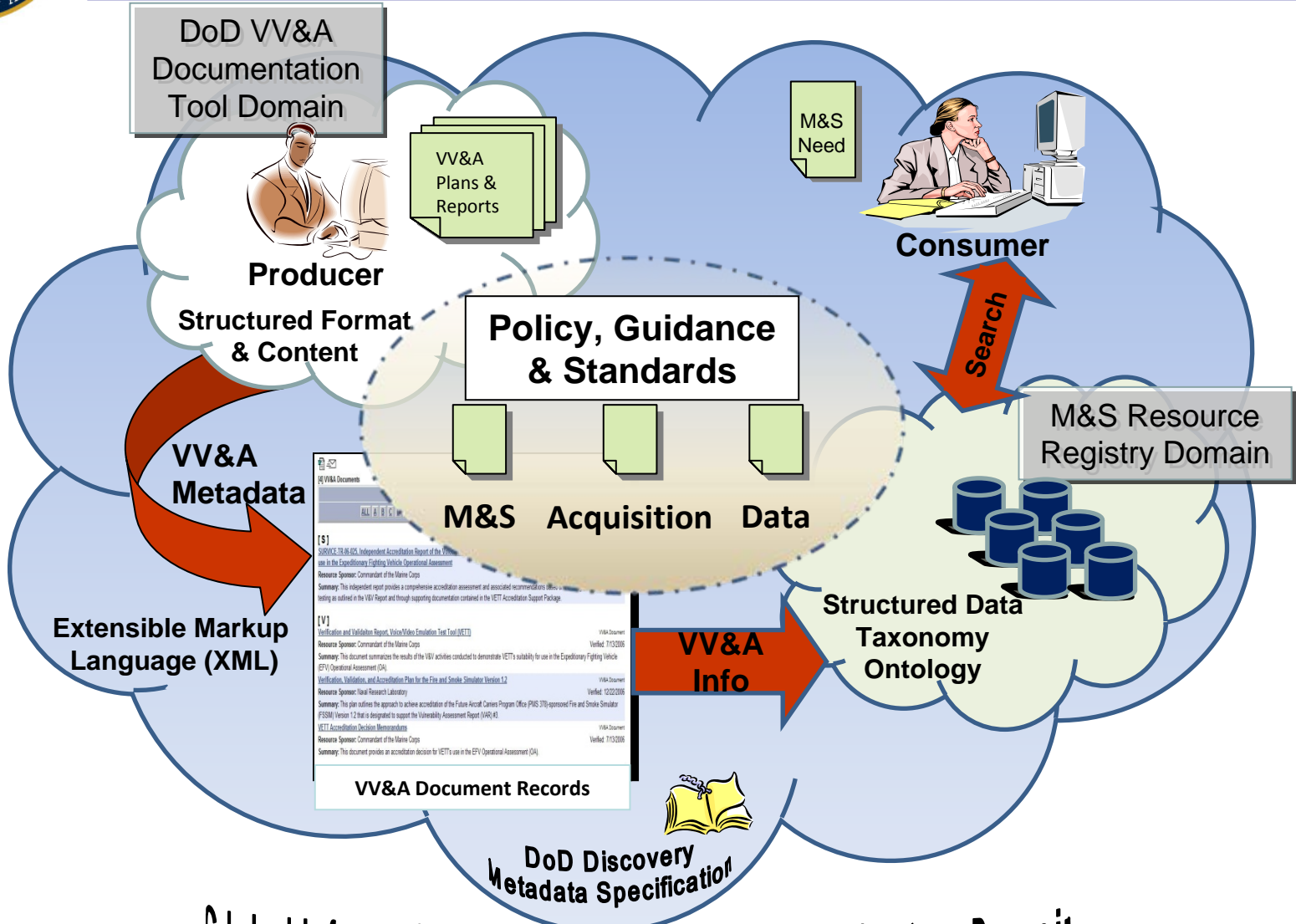


Acquisition Objectives & Actions

- Address objectives and actions identified in the DoD Acquisition M&S Master Plan
- **OBJECTIVES**
 - Obj 2: Enhance the technical framework for M&S
 - Obj 4: Improve M&S use
- **ACTIONS**
 - Establish a standard template of key characteristics (metadata) to describe reusable M&S resources
 - Enhance the means (e.g., directory service, registries, bulletin boards) to discover the existence of reusable resources required for M&S and contact information
 - Require standardized documentation of VV&A DoD-wide



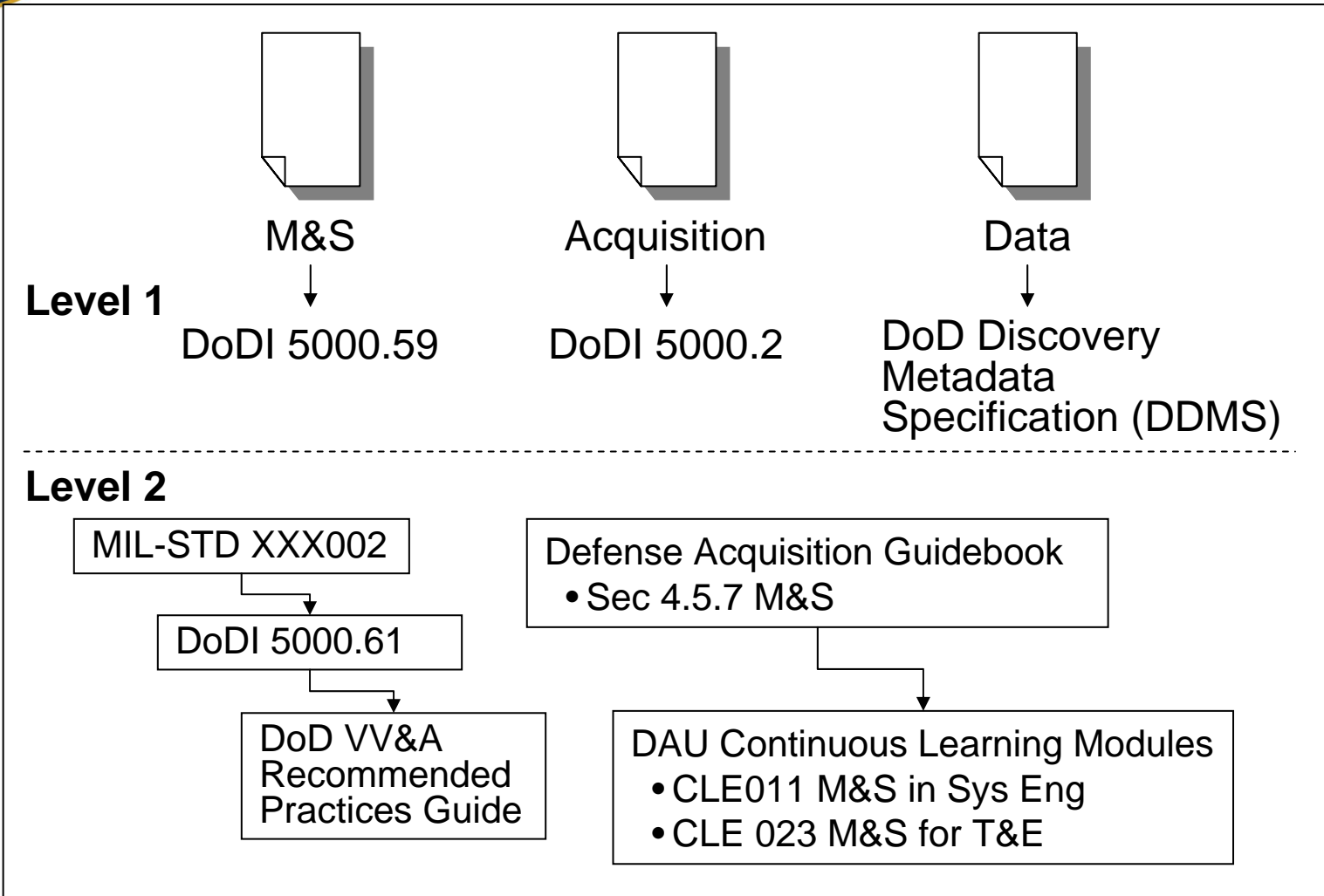
Concept of Operations



Global Information Grid Service - Oriented Architecture Domain



Policy, Guidance & Standards



VV&A information is important not only for the decision at hand, but for future decisions to reuse M&S

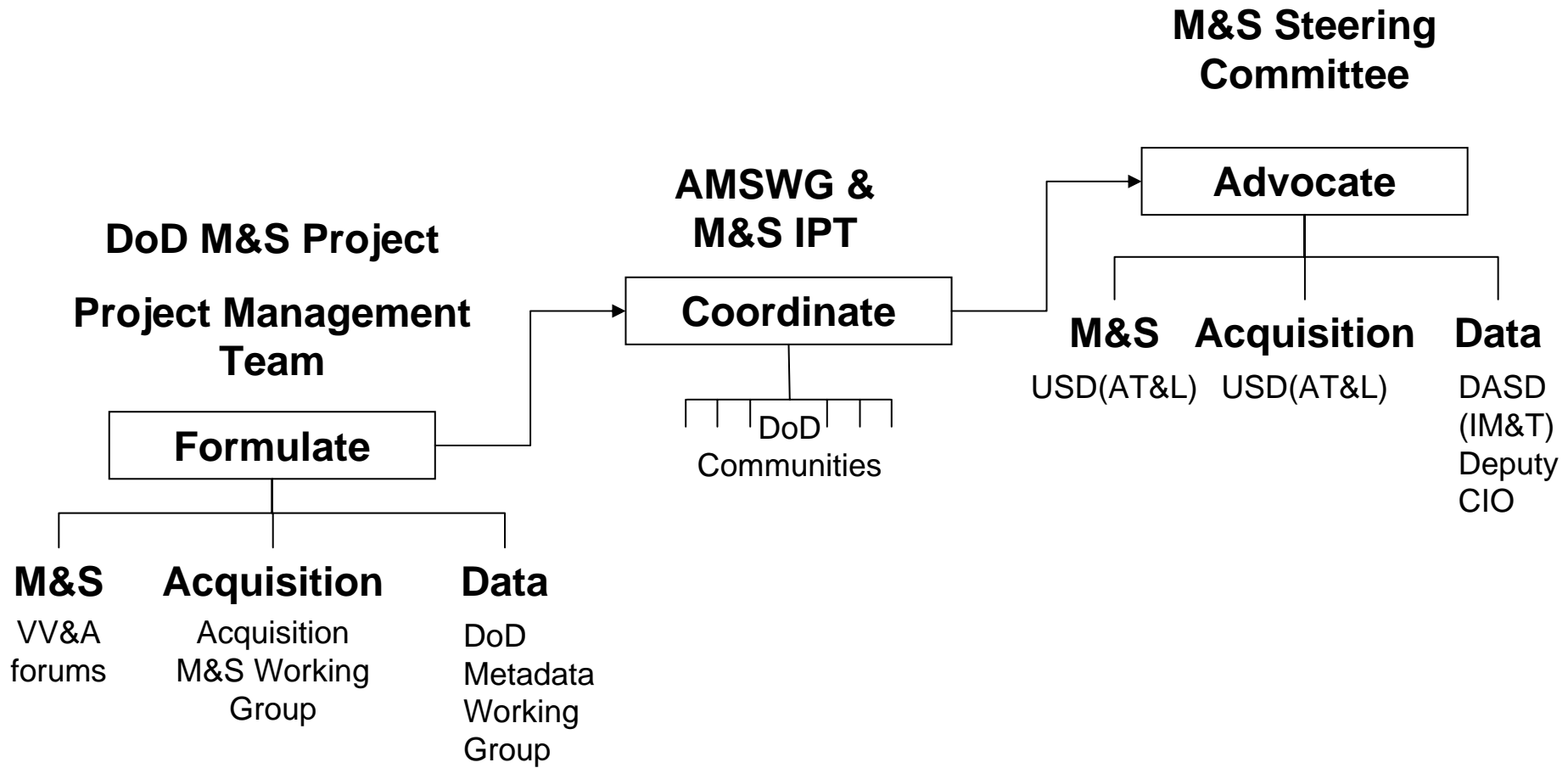


Policy, Guidance & Standards

- Develop recommended changes to policy, guidance, and standards documents to advocate:
 - making the standardized templates a MIL-STD
 - using standardized templates for documenting VV&A
 - automating production of VV&A information
- Provide recommendations to Acquisition M&S Working Group
- Deliver recommendations to Acquisition member of M&S Steering Committee (M&S SC):
 - formally request changes to related policy, guidance, and standards documents through Communities

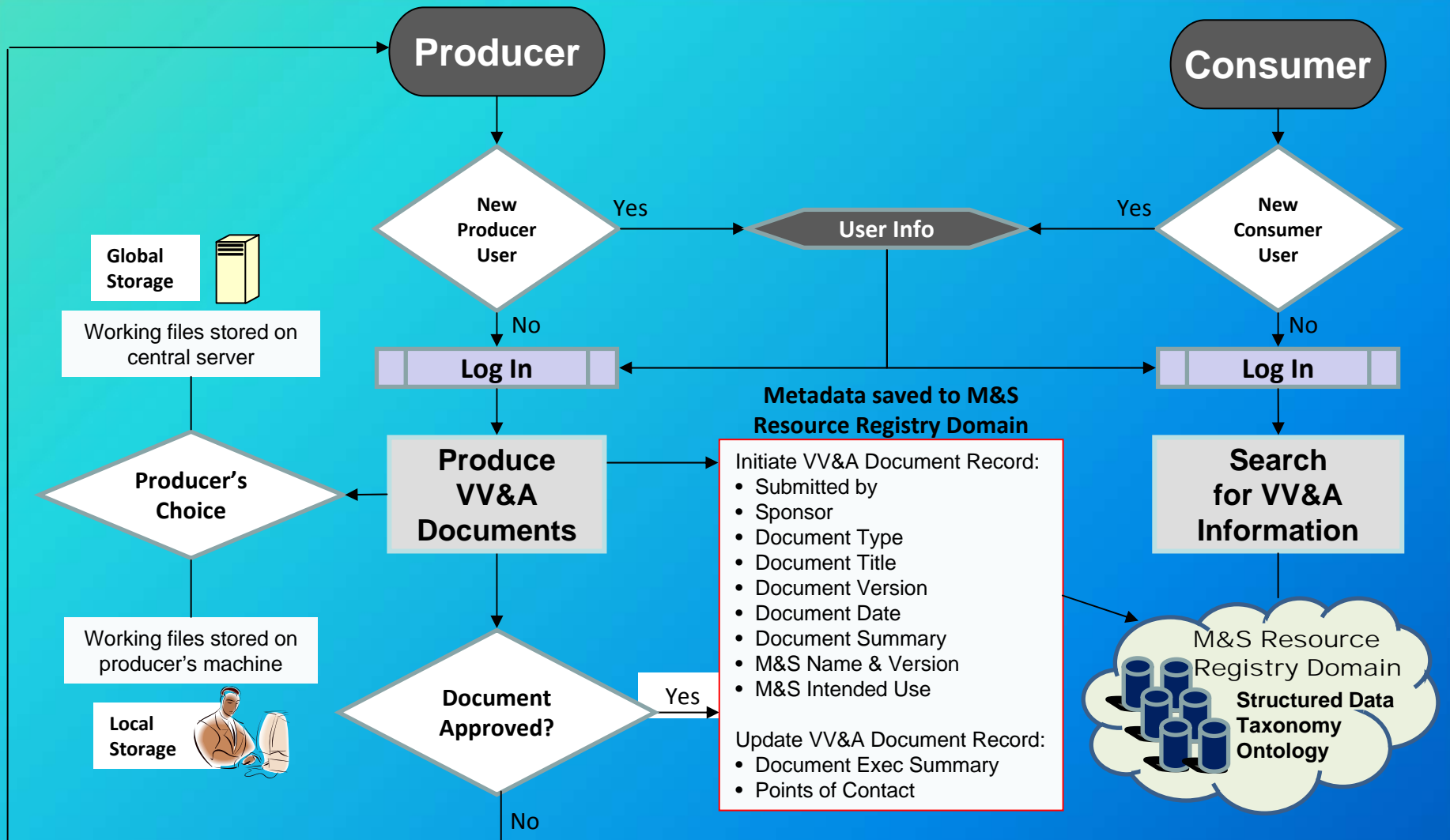


Policy, Guidance & Standards Recommendations





Producer / Consumer View





DoD VV&A Documentation Tool (DVDT)

- Technology development effort to automate standard DoD VV&A templates
- Benefits to automation
 - expedites VV&A documentation production process
 - ensures standardization of content and format across DoD
 - ensures compliance with policy and guidance
 - guides Producer through the VV&A processes
 - enables content consistency and completeness across all Communities
 - facilitates and contributes to M&S reuse
 - provides quality and complete VV&A information to stakeholders faced with making decisions on the application of M&S results
 - provide standardized methods to communicate VV&A information at appropriate levels of detail
 - ensures appropriate/useful metadata is extracted and posted



DVDT (1)

JVDT - Test 1 - Windows Internet Explorer

http://dodvdt.crata.af.edu/jvdt

Accreditation Plan | **V&V Plan** | Accreditation Report | V&V Report | Logout

Current M&S Project Name: Test 1 JVDT Beta 1: 01.19.2007

Current Project: Example Project: CVN-21

File

- Accreditation Plan
 - Title Page
 - Accreditation Plan Executive Summary
- 1. Problem Statement
- 2. M&S Requirements and Acceptability Criteria
- 3. M&S Assumptions, Capabilities, Limitations & Risks/Impacts
- 4. Accreditation Methodology
- 5. Accreditation Issues
- 6. Key Participants
- 7. Planned Accreditation Resources

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

- V&V Plan
- Accreditation Report
- V&V Report

Accreditation Plan Executive Summary

The goal of effective Modeling and Simulation (M&S) reuse requires data to be visible and exchanged as openly and freely as possible. Resource sharing of M&S is consistent with the DoD Net-Centric Data strategy (NCDS) and with DON CIO direction for Service-Oriented Architecture (SOA) which ensures that all services are visible, trusted, accessible and usable. The following approaches can assist the Navy in moving to an enterprise approach in identifying and exposing information on M&S for Navy use:

- Identify authoritative data sources that contain M&S information and data, and expose the information via a portal using SOA standards and business rules. By using existing authoritative data sources the burden of maintaining the databases remains with the data owners that will keep them up to date.
- Expose existing repositories of models that are available to be downloaded like NRL's SimDisk and the IAC for survivability assessment models.
- Use tools like the VV&A Documentation tool, due to be beta tested in FY08, which will store metadata on M&S that is going through the VV&A process. This information will be searchable via a portal allowing users to identify existing M&S and the associated VV&A information

[Edit Accreditation Plan Executive Summary](#)

Accreditation Plan Executive Summary

The executive summary provides an overview of the Accreditation Plan. It should be a synopsis, two to four pages in length, of the major elements from all sections of the document, with emphasis on accreditation scope, M&S requirements and acceptability criteria, accreditation methodology, and accreditation issues.



DVDT (2)

JVDT - Test 1 - Windows Internet Explorer

http://dodvdt.crata.af.edu/jvdt

Accreditation Plan | **V&V Plan** | Accreditation Report | V&V Report | Logout

Current M&S Project Name: Test 1 JVDT Beta 1: 01.19.2007

Current Project: Example Project: CVN-21

File

- Accreditation Plan
 - Title Page
 - Accreditation Plan Executive Summary
 - 1. Problem Statement
 - 2. M&S Requirements and Acceptability Criteria
 - 3. M&S Assumptions, Capabilities, Limitations & Risks/Impacts
 - 4. Accreditation Methodology
 - 5. Accreditation Issues
 - 6. Key Participants
 - 7. Planned Accreditation Resources
 - Appendix A - M&S Description
 - Appendix B - M&S Requirements Traceability Matrix**
 - Appendix C - Basis of Comparison
 - Appendix D - References
 - Appendix E - Acronyms
 - Appendix F - Glossary
 - Appendix G - Accreditation Programmatic
 - Appendix H - Distribution List
- V&V Plan
- Accreditation Report
- V&V Report

Requirements Traceability Matrix

List of Requirements

Section	Description	
1	Identify authoritative data sources that contain M&S information and data, and expose the information via a portal using SOA standards and business rules. By using existing authoritative data sources the burden of maintaining the databases remains with the data owners that will keep the data up to date.	Create New Edit Delete Acceptability Criteria
2	Identify existing authoritative M&S data sources like DoN Application Database Management System (DADMS)	Create New Edit Delete Acceptability Criteria

[Create New Requirement](#)

Appendix B - M&S Requirements Traceability Matrix

This appendix traces (e.g., in a table) the acceptability criteria and their measures and metrics to each M&S requirement. The M&S Requirements Traceability Matrix provides a visual demonstration of the degree to which a relationship can be established between the M&S requirements and associated acceptability criteria for accreditation (and eventually will visually demonstrate the totality of evidence collected during V&V implementation). As the M&S requirements provide the backbone of accreditation and its associated V&V effort, the clearer the articulation and detailed level of requirements and acceptability criteria, the more accurate and relevant the V&V. In this light, an M&S Requirements Traceability Matrix can be an invaluable tool in capturing the "one to one" tie between the Acceptability Criteria and the M&S Requirements.



DVDT (3)

JVDT - Test 1 - Windows Internet Explorer
http://dodvdt.crata.ucf.edu/jvdt#

File Edit View Favorites Tools Help

JVDT - Test 1

Accreditation Plan V&V Plan Accreditation Report V&V Report Logout

Current M&S Project Name: Test 1 JVDT Beta 1: 01.19.2007

Current Project Example Project: CVN-21

Print

- Accreditation Plan
- V&V Plan
 - Title Page
 - V&V Plan Executive Summary
- 1. Problem Statement
- 2. M&S Requirements & Acceptability Criteria
- 3. M&S Assumptions, Capabilities, Limitations & Risks/Impacts
- 4. V&V Task Methodology
- 5. V&V Issues
- 6. Key Participants
- 7. Planned V&V Resources
- 8. V&V Lessons Learned

- Appendix A - M&S Description
- Appendix B - Requirements Traceability Matrix
- Appendix C - Basis of Comparison
- Appendix D - References
- Appendix E - Acronyms
- Appendix F - Glossary
- Appendix G - V&V Programmatic
- Appendix H - Distribution List
- Appendix I - Accreditation Plan
- Appendix J - Test Information

- Accreditation Report
- V&V Report

Title of Abstract Journal:

Name of Dissertation or Article:

Include as much information as possible (if unavailable, leave blank):

Author of Orig. Work: Add

First M.I. Last

---Add Your Authors Here---

Name of Sponsoring University:

Year Dissertation was Given:

Volume of Abstract Journal:

Year of Journal Publication:

Page or Item Number:

Ex: 12-25, 46, 2568

Appendix D - References

This appendix identifies all of the references used in the development of this document.



DVDT (4)

JVDT - Test 1 - Windows Internet Explorer
http://dodvdt.crata.ucf.edu/jvdt

Accreditation Plan | **V&V Plan** | Accreditation Report | V&V Report | Logout

Current M&S Project Name: Test 1 JVDT Beta 1: 01.19.2007

Current Project: Example Project: CVN-21

Print

- Accreditation Plan
 - Title Page
 - Accreditation Plan Executive Summary
 - 1. Problem Statement
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V&V Plan
Accreditation Report
V&V Report

KeyParticipant was successfully created.

Key Participants List

Key Participant Type	Full Name	Key Participant Role	Organization	Address	City	State	Zip Code	Phone	DSN	Fax	E-mail
Accreditation Participant	Joe H. Tester	Accreditation Agent	NAVSEA	1 Main St	Springfield	MO	22222	999-9999	999-9999	999-777-9999	joe.h.testers@dod.

[New Key Participant](#)

Key Participants

This section identifies the participants involved in the V&V effort as well as the roles that they are assigned and their key responsibilities within that role. Roles and key responsibilities are defined during initial planning; names and contact information of the actual participants are added when they are determined. For each person serving as a Subject Matter Expert (SME), include a listing of the person's qualifications.



Structured VV&A Documents

- Effective data sharing requires the commonly understood representation of the data
- Defined and published data structures facilitate information exchange and application development

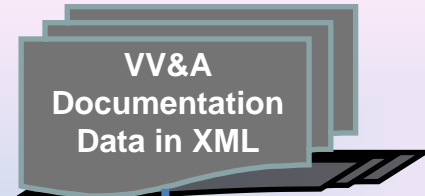
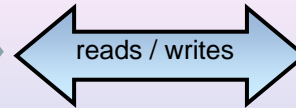


VV&A Documents (Structured Data and Semantics)

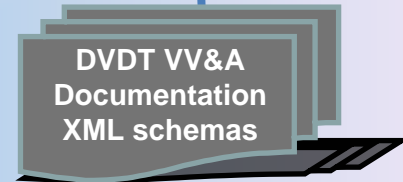


Producer

User employs the DVDT to create VV&A documents stored as XML files



XML data structure and content conforms to the DVDT schema



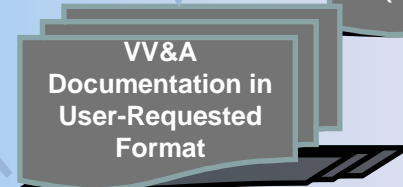
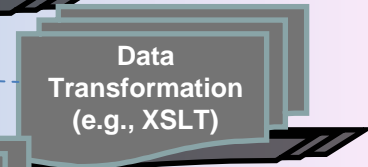
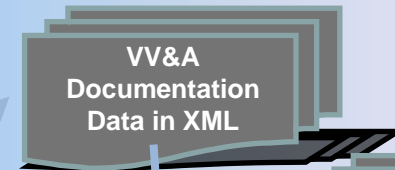
Structured Data stored in XML files and conforms to established XML schemas

Auto-Generation of Documentation from stored XML data



Producer

User opens VV&A documents in DVDT and generates products in desired formats (e.g., XML, HTML, PDF, DOC)

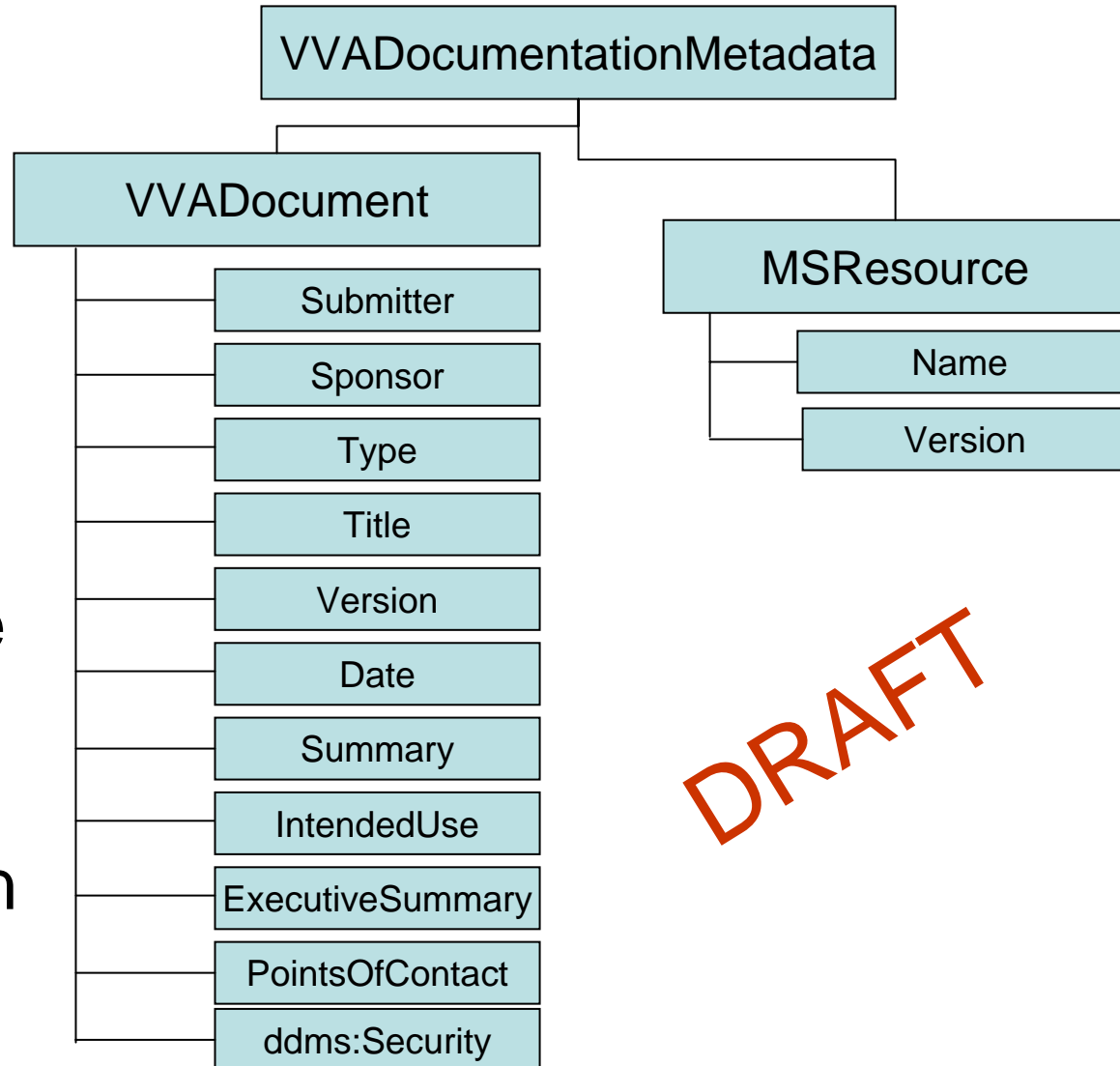


Auto-Generation of Documentation from stored XML data



VV&A Metadata XML Schema (Draft)

- Describes data types and constraints compliant with XML Schema definitions
- Metadata will be published to the M&S Resource Registry Domain



DRAFT

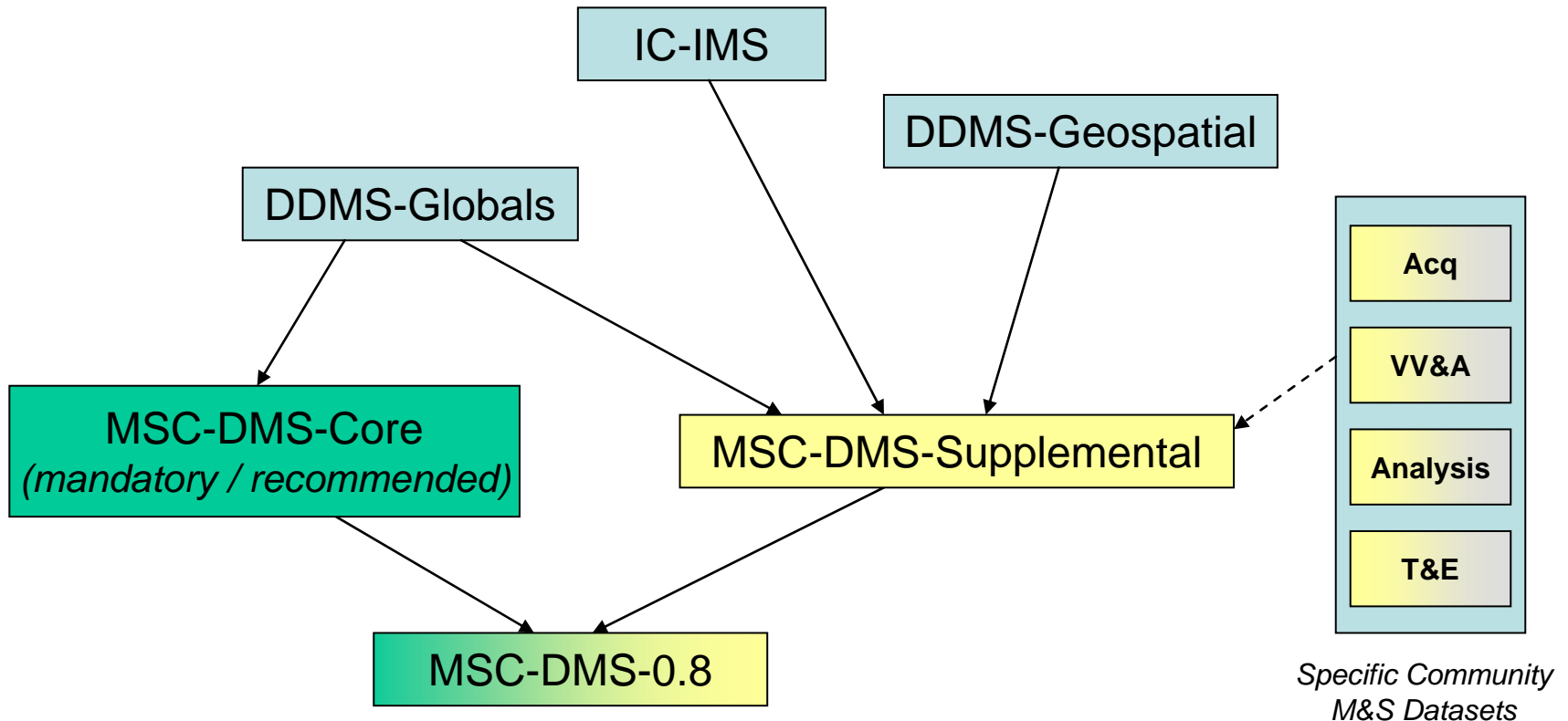


Metadata Design Considerations

- Formalize structure and content of standard VV&A document templates into XML schemas
- Capture key elements from the standard VV&A document templates for posting to the M&S resource registry
- Include mandatory DoD Discovery Metadata Specification (DDMS) elements sufficient to construct valid DDMS Resource metadata document
- Include mandatory DoD M&S Community of Interest Discovery Metadata Specification elements
- Reuse existing XML namespaces directly or through transformations (mappings)
- Comply with best practice as described in XML Naming and Design Rules (e.g., DoN, UN/CEFACT)



M&S COI Discovery Metadata Specification: Organization Structure



Specification work occurring in parallel with DVDT schema development offering opportunity to maximize compatibility and mutual benefit.



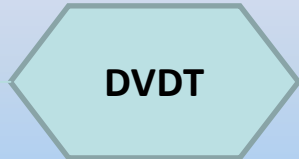
VV&A Metadata (Structured Data and Semantics)

DVDT generates VV&A metadata for posting to M&S Resource Registry Domain to support search in the GIG



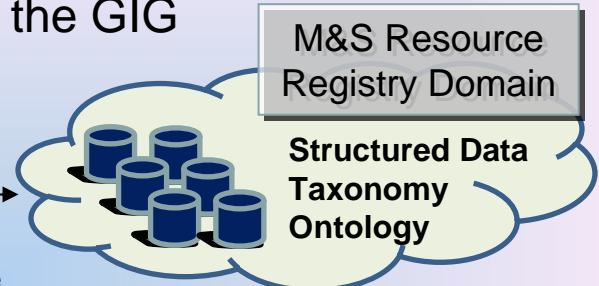
Producer

User employs the DVDT to create VV&A documents stored as XML files



Metadata

- Submitted by Sponsor
- Document Type
- Document Title
- Document Version
- Document Date
- Document Summary
- Document Exec Summary
- Points of Contact
- M&S Name & Version
- M&S Intended Use
- DDMS tags



Search of stored VV&A data



Consumer

User searches M&S Resource Registry Domain for VV&A document metadata



Structured VV&A Metadata

- Consistent use of the DVDT across the DoD and Military Departments, will
 - enable publishing of VV&A metadata
 - facilitate discovery and sharing of VV&A information over the Global Information Grid (GIG)
- Align metadata design with DoD Discovery Metadata Specification (DDMS) and M&S Community of Interest Discovery Metadata Specification



VV&A Ontology for M&S

- Establishes technical case for application of formalized semantics relating to VV&A processes and records
- Employed by software and humans to discover M&S resources and to assess suitability for the intended use
- Will use Web Ontology Language (OWL) and other Semantic Web standards



Points of Contact

For more information,
to become a DVDT beta tester, or
to use the DVDT to support a VV&A project,
contact any one of the authors below.

Kevin Charlow

David H. Broyles

Space and Naval Warfare Systems

Center Charleston

P.O. Box 190022

North Charleston, SC 29419

843-218-5372, 843-218-4834

kevin.charlow@navy.mil

david.h.broyles@navy.mil

Curtis Blais

MOVES Institute

Naval Postgraduate School

700 Dyer Road

Monterey, CA 93943-5001

831-656-3215, DSN 756-3215

clblais@nps.edu

Marcy Stutzman

Northrop Grumman Space &

Mission Systems Corporation

Defense Mission Systems

3422 Londonleaf Lane

Laurel, MD 20724

301-317-9698

marcy.stutzman@ngc.com



Acronyms

- DMSP DoD M&S Project
- DoD Department of Defense
- DT&E Developmental Test and Evaluation
- DVDT DoD VV&A Documentation Tool
- GIG Global Information Grid
- IPT Integrated Product Team
- M&S Modeling and Simulation, model(s) and simulation(s)
- M&S CO M&S Coordination Office
- M&S SC M&S Steering Committee
- PMT Project Management Team
- ODUSD(A&T) Office of the Deputy Under Secretary of Defense (Acquisition & Technology)
- POA&M Plan of Action and Milestones
- SSE Systems & Software Engineering
- VV&A Verification, Validation, and Accreditation
- XML Extensible Markup Language
- XSLT Extensible Stylesheet Language for Transformations