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, 2005[1]
(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(AT&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:

1

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.

MIL-STD-XXX002

Not Measurement Sensitive

MIL-STD-XXX002
Draft of XX August 2007

Department of Defense Standard Practice

**Modeling and Simulation (M&S)
Verification, Validation, and
Accreditation (VV&A)
Documentation Templates**

AMSC: AMSC-XXX   AREA: MSSM

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DoD M&S Project

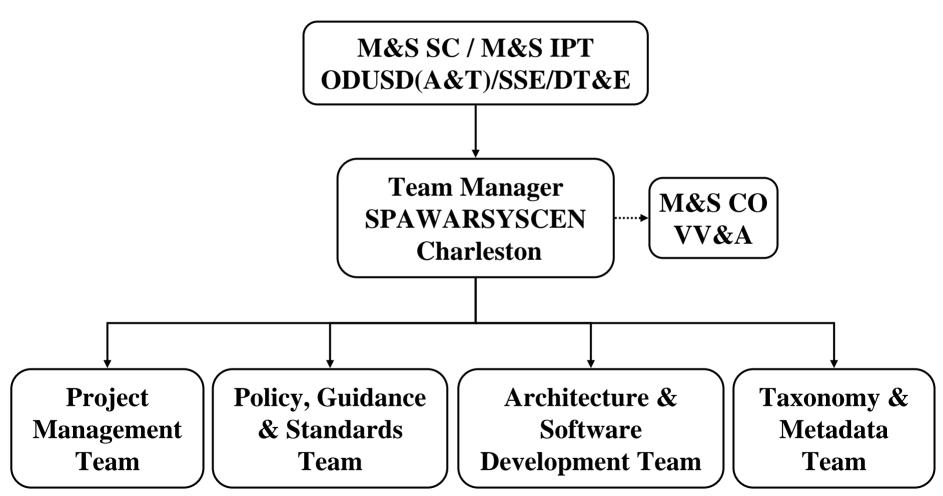- Sponsor: Department of Defense (DoD) M&S Steering Committee (M&S SC)

- Oversight: Acquisition Community Lead

- Project title: Standardized Documentation for VV&A

Project Management Structure

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│      M&S SC / M&S IPT        │
│    ODUSD(A&T)/SSE/DT&E       │
└─────────────────────────────┘
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              ▼
┌─────────────────────────────┐        ┌──────────────┐
│        Team Manager         │ ┄┄┄┄┄▶ │   M&S CO     │
│        SPAWARSYSCEN         │        │    VV&A      │
│          Charleston         │        └──────────────┘
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| Project Management Team | Policy, Guidance & Standards Team | Architecture & Software Development Team | Taxonomy & Metadata Team |

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
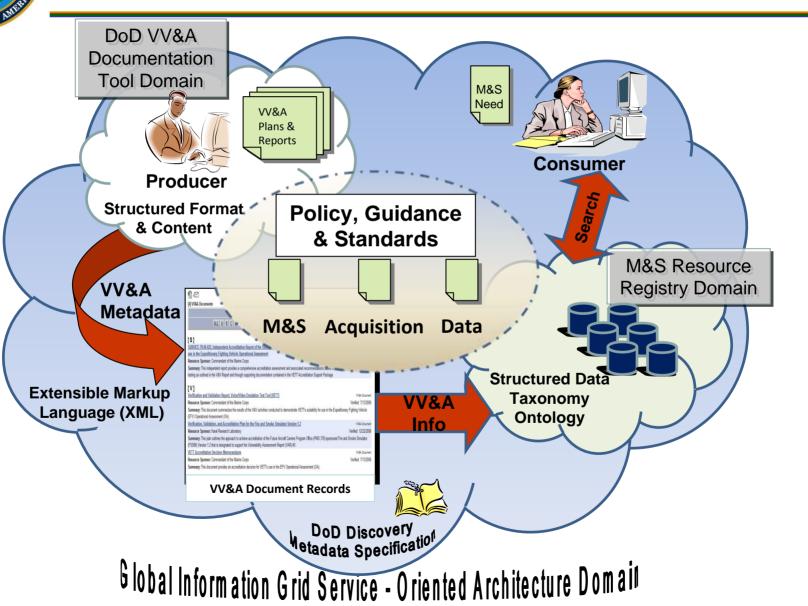
- **OBJECTIVES**
  - Obj 2: Enhance the technical framework for M&S
  - Obj 4: Improve M&S use

- **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
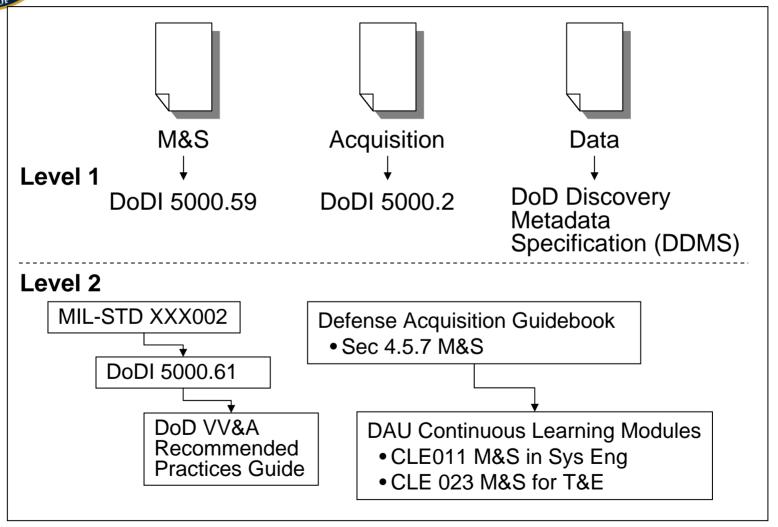 - Require standardized documentation of VV&A DoD-wide

Concept of Operations

DoD VV&A Documentation Tool Domain

VV&A Plans & Reports

Producer

Structured Format & Content

VV&A Metadata

Extensible Markup Language (XML)

Policy, Guidance & Standards

M&S   Acquisition   Data

VV&A Document Records

M&S Need

Consumer

Search

M&S Resource Registry Domain

Structured Data Taxonomy Ontology

VV&A Info

DoD Discovery Metadata Specification

Global Information Grid Service - Oriented Architecture Domain

Policy, Guidance & Standards

M&S

Acquisition

Data

Level 1

DoDI 5000.59

DoDI 5000.2

DoD Discovery Metadata Specification (DDMS)

Level 2

MIL-STD XXX002

↓

DoDI 5000.61

↓

DoD VV&A Recommended Practices Guide

Defense Acquisition Guidebook
- Sec 4.5.7 M&S

DAU Continuous Learning Modules
- CLE011 M&S in Sys Eng
- CLE 023 M&S for T&E

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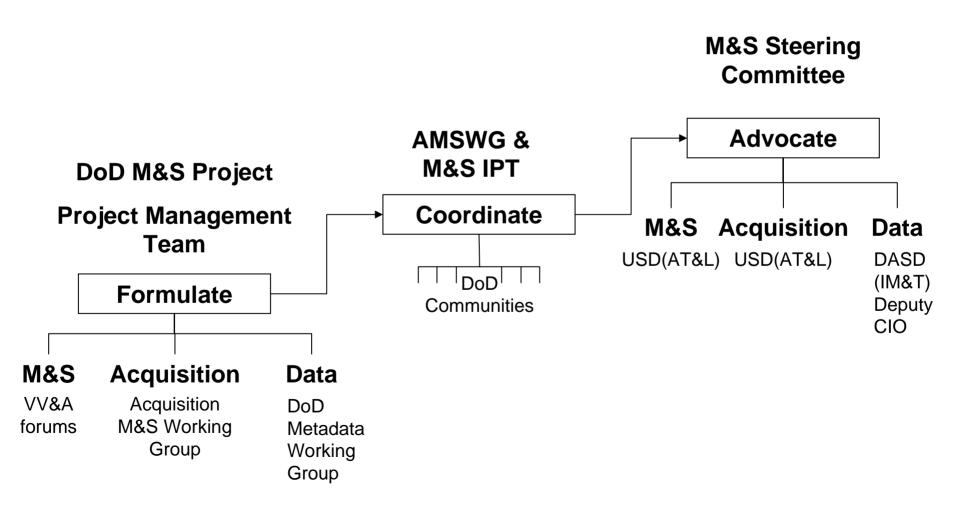
Policy, Guidance & Standards

- 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
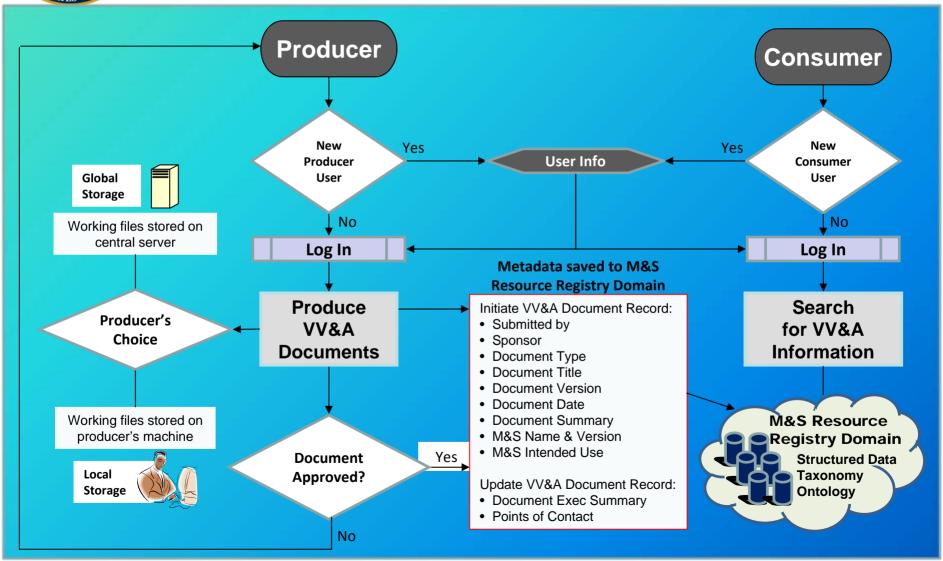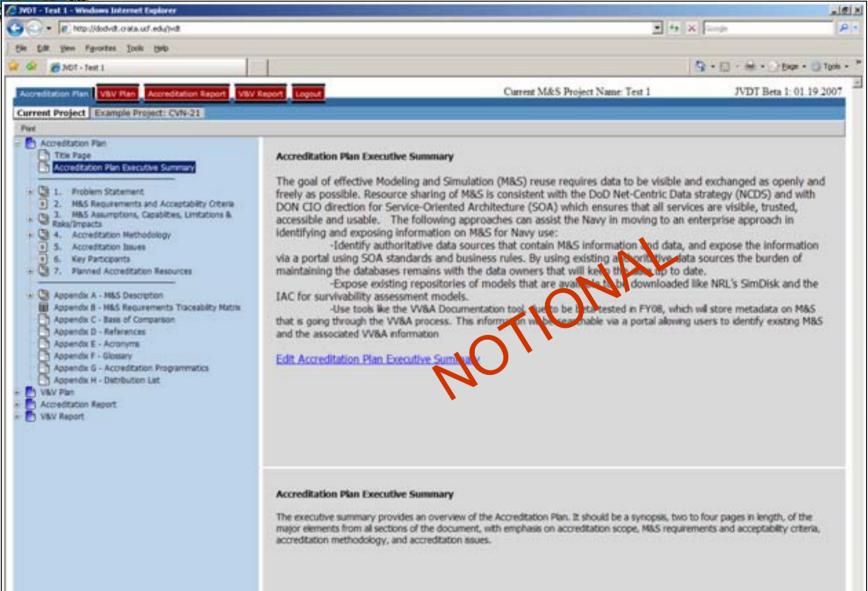
Policy, Guidance & Standards Recommendations

M&S Steering Committee

AMSWG & M&S IPT

DoD M&S Project

Project Management Team

| Formulate | → | Coordinate | → | Advocate |

Coordinate
- DoD Communities

Advocate

M&S	**Acquisition**	**Data**
USD(AT&L)	USD(AT&L)	DASD (IM&T) Deputy CIO

Formulate

M&S	**Acquisition**	**Data**
VV&A forums	Acquisition M&S Working Group	DoD Metadata Working Group

Producer / Consumer View

Producer

Consumer

Global Storage

Working files stored on central server

New Producer User — Yes → **User Info** ← Yes — **New Consumer User**

No ↓

No ↓

Log In ← **Log In**

Metadata saved to M&S Resource Registry Domain

Producer's Choice

Produce VV&A Documents

Search for VV&A Information

Initiate VV&A Document Record:
- Submitted by
- Sponsor
- Document Type
- Document Title
- Document Version
- Document Date
- Document Summary
- M&S Name & Version
- M&S Intended Use

Update VV&A Document Record:
- Document Exec Summary
- Points of Contact

Working files stored on producer's machine

Local Storage

Document Approved? — Yes →

No ↓

M&S Resource Registry Domain

Structured Data Taxonomy Ontology

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
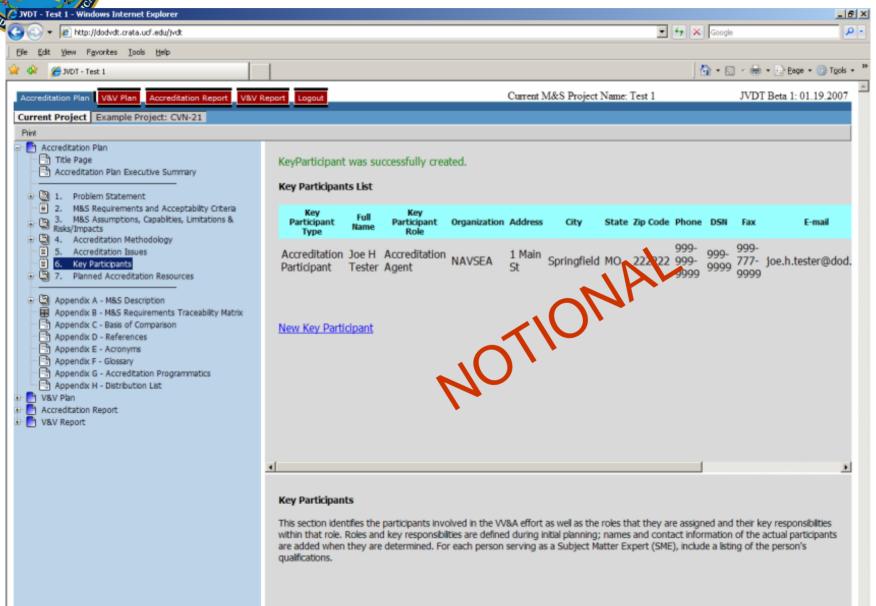
DVDT (1)

DVDT (2)

DVDT (3)

DVDT (4)

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
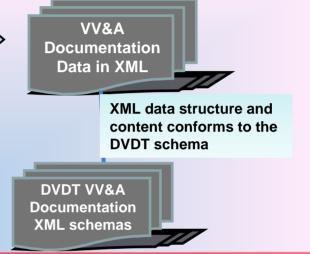
VV&A Documents
(Structured Data and Semantics)

Producer

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

DVDT

reads / writes

VV&A Documentation Data in XML

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

XML data structure and content conforms to the DVDT schema

DVDT VV&A Documentation 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)

DVDT

VV&A Documentation Data in XML

Data Transformation (e.g., XSLT)
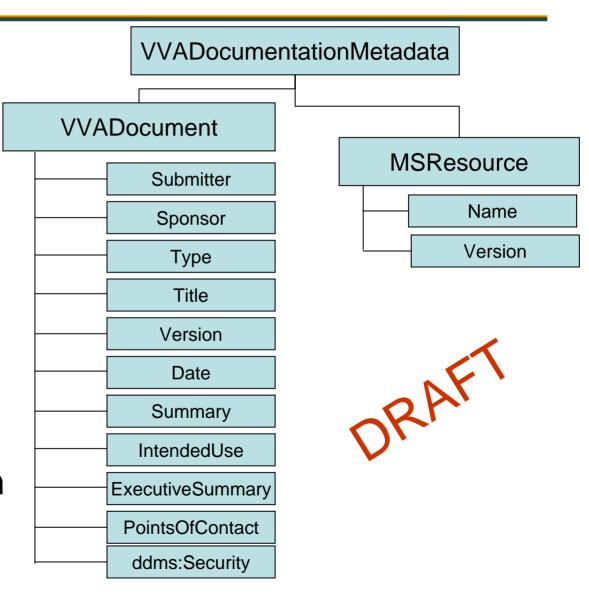
VV&A Documentation in User-Requested Format

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

VVADocumentationMetadata

VVADocument
- Submitter
- Sponsor
- Type
- Title
- Version
- Date
- Summary
- IntendedUse
- ExecutiveSummary
- PointsOfContact
- ddms:Security

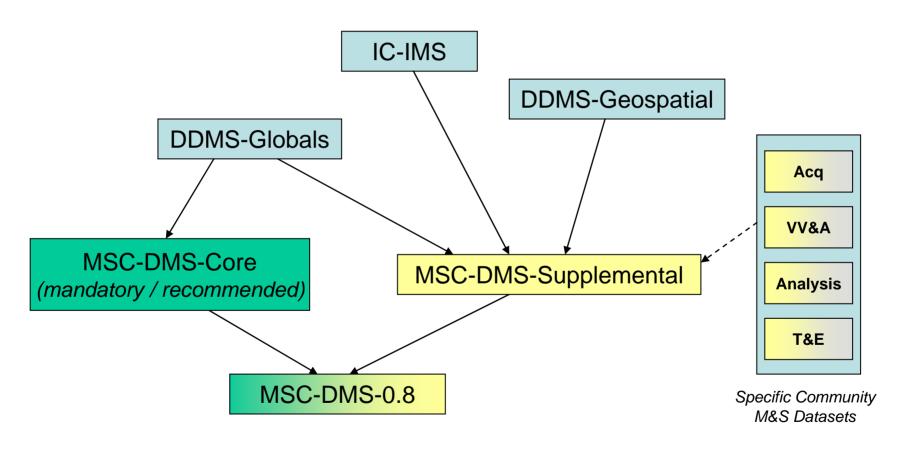MSResource
- Name
- Version

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

IC-IMS

DDMS-Geospatial

DDMS-Globals

MSC-DMS-Core
(mandatory / recommended)

MSC-DMS-Supplemental

MSC-DMS-0.8

Acq

VV&A

Analysis

T&E

Specific Community M&S Datasets

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

M&S Resource Registry Domain

Structured Data Taxonomy Ontology

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

Producer

DVDT

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

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

Consumer

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
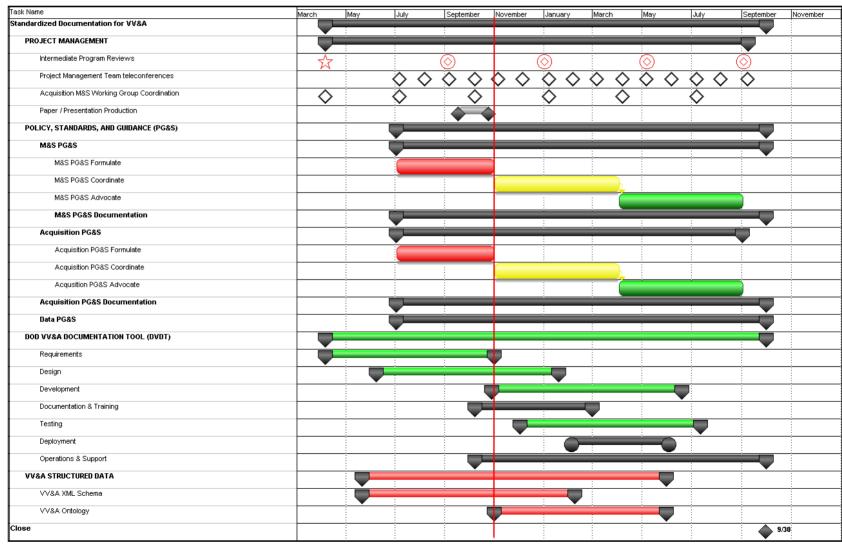
VV&A Ontology for M&S

- 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

Plan of Action and Milestones

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.

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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