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## Standardized Documentation for Verification, Validation and Accreditation / Paper 08F-SIW-003

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# Standardized Documentation for Verification, Validation, and Accreditation

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**ABSTRACT:** *This paper updates the Modeling and Simulation (M&S) community on the status of the M&S Project "Standardized Documentation for Verification, Validation, and Accreditation (VV&A)" sponsored by the Department of Defense (DoD) M&S Steering Committee. The project's purpose is to support DoD- and Service-level Communities with an automated tool that produces standardized VV&A documentation and with VV&A XML schemas that meet net-centric architecture requirements within the Global Information Grid enterprise. At the 2007 Fall Simulation Interoperability Workshop (SIW), paper 07F-SIW-068 titled, "Automating Standardized Information for the Verification, Validation, and Accreditation Process: An Acquisition Community Sponsored M&S Project," first introduced the project and provided some background information. At the 2008 Spring SIW, paper 08S-SIW-003 titled, "Standardized Documentation for Verification, Validation, and Accreditation," updated the M&S community on the progress made since the last report. This paper will discuss the project's progress in four areas: project management; policy, guidance, and standards; taxonomy and metadata; and architecture and software development.*

## 1. Introduction

Standardized documentation for Verification, Validation, and Accreditation (VV&A) plans and reports relating to the use of Modeling and Simulation (M&S) is critical to deciding upon the application of an existing M&S to meet a need. Standardized documentation templates are described in the recently published Military Standard 3022 (MIL-STD-3022) [1]. The Department of Defense (DoD) M&S Steering Committee (M&S SC) sponsors the

"Standardized Documentation for VV&A" M&S Project to develop an automated tool that produces standardized VV&A documentation in accordance with MIL-STD-3022.

This paper updates the M&S community on the status of this DoD M&S Project. At the 2007 Fall Simulation Interoperability Workshop (SIW), paper 07F-SIW-068 titled, "Automating Standardized Information for the Verification, Validation, and Accreditation Process: An

Acquisition Community Sponsored M&S Project," first introduced the project and provided some background information [2]. At the 2008 Spring SIW, paper 08S-SIW-003 titled, "Standardized Documentation for Verification, Validation, and Accreditation," updated the M&S community on the progress made since that first report [3]. The focus of the current paper for the 2008 Fall SIW is on the project's progress and products since April 2008.

The project has three major tasks and associated deliverables:

- Recommend updates to associated policy, guidance, and standards documents
- Develop M&S VV&A XML schemas and M&S VV&A ontology
- Produce and field the DoD VV&A Documentation Tool (DVDT)

The project's purpose is to support DoD- and Service-level Communities with a tool that produces standardized VV&A documentation and with VV&A XML schemas that meet net-centric architecture requirements within the Global Information Grid (GIG) enterprise.

The DVDT will execute services to generate a core set of VV&A documents: the Accreditation Plan, the Verification and Validation (V&V) Plan, the V&V Report, and the Accreditation Report, as standardized in Military Standard (MIL-STD) 3022 [1]. DVDT services will assist producers in creating and maintaining these documents. The project also works toward incorporating information about standardized VV&A information into appropriate M&S, data, and acquisition policy, guidance, and standards documents.

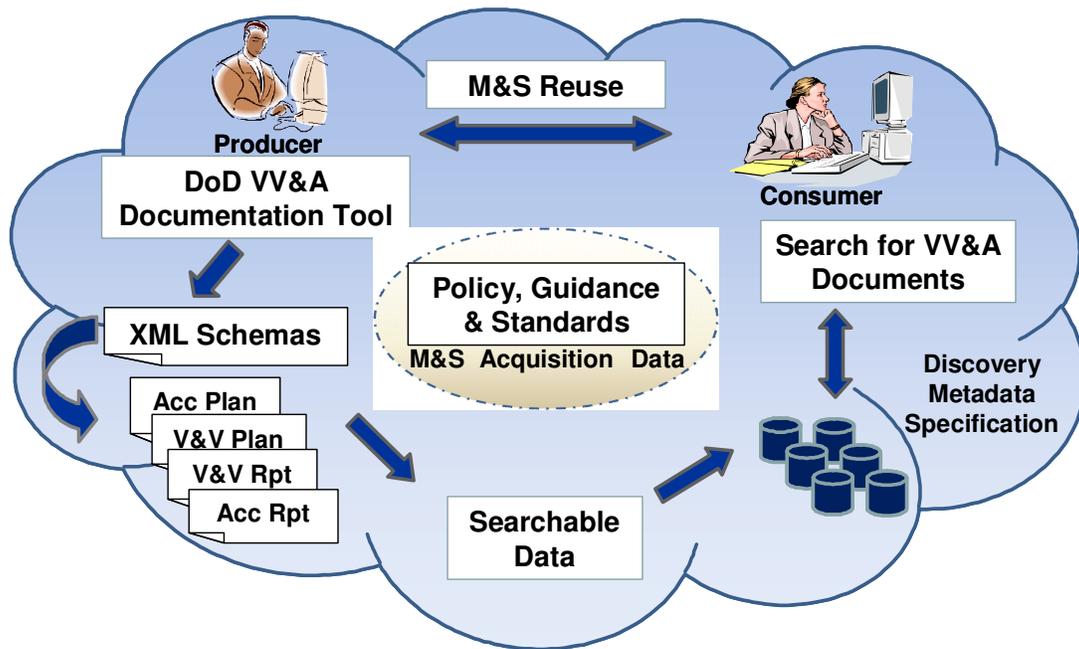


Figure 1. Project Concept of Operations

## 2. Project Management

The project's concept of operations was modified (see Figure 1) in the winter of 2008. The reader will notice the diagram has changed slightly when compared to diagrams previously published. This was done to simplify and update the concept of operations with findings occurring in the project. Additionally, the project began to focus on an architecture that would allow offline document production and storage (see Figure 2).

The concept of operations in Figure 1 starts with the consumer in the upper right hand corner. A consumer has a need to use M&S. The consumer employs the GIG to conduct a search for information about VV&A documents to locate resources that best meet requirements for the use of M&S. VV&A metadata transferred from the DVDT and conforming to the M&S Community of Interest Discovery Metadata Specification (MSC DMS) [4] will be searchable via the GIG. Based upon the information retrieved, the consumer is exposed to information that can inform the decision to reuse a legacy M&S "as is," to modify a legacy M&S, or to build a new M&S.

Starting in the upper left hand corner of Figure 1, the producer uses the DVDT to document VV&A planning, implementation, and reporting. Upon registering and logging in to the DVDT, the producer downloads a collection of interrelated XML-based files that are stored offline (e.g., on the producer's computer). These files represent the four templates for VV&A documents formalized in MIL-STD-3022 [1]. These files use XML source data to produce printable documents. When the producer initiates a VV&A Document Project in the

DVDT, certain VV&A metadata conforming to the MSC DMS will be made available for search and discovery (see Figure 2). After an individual VV&A document is finalized and formally approved (e.g., signed by an approval authority), additional VV&A metadata can be made available for search and discovery.

Succinctly, the project codifies VV&A business rules in XML and the DVDT executes those rules.

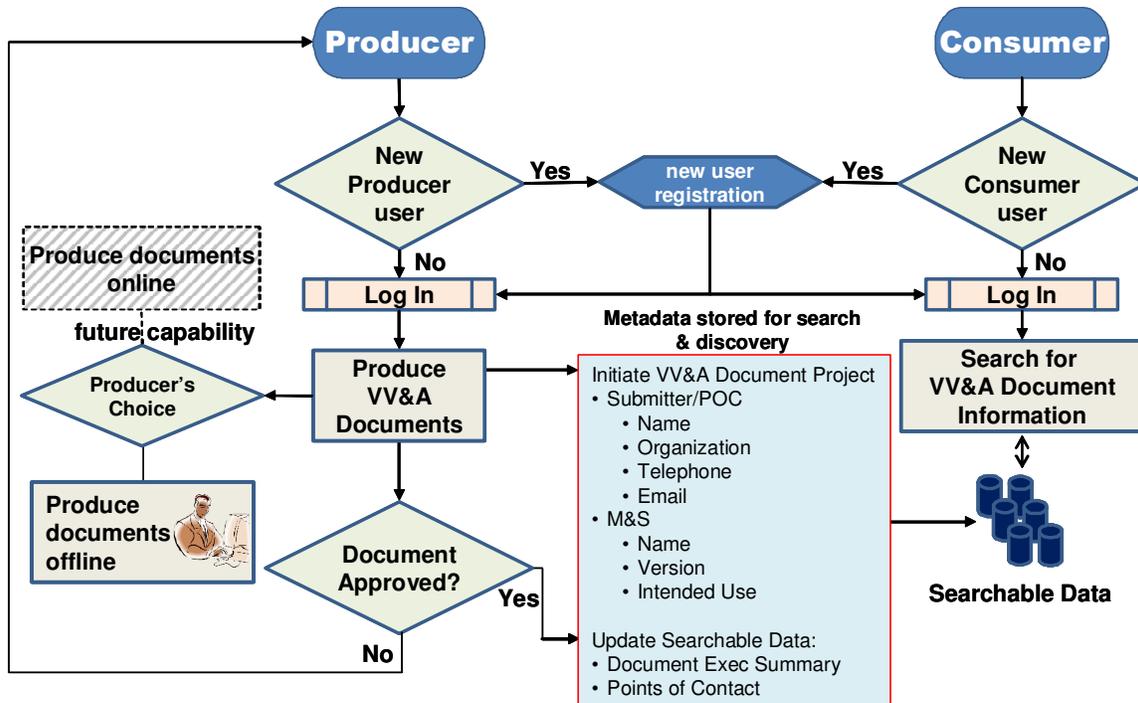


Figure 2. DVDT Producer / Consumer Views

## 2.1 Architecture Focus

As previously stated, the focus turned to an architecture that would allow offline document production and storage versus one that would provide an online capability to produce documents (Figure 2).

The offline production and storage capability assists the producer in managing the information that is common to all four documents identified in MIL-STD-3022 [3 - see Table I]. The DVDT will populate the four documents with the common information when those documents are stored together.

Coordination on the production of each of the individual documents by the disparate organizations involved in implementing the individual verification, validation, and accreditation processes will occur through the means used

by those organizations (e.g., integrated digital environment, engineering environment, knowledge sharing environment, or sharing files through email). The decisions where to retain the documents under control are left to the producers.

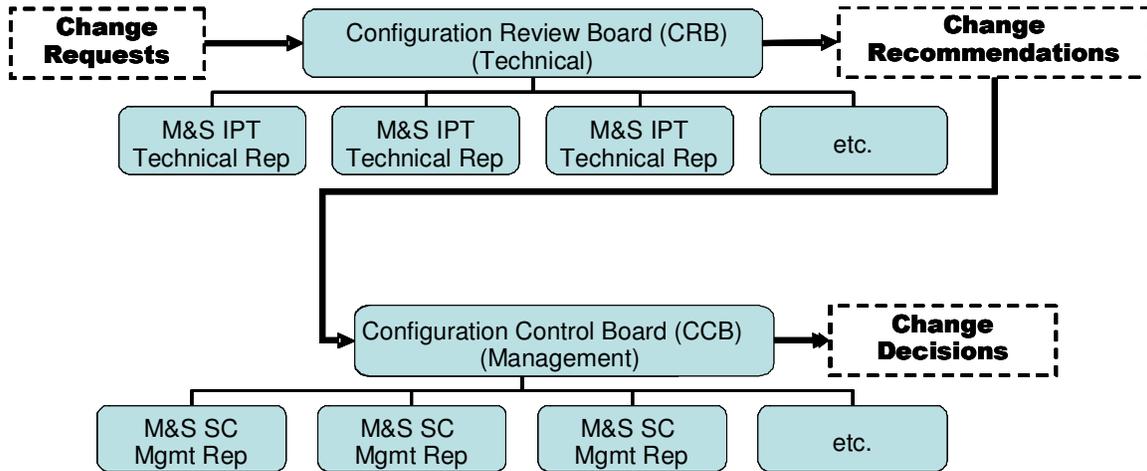
Access to the DVDT will be achieved through the use of a username and password and/or a government Common Access Card or an External Certification Authority Public Key Infrastructure certificate. An infrastructure to process registrations is necessary to approve or reject applicants and to track usage by organizations to support the determination of return of investment.

## 2.2 Configuration Management

As development of the initial version of the tool progresses, the need to establish Configuration

Management becomes clearer. It is probable as Communities and Services begin using the tool, that new requirements will be received. Therefore, a configuration management process at both managerial and technical levels is needed to determine which requirements to implement, how to implement, and when to implement the requirements.

At the time of writing, work was progressing on drafting a Configuration Management Plan. The basic proposed concept is for a two-tiered configuration management organization that mirrors the membership of the M&S SC and its subordinate M&S Integrated Product Team (M&S IPT) (Figure 3). The information provided in Sections 2.2 and 2.3 is still draft and has yet to receive final approval.



**Figure 3. Configuration Management Structure and Workflow**

The Configuration Review Board (CRB) makes technical recommendations regarding requested changes. The Configuration Control Board (CCB) makes business decisions regarding recommended changes. The CRB represents the technical aspects of configuration management, while the CCB represents the managerial aspects.

Because of the technical nature of matters conducted by the CRB, M&S IPT members assign a qualified technical representative to serve on the CRB. Technical representatives assigned to serve on the CRB must be empowered to make change recommendations on behalf of the organization that they represent.

M&S SC members assign a managerial representative to serve on the CCB. Managerial representatives assigned to serve on the CCB must be empowered to make change decisions on behalf of the organization that they represent.

It is the responsibility of the managerial and technical representatives to coordinate in advance with the respective M&S SC or M&S IPT members to prepare for meetings where change recommendations and decisions will be made. The respective M&S SC or M&S IPT members must provide funding for representative participation on these boards.

The DVDT Project Team Manager will chair the CCB. The Configuration Manager will chair the CRB. Each board will be chartered separately and the members of the specific board will agree upon each charter. Each board will include the specific details of its business processes and meeting procedures in its charter.

### 2.3 Change Process

Together the CRB and CCB implement the change process depicted in Figure 4. A change request is originated by an individual within the configuration management structure who is referred to as the Requestor. A change request might propose an enhancement or improvement, report a problem, introduce a new requirement, or change an existing requirement (all referred to collectively as change requests). The Requester completes a Change Request Form and submits the completed form to the Configuration Manager.

The Configuration Manager reviews the Change Request Form to ensure its completeness, correctness, and consistency. If additional information is needed, the Configuration Manager returns the form to the Requester. Once all information is in order, the Configuration Manager enters the change request into the configuration status accounting information system (CSAIS).

The CRB Chair develops an initial estimate for the resources (schedule, cost, and manpower) required to effect each recommended change based on what is known at the time the request is under review. The CRB meets monthly (or on a basis to be determined) to assess change requests. A read-ahead package is made available at least a week in advance of the meeting. All members are expected to prepare for the meeting by reviewing the

package and formulating their opinions. The meeting is not the place to review the change requests for the first time.

The CRB Chair leads the discussion about each change request. The board's discussions, prioritization of change requests, and change recommendations are documented.

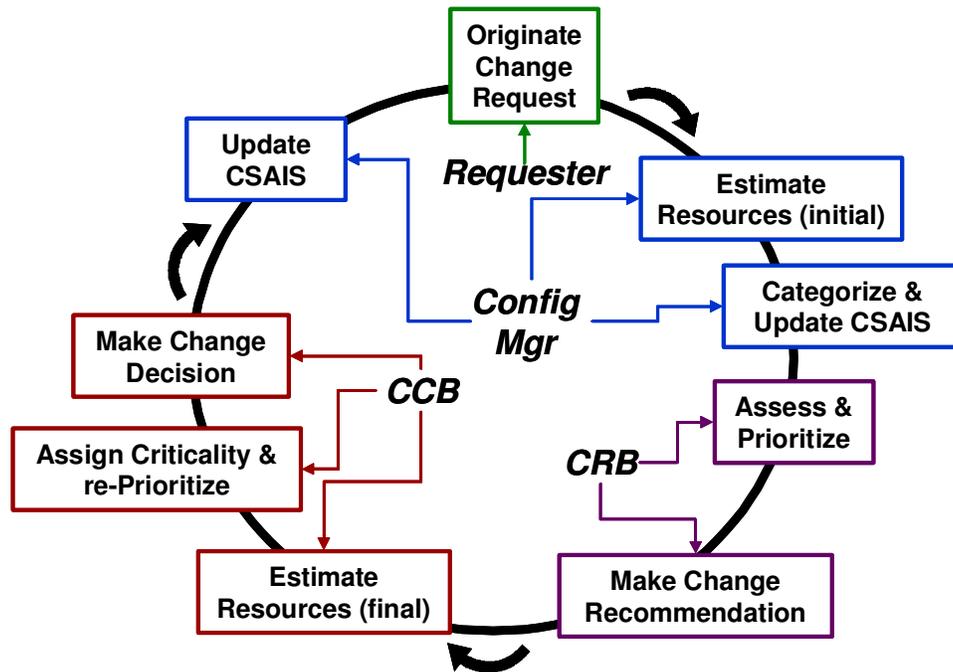


Figure 4. Change Process

The Configuration Manager collates all the change requests processed by the CRB and presents them to the CCB Chair. The CCB Chair/Secretariat produces final estimates of the resources required to implement the changes. The CCB Chair/Secretariat collects and prepares the change requests during the months prior to the CCB meeting.

The CCB meets quarterly (or on a basis to be determined) to assess the critically of the change requests, to re-prioritize if necessary, and to make change decisions. The decisions can be to approve, disapprove, or to send back to the CRB or Requester for more information. The Configuration Manager updates the CSAIS based on the CCB's decisions.

The details of the procedures implemented by the boards are documented separately, as needed, and approved by the each board's members.

### 3. Policy, Guidance & Standards

MIL-STD-3022 [1], approved in January 2008, provides a common framework for documenting information produced during the VV&A processes by establishing templates for capturing VV&A planning, implementation, and reporting. As a Defense Standard Practice, this military standard may be cited as a contractual requirement in contracts.

Additionally, Data Item Descriptions (DIDs) that can be listed on the Contract Data Requirements List (DD Form 1423) are available as follows:

- DI-MSSM-81750 DoD M&S Accreditation Plan [6]
- DI-MSSM-81751 DoD M&S V&V Plan [7]
- DI-MSSM-81752 DoD M&S V&V Report [8]
- DI-MSSM-81753 DoD M&S Accreditation Report [9]

Both the MIL-STD-3022 and DIDs are available from the Acquisition Streamlining and Standardization Information System at <http://assist.daps.dla.mil/>.

The DVDT automates the production of the four VV&A documents captured in the standard templates formalized in MIL-STD-3022 and the four DIDs. The DVDT helps organizations to produce documents more efficiently by

- automatically populating common elements of a document with information that the producer entered when developing an earlier document (i.e., sharing common information across the documents),
- organizing the information in the documents,
- outputting documents in a common format, and
- making metadata about VV&A documents available to consumers across the GIG enterprise.

DoD Instruction 5000.61 [10] is being reviewed and revised by the M&S SC. The Policy, Guidance & Standards Team advocates for referencing the templates established in MIL-STD-3022 and implemented by the DVDT in the updated instruction.

#### **4. Taxonomy & Metadata**

To support the DVDT development, the Taxonomy & Metadata Team created a number of VV&A XML schemas to specify structure and content of the VV&A documents. The schemas include:

- VV&A Documentation Project-Level Metadata
- Accreditation Plan content
- V&V Plan content
- V&V Report content
- Accreditation Report content
- Data structures common to two or more of the VV&A documents

The VV&A XML schemas for the content of VV&A documents are supported by a schema defining base types for information structures that are used in two or more of the documents. The project-level metadata schema uses data structures defined in the MSC DMS [4], which in turn references structures defined in the DoD Discovery Metadata Specification [11]. By referencing these specifications, we ensure that metadata required for resource discovery is fully supported. Document-level metadata conforming to the MSC DMS is extracted from the XML-encoded content of each VV&A document using Extensible Stylesheet Language Transformations (XSLT).

Annotations in the VV&A XML schemas describing the content of the VV&A documents are read by the DVDT to serve as input aids to the producer. Furthermore, data structures and indications of mandatory and optional entries are used by the tool graphical user interface implementation. When the tool is released for use, the VV&A XML schemas will be available through the DoD Metadata Registry.

The VV&A documentation XML schemas mainly govern the structure of the documents. For the initial tool release, much of the information will be entered by the producer in free text. Therefore, very little of the content will be subject to type checking to ensure entries conform to specific types, values, and other constraints. It is envisioned that future enhancements to the tool will include more explicit specification of content in the VV&A document schemas to support stronger use of XML content validation techniques.

While the VV&A XML schemas provide useful specification of the structure and content of XML files supporting the tool and content discovery, they do not convey machine-understandable representation of the semantics of VV&A information. Such representations can be beneficial as aids to searches by providing richer context regarding the conduct and findings of VV&A processes applied to M&S. Simplistically stated, VV&A processes involve (1) the specification of required capabilities in the context of a particular use of an M&S and (2) the gathering of evidence confirming or disconfirming achievement of those capabilities. The Taxonomy & Metadata Team is designing taxonomic and ontological descriptions of the products, processes, and evidentiary artifacts to investigate and demonstrate enhanced search, matching of resources to consumer needs, and machine-derived inferences.

#### **5. Architecture & Software Development**

At the time of writing, beta testing of the DVDT was expected to begin during Summer 2008. As previously described in O8S-SIW-003 [3], test items are designed to address specific requirements as expressed in various use cases. Some of the major requirements are summarized below:

- Create documents structured in accordance with MIL-STD-3022 [1]
- Support requirements traceability
- Support publishing metadata for search and discovery
- Offer context-sensitive help and point to VV&A help in general

- Support images, boldface, italics, cut-and-paste/copy, etc.
- Support versioning and archiving

Some examples of how the testing will be conducted are included below:

- Creation of documents in accordance with MIL-STD-3022 and correctness of XML representation of content both will be tested with use cases for producing output.
  - For compliance with MIL-STD-3022, the tester will select “Print” for a document and then compare the output with MIL-STD-3022.
  - Correctness of XML tagging of document content will be tested by selecting “Save” and then reviewing the saved files with an XML-aware editor.
- Support of requirements traceability will be tested as part of the “Enter/Modify Document” use case.
- Support of posting metadata for search and discovery will be tested with the “Enter/Modify Project” use case and with the “Post Document Metadata” use case.
- Support of versioning and archiving will be tested with the “Save New Copy” and “Rename Project” use cases.

Several organizations have expressed interest in participating in the beta testing process, including the following:

- Joint Test and Evaluation Methodology (JTEM)
- Military Satellite Communications Joint Program Office
- National Security Agency
- Naval Air Systems Command, Unmanned Aerial Vehicles Program Office (PMA-263)
- Naval Air Warfare Center Aircraft Division (AIR 5.1.6.11)
- Naval Air Warfare Center Weapons Division, Tactical Weapons Office
- Naval Postgraduate School Modeling, Virtual Environments, and Simulation Institute
- NAVSEA Dahlgren Accreditation Team
- U.S. Air Force Air Mobility Command Integration Division
- U.S. Army Capabilities Integration Center
- U.S. Army Research, Development, and Engineering Command (RDEC)
- U.S. Coast Guard Office of Requirements and Analysis

## 6. Related Efforts

Department of Defense Directive 8320.02, *Data Sharing in a Net-Centric Department of Defense*, establishes policies and responsibilities to implement data sharing and provides the definitions for data and metadata as follows [12]:

- **Data.** A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means. Data and information are equivalent terms for the purposes of this policy.
- **Metadata.** Information describing the characteristics of data; data or information about data; or descriptive information about an entity's data, data activities, systems, and holdings. For example, discovery metadata is a type of metadata that allows data assets to be found using enterprise search capabilities.
- **Semantic Metadata.** Information about a data asset that describes or identifies characteristics about that asset that convey meaning or context (e.g., descriptions, vocabularies, taxonomies).
- **Structural Metadata.** Information provided about a data asset that describes the internal structure or representation of a data asset (e.g., database field names, schemas, web service tags).

The DVDT and XML VV&A Schemas are being developed with the GIG in mind. VV&A information is important not only for the decision at hand but also for the reuse of an M&S in the future. Archiving the resulting VV&A information from the DVDT will facilitate its search and discovery by future consumers.

Figure 5 depicts the information the producer makes available to the GIG enterprise through XML schemas and document files. On the one hand, the tool assists the producer by extracting and publishing discovery metadata to the GIG. As presented earlier, the discovery metadata initially describes the conduct of a VV&A documentation effort (project-level metadata) and later describes specific VV&A documents (document-level metadata). The former metadata is published when the producer first begins a VV&A documentation project with the DVDT and anytime thereafter at the producer's discretion. The latter metadata (document-level) is extracted and published at the producer's discretion as VV&A documents are completed and the metadata about those documents is made available via the GIG to the M&S community.

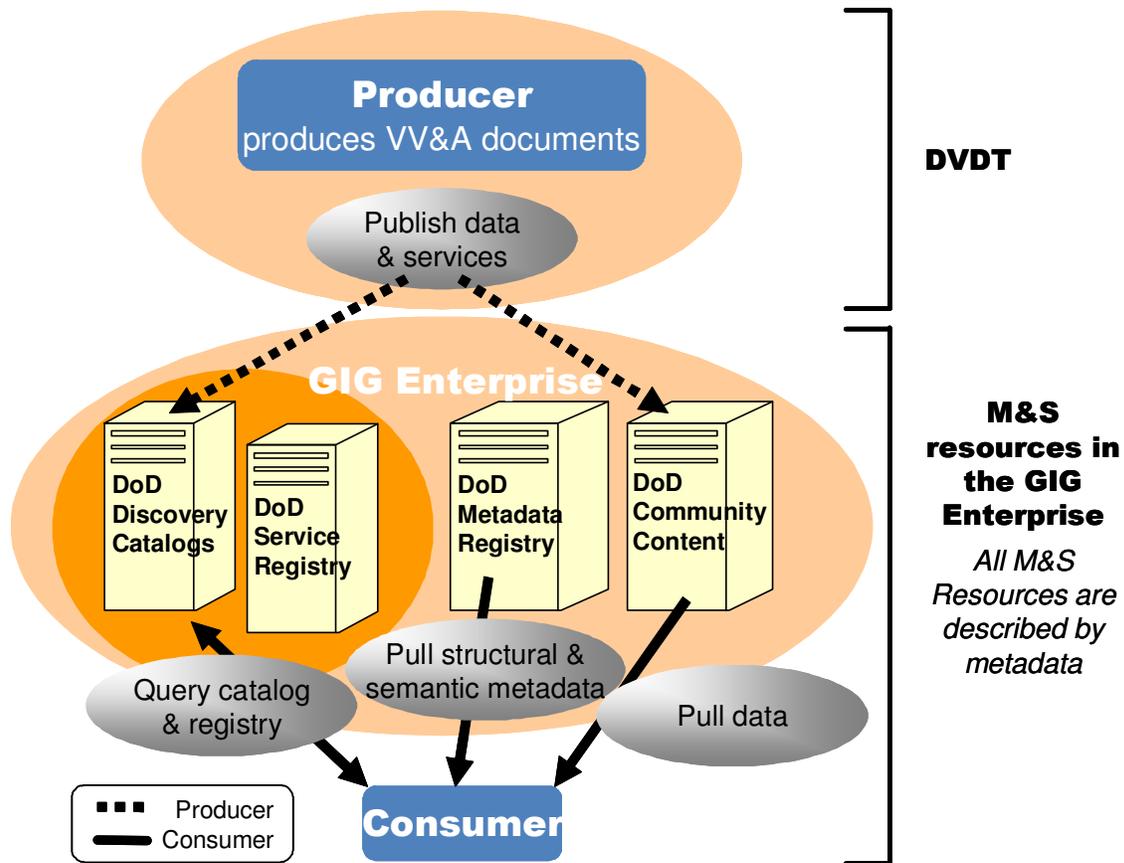


Figure 5. VV&A Document Data Discoverable through M&S Catalog

On the other hand, the producer publishes data (i.e., the VV&A documents themselves) and services as DoD Community Content for discovery and possible reuse by consumers. The VV&A documents may be made available in a variety of formats, such as XML or several commercially available word processing applications. Posting of XML formats offers consumers a variety of options for rendering or processing the VV&A document content; for example, the use of XSLT to extract information from the XML documents to create or update webpages in Hyper-Text Markup Language (HTML).

Discovery services enable search activities within the M&S Catalog, described in the next subsection. The consumer seeking VV&A information queries the M&S Catalog and pulls information about VV&A documents from it. It is the responsibility of the DoD Communities to provide the content available for search and discovery. The DVDT automates that capability for all the DoD Communities that use it to produce VV&A documentation.

### 6.1 M&S catalog

In addition to this project, the M&S SC also sponsors an M&S Catalog project that is developing a capability to open various M&S resources to search and discovery, and coordinating various M&S Resource Repository (MSRR) metadata constructs with the MSC DMS [4]. The DVDT and VV&A XML schemas are also coordinated with the GIG M&S Community of Interest that is responsible for production and configuration control of the MSC DMS. Therefore, the VV&A XML Schemas, DVDT, and the M&S Catalog will together provide a search and discovery mechanism for VV&A document information.

The M&S Catalog is based on a few principles:

- A central search and discovery appliance
- Negotiated data exchange agreements between resources and the catalog
- Alignment of the MSC DMS with data organization of resources

Agreements can be negotiated to govern data exchanges between the M&S Catalog's search and discovery

appliance and various resources (e.g., catalogs, directories, repositories, and registries). Initially, access will be limited to the DoD Communities, but it is anticipated that future development spirals will accommodate other consumer levels, e.g., the general public and NATO partners.

The data structures of initially participating MSRRs (representing Navy, Air Force, and DoD) were carefully compared with the MSC DMS [4]. As a result, some changes to the MSC DMS were recommended to facilitate useful search and discovery. As a specific example, it was recommended that Accreditation Status be added to the "Resource" component of the MSC DMS, so that consumers can specifically search for accredited resources. This capability was already part of some MSRRs, but not written into the MSC DMS.

## 6.2 XML schemas enable M&S catalog search

XML "tags" are illustrated in 08S-SIW-003 [3 - see Figure 6]. They serve a function similar to the record structure of a traditional database table, by identifying the kind of information a particular item represents. However, they are more flexible than fixed database structures and do not require a database engine to function. As an example of their utility, consider the points of contact (POCs) for an M&S resource. A human-readable document may clearly indicate program manager, document author, and technical POC, but how can an automated tool distinguish them? The MSC DMS metadata structure for POC includes a field named "Role." If the document is stored with an MSC DMS-compatible XML structure, the consumer can specify a role of "technical POC" (from a pull-down list of choices), which translates into an XML-based search string that will locate the desired information in the document.

## 7. Summary

This paper updated the status of the DoD M&S Project, "Standardized Documentation for VV&A" by focusing on the progress made since April 2008.

The DoD M&S Project remains on schedule and plans to release the initial version of the DVDT in Fall 2008. If the reader is interested in using the DVDT to support a VV&A implementation project, please contact any of the authors to obtain more information.

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## Acronyms

CCB	Configuration Control Board
CRB	Configuration Review Board
CSAIS	Configuration Status Accounting Information System
DID	Data Item Description
DoD	Department of Defense
DVDT	DoD VV&A Documentation Tool
GIG	Global Information Grid
HTML	Hyper-Text Markup Language
M&S	Modeling and simulation, model, simulation, model and simulation
M&S SC	Modeling and Simulation Steering Committee
M&S IPT	Modeling and Simulation Steering Integrated Product Team
MIL-STD	Military Standard
MOVES	Modeling, Virtual Environments, and Simulation
MSC DMS	Modeling and Simulation Community of Interest Discovery Metadata Specification
MSRR	Modeling and Simulation Resource Repository
NMSO	Navy Modeling and Simulation Office
POC	Point of contact
SIW	Simulation Interoperability Workshop
V&V	Verification and validation
VV&A	Verification, Validation, and Accreditation
XML	Extensible Markup Language
XSLT	Extensible Stylesheet Language Transformations

## Author Biographies

**KEVIN CHARLOW** is the Technical Operation Manager for the Enterprise C2 Engineering Division for the Space and Naval Warfare Systems Center Charleston, South Carolina. He is the project team lead for the Standardized Documentation for Verification, Validation, and Accreditation Project. He has supported the Navy Modeling and Simulation Office (NMSO) for the last 6 years. He has a Bachelor of Science degree in Computer Engineering from Clemson University and a Master of Business Administration degree from Webster University.

**CURTIS BLAIS** is a Research Associate with the Naval Postgraduate School MOVES Institute. His primary areas of research and development include application of semantic web technologies to improve interoperability and for identifying and delivering valued information in network-centric environments such as the Global

Information Grid. Mr. Blais earned Bachelor of Science and Master of Science degrees from the University of Notre Dame. He is currently a Ph.D. candidate in the MOVES program.

**RICHARD DAEHLER-WILKING** has been a computer scientist in the Command and Control Department of the Space and Naval Warfare Systems Center Charleston, South Carolina, since 2000. He is a longtime participant in the NETWARS community, having led the development of models for both EHF Milstar and UHF DAMA satellite communications. More recently, he has begun supporting NMSO. He has a Bachelor of Arts degree in Mathematics from Reed College, a Master of Arts degree in Mathematics from the University of Oregon, and a Ph.D. from the Medical University of South Carolina in biometry (systems science track). He taught mathematics, computer programming, and physics at the college level for 25 years. His hobbies include alpine skiing and barbershop harmony.

**MARCY STUTZMAN** supports the DoD M&S Project, "Standardized Documentation for Verification, Validation and Accreditation," as an Operations Research Analyst for the Northrop Grumman Corporation. She is the Policy, Guidance, and Standards Team Lead for that project. Additionally, she provides management and technical services to the NMSO VV&A Lead as a member of the NMSO VV&A Support Team. She served in the U.S. Army as a Senior Intelligence Research Analyst, Cryptologic Language Analyst, Reporter, and Voice Interceptor with five years duty at the National Security Agency. She is a member of the National Defense Industrial Association M&S Committee, the Simulation Interoperability Standards Organization, and the IEEE Standards Association. She has a Bachelor's degree from Indiana University and has provided M&S and VV&A support to the Department of Defense, Army, and Navy since 1990. Her hobby is birding.