A Proposed Standardization of the Navy VV&A Process through the Application of VVML & the VDT

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ABSTRACT: *As in the commercial world, modeling and simulation (M&S) is increasingly pervasive throughout the Navy. There is a constant drive to expand the utility of these M&S through distributed M&S, federations, and other combinatorial simulations in the High Level Architecture (HLA), FORCEnet, and other such programs. The DOD and commercial sectors' increased reliance on M&S has necessitated a method to provide documented proof of M&S' credibility. Although the Navy has mandated M&S Verification, Validation, and Accreditation (VV&A) to provide this credibility, no single standard exists to execute the documentation process.*

Clearly, this lack of coordination and consistency begs the development of a single, clear, standard method and repository to facilitate the execution of this mandate. The development of Department of the Navy (DON) VV&A Documentation Tool (VDT) and its VV&A Markup Language (VVML) seeks to fill this need by standardizing and streamlining the M&S VV&A documentation process. The web-enabled VDT can not only house all VV&A documentation and its associated information in one repository, but can also standardize and expedite the documentation process through intuitive templates and inherent flexibility via its VVML base. This paper builds the case for a VV&A documentation standard and details the role that VVML and the VDT play in the realization of standardization.

1. Introduction

The ever-increasing use of M&S across all areas of global communication, education, business, and day-to-day functions has come to define the twenty-first century. Seemingly all areas of everyday life has come acquisitions to assessment and management, weapon systems testing in lieu of live firing, and ship and aircraft design. As this M&S presence continues to evolve into reuse, greater federations, and combinatorial simulations, the need for a standardized means to prove the credibility of these M&S becomes more urgent.

to rely on M&S to enrich our world with greater capabilities at lower costs. It is not surprising then that the US Navy has led the way in incorporating this highly malleable technology to build, assess, and meet their technological advancement: from training and education to operations and experimentations,

1.1 Background: Verification, Validation, and Accreditation (VV&A)

The DON has issued a mandate for M&S VV&A (*SECNAVINST 5200.40* [1] and *5200.40A draft* [2]) to address this need. The key focuses of Naval M&S VV&A are two-fold: 1) to ensure the M&S

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developers are producing credible models that fulfill their intended uses and 2) to present accurate and correct information to the users so that they can make conscientious and informed decisions regarding their use. *De facto* accreditation has often been used due to the lack of V&V documentation. Because of this lack of a formalized VV&A standard, the credibility of the M&S's pedigree is generally unsubstantiated. However, as M&S is increasingly relied upon to make realistic representations of the "real world" as well as critical decisions with substantial risks, it is clear that "it has worked so far" no longer suffices. With such factors as the safety of human lives and the reduction of cost and time dependent upon the accuracy of M&S, it is clear that VV&A must be accurate and consistent.

The need for standardization of VV&A is thus a formalized set of processes designed to ensure the safety, cost effectiveness, and reliability of M&S. To facilitate the execution of these processes, a VV&A framework and processes have been outlined and in the *Department of the Navy Modeling and Simulation Verification, Validation, and Accreditation Implementation Handbook (2001)* [3] and *The Modeling and Simulation Verification, Validation, and Accreditation Implementation Handbook, Volume I: VV&A Framework* [4]. Thus, the vehicle for creating M&S credibility is set into motion through VV&A.

1.2 Necessity: Standardized VV&A Documentation

Although VV&A creates the framework and processes required to ensure the credibility of M&S, VV&A may be considered an incomplete effort without structured documentation. VV&A documentation must address the concerns of the M&S user by demonstrating its credibility with solid evidence. In other words, VV&A documentation must build on the M&S requirements, design and development, and reporting and documentation of the M&S performances' end results. The efficacy of VV&A hinges upon its thoroughness and consistency.

The simplest way to ensure this pedigree of VV&A is to standardize the documentation process. The Navy Modeling and Simulation Master Plan includes standards as one of the enablers to "promote the development and use of standards, in order to reduce M&S production costs, while enabling consistent and comprehensive representation" [5]. As mentioned above, although the need for standardization, facilitation, and expedition has been identified, no one tool, template, or language exists to facilitate such standardization. Therefore, it is not surprising that the VV&A documentation process remains daunting, inefficient, and generally unpopular. By extension, the potential for legacy M&S reuse under such conditions has been heretofore hindered by this lack of consistent documentation and the arduous amounts of research needed to assess the applicability of an M&S in question for the new user's purpose.

Credible and consistent VV&A documentation has remained elusive. Since hesitation to conduct VV&A continues despite a SECNAVINST mandate and practitioners' guides, something further is still needed to activate and facilitate the VV&A documentation process. In an effort to capture the problem, the Navy has been collecting data on VV&A implementation needs for the last three to four years. The dominant stumbling block has been the facilitation of its execution. VV&A agents have consistently indicated that the most difficult aspect of implementation was the initiation: when and where to start, what to consider, and how to bring about structured management to produce precise, complete, and useful documentation that users can use to make informed decisions. The fundamental problem is therefore clear: implementation guidance alone cannot meet the needs of consistency and reuse. A concrete, tangible standard for reporting information that is easy to use is needed.

1.3 The Utility of VVML and the VDT in VV&A

The clamor to simplify the documentation process with an intuitive format is the foundation for the creation of VVML. The evolution of the Navy's effort to support VV&A documentation has brought several key, M&S-wide desideratum to light: the possibility of VV&A standardization; the need to promote M&S reuse, and the need for easy, on-line VV&A collaboration. Richly structured VV&A processes are possible by utilizing the Extensible Markup Language (XML) to create universal access to M&S data. The VVML concept directly addresses these VV&A needs by leveraging the XML-based framework into a VV&A-specific language, thereby providing a bridge between M&S requirements and open/commercial web-enabled standards. Further, the execution of VVML in the VDT, with its intuitive templates and user interface, solves both the initial documentation and reuse standardization problems. The associated benefits of such a marriage are numerous: adaptability to changes in VV&A structure and data, portability to enable universal, web-enabled access to VV&A information; the capacity to link to the Navy Modeling and Simulation Resource Repository (NMSRR) [6]; and easy maintenance and reference.

2. Purpose:

To date, no standards specify what information, documentation, or format is required for M&S VV&A. However, observation the common needs of numerous M&S VV&A programs reveals that an efficacious and accommodating VV&A documentation process hinges on two key factors: a common documentation standard and a method by which to achieve this documentation. This paper will show that the VVML provides the extensible language

necessary to generate a common VV&A template and that VDT provides a standard content and format for all VV&A implementation. Continued discussions, collaboration, and incorporation of M&S VV&A needs will only provide ever greater utility of the VVML and VDT.

Thus, this paper will argue the need and justification for a single M&S VV&A documentation standard; provide a walkthrough of the VVML concept and its application through the VDT; and delineate the evidence needed to place VVML and the VDT as considerations for M&S VV&A standards. By extension, the need for VVML and the VDT in the context of the Navy's emphasis on M&S reuse and future endeavors will be highlighted. VVML and the VDT will prove to be inextricably vital to the creation of a formal and consistent means to evaluate M&S and the creation of federative, distributive, Defense Information Infrastructure Common Operation Environmental (DII COE), and composable M&S.

This argument will be laid out in three parts: the presentation of the VVML concept, its utility as facilitated by the VDT, and the justification for its consideration as the foundation for future standardization. Finally, the discussion will conclude with future VVML/VDT capabilities and areas for consideration by the VV&A community in expanding VVML/VDT utility.

3. Revolution: The Utility of VVML and the VDT

VVML and its application, the VDT, provide the standardization and flexibility needed to create consistency in VV&A documentation by leveraging XML and providing users with a physical and tangible object to guide them through the VV&A documentation process. VVML creates consistency with Navy mandate by paralleling its contextual structure to *The Department of the Navy Modeling and Simulation Verification, Validation, and Accreditation Implementation Handbook, Volume I: VV&A Framework* [7] while the VDT creates VV&A metadata files to record the VV&A process and progress. For each M&S project a single metadata file is created that contains four related reports: the Accreditation Plan and Report, V&V Plan and V&V Report. The resulting VVML file establishes a searchable index that facilitates configuration management, traceability and a host of other benefits that will be addressed in the body of this paper. The flexibility of this web-based language and tool will also save the Navy valuable time and money by uniformly delivering M&S projects for accreditation and creating M&S repositories with searchable entities for future reference.

3.1 VDT: the VV&A Implementers' Interface with VVML

VV&A implementers require a quick and efficacious means to understand and perform the VV&A process. The VDT fulfills this need by formatting the required reports directly from the VV&A template and creating a manageable VV&A task list. Correlation with the VV&A handbook [8] and SECNAVINST 5200.40A [9] provide additional clarification of those sections that new VV&A implementers may not understand and facilitates the easy creation of required documents and reports. Once the VV&A agent familiarizes him/herself with the VDT template fields and creates a VV&A task list, the VVML supports the execution of these tasks by connecting all members involved in the M&S development and VV&A effort through a single collaborative documentation standard. The VDT captures the textual documentation within specific contexts defined by the VVML. The collection of VVML files is then stored in a single repository, such as the NMSRR, creating a valuable asset to the DON M&S communities.

This standardization of process inherently makes systems development more formalized and rigorous. VVML adheres to the standard the VV&A template for documentation by representing the required M&S VV&A information while the VDT uses VVML to surround the VV&A content. With the VDT portal, VV&A metadata can be captured for multiple projects and will be able to be linked with the Navy's NMSRR. Thus, VVML promotes project visibility and facilitates information exchange. This specialized portal and/or the NMSRR will provide a robust web interface for searching M&S projects using specific VV&A criteria.

4. Evolution: The Creation and Development of VVML and the VDT

The VDT's first iteration was as a stand-alone Microsoft Access database and has evolved into the DON VV&A Documentation Tool, Versions 1 and 2. Developed by SPAWAR Systems Center, Charleston, multiple users tested Version 1; their comments were incorporated in the final Version 1. With the release of Version 1, numerous other comments called for collaboration and information-sharing utilities. The success of VV&A hinges upon participation from various members within the program and organizational resources, both internal and external. Hence, responses to the VDT v.1's utility and capabilities were addressed to several users including: OPNAV, Marine Corps, Navy and Army threat systems offices and other organizations.

Strong consideration was also given to interoperability with the NMSRR. As the NMSRR was created to promote M&S reuse by providing a centralized collection point where a registered user can enter

information about their M&S, the linking and portability of XML can allow certain fields of the VDT to be directly linked to NMSRR and populating the database with current information with the consent of the users. The automation of this VDT/NMSRR posting will relieve M&S VV&A agents from having to manually duplicate the entry of this vital information. Running historical information that other users can access in the NMSRR facilitates the evaluation of existing M&S for reuse based on the VV&A documentation.

4.1 VVML: Metadata

Metadata can be stored as data; as well as a resource indicated as a URL, i.e. http://www.navmsmo.navy.mil/; one resource may therefore contain information about itself and/or another resource. One goal of writing structured Metadata is to include as much of the syntax and semantics such that maximum information can be acquired when referencing a Metadata document. In the context of the NMSRR, structured content in the metadata is paramount to populating the database with useful information.

To make this XML data interchange a reality, the establishment of a metadata standard is necessary to so that its content conforms to the Navy's VV&A policy and complies with the World Wide Web Consortium (W3C) XML Schema [10]. As the primary goal of the VVML is inherently to provide a framework for tracking V&V activity, the source code in Figure 1 is provided to show the attribute tags used to track events:

```
<?xml version="1.0" encoding="UTF-8" ?>
<!-- edited with XMLSPY v5 rel. 4 U (http://www.xmlspy.com) by
David Broyles (Home)  -->
- <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
- <xs:element name="ACC_ACTIVITIES">
  + <xs:complexType>
  - <xs:keyref name="ACC_ACTIVITIES_VV_AND_A"
      refer="VV_AND_A_MAIN_VV_AND_A_ID">
      <xs:selector xpath="." />
      <xs:field xpath="VV_AND_A" />
    </xs:keyref>
  </xs:element>
- <xs:element name="ACC_EVENTS">
  - <xs:complexType>
    - <xs:sequence>
        <xs:element name="ACC_EVENTID" type="xs:integer" />
        <xs:element name="VV_AND_A" type="xs:integer" />
      - <xs:element name="COMPLETION_DATE">
        - <xs:simpleType>
          - <xs:restriction base="xs:string">
              <xs:maxLength value="10" />
            </xs:restriction>
          </xs:simpleType>
        </xs:element>
        <xs:element name="RESPONSIBLE_PARTY"
          type="xs:integer" />
        <xs:element name="EVENT_TYPE" type="xs:integer" />
      </xs:sequence>
    </xs:complexType>
```

Figure 1- *XML Code segment*

4.2 VVML: Hyperlinks and XML Sub-languages

Further supporting the use of XML and web-based applications as the basis for VV&A documentation standardization are hyperlinks, which provide a simple, yet powerful, means of linking documents. As such, VVML applies the the XML Linking Language (XLink), XInclude and XPointer languages to facilitate the VVML's role of Metadata Collector and future capabilities discussed later in this document. Because XLink allows more abstract linking than standard HTML, users can insert and move elements into XML documents with greater flexibility, the creation and description of links between resources becomes more robust. "XLink provides a framework for creating both basic unidirectional links and more complex linking structures[,] allow[ing] XML documents to assert linking relationships among more

than two sources, associate Metadata with a link, and express links that reside in a location separate from the linked resources [11]." By using the XML syntax to create structures that can describe both simple, unidirectional hyperlinks (similar to HTML) and more sophisticated links, XLink's value to VVML and the VV&A practitioner is that it can include a wide array of documents. Audio, video, database data, training media, schedules, and even XML-enabled test results can thus be added to any VV&A file. This will be particularly useful in the realm of regression testing by linking statistical applications directly to the VDT.

While XLink is an XML-based language that specifies constructs for advancing linking in XML documents, XPointer is a non-XML language that allows the user to address the internal structures of XML documents by specifying link sources and targets [12]. The XPointer language can be used as the basis as a fragment identifier for any Uniform Resource Identifier (URI) reference. By definition, a URI is a series of characters used to differentiate names. URIs locate a resource whose Internet media type is one of text/xml, application/xml, text/xml-external-parsed-entity, or application/xml-external-parsed-entity [13]**.** The XPointer's capacity to harness URI fragments allows the VDT to manage validation test parameters. In contrast, XLink allows the management of parameters such parameters as schedules and costs is shown in Figure 03 below as a requirements matrix that links pre-test predictions to test results. Using the XPointer specification, the VDT can reference test results pointing directly to another application by simply pointing to the URI of the application.

Finally, the VVML incorporates the XInclude specification to provide the mechanism for organizing and capturing non-text data such as graphics, embedded objects or files. XInclude provides a link with the attribute value of embedded resources in documents generated by the VDT. Such links provide syntax independent of media type to indicate that a resource is to be embedded graphically within the display of the document [14]. This capability has far-reaching implications. For example, it can add the ability to link live schedule information or even model information directly from the M&S applications to the VV&A project file.

5. UTILITY: The Benefits & Current Limitations of the VDT/VVML

The benefits of VVML and the VDT are numerous: from one-step standardization and aggregation to universal applicability. Further utility and expansion into the area of M&S scheduling and management covers only one feature that the VDT may hope to achieve in the future. However, it is also important to note the current limitations of VVML and the VDT, not only its benefits. As such, this section seeks to provide the road ahead as well as the current status of VVML and the VDT's utility.

5.1 One-Step Standardization and Aggregation

The main benefit of using the VDT over Microsoft Word® is that only the VDT facilitates standardized preparation of VV&A documentation *and* supports the aggregation of V&V information in an M&S repositories, such as the NMSRR. The result is similar to using tax-preparation software to fill in your tax forms and file your income tax return electronically. Both the preparer and the government easily achieve greater levels of consistency and efficiency by using this standardized method.

The overall VDT process produces standardized representations that can be scaled to accommodate both small to large M&S projects. Specifically, VVML is structured to provide the four report templates articulated in the *M&S VV&A Implementation Handbook Volume I* [15] *in* electronic form:

- Accreditation Plan
- Verification And Validation Plan
- Accreditation Report
- Verification And Validation Report

These four reports contain documentation of the specific VV&A plan details, correlating to the VV&A process. These processes include:

- Data Verification
- Data Validation
- Design Verification
- Implementation Verification
- Conceptual Model Validation
- Results Validation
- V&V Reporting

Thus the VDT and its VVML underlay form the only tool that not only creates standardized documentation, robust flexibility, and XML-based utility, but also ensures compliance with Navy M&S mandates.

5.2 EASE OF USE & UNIVERSAL APPLICATION

As noted above, the Web-based VDT application utilizes XML to enable its underlying database to create an easily accessible user interface that supports mandated Navy VV&A standards. The VDT is accessible from any browser and connects to a specialized Navy website that serves the latest VDT version. The web interface supports multiple platforms to ease and assist the user to produce standardized Navy VV&A documentation. In order to consistently fulfill this tall order; verify that all VV&A standards are met; and ensure that any user, regardless of familiarization with the VV&A process, can easily accomplish all tasks, the VDT represents a tree of documentation headings with user directions and an edit pane that accepts formatted text and pictures, as depicted in Figure 02:

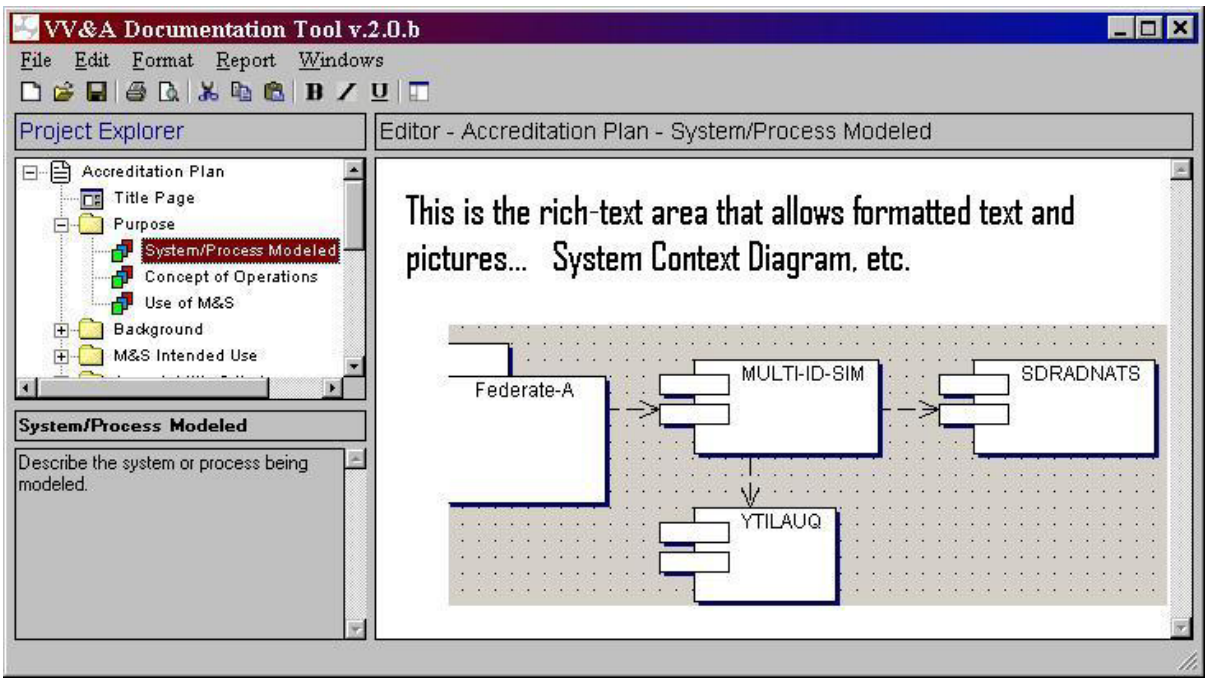

Figure 2- *The VDT main window displays the content associated with the "System/Process Modeled" subject of the V&V Accreditation Plan.*

Additionally, the current iteration of the VDT interface is sufficient to represent all M&S acquired, developed, managed, and used by DON activities. The fact that all categories of M&S used by DON activities (including live, virtual, and constructive simulations; distributed simulations; federates and federations; emulators; prototypes, simulators; and stimulators) can harness this tool with relative ease with little additional effort is in itself a revolution in M&S VV&A documentation. In the increasingly demanding world of Navy M&S management, the importance of the VDT for project developers, system engineers, system architects, testers, and management attempting to balance their traditional responsibilities, challenging schedules, and tight budgets with the new demands of M&S VV&A can hardly be understated.

As discussed earlier, the VDT creates each report separately by user request to the format prescribed by the Navy standards for VV&A documentation. For easier access and standard formatting, project VV&A content is sequentially placed between indexed documentation headers while maintaining the user-supplied formatting intact. Each report is then generated and can be previewed using the VDT using the universally recognizable "Print Preview" menu selection. The "Print" menu selection generates and sends a standardized report to the specified printer. The following is an example of the Print Preview window:

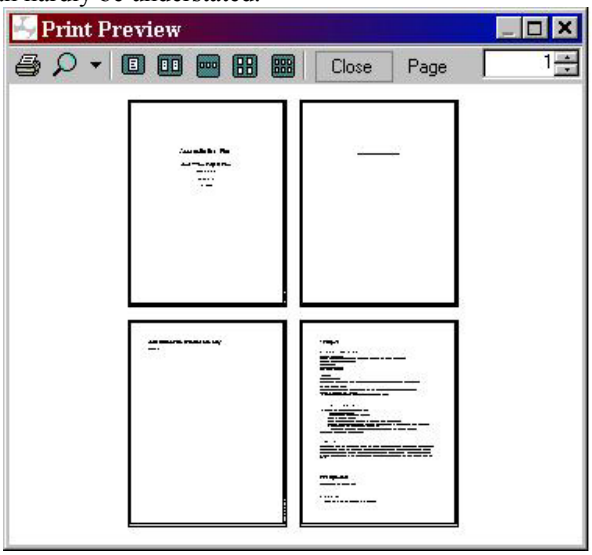

Figure 3- *Standard Print Preview window*

5.3 Current VDT Limitations

The VDT directly manages the VVML structure and document content to the new VV&A standard. Because the VDT can include "cut-and-paste" data from other editors and tools, the VDT inspires thoughts of composability and substantive interoperability between M&S components. The VDT can represent and relates a user's high-level perspectives of the usefulness of M&S. However, further development is needed for the VDT to provide users with these advanced features and capabilities. Some known issues include:

- Dependent on Web connectivity
- The addition of a spell check feature
- The capacity to add a table of contents, page numbers, and indexes
- Binary representation of images that occupy less disk space that XML-wrapped rich text

5.4 The Tailoring of V&V

The process of VV&A can be exhaustive and costly, so it is suggested that this judgment process be conducted using common sense, sound business management practices, and considerate of time and resources efficiencies. We believe that organizations can adhere and comply with regulations to do VV&A, follow the guidelines, and produce meaningful VV&A documentation efficiently with the use of the VVML Documentation Tool. Documentation content is the sole responsibility of VV&A practitioners. As such, portions of the VV&A content may be left blank, resulting in abridge VV&A reports.

6. Further Fruition: Future Capabilities

6.1 Flexibility and the Additional Functionality

In 2004 the release of a new standard for Navy VV&A documentation clarifies, characterizes, and evolves the VV&A process. In synergy with this evolution, VVML emerges as the single standard to represent project VV&A artifacts. Because VVML is a language that can easily adapt to future requirements and evolving VV&A methods, software development, and VV&A process maturity, higher levels of validation categorization and new means of requirements traceability can be established and standardized through the VDT. VVML also has the capacity to adapt to additional XML tags. VVML extensions open new possibilities to represent complex relationships between M&S components. Often expensive, proprietary tools appear to fill the current void. However, continued improvements to the VDT will extend and improve the management of the VV&A process, including:

- Monitors and metrics of VV&A activities and progress
- The provision of essential feedback regarding the organization of VV&A activities with M&S development lifecycle.
- The collection and summarization of lessons learned to extrapolate possible changes and improvements to future VV&A processes and standards
- The ability to expand data import and export methods including requirements traceability matrixes (RTM) and other tool matrixes.

6.2 VDT Support of DON Web-Centricity and Streamlined Schedules

With regard to the DON's emerging web-centric approach, the VDT application has the possibility of improving the management of VV&A processes by providing timely visibility of progress, audits, summary analysis, and judgments of credibility. By using the VDT, M&S managers can coordinate their efforts to respond to critical issues of performance and effectiveness, thereby streamlining the effort to quantify and mitigate risks. Future versions of the VDT will manage a template that extends for each of the project M&S components. After the VV&A process is tailored to fit the project, a schedule can be created that associates VV&A activities and time with costs. Thus, the VDT has the potential to quantify and track costs. This functionality will help evaluate project risk as a relationship of historical costs, budgeted costs, and projected costs.

As the VV&A Documentation Tool suggests a roadmap for the direction and completeness of the documentation based on the stage of the M&S development cycle, the VDT can evolve to promote each specific V&V process M&S development stage. The V&V calendar can be used as a simplified resource planner to organize high-level V&V tasks. As a Web-accessible tool, the VDT can support a standardized process to efficiently capture and share V&V data for streamlined documentation and collaboration while V&V activities are audited throughout the execution. Hence, the VDT emerges from a documentation template program to a full service VV&A assistant that supports an organization's advance into process maturity.

The VDT organizes VV&A information that identifies how the M&S project can sufficiently execute VV&A and meet acceptability criteria. When actual results of V&V testing are available, M&S management gains a cohesive understanding of the M&S progress by tapping into this rich resource, thus casting away the vagueness and opacity so often noted as a frustration of VV&A. With such openness and clarity, the acceleration of the overall M&S schedule is likely as developers will be able to identify and focus on higher-priority tasks which directly relate to the most important M&S acceptability criteria. Because VVML has the capability to conjoin system-level tests with

expected results, the applications of VVML in the VDT can be expanded ad infinitum to create and maintain a matrix of relationships that represent the acceptability criteria and the status of system-level tests and analysis.

6.3 Composability

The capacity for any one standardized template to be deployed without knowledge of the M&S developer's methodology (object-oriented, functional decomposition, or fast-prototyping), has been noted during the VDT development effort. By encapsulating the details VVML uses to represent a structure of data, models, and simulation component documentation in the extensive template framework, documentation interoperability can be substantively evolved via VVML generation and links. VVML supports true composability among M&S iteratively feeding the VDT new tools. This iterative process also achieves technical interoperability.

A concerted effort by the SISO Extensible Modeling and Simulation Framework (XMSF) Group [16] promotes the concept of composable components using the). In order to arrange and compose new M&S projects and configurations, M&S will require consistent and standardized nomenclature, high-level descriptions, and the designation of each M&S's specific solution. It is important to note that although VVML is designed to support associations in the Navy's standard of the VV&A documentation, certain sections of VV&A documentation describe unique qualities: system components and their associated requirements, acceptability criteria, assumptions, qualifications, constraints, and test results. Those who would compose an M&S need a strong understanding of the various implementation techniques and their purposes. In such circumstances, there may be no better representation of the documented, analyzed, and approved M&S, than the project's VVML file.

6.4 M&S Reuse and Cost Savings

The consistent use of the VDT and VVML directly aids in effort to reuse M&S by standardizing original VV&A documentation for ready accessible for reference, reducing the cost of the overall costs of legacy VV&A. VV&A documentation provides a concrete, value-added deliverable for that benefits the entire M&S community. Developers who evaluate M&S for reuse will not only have easily accessible and consistent VV&A documentation, but also access to the original validation test results and expected outcomes in one file, thus streamlining the future efforts to understanding of the legacy's M&S performance and capabilities.

7. Summary

The Navy Simulation Baseline Assessment [17] for FY02 reported a DON-wide expenditure on M&S of over $380M in the areas of training and education, operations and experimentations, acquisitions, assessment, and management, science, and technology. With so much riding on the line, the standardization of VV&A is no longer a nicety; it is a necessity. VVML and its implementation via the VDT specifically address this exigency by developing a single Navy VV&A documentation standard.

Together, VVML and the VDT streamline VV&A by automatically generating standardized documentation and saving the information as constant VVML files. VVML provides a specialized XML-based language to create a unique Navy VV&A documentation template. The VDT dynamically applies VVML to aggregate the VV&A content. It is the VDT's use of VVML that solidifies a solution that aggregates the VV&A documentation process and provides a more meaningful representation of VV&A information. As the foundation of VVML is the highly malleable XML, future growth in addressing the growing demands of M&S VV&A, its management, and processes and flexibility is virtually limitless. VVML, *the* foundation of the VDT, may lead to advancements in how VV&A results are composed, organized, distributed, searched, shared, and reused.

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9. Acronyms

DII COE	Defense Information Infrastructure Common Operating Environnment
DON	Department of the Navy
HLA	High Level Architecture
HTML	Hyper Text Markup Language
M&S	Modeling and Simulation
NAVMSMO	Navy Modeling and Simulation Management Office
NMSRR	Navy Modeling and Simulation Resource Repository
OPNAV	Office of the Chief of Naval Operations
SECNAVINST	Secretary of the Navy Instruction
T&E	Test and Evaluation
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
VDT	DON Verification, Validation, and Accreditation Documentation Tool
VV&A	Verification, Validation, and Accreditation
VVML	Verification, Validation, and Accreditation Markup Language
W3C	World Wide Web Consortium
XML	Extensible Markup Language
XMSF	Extensible Modeling and Simulation Framework

10. Biographies

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