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DEPARTMENT OF DEFENSE STANDARD PRACTICE

DOCUMENTATION OF VERIFICATION, VALIDATION, AND ACCREDITATION (VV&A) FOR MODELS AND SIMULATIONS

AMSC: 9037

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FOREWORD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense.

2. This standard was developed by the Modeling and Simulation Coordination Office in coordination with the Military Departments. It establishes templates for the four core products of the Modeling and Simulation Verification, Validation, and Accreditation processes. The intent of this standard is to provide consistent documentation that minimizes redundancy and maximizes reuse of information. This promotes a common framework and interfacing capability that can be shared across all Modeling and Simulation programs within the Department of Defense, other government agencies and allied nations.

3. Comments, suggestions, or questions on this document should be addressed to: Director, Modeling and Simulation Coordination Office, 1901 North Beauregard Street, Suite 500, Alexandria, Virginia 22311-1705, or ms.standards@osd.mil. Since contact information can change, you can verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil/.

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1. SCOPE

1.1 Scope. This standard establishes templates for the four core products of the Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A) processes: Accreditation Plan; V&V Plan; V&V Report, and Accreditation Report. These documents are normally prepared and used at different times and by different groups; much of the information included in each is common and should be shared. The templates provide a common framework and interfacing capability between the four documents and support consistency and efficiency. Additionally, the plans and reports produced by following the templates serve as a communications device between the participants in the VV&A processes. Specific templates for each document are found in the appendices.

1.2 Purpose. The purpose of this standard is to provide a common framework for sharing information throughout the VV&A processes. The common method of documentation benefits participants in the VV&A processes by eliminating unnecessary redundancy and facilitating reuse of information when accrediting an M&S for an intended use.

1.3 Application. This standard is applicable to the VV&A of all M&S developed, used, or managed by the Department of Defense or any of its Components.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3, 4, and 5 of this standard, whether or not they are listed in this section.

2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE INSTRUCTIONS

DoD Instruction 5000.61	DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)

(Copies of this document are available online at http://www.dtic.mil/whs/directives/ or from the Superintendent of Documents, U.S. Government Printing Office, 732 North Capitol St. NW, Washington, DC 20401.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the reference cited herein, the text of this document takes precedence. Nothing in this

document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

3.1 Definitions. The definitions used in this document are derived from various DoD policy and guidance documents. Definitions applicable to this standard are as follows.

3.1.1 Acceptability criteria. A set of standards that a particular model, simulation, or federation will meet to be accredited for a specific purpose

3.1.2 Accreditation. The official certification that a model, simulation, or federation of models and simulations and its associated data are acceptable for use for a specific purpose

3.1.3 Accreditation Agent. The organization designated to conduct an accreditation assessment for an M&S application

3.1.4 Accreditation Authority. The organization or individual responsible to approve the use of a model, simulation, or federation of models and simulations for a particular application (Also see M&S Application Sponsor.)

3.1.5 Data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means

3.1.6 Data verification and validation (V&V). The process of verifying the internal consistency and correctness of data and validating that it represents real-world entities appropriate for its intended purpose or an expected range of purposes. The process has two perspectives: the producer and the user

3.1.7 Federation of models and simulations. A system of interacting models and/or simulations, and a supporting infrastructure that are based on a common understanding of the objects portrayed in the system

3.1.8 Military Departments. The Department of the Army, Department of the Navy, and Department of the Air Force, including their National Guard and Reserve components

3.1.9 Model. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process

3.1.10 Modeling and Simulation (M&S). *n.* The discipline that comprises the development and/or use of models and simulations (DoDD 5000.59); *v.* The use of models and simulations, either statically or over time, to develop data as a basis for making managerial or technical decisions. This includes, but is not limited to, emulators, prototypes, simulators, and stimulators. DoDI 5000.61)

3.1.11 M&S Application Sponsor. The organization that accredits and uses the results or products from a specific application of a model or simulation (Also see Accreditation Authority and M&S User.)

3.1.12 M&S Developer. The agency that develops an M&S or the agency that is overseeing the M&S development by a contractor

3.1.13 M&S Program Manager. The individual responsible for planning and managing resources for simulation development, directing the overall simulation effort, and overseeing configuration management and maintenance of the simulation. In legacy simulation reuse when a major modification effort is involved, the M&S User may designate an M&S Program Manager to plan and manage the modification effort.

3.1.14 M&S Proponent. The DoD Component organization that has primary responsibility to initiate development and life-cycle management of the reference version of one or more models and/or simulations

3.1.15 M&S User. M&S User is the term used to represent the organization, group, or person responsible for the overall application. The M&S User needs to solve a problem or make a decision and wants to use modeling or simulation to do so. The M&S User defines the requirements, establishes the criteria by which model or simulation fitness will be assessed, determines what method or methods to use, makes the accreditation decision, and ultimately accepts the results. (Also see M&S Application Sponsor.)

3.1.16 Validation. The process of determining the degree to which a model, simulation, or federation of models and simulations, and their associated data are accurate representations of the real world from the perspective of the intended use(s)

3.1.17 Verification. The process of determining that a model, simulation, or federation of models and simulations implementations and their associated data accurately represents the developer's conceptual description and specifications

3.1.18 Verification and Validation (V&V) Agent. The person or organization designated to perform the verification, validation, or both, of a model, simulation, or federation of models and simulations, and their associated data

3.2 Acronyms and abbreviations. The following acronyms and abbreviations are applicable.

DID	Data Item Description
DoD	Department of Defense
M&S	Modeling and Simulation
POC	Point of Contact
SME	Subject Matter Expert
V&V	Verification and Validation
VV&A	Verification, Validation, and Accreditation

4. GENERAL REQUIREMENTS

4.1. DoD Instruction 5000.61, specifies that VV&A information shall be documented (see DoD Instruction 5000.61 paragraph 6.4). The templates in Appendices A through D provide the format and describe the content to document VV&A information.

4.2. VV&A documentation shall be prepared in accordance with the standard templates in Appendices A through D.

5. DETAILED REQUIREMENTS

5.1 Template descriptions. The VV&A effort shall be documented to demonstrate fitness for the intended use and to support model and simulation reuse. The core set of VV&A documents consists of the Accreditation Plan, the V&V Plan, the V&V Report, and the Accreditation Report.

5.1.1 The Accreditation Plan (Appendix A) focuses on; defining the criteria to be used during the accreditation assessment; defining the methodology to conduct the accreditation assessment; defining the resources needed to perform the accreditation assessment; and identifying issues associated with performing the accreditation assessment.

5.1.2 The V&V Plan (Appendix B) focuses on defining the methodology for scoping the V&V effort to the application and the acceptability criteria; defining the V&V tasks to that will produce information to support the accreditation assessment; defining the resources needed to perform the V&V; and identifying issues associated with performing the V&V.

5.1.3 The V&V Report (Appendix C) focuses on documenting the results of the V&V tasks; documenting M&S assumptions, capabilities, limitations, risks, and impacts; identifying unresolved issues associated with V&V implementation; and documenting lessons learned during V&V.

5.1.4 The Accreditation Report (Appendix D) focuses on documenting the results of the accreditation assessment; documenting the recommendations in support of the accreditation decision; and documenting lessons learned during accreditation.

5.2 Information shared across templates. Table I shows the outlines of the four core VV&A documents. Because the documents are normally prepared and used at different times and by different groups, each document needs to be complete. Much of the information included in each is common and should be shared for consistency and efficiency. Information that is common and shared across the documents appears in italicized font in the table below.

TABLE I. Outlines of four core VV&A documents

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

5.3 Template tailoring guidance. When a section or subsection of a template is not applicable, the section or subsection shall be retained for completeness and include the phrase "This section is not applicable." Because planning, implementing, and reporting processes are conducted over time, information not available at the beginning of the process shall be documented as it becomes available.

5.4 Automation and archiving. Automating the production of VV&A information could enhance the efficiency of preparing VV&A documents for the various individuals involved in either the accreditation or the V&V aspects of a project by eliminating the need to recreate information about the VV&A processes or about the M&S itself, (e.g., the problem being solved, the description of the M&S, the intended use, requirements traceability, etc.). VV&A information is important not only for the decision at hand but also for the reuse of M&S applications in the future. Archiving the resulting VV&A information will facilitate its search and discovery by future M&S Users.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This DoD Standard Practice is intended to support the verification, validation, and accreditation of DoD models, simulations, federations, and other types of distributed simulations by providing a common framework for documenting information produced during the VV&A processes. This DoD Standard Practice specifies procedures for documenting information obtained through implementing the verification, validation, and accreditation processes for M&S when the outputs will be used to supplement decisionmaking in the DoD. These types of information, at least some of the time, are obtained via contract from commercial firms. This standard practice may be cited as a contractual requirement in contracts for the verification, validation, or accreditation of all M&S developed, used, or managed by the DoD.

6.2 Acquisition requirements. Acquisition documents should specify the title, number, and date of this standard.

6.3 Associated Data Item Description (DIDs). This standard has been assigned an Acquisition Management Systems Control number authorizing it as the source document for the following DIDs. When it is necessary to obtain the data, the applicable DIDs must be listed on the Contract Data Requirements List (DD Form 1423).

DID Number	DID Title
DI-MSSM-81750	Department of Defense (DoD) Modeling and Simulation (M&S) Accreditation Plan
DI-MSSM-81751	Department of Defense (DoD) Modeling and Simulation (M&S) Verification and Validation (V&V) Plan
DI-MSSM-81752	Department of Defense (DoD) Modeling and Simulation (M&S) Verification and Validation (V&V) Report
DI-MSSM-81753	Department of Defense (DoD) Modeling and Simulation (M&S) Accreditation Report

The above DIDs were current as of the date of this standard. The ASSIST database should be searched at http://assist.daps.dla.mil/quicksearch or http://assist.daps.dla.mil/online/start/ to ensure that the current and approved DIDs are cited on the DD Form 1423.

6.4 Tailoring guidance for contractual applications. To ensure proper application of this standard, invitation for bids, request for proposals, and contractual statements should tailor Appendices A through D in accordance with the requirements of the contractual effort.

6.5 Subject Term (key word) listing

Accreditation Plan
Accreditation Report
Modeling and Simulation (M&S)
Validation and Verification (V&V) Plan
Validation and Verification (V&V) Report

APPENDIX A

ACCREDITATION PLAN TEMPLATE

A.1 SCOPE. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance. This appendix provides a template for the Accreditation Plan. It is organized as the Accreditation Plan would appear when produced.

A.2 ACCREDITATION PLAN TITLE PAGE. The title page shall include the following information. The arrangement of the information on the title page should comply with organizational guidelines.

Document date

Identification of program, project, exercise, or study

Identification of the sponsoring organization or program manager

Document title (e.g., Accreditation Plan for the Capability of ABC M&S Version 1.0 to Support XYZ System Testing)

- Document type (i.e., Accreditation Plan, V&V Plan, V&V Report, or Accreditation Report)
- M&S name and version

Document version

Identification of document preparer (e.g., Lead Investigator, Organization, or Contract)

Distribution statement (if required)

Classification (if required)

APPENDIX A

A.3 RECORD OF CHANGES

Version	Date	Changes

APPENDIX A

A.4 ACCREDITATION PLAN OUTLINE

ACCREDITATION PLAN EXECUTIVE SUMMARY

PROBLEM STATEMENT
- Intended Use
- M&S Overview
- M&S Application
- Accreditation Scope

M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA

M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS
- M&S Assumptions
- M&S Capabilities
- M&S Limitations
- M&S Risks/Impacts

ACCREDITATION METHODOLOGY
- Accreditation Information Needs
- Information Collection Plan
- Assessment Plan

ACCREDITATION ISSUES

KEY PARTICIPANTS
- Accreditation Participants
- V&V Participants
- Other Participants

PLANNED ACCREDITATION RESOURCES
- Accreditation Resource Requirements
- Accreditation Milestones and Timeline

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 PROGRAMMATICS
APPENDIX H DISTRIBUTION LIST

APPENDIX A

A.5 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, acceptability criteria, accreditation methodology, and accreditation issues.

A.6 PROBLEM STATEMENT. This section describes the problem the M&S is expected to address. The problem statement serves as the foundation for the definition of requirements, acceptability criteria, and ultimately the accreditation assessment. It documents (1) the question(s) to be answered and the particular aspects of the problem that the M&S will be used to help address; (2) the decisions that will be made based on the M&S results; and (3) the consequences resulting from erroneous M&S outputs.

A.6.1 Intended Use. This subsection describes the problem to be addressed by the M&S, including the system or process being represented and the role it plays in the overall program.

A.6.2 M&S Overview. This subsection provides an overview of the M&S for which this plan is written and discusses the level of configuration control that currently exists for the M&S. Detailed M&S information is provided in Appendix A.

A.6.3 M&S Application. This subsection describes how the M&S will be used in the overall program and lists the program objectives the M&S should meet in order to fulfill the intended use.

A.6.4 Accreditation Scope. This subsection describes the scope of the accreditation effort based on the assessment of the risk of using the M&S and the availability of resources.

A.7 M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA. This section describes the M&S requirements defined for the intended use, the derived acceptability criteria that should be met to satisfy the requirements, the quantitative and qualitative metrics used to measure their success, and the order of their priority. The relationships among the requirements, acceptability criteria, and metrics/measures can be shown either in the text or in a table (an example of which is shown below).

APPENDIX A

TABLE A-I. Example requirements relationship table

#	M&S Requirement	Acceptability Criteria	Metrics/Measures
1		1.1	1.1
		1.2	1.2
		1.n	1.n
2		2.1	2.1
		2.n	2.n
n		n.n	n.n

A.8 M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS. This section describes known factors that constrain the development and/or use of the M&S or that impede the VV&A effort, including the assumptions, capabilities, limitations, and risk factors affecting M&S development and risks associated with using the M&S for the intended use.

A.8.1 M&S Assumptions. This subsection describes the known assumptions about the M&S and the data used in support of the M&S in the context of the problem.

A.8.2 M&S Capabilities. This subsection describes the known capabilities of the M&S.

A.8.3 M&S Limitations. This subsection describes the known constraints and limitations associated with the development, testing, and/or use of the M&S. These constraints and limitations may be introduced as a result of an ongoing development process or may result from information garnered in previous VV&A efforts. Limiting factors include constraints on M&S capability as well as constraints associated with M&S testing that may result in inadequate information (e.g., inadequate resources, inadequate technical knowledge and subject matter expertise, unavailable data, inadequately defined M&S requirements and methodologies, and inadequate test environments) to support the M&S assessment process.

A.8.4 M&S Risks/Impacts. This subsection describes the known risks associated with the development and/or use of the M&S within the context of the application. Risk factors include identified constraints and limitations; tasks selection and implementation; and schedule. The impacts associated with these risk factors shall also be described.

A.9 ACCREDITATION METHODOLOGY. This section describes the methods to be used in the accreditation assessment.

A.9.1 Accreditation Information Needs. This subsection describes the information needed to conduct the accreditation assessment, e.g., the information expected from the V&V effort, information expected from the development testing effort, information from the M&S developers, and information from the application.

APPENDIX A

A.9.2 Information Collection Plan. This subsection describes how, when, and from whom the information is to be obtained, the form in which the information is to be provided, and the priority of each item.

A.9.3 Assessment Plan. This subsection describes the assessment events, including the assessment techniques to be used, the specific roles and responsibilities of the participants, the milestones to be achieved, and the products to be produced.

A.10 ACCREDITATION ISSUES. This section describes issues associated with the accreditation effort that may arise due to resourcing, scheduling, development, or data problems. The section identifies the issue, the likelihood of its occurrence, contingency plans for addressing it, and the probability of success.

A.11 KEY PARTICIPANTS. This section identifies the participants involved in the VV&A 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.

A.11.1 Accreditation Participants. This subsection lists the participants involved in the accreditation effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical accreditation roles include Accreditation Authority, Accreditation Agent, Accreditation Team, and SMEs.

A.11.2 V&V Participants. This subsection lists the participants involved in the V&V effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical V&V roles include M&S Proponent, V&V Agent, V&V Team, Validation Authority, Data Source, and SMEs.

A.11.3 Other Participants. This subsection identifies the members of the application program and model development effort with V&V or accreditation responsibilities as well as others who have a role in the VV&A processes. The information should include their position or role, contact information, and VV&A responsibilities. Typical roles include M&S Program Manager, M&S Application Sponsor, M&S User, M&S Developer, Data Source, Milestone Decision Authority, Program Office, M&S Development Team, User Group, Configuration Control Board, and SMEs.

A.12 PLANNED ACCREDITATION RESOURCES. This section discusses the resources required to implement this Accreditation Plan, such as performers, man-hours, materials, and funding. This information establishes a mechanism for tracking required resources, the availability of resources, and the impact of resource availability on performing accreditation activities and meeting milestones.

APPENDIX A

A.12.1 Accreditation Resource Requirements. This subsection identifies the resources needed to accomplish the accreditation as planned. The information provided here should include the activity, task, or event; assigned performer; and the list of required resources (e.g., SMEs, equipment, and TDY funding).

A.12.2 Accreditation Milestones and Timeline. This subsection provides a chart of the overall program timeline with program, development, V&V, and accreditation milestones. The activities, tasks, and events, and their associated milestones, products, and deadlines should be consistent with information provided elsewhere in this plan.

A.13 APPENDIX A M&S DESCRIPTION. This appendix contains pertinent detailed information about the M&S being assessed.

A.13.A.1 M&S Overview. This section provides a description of the M&S including the type of model (e.g., stochastic, deterministic, high resolution, low resolution, human in the loop [HITL], hardware in the loop [HWIL], stand-alone, engineering, or aggregated), and what types of problems it is intended to support (e.g., training, force structure analysis, command and control, experimentation, system analysis, or analysis of alternatives).

A.13.A.2 M&S Development and Structure. This section provides information about how the M&S is organized and/or constructed (e.g., the M&S design), hardware and software specifics, and technical statistics (e.g., runtime speed, capacity, and bandwidth). For M&S under development, this section includes the M&S development plan, including the development paradigm being followed (e.g., spiral development or model-test-model), and basic assumptions about its execution.

A.13.A.3 M&S Capabilities and Limitations. This section summarizes the capabilities and the limitations of the M&S.

A.13.A.4 M&S Use History. This section describes how and when the model has been used in the past as well as references relevant historical use documents.

A.13.A.5 Data

A.13.A.5.1 Input Data. This subsection identifies the data required to populate and execute the M&S, including input data sets, hard-wired data (constants), environmental data, and operational data. Provide descriptive metadata, metrics, and authoritative or approved sources for each.

A.13.A.5.2 Output Data. This subsection identifies the M&S output data, including a definition, the unit of measure, and the range of values for each data item.

APPENDIX A

A.13.A.6 Configuration Management. This section includes a description of the M&S configuration management program, lists the M&S artifacts and products that are under configuration management, identifies documentation and reporting requirements that impact the VV&A effort, and provides contact information.

A.14 APPENDIX B M&S REQUIREMENTS TRACEABILITY MATRIX. This appendix establishes the links between the M&S requirements, the acceptability criteria, and the evidence collected during the V&V processes. Building on Table I in Section 2, the traceability matrix provides a visual representation of the chain of information that evolves as the VV&A processes are implemented. As implementation progresses from the planning to reporting phases, the traceability matrix assists in the identification of information gaps that may result from VV&A activities not performed, not addressed, or not funded. The following table provides an example of a traceability matrix.

TABLE A-II. M&S requirements traceability

	Accreditation Plan		V&V Plan	V&V Report	Accreditation Report
#	M&S Requirement	Acceptability Criterion	Planned V&V Task / Activity	V&V Task Analysis	Accreditation Assessment
1		1.1	1.1.1	1.1.1	1.1.1
			1.1.2	1.1.2	1.1.2
		1.2	1.2	1.2	1.2
		1.n	1.n	1.n	1.n
2		2.1	2.1	2.1	2.1
		2.n	2.n	2.n	2.n
n		n.n	n.n	n.n	n.n

A.15 APPENDIX C BASIS OF COMPARISON. This appendix describes the basis of comparison used for validation. The basis for comparison serves as the reference against which the accuracy of the M&S representations is measured. The basis of comparison can come in many forms, such as the results of experiments, theory developed from experiments, validated results from other M&S, and expert knowledge obtained through research or from SMEs.

A.16 APPENDIX D REFERENCES. This appendix identifies all of the references used in the development of this document.

A.17 APPENDIX E ACRONYMS. This appendix identifies all acronyms used in this document.

A.18 APPENDIX F GLOSSARY. This appendix contains definitions that aid in the understanding of this document.

APPENDIX A

A.19 APPENDIX G ACCREDITATION PROGRAMMATICS. This appendix contains detailed information regarding resource allocation and funding that can be used to track VV&A expenditures. The following table provides an example of a resource allocation table.

TABLE A-III. Example resource allocation table

Planned Resource Allocations and Funding						
Accreditation Activity	**Required Resources**	**Funding Source**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**

A.20 APPENDIX H DISTRIBUTION LIST. This appendix provides the distribution list for hardcopies or digital copies of the approved document.

APPENDIX B

V&V PLAN TEMPLATE

B.1 SCOPE. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance. This appendix provides a template for the V&V Plan. It is organized as the V&V Plan would appear when produced.

B.2 V&V PLAN TITLE PAGE. The title page shall include the following information. The arrangement of the information on the title page should comply with organizational guidelines.

Document date

Identification of program, project, exercise, or study

Identification of the sponsoring organization or program manager

Document title (e.g., V&V Plan for the Capability of ABC M&S Version 1.0 to Support XYZ System Testing)

- Document type (i.e., Accreditation Plan, V&V Plan, V&V Report, or Accreditation Report)
- M&S name and version

Document version

Identification of document preparer (e.g., Lead Investigator, Organization, or Contract)

Distribution statement (if required)

Classification (if required)

APPENDIX B

B.3 RECORD OF CHANGES

Version	Date	Changes

APPENDIX B

B.4 V&V PLAN OUTLINE

V&V PLAN EXECUTIVE SUMMARY

PROBLEM STATEMENT
- Intended Use
- M&S Overview
- M&S Application
- Accreditation Scope
- V&V Scope

M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA

M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS
- M&S Assumptions
- M&S Capabilities
- M&S Limitations
- M&S Risks/Impacts

V&V METHODOLOGY
- Planned Data V&V Tasks/Activities
  - Data Verification Tasks/Activities
  - Data Validation Tasks/Activities
  - Required Validation Data
- Planned Conceptual Model Validation Tasks/Activities
- Planned Design Verification Tasks/Activities
- Planned Implementation Verification Tasks/Activities
  - Define Suite of Tests
  - Implementation Verification Test Description
- Planned Results Validation Tasks/Activities
  - Define Suite of Tests
  - Results Validation Test Description
- Planned V&V Reporting Tasks/Activities

V&V ISSUES

KEY PARTICIPANTS
- Accreditation Participants
- V&V Participants
- Other Participants

APPENDIX B

B.4 V&V PLAN OUTLINE - CONTINUED

PLANNED V&V RESOURCES
- V&V Resource Requirements
- V&V Milestones and Timeline

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 V&V PROGRAMMATICS
APPENDIX H DISTRIBUTION LIST
APPENDIX I ACCREDITATION PLAN

APPENDIX B

B.5 V&V PLAN EXECUTIVE SUMMARY. The executive summary provides an overview of the V&V 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 V&V scope, M&S requirements and acceptability criteria, V&V methodology, and V&V issues.

B.6 PROBLEM STATEMENT. This section describes the problem the M&S is expected to address. The problem statement serves as the foundation for the definition of requirements, acceptability criteria, and ultimately the accreditation assessment. It documents (1) the question(s) to be answered and the particular aspects of the problem that the M&S will be used to help address; (2) the decisions that will be made based on the M&S results; and (3) the consequences resulting from erroneous M&S outputs.

B.6.1 Intended Use. This subsection describes the problem to be addressed by the M&S, including the system or process being represented and the role it plays in the overall program.

B.6.2 M&S Overview. This subsection provides an overview of the M&S for which this plan is written and discusses the level of configuration control that currently exists for the M&S. Detailed M&S information is provided in Appendix A.

B.6.3 M&S Application. This subsection describes how the M&S will be used in the overall program and lists the program objectives the M&S should meet in order to fulfill the intended use.

B.6.4 Accreditation Scope. This subsection describes the scope of the accreditation effort based on the assessment of the risk of using the M&S and the availability of resources.

B.6.5 V&V Scope. This subsection describes the scope of the V&V effort based on the assessment of M&S requirements, acceptability criteria, and the availability of resources.

B.7 M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA. This section describes the M&S requirements defined for the intended use, the derived acceptability criteria that should be met to satisfy the requirements, the quantitative and qualitative metrics used to measure their success, and the order of their priority. The relationship between the requirements, acceptability criteria, and metrics/measures can be shown either in text or in a table (an example of which is shown below).

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TABLE B-I. Example requirements relationship table

#	M&S Requirement	Acceptability Criteria	Metrics/Measures
1		1.1	1.1
		1.2	1.2
		1.n	1.n
2		2.1	2.1
		2.n	2.n
n		n.n	n.n

B.8 M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS. This section describes known factors that constrain the development and/or use of the M&S or that impede the VV&A effort, including the assumptions, capabilities, limitations, and risk factors affecting M&S development and risks associated with using the M&S for the intended use.

B.8.1 M&S Assumptions. This subsection describes the known assumptions about the M&S and the data used in support of the M&S in the context of the problem.

B.8.2 M&S Capabilities. This subsection describes the known capabilities of the M&S.

B.8.3 M&S Limitations. This subsection describes the known constraints and limitations associated with the development, testing, and/or use of the M&S. These constraints and limitations may be introduced as a result of an ongoing development process or may result from information garnered in previous VV&A efforts. Limiting factors include constraints on M&S capability as well as constraints associated with M&S testing that may result in inadequate information (e.g., inadequate resources, inadequate technical knowledge and subject matter expertise, unavailable data, inadequately defined M&S requirements and methodologies, and inadequate test environments) to support the M&S assessment process.

B.8.4 M&S Risks/Impacts. This subsection describes the known risks associated with the development and/or use of the M&S within the context of the application. Risk factors include identified constraints and limitations; tasks selection and implementation; and schedule. The impacts associated with these risk factors shall also be described.

B.9 V&V METHODOLOGY. The core of the V&V Plan lies in a step-by-step road-mapping of how the V&V tasks should be performed. V&V tasks should be tailored according to need, valued added, and resources. In this section, describe what V&V tasks are planned, as well as each task's objectives, assumptions, constraints, criteria, methodology, and how they should be measured and evaluated. Identify what performance metrics should be used.

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B.9.1 Planned Data V&V Tasks/Activities

B.9.1.1 Data Verification Tasks/Activities. This subsection describes the overall approach for verifying the data within the context of how it is used in the M&S.

B.9.1.2 Data Validation Tasks/Activities. This subsection describes the overall approach for validating the data within the context of how it is used in the M&S.

B.9.1.3 Required Validation Data. This subsection describes/identifies the data that are needed to implement the tasks. It also describes the coordination mechanism and schedule for obtaining the needed data.

B.9.2 Planned Conceptual Model Validation Tasks/Activities. This subsection describes the overall approach for validating the conceptual model. It should correlate specific segments of the conceptual model to the M&S requirements and acceptability criteria as well as identify which authoritative resources will be used to establish the validity, including subject matter experts (SMEs), reference documents, and reference data. For each, the following information should be provided:

a. Name and contact information (e.g., address, phone number, email)
b. Agency
c. Summary of relevant experience
d. Education credentials
e. Relevant publications

B.9.3 Planned Design Verification Tasks/Activities. This subsection describes the overall approach for verifying the M&S design. It should correlate specific segments of the design to the conceptual model and to the acceptability criteria as well as cite applicable standards, codes, best practices, etc., to which the design should adhere and how adherence should be evaluated.

B.9.4 Planned Implementation Verification Tasks/Activities. This subsection describes the overall approach for verifying the M&S implementation. It should describe how the M&S development documentation (installation guide, user's manual, etc.) should be reviewed and evaluated, as well as state how completeness, correctness, and consistency of functional requirements should be measured.

B.9.4.1 Define Suite of Tests. This subsection should include a discussion of the planned scenarios, test cases, and sample size required, as well as a determination of the completeness of the test suite to support traceability to the M&S requirements. Traceability to requirements and acceptability criteria are documented in Appendix B M&S Requirements Traceability Matrix. Additionally, these tests are intended to verify that the software code is error free and that there is successful integration of all components into a single system, system of systems, or federation.

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B.9.4.2 Implementation Verification Test Description. This subsection should discuss what organization will run the tests, what organization will analyze the results, the time required to do so, and the schedule for accomplishing the runs. An example of the type of information to document follows:

a. Identify the test by name, date, and time.
b. Identify tester's name, organization, phone, and email address.
c. Describe the hardware/software architecture.
d. State purpose relative to the acceptability criteria.
e. Provide brief description.
f. Identify any prerequisite conditions that must be established prior to performing the test case.
g. Describe test inputs necessary for the test case.
h. Identify all expected results for the test case.
i. Define the test procedure for the test case.
j. Identify any assumptions made or constraints imposed in the description of the test case.
k. Identify the verification technique to be used.

B.9.5 Planned Results Validation Tasks/Activities. This subsection describes the overall approach for validating the M&S results. It should correlate M&S results with acceptability criteria and M&S requirements as well as identify all authoritative resources to be used in evaluating the M&S results, including SMEs; mathematical or statistical techniques; and data resources. It should state how the resources are to be applied and how the results are to be evaluated. For SMEs, it should describe the specialized skills or knowledge that is needed.

B.9.5.1 Define Suite of Tests. This subsection includes a discussion of the planned scenarios, test cases, and sample size required to assess the M&S results from the perspective of the intended use. Traceability to requirements and acceptability criteria are documented in Appendix B M&S Requirements Traceability Matrix.

B.9.5.2 Results Validation Test Description. This subsection describes the planned results validation tests, the organization that will run the tests, the organization that will analyze the results, the time required to do so, and the schedule for accomplishing the tests. An example of the type of information to document follows:

APPENDIX B

a. Identify the test by name, date, and time.
b. Identify tester's name, organization, phone, and email address.
c. Describe the hardware/software architecture.
d. State purpose relative to the acceptability criteria.
e. Provide brief description.
f. Identify any prerequisite conditions that must be established prior to performing the test case.
g. Describe test inputs necessary for the test case.
h. Identify all expected results for the test case.
i. Define the test procedure for the test case.
j. Identify any assumptions made or constraints imposed in the description of the test case.
k. Identify the validation technique to be used.

B.9.6 Planned V&V Reporting Tasks/Activities. This subsection describes the plans for producing and delivering the V&V Report and Accreditation Package.

B.10 V&V ISSUES. This section discusses the important unresolved issues relevant to this stage of the VV&A effort, including administration, coordination, and execution. Report activities underway to address these issues and the probability of each activity's success. As the V&V effort is both iterative and dependent on the products of the M&S development process, the V&V processes should, most likely, uncover several unresolved issues throughout the VV&A effort. Although these open-ended areas of concern are common, it is important to document all issues early on and formulate what activities are being executed, or will be conducted, to address each issue, along with the probability of their success.

B.11 KEY PARTICIPANTS. This section identifies the participants involved in the VV&A 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.

B.11.1 Accreditation Participants. This subsection lists the participants involved in the accreditation effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical accreditation roles include Accreditation Authority, Accreditation Agent, Accreditation Team, and SMEs.

B.11.2 V&V Participants. This subsection lists the participants involved in the V&V effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical V&V roles include M&S Proponent, V&V Agent, V&V Team, Validation Authority, Data Source, and SMEs.

APPENDIX B

B.11.3 Other Participants. This subsection identifies the members of the application program and model development effort with V&V or accreditation responsibilities as well as others who have a role in the VV&A processes. The information should include their position or role, contact information, and VV&A responsibilities. Typical roles include M&S Program Manager, M&S Application Sponsor, M&S User, M&S Developer, Data Source, Milestone Decision Authority, Program Office, M&S Development Team, User Group, Configuration Control Board, and SMEs.

B.12 PLANNED V&V RESOURCES. This section discusses the resources required to implement this V&V Plan, such as performers, man-hours, materials, and funding. This information establishes a mechanism for tracking required resources, the availability of resources, and the impact of resource availability on performing V&V activities and meeting milestones.

B.12.1 V&V Resource Requirements. This subsection identifies the resources needed to accomplish the V&V as planned. The information provided here should include the activity, task, or event; assigned performer; and the list of required resources (e.g., SMEs, equipment, and TDY funding).

B.12.2 V&V Milestones and Timeline. This subsection provides a chart of the overall program timeline with program, development, V&V, and accreditation milestones. The activities, tasks, and events, and their associated milestones, products, and deadlines should be consistent with information provided elsewhere in this plan.

B.13 APPENDIX A M&S DESCRIPTION. This appendix contains pertinent detailed information about the M&S being assessed.

B.13.A.1 M&S Overview. This section provides a description of the M&S including the type of model (e.g., stochastic, deterministic, high resolution, low resolution, human in the loop [HITL], hardware in the loop [HWIL], stand-alone, engineering, or aggregated), and what types of problems it is intended to support (e.g., training, force structure analysis, command and control, experimentation, system analysis, or analysis of alternatives).

B.13.A.2 M&S Development and Structure. This section provides information about how the M&S is organized and/or constructed (e.g., the M&S design), hardware and software specifics, and technical statistics (e.g., runtime speed, capacity, and bandwidth). For M&S under development, this section includes the M&S development plan, including the development paradigm being followed (e.g., spiral development or model-test-model), and basic assumptions about its execution.

B.13.A.3 M&S Capabilities and Limitations. This section summarizes the capabilities and the limitations of the M&S.

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B.13.A.4 M&S Use History. This section describes how and when the model has been used in the past as well as references relevant historical use documents.

B.13.A.5 Data

B.13.A.5.1 Input Data. This subsection identifies the data required to populate and execute the M&S, including input data sets, hard-wired data (constants), environmental data, and operational data. Provide descriptive metadata, metrics, and authoritative or approved sources for each.

B.13.A.5.2 Output Data. This subsection identifies the M&S output data, including a definition, the unit of measure, and the range of values for each data item.

B.13.A.6 Configuration Management. This section includes a description of the M&S configuration management program, lists the M&S artifacts and products that are under configuration management, identifies documentation and reporting requirements that impact the VV&A effort, and provides contact information.

B.14 APPENDIX B M&S REQUIREMENTS TRACEABILITY MATRIX. This appendix establishes the links between the M&S requirements, the acceptability criteria, and the evidence collected during the V&V processes. Building on Table I defined in Section 2, the traceability matrix provides a visual representation of the chain of information that evolves as the VV&A processes are implemented. As implementation progresses from the planning to reporting phases, the traceability matrix assists in the identification of information gaps that may result from VV&A activities not performed, not addressed, or not funded. The following table provides an example of a traceability matrix.

TABLE B-II. M&S requirements traceability

	Accreditation Plan		V&V Plan	V&V Report	Accreditation Report
#	M&S Requirement	Acceptability Criterion	Planned V&V Task / Activity	V&V Task Analysis	Accreditation Assessment
1		1.1	1.1.1	1.1.1	1.1.1
			1.1.2	1.1.2	1.1.2
		1.2	1.2	1.2	1.2
		1.n	1.n	1.n	1.n
2		2.1	2.1	2.1	2.1
		2.n	2.n	2.n	2.n
n		n.n	n.n	n.n	n.n

APPENDIX B

B.15 APPENDIX C BASIS OF COMPARISON. This appendix describes the basis of comparison used for validation. The basis for comparison serves as the reference against which the accuracy of the M&S representations is measured. The basis of comparison can come in many forms, such as the results of experiments, theory developed from experiments, validated results from other M&S, and expert knowledge obtained through research or from SMEs.

B.16 APPENDIX D REFERENCES. This appendix identifies all of the references used in the development of this document.

B.17 APPENDIX E ACRONYMS. This appendix identifies all acronyms used in this document.

B.18 APPENDIX F GLOSSARY. This appendix contains definitions that aid in the understanding of this document.

B.19 APPENDIX G V&V PROGRAMMATICS. This appendix contains detailed information regarding resource allocation and funding. The following table provides an example of a resource allocation table.

TABLE B-III. Example resource allocation table

Planned Resource Allocations and Funding						
V&V Activity	**Required Resources**	**Funding Source**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**

B.20 APPENDIX H DISTRIBUTION LIST. This appendix provides the distribution list for hardcopies or digital copies of the approved document.

B.21 APPENDIX I ACCREDITATION PLAN. This appendix provides a copy of or a reference to the Accreditation Plan for the simulation for which this document has been prepared.

APPENDIX C

V&V REPORT TEMPLATE

C.1 SCOPE. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance. This appendix provides a template for the V&V Report. It is organized as the V&V Report would appear when produced.

C.2 V&V REPORT TITLE PAGE. The title page shall include the following information. The arrangement of the information on the title page should comply with organizational guidelines.

Document date

Identification of program, project, exercise, or study

Identification of the sponsoring organization or program manager

Document title (e.g., V&V Report for the Capability of ABC M&S Version 1.0 to Support XYZ System Testing)

- Document type (i.e., Accreditation Plan, V&V Plan, V&V Report, or Accreditation Report)

- M&S name and version

Document version

Identification of document preparer (e.g., Lead Investigator, Organization, or Contract)

Distribution statement (if required)

Classification (if required)

APPENDIX C

C.3 RECORD OF CHANGES

Version	Date	Changes

APPENDIX C

C.4 V&V REPORT OUTLINE

V&V REPORT EXECUTIVE SUMMARY

PROBLEM STATEMENT
- Intended Use
- M&S Overview
- M&S Application
- Accreditation Scope
- V&V Scope

M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA

M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS
- M&S Assumptions
- M&S Capabilities
- M&S Limitations
- M&S Risks/Impacts

V&V TASK ANALYSIS
- Data V&V Task Analysis
  - Data Verification Task Analysis
  - Data Validation Task Analysis
- Conceptual Model Validation Task Analysis
- Design Verification Task Analysis
- Implementation Verification Task Analysis
- Results Validation Task Analysis
- V&V Reporting Task Analysis

V&V RECOMMENDATIONS

KEY PARTICIPANTS
- Accreditation Participants
- V&V Participants
- Other Participants

ACTUAL V&V RESOURCES EXPENDED
- V&V Resources Expended
- Actual V&V Milestones and Timeline

V&V LESSONS LEARNED

APPENDIX C

C.4 V&V REPORT OUTLINE - CONTINUED

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 PROGRAMMATICS
APPENDIX H DISTRIBUTION LIST
APPENDIX I V&V PLAN
APPENDIX J TEST INFORMATION

APPENDIX C

C.5 V&V REPORT EXECUTIVE SUMMARY. The executive summary provides an overview of the V&V Report. It should be a synopsis, two to four pages in length, of the major elements from all sections of the document, with emphasis on V&V scope, M&S requirements and acceptability criteria, V&V task analysis, and V&V recommendations.

C.6 PROBLEM STATEMENT. This section describes the problem the M&S is expected to address. The problem statement serves as the foundation for the definition of requirements, acceptability criteria, and ultimately the accreditation assessment. It documents (1) the question(s) to be answered and the particular aspects of the problem that the M&S will be used to help address; (2) the decisions that will be made based on the M&S results; and (3) the consequences resulting from erroneous M&S outputs.

C.6.1 Intended Use. This subsection describes the problem to be addressed by the M&S, including the system or process being represented and the role it plays in the overall program.

C.6.2 M&S Overview. This subsection provides an overview of the M&S for which this report is written and discusses the level of configuration control that currently exists for the M&S. Detailed M&S information is provided in Appendix A.

C.6.3 M&S Application. This subsection describes how the M&S will be used in the overall program and lists the program objectives the M&S should meet in order to fulfill the intended use.

C.6.4 Accreditation Scope. This subsection describes the focus of the accreditation effort based on the assessment of the risk of using the M&S and the availability of resources.

C.6.5 V&V Scope. This subsection describes the scope of the V&V effort based on the assessment of M&S requirements, acceptability criteria, and the availability of resources.

C.7 M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA. This section describes the M&S requirements defined for the intended use, the derived acceptability criteria that should be met to satisfy the requirements, the quantitative and qualitative metrics used to measure their success, and the order of their priority. The relationship between the requirements, acceptability criteria, and metrics/measures can be shown either in text or in a table (an example of which is shown below).

APPENDIX C

TABLE C-I. Example requirements relationship table

#	M&S Requirement	Acceptability Criteria	Metrics/Measures
1		1.1	1.1
		1.2	1.2
		1.n	1.n
2		2.1	2.1
		2.n	2.n
n		n.n	n.n

C.8 M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS. This section describes known factors that constrain the development and/or use of the M&S or that impede the VV&A effort, including the assumptions, capabilities, limitations, and risk factors affecting M&S development and risks associated with using the M&S for the intended use.

C.8.1 M&S Assumptions. This subsection describes the known assumptions about the M&S, the M&S capabilities, the data used in support of the M&S, and any constraints placed upon the M&S by the context of the problem.

C.8.2 M&S Capabilities. This subsection describes the known capabilities of the M&S.

C.8.3 M&S Limitations. This subsection describes the known constraints and limitations associated with the development, testing, and/or use of the M&S. These constraints and limitations may be introduced as a result of an ongoing development process or may result from information garnered in previous VV&A efforts. Limiting factors include constraints on M&S capability as well as constraints associated with M&S testing that may result in inadequate information (e.g., inadequate resources, inadequate technical knowledge and subject matter expertise, unavailable data, inadequately defined M&S requirements and methodologies, and inadequate test environments) to support the M&S assessment process.

C.8.4 M&S Risks/Impacts. This subsection describes the risks including those discovered during implementation that are associated with the development and/or use of the M&S within the context of the application. Risk factors include identified constraints and limitations; tasks selection and implementation; and schedule. The impacts associated with these risk factors shall also be described.

C.9 V&V TASK ANALYSIS. This section provides an overview of the results of the V&V inspection and testing activities, as outlined below. Included are details regarding any deviations from the V&V Plan and the justification for each change as well as all sources of data and any applicable quality-assurance documentation.

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C.9.1 Data V&V Task Analysis

C.9.1.1 Data Verification Task Analysis. This subsection describes the analysis of the results of each data verification task.

C.9.1.2 Data Validation Task Analysis. This subsection describes the analysis of the results of each data validation task.

C.9.2 Conceptual Model Validation Task Analysis. This subsection describes the analysis of the results of each conceptual model validation task.

C.9.3 Design Verification Task Analysis. This subsection describes the analysis of the results of each design verification task.

C.9.4 Implementation Verification Task Analysis. This subsection describes the analysis of the implementation verification test results. An example of the type of information to document follows:

Test Results:

a. Record results for each step of the test procedure executed and describe any unresolved anomalies or discrepancies of any kind encountered during the execution of the test. Identify the verification technique(s) used.
b. Correlate the expected results with the test results. Describe and analyze anomalies.
c. Include or reference amplifying information that may help to isolate and correct the cause of any discrepancy.
d. Provide an assessment by the tester as to the cause of each discrepancy and a means of correcting it.
e. Assess and describe how the results compare to the related acceptability criteria.

C.9.5 Results Validation Task Analysis. This subsection describes the analysis of the validation test results. An example of the type of information to document follows:

Test Results:

a. Record results for each step of the test procedure executed and describe any unresolved anomalies or discrepancies of any kind encountered during the execution of the test. Identify the validation technique(s) used.
b. Correlate the expected results with the test results. Describe and analyze anomalies.
c. Include or reference amplifying information that may help to isolate and correct the cause of any discrepancy.
d. Provide an assessment by the tester as to the cause of each discrepancy and a means of correcting it.
e. Assess and describe how the results compare to the related acceptability criteria.

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C.9.6 V&V Reporting Task Analysis. This subsection describes how the V&V activities were documented and what documentation was delivered.

C.10 V&V RECOMMENDATIONS. This section discusses any unresolved issues relevant to the V&V effort and reports activities undertaken to address these issues and associated recommendations. This section also describes the conclusions of the M&S fidelity as drawn from the V&V processes and the articulation of any unresolved issues. These issues should be enumerated along with any processes undertaken for their resolution, and recommendations relevant to M&S development, V&V processes, accreditation, and/or M&S use.

C.11 KEY PARTICIPANTS. This section identifies the participants involved in the VV&A 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.

C.11.1 Accreditation Participants. This subsection lists the participants involved in the accreditation effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical accreditation roles include Accreditation Authority, Accreditation Agent, Accreditation Team, and SMEs.

C.11.2 V&V Participants. This subsection lists the participants involved in the V&V effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical V&V roles include M&S Proponent, V&V Agent, V&V Team, Validation Authority, Data Source, and SMEs.

C.11.3 Other Participants. This subsection identifies the members of the application program and model development effort with V&V or accreditation responsibilities as well as others who have a role in the VV&A processes. The information should include their position or role, contact information, and VV&A responsibilities. Typical roles include M&S Program Manager, M&S Application Sponsor, M&S User, M&S Developer, Data Source, Milestone Decision Authority, Program Office, M&S Development Team, User Group, Configuration Control Board, and SMEs.

C.12 ACTUAL V&V RESOURCES EXPENDED. This section discusses the resources expended during execution of the V&V Plan, such as performers, man-hours, materials, and funding. This information provides a mechanism to identify the impact of resource gaps on the current application and to scope resource requirements for future applications.

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C.12.1 V&V Resources Expended. This subsection identifies the resources that were expended to accomplish the V&V activities. The information provided here should include the activity, task, or event; assigned performer; and the list of required resources (e.g., SMEs, equipment, and TDY funding). A gap analysis should be conducted that compares the required resources as identified in the V&V Plan to the resources expended to determine if a shortfall existed and, as a result, what information needed to support the accreditation assessment was not produced.

C.12.2 Actual V&V Milestones and Timeline. This subsection provides a chart of when the V&V milestones were achieved within the context of the overall program timeline.

C.13 V&V LESSONS LEARNED. The development and fulfillment of any successful and streamlined process necessarily includes adjustments to its steps. This section provides a summary of the adjustments and lessons learned during the V&V implementation.

C.14 APPENDIX A M&S DESCRIPTION. This appendix contains pertinent detailed information about the M&S being assessed.

C.14.A.1 M&S Overview. This section provides a description of the M&S including the type of model (e.g., stochastic, deterministic, high resolution, low resolution, human in the loop [HITL], hardware in the loop [HWIL], stand-alone, engineering, or aggregated), and what types of problems it is intended to support (e.g., training, force structure analysis, command and control, experimentation, system analysis, or analysis of alternatives).

C.14.A.2 M&S Development and Structure. This section provides information about how the M&S is organized and/or constructed (e.g., the M&S design), hardware and software specifics, and technical statistics (e.g., runtime speed, capacity, and bandwidth). For M&S under development, this section includes the M&S development plan, including the development paradigm being followed (e.g., spiral development or model-test-model), and basic assumptions about its execution.

C.14.A.3 M&S Capabilities and Limitations. This section summarizes the capabilities and the limitations of the M&S.

C.14.A.4 M&S Use History. This section describes how and when the model has been used in the past as well as references relevant historical use documents.

C.14.A.5 Data

C.14.A.5.1 Input Data. This subsection identifies the data required to populate and execute the M&S, including input data sets, hard-wired data (constants), environmental data, and operational data. Provide descriptive metadata, metrics, and authoritative or approved sources for each.

APPENDIX C

C.14.A.5.2 Output Data. This subsection identifies the M&S output data, including a definition, the unit of measure, and the range of values for each data item.

C.14.A.6 Configuration Management. This section includes a description of the M&S configuration management program, lists the M&S artifacts and products that are under configuration management, identifies documentation and reporting requirements that impact the VV&A effort, and provides contact information.

C.15 APPENDIX B M&S REQUIREMENTS TRACEABILITY MATRIX. This appendix establishes the links between the M&S requirements, the acceptability criteria, and the evidence collected during the V&V processes. Building on Table I in Section 2, the traceability matrix provides a visual representation of the chain of information that evolves as the VV&A processes are implemented. As implementation progresses from the planning to reporting phases, the traceability matrix assists in the identification of information gaps that may result from VV&A activities not performed, not addressed, or not funded. The following table provides an example of a traceability matrix.

TABLE C-II. M&S requirements traceability

	Accreditation Plan		V&V Plan	V&V Report	Accreditation Report
#	M&S Requirement	Acceptability Criterion	Planned V&V Task / Activity	V&V Task Analysis	Accreditation Assessment
1		1.1	1.1.1	1.1.1	1.1.1
			1.1.2	1.1.2	1.1.2
		1.2	1.2	1.2	1.2
		1.n	1.n	1.n	1.n
2		2.1	2.1	2.1	2.1
		2.n	2.n	2.n	2.n
n		n.n	n.n	n.n	n.n

C.16 APPENDIX C BASIS OF COMPARISON. This appendix describes the basis of comparison used for validation. The basis for comparison serves as the reference against which the accuracy of the M&S representations is measured. The basis of comparison can come in many forms, such as the results of experiments, theory developed from experiments, validated results from other M&S, and expert knowledge obtained through research or from SMEs.

C.17 APPENDIX D REFERENCES. This appendix identifies all of the references used in the development of this document.

C.18 APPENDIX E ACRONYMS. This appendix identifies all acronyms used in this document.

APPENDIX C

C.19 APPENDIX F GLOSSARY. This appendix contains definitions that aid in the understanding of this document.

C.20 APPENDIX G V&V PROGRAMMATICS. This appendix contains detailed information regarding resource allocation and funding. The following table provides an example of a resource allocation table.

TABLE C-III. Example resource allocation table

Actual Resource Allocations and Funding						
V&V Activity	**Required Resources**	**Funding Source**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**

C.21 APPENDIX H DISTRIBUTION LIST. This appendix provides the distribution list for hardcopies or digital copies of the approved document.

C.22 APPENDIX I V&V PLAN. This appendix provides a copy of or a reference to the V&V Plan in its most current iteration.

C.23 APPENDIX J TEST INFORMATION. This appendix contains information on scenarios, data, setup, etc.

APPENDIX D

ACCREDITATION REPORT TEMPLATE

D.1 SCOPE. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance. This appendix provides a template for the Accreditation Report. It is organized as the Accreditation Report would appear when produced.

D.2 ACCREDITATION REPORT TITLE PAGE. The title page shall include the following information. The arrangement of the information on the title page should comply with organizational guidelines.

Document date

Identification of program, project, exercise, or study

Identification of the sponsoring organization or program manager

Document title (e.g., Accreditation Report for the Capability of ABC M&S Version 1.0 to Support XYZ System Testing)

Document type (i.e., Accreditation Plan, V&V Plan, V&V Report, or Accreditation Report)

M&S name and version

Document version

Identification of document preparer (e.g., Lead Investigator, Organization, or Contract)

Distribution statement (if required)

Classification (if required)

APPENDIX D

D.3 RECORD OF CHANGES

Version	Date	Changes

APPENDIX D

D.4 ACCREDITATION REPORT OUTLINE

ACCREDITATION REPORT EXECUTIVE SUMMARY

PROBLEM STATEMENT
- Intended Use
- M&S Overview
- M&S Application
- Accreditation Scope

M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA

M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS
- M&S Assumptions
- M&S Capabilities
- M&S Limitations
- M&S Risks/Impacts

ACCREDITATION ASSESSMENT
- Accreditation Information Used
- Information Collection
- Assessment

ACCREDITATION RECOMMENDATIONS

KEY PARTICIPANTS
- Accreditation Participants
- V&V Participants
- Other Participants

ACTUAL ACCREDITATION RESOURCES EXPENDED
- Accreditation Resources Expended
- Actual Accreditation Milestones and Timeline

ACCREDITATION LESSONS LEARNED

APPENDIX D

D.4 ACCREDITATION REPORT OUTLINE - CONTINUED

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 ACCREDITATION PROGRAMMATICS
APPENDIX H DISTRIBUTION LIST
APPENDIX I ACCREDITATION PLAN
APPENDIX J V&V REPORT

APPENDIX D

D.5 ACCREDITATION REPORT EXECUTIVE SUMMARY. The executive summary provides an overview of the Accreditation Report. 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, accreditation assessment, and the accreditation recommendations.

D.6 PROBLEM STATEMENT. This section describes the problem the M&S is expected to address. The problem statement serves as the foundation for the definition of requirements, acceptability criteria, and ultimately the accreditation assessment. It documents (1) the question(s) to be answered and the particular aspects of the problem that the M&S will be used to help address; (2) the decisions that will be made based on the M&S results; and (3) the consequences resulting from erroneous M&S outputs.

D.6.1 Intended Use. This subsection describes the problem to be addressed by the M&S, including the system or process being represented and the role it plays in the overall program.

D.6.2 M&S Overview. This subsection provides an overview of the M&S for which this report is written and discusses the level of configuration control that currently exists for the M&S. Detailed M&S information is provided in Appendix A.

D.6.3 M&S Application. This subsection describes how the M&S will be used in the overall program and lists the program objectives the M&S should meet in order to fulfill the intended use.

D.6.4 Accreditation Scope. This subsection describes the focus of the accreditation effort based on the assessment of the risk of using the M&S and the availability of resources.

D.7 M&S REQUIREMENTS AND ACCEPTABILITY CRITERIA. This section describes the M&S requirements defined for the intended use, the derived acceptability criteria that should be met to satisfy the requirements, the quantitative and qualitative metrics used to measure their success, and the order of their priority. The relationship between the requirements, acceptability criteria, and metrics/measures can be shown either in text or in a table (an example of which is shown below).

APPENDIX D

TABLE D-I. Example requirements relationship table

#	M&S Requirement	Acceptability Criteria	Metrics/Measures
1		1.1	1.1
		1.2	1.2
		1.n	1.n
2		2.1	2.1
		2.n	2.n
n		n.n	n.n

D.8 M&S ASSUMPTIONS, CAPABILITIES, LIMITATIONS, & RISKS/IMPACTS. This section describes known factors that constrain the development and/or use of the M&S or that impede the VV&A effort, including the assumptions, capabilities, limitations, and risk factors affecting M&S development and risks associated with using the M&S for the intended use.

D.8.1 M&S Assumptions. This subsection describes the known assumptions about the M&S, the M&S capabilities, the data used in support of the M&S, and any constraints placed upon the M&S by the context of the problem.

D.8.2 M&S Capabilities. This subsection describes the known capabilities of the M&S.

D.8.3 M&S Limitations. This subsection describes the known constraints and limitations associated with the development, testing, and/or use of the M&S. These constraints and limitations may be introduced as a result of an ongoing development process or may result from information garnered in previous VV&A efforts. Limiting factors include constraints on M&S capability as well as constraints associated with M&S testing that may result in inadequate information (e.g., inadequate resources, inadequate technical knowledge and subject matter expertise, unavailable data, inadequately defined M&S requirements and methodologies, and inadequate test environments) to support the M&S assessment process.

D.8.4 M&S Risks/Impacts. This subsection describes the risks including those discovered during implementation that are associated with the development and/or use of the M&S within the context of the application. Risk factors include identified constraints and limitations; tasks selection and implementation; and schedule. The impacts associated with these risk factors shall also be described.

D.9 ACCREDITATION ASSESSMENT. This section describes the methods used in the accreditation assessment.

D.9.1 Accreditation Information Used. This section describes the information used to conduct the accreditation assessment. It should map to the Accreditation Information Needs subsection of the Accreditation Plan.

D.9.2 Information Collection. This subsection describes how, when, and from whom the information was obtained and references the appendix, document, or archive where the actual information can be found.

D.9.3 Assessment. This subsection describes the assessment events, including assessment techniques used, participants involved, milestones achieved, and the results of the assessment events. The assessment focuses on the evidence documented in the V&V Report and how well that evidence addresses the acceptability criteria documented in the Accreditation Plan. This assessment forms the basis for the accreditation recommendations. The relationship of the accreditation assessment findings to the V&V evidence is recorded in Appendix B.

D.10 ACCREDITATION RECOMMENDATIONS. This section describes the accreditation recommendations to be forwarded to the Accreditation Authority and provides the rationale for each.

D.11 KEY PARTICIPANTS. This section identifies the participants involved in the VV&A 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.

D.11.1 Accreditation Participants. This subsection lists the participants involved in the accreditation effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical accreditation roles include Accreditation Authority, Accreditation Agent, Accreditation Team, and SMEs.

D.11.2 V&V Participants. This subsection lists the participants involved in the V&V effort, including their contact information, assigned role, and the key responsibilities associated with that role. Typical V&V roles include M&S Proponent, V&V Agent, V&V Team, Validation Authority, Data Source, and SMEs.

D.11.3 Other Participants. This subsection identifies the members of the application program and model development effort with V&V or accreditation responsibilities as well as others who have a role in the VV&A processes. The information should include their position or role, contact information, and VV&A responsibilities. Typical roles include M&S Program Manager, M&S Application Sponsor, M&S User, M&S Developer, Data Source, Milestone Decision Authority, Program Office, M&S Development Team, User Group, Configuration Control Board, and SMEs.

D.12 ACTUAL ACCREDITATION RESOURCES EXPENDED. This section discusses the resources expended during execution of the Accreditation Plan, such as performers, man-hours, materials, and funding. This information provides a mechanism to identify the impact of resource gaps on the current application and to scope resource requirements for future applications.

APPENDIX D

D.12.1 Accreditation Resources Expended. This subsection identifies the resources that were expended to accomplish the accreditation activities. The information provided here should include the activity, task, or event; assigned performer; and the list of required resources (e.g., SMEs, equipment, and TDY funding). Impacts on the completeness of the accreditation assessment as a result of information gaps in the V&V Report due to resource shortfalls should be identified.

D.12.2 Actual Accreditation Milestones and Timeline. This subsection provides a chart of when the accreditation milestones were achieved within the context of the overall program timeline.

D.13 ACCREDITATION LESSONS LEARNED. The development and fulfillment of any successful and streamlined process necessarily includes adjustments to its steps. This section provides a summary of the adjustments and lessons learned during the accreditation process.

D.14 APPENDIX A M&S DESCRIPTION. This appendix contains pertinent detailed information about the M&S being assessed.

D.14.A.1 M&S Overview. This section provides a description of the M&S including the type of model (e.g., stochastic, deterministic, high resolution, low resolution, human in the loop [HITL], hardware in the loop [HWIL], stand-alone, engineering, or aggregated), and what types of problems it is intended to support (e.g., training, force structure analysis, command and control, experimentation, system analysis, or analysis of alternatives).

D.14.A.2 M&S Development and Structure. This section provides information about how the M&S is organized and/or constructed (e.g., the M&S design), hardware and software specifics, and technical statistics (e.g., runtime speed, capacity, and bandwidth). For M&S under development, this section includes the M&S development plan, including the development paradigm being followed (e.g., spiral development or model-test-model), and basic assumptions about its execution.

D.14.A.3 M&S Capabilities and Limitations. This section summarizes the capabilities and the limitations of the M&S.

D.14.A.4 M&S Use History. This section describes how and when the model has been used in the past as well as references relevant historical use documents.

D.14.A.5 Data

D.14.A.5.1 Input Data. This subsection identifies the data required to populate and execute the M&S, including input data sets, hard-wired data (constants), environmental data, and operational data. Provide descriptive metadata, metrics, and authoritative or approved sources for each.

APPENDIX D

D.14.A.5.2 Output Data. This subsection identifies the M&S output data, including a definition, the unit of measure, and the range of values for each data item.

D.14.A.6 Configuration Management. This section includes a description of the M&S configuration management program, lists the M&S artifacts and products that are under configuration management, identifies documentation and reporting requirements that impact the VV&A effort, and provides contact information.

D.15 APPENDIX B M&S REQUIREMENTS TRACEABILITY MATRIX. This appendix establishes the links between the M&S requirements, the acceptability criteria, and the evidence collected during the V&V processes. Building on Table I in Section 2, the traceability matrix provides a visual representation of the chain of information that evolves as the VV&A processes are implemented. As implementation progresses from the planning to reporting phases, the traceability matrix assists in the identification of information gaps that may result from VV&A activities not performed, not addressed, or not funded. The following table provides an example of a traceability matrix.

TABLE D-II. M&S requirements traceability

	Accreditation Plan		V&V Plan	V&V Report	Accreditation Report
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			1.1.2	1.1.2	1.1.2
		1.2	1.2	1.2	1.2
		1.n	1.n	1.n	1.n
2		2.1	2.1	2.1	2.1
		2.n	2.n	2.n	2.n
n		n.n	n.n	n.n	n.n

D.16 APPENDIX C BASIS OF COMPARISON. This appendix describes the basis of comparison used for validation. The basis for comparison serves as the reference against which the accuracy of the M&S representations is measured. The basis of comparison can come in many forms, such as the results of experiments, theory developed from experiments, validated results from other M&S, and expert knowledge obtained through research or from SMEs.

D.17 APPENDIX D REFERENCES. This appendix identifies all of the references used in the development of this document.

APPENDIX D

D.18 APPENDIX E ACRONYMS. This appendix identifies all acronyms used in this document.

D.19 APPENDIX F GLOSSARY. This appendix contains definitions that aid in the understanding of this document.

D.20 APPENDIX G ACCREDITATION PROGRAMMATICS. This appendix contains detailed information regarding resource allocation and funding that was used to track accreditation expenditures. The following table provides an example of a resource allocation table.

TABLE D-III. Example resource allocation table

Actual Resource Allocations and Funding						
Accreditation Activity	**Required Resources**	**Funding Source**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**	**FY/Q $K**

D.21 APPENDIX H DISTRIBUTION LIST. This appendix provides the distribution list for hardcopies or digital copies of the approved document.

D.22 APPENDIX I ACCREDITATION PLAN. This appendix provides a copy of or a reference to the Accreditation Plan in its most current iteration.

D.23 APPENDIX J V&V REPORT. This appendix provides a copy of or a reference to the V&V Report in its most current iteration

CONCLUDING MATERIAL

Custodians:
Army – AC
Navy – EC
Air Force – 05

Preparing activity:
OSD – DMS
(Project MSSM-2005-002)

Review activities:
Army – AC, CR, PT
Navy – EC, MC, ND, NP, SH
Air Force – 01, 13
DISA – DC1, DC2
DTRA – DS
NGIA – MP
OSD – IR, SE
USCG – CG

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil/.