

Accreditation Agent's Role in Verification, Validation, and Accreditation (VV&A) of New Development

This document addresses the role of the Accreditation Agent in a new modeling and simulation (M&S) development. The primary objective of the Accreditation Agent is to prepare for and conduct a cost-effective accreditation assessment that results in a logical, sufficient, and fully justified accreditation recommendation to the User. Accreditation is a judgment that a simulation is fit for a specific purpose. As discussed in the [Key Concepts](#) document, the Accreditation Agent not only is responsible for planning and performing the accreditation assessment, but also assists the User with activities that help establish the scope of the problem to be addressed. The Accreditation Agent serves as the User's advocate throughout the M&S development process to ensure that the simulation being developed will meet the User's requirements and that sufficient evidence is available to justify an accreditation decision.

How Does the Accreditation Agent Impact VV&A?

The Accreditation Agent performs a series of tasks throughout the simulation development process to ensure there will be sufficient evidence to assess the simulation's capabilities, such as:

- Ensuring that the M&S requirements and acceptability criteria are complete, sufficiently detailed, and fully documented
- Developing an accreditation plan that identifies information needed for accreditation and the strategy for the assessment
- Ensuring that the VV&A plan addresses all the needs of the accreditation assessment
- Ensuring that the VV&A effort provides the information needed for the accreditation assessment
- Gathering additional accreditation information (when necessary)
- Conducting the accreditation assessment and providing a recommendation to the User
- Preparing the necessary reports

The Accreditation Agent's contribution to the verification and validation (V&V) effort depends greatly on when the User designates the agent. When designated at the

beginning of the M&S development program, the Accreditation Agent can make a substantial contribution to the efficiency of the VV&A program by:

- Participating in the problem analysis effort to assess risks in order to:
 - Support the definition of M&S requirements
 - Determine appropriate measures (e.g., measures of effectiveness, measures of performance)
 - Establish VV&A priorities
- Participating in M&S requirements definition and verification
- Leading the effort to define accreditation information needs
- Assisting in the development of VV&A plans and the selection and focus of VV&A activities

In some instances the Accreditation Agent may not be selected at the beginning of the development process, for example, when funding is not available; when a simulation is being developed for multiple Users and the first intended use has not been determined; or when spiral development or multiple builds are involved and early builds do not need to be accredited. When appointment of an Accreditation Agent is delayed, however, the User, M&S Program Manager (PM), and verification and validation (VV&A) Agent should work together to ensure that the VV&A effort addresses the appropriate issues and can produce sufficient evidence to support the accreditation assessment.

When joining an M&S development program in progress, the Accreditation Agent should review the status of the program (e.g., objectives, M&S requirements, development paradigm, plans, progress-to-date) and evaluate the plans, objectives, and progress-to-date of the VV&A effort to determine if they are sufficient to provide the information needed to establish the simulation's fitness for purpose. In particular, the Accreditation Agent should:

- Support the definition of acceptability criteria that will serve as the basis for accreditation
- Assess the ability of the VV&A activities to provide appropriate and sufficient evidence of simulation fitness for purpose to satisfy accreditation needs
- Identify any deficiencies or inconsistencies that may lead to an unfavorable assessment and provide recommendations for their resolution

Once the status of the program is known and problems have been resolved, the Accreditation Agent should plan and conduct the accreditation assessment in coordination with the VV&A process.

How Does VV&A Impact the Accreditation Agent?

The goal of the accreditation process is to accumulate and evaluate a body of evidence that increases the User's confidence in the ability of the simulation to address an intended use. Most (but not all) of the information required to support accreditation comes from the results of the VV&A effort conducted during simulation development and preparation. Consequently, the scope and depth of the Accreditation Agent's tasking is profoundly affected by the effectiveness and appropriateness of the VV&A tasks performed and the accuracy and completeness of the resulting products. A VV&A effort that is underfunded, is unsynchronized with the development process, or lacks clear accreditation information needs is unlikely to provide the amount of evidence necessary. A VV&A effort that is not focused on appropriate priorities or uses inappropriate techniques is likely to produce misleading and unusable results.

What Are the Accreditation Agent's Responsibilities in VV&A?

The basic VV&A responsibilities of the Accreditation Agent are shown in the table below.

Basic Responsibilities of the Accreditation Agent
<ul style="list-style-type: none">• Work with the User to refine the M&S requirements and develop appropriate measures and acceptability criteria
<ul style="list-style-type: none">• Work with the User and V&V Agent to develop an overall VV&A strategy and develop the accreditation plan
<ul style="list-style-type: none">• Support the VV&A effort to assess the utility and sufficiency of the products in terms of meeting accreditation needs
<ul style="list-style-type: none">• Incorporate evolving M&S requirements and account for fluctuating risks and priorities in accreditation plans
<ul style="list-style-type: none">• Provide guidance and information to help the V&V Agent adjust VV&A plans and activities to accommodate changes in priorities and objectives
<ul style="list-style-type: none">• Conduct and report on the accreditation assessment(s) as necessary
<ul style="list-style-type: none">• Represent the User's interests throughout the development process

What Challenges Does the Accreditation Agent Face Relative to VV&A?

Seven of the challenges that influence the accreditation of a new simulation are listed below and described in the following paragraphs.

1. Clarity and Completeness of Objectives and Requirements

Well-defined, measurable, consistent M&S requirements that are verified and traceable throughout the development process (i.e., from the objective statement through to the code) are fundamental to the credibility of the simulation. To establish the accreditation needs and appropriate VV&A priorities, the Accreditation Agent requires:

- Clearly stated, consistent, completely defined, verified M&S requirements
- Sufficient information to understand the level of operational risk that can result from the use of erroneous simulation outputs
- Sufficient information to understand the level of credibility the User requires
- Adequate metrics and acceptability criteria by which the simulation's ability to address each requirement can be evaluated

The Accreditation Agent should ensure that the M&S requirements are sufficiently detailed with appropriate metrics and acceptability criteria to enable complete and comprehensive accreditation and VV&A planning. Because M&S requirements can evolve throughout the development process, the VV&A effort should review them at reasonable intervals to ensure their continued currency, completeness, and consistency.

2. Accuracy, Completeness, and Availability of VV&A Documentation

Because the information supplied by the V&V effort constitutes much of the evidence used in the accreditation assessment, the accreditation process can be significantly impacted by the inability to obtain the necessary V&V information in a timely manner and in a usable form. The Accreditation Agent should coordinate with the V&V Agent and M&S PM to develop the VV&A plan and establish appropriate report formats and milestones. In addition, the Accreditation Agent should monitor the V&V effort throughout the development process to ensure that potential problems can be addressed in a timely manner.

3. Soundness of the Configuration Management Program

A sound (and soundly managed) configuration management program is an indicator of simulation maturity and stability. Configuration management data give the Accreditation Agent the means to correlate any information about the simulation (including V&V information) with a particular development version. This becomes particularly important when dealing with iterative development paradigms, such as the spiral and incremental development paradigms. The credibility of the information provided throughout simulation development and assessment is dependent in part on the reliability of the configuration management program.

4. Delayed Appointment of the Accreditation Agent

The selection of an Accreditation Agent may be delayed for a variety of reasons:

- Funding is not available early in the program.
- The development process is complex, involving multiple builds or iterations that do not require interim accreditation (e.g., incremental development).

- The simulation is being developed as part of a multi-user program and the intended use has not been identified.
- The User does not expect the simulation to need formal accreditation.

Any delay in selecting the Accreditation Agent is detrimental; however, the longer the delay, the greater the risk that the V&V effort will not be able to provide all the necessary information and the greater the cost of establishing simulation credibility.

5. Inadequate VV&A Resources

Obtaining adequate funding for either the V&V effort or the accreditation assessment is difficult, particularly if funding is allocated before detailed planning has been done. Because program budgets are often established before either the Accreditation Agent or the V&V Agent is appointed, funding and resource allocations are not likely to be based on sound information about the actual needs of the program. Consequently, the resources allotted to VV&A tend to be under-allocated.

The Accreditation Agent should define a comprehensive set of accreditation needs and work with the V&V Agent to identify VV&A tasks needed to establish an acceptable level of simulation credibility. The cost of performing these VV&A tasks and the risks associated with not performing them should then be estimated. Only then can the Accreditation Agent present the User with a clear explanation of the risks involved should the necessary VV&A activities not be accomplished as well as a reasonable estimate of the costs involved. Such a presentation can make it easier for the M&S PM to justify the reprogramming of funds to cover the recommended activities and reduce the indicated level of risk. The Accreditation Agent and V&V Agent should make every effort to identify reasonable workarounds within the budget that still minimize risks and are acceptable to the M&S PM.

6. Locating and Using Subject Matter Experts

A major challenge to the Accreditation Agent is to identify and locate subject matter experts (SMEs) to participate in the accreditation assessment. The user community is usually the best source for experts in the problem domain, and the User can often either supply these people or make good recommendations about whom to request and how to secure their help. Additional SMEs may be needed with expertise in other areas, such as the programming languages and methods used in the development effort or a specific subject (e.g., mathematics, physics). Additional criteria to consider when selecting SMEs include background or formal training in analytical disciplines (e.g., operations research), availability, interest, experience, and willingness to support the effort for the specified time. For more information see [Advanced Topics>Special Topics>Subject Matter Experts and VV&A](#).

7. Lack of Sound Software Practices

By employing sound software engineering principles and practices, such as those cited in the Software Engineering Institute's Software Capability Maturity Model, a Developer can ensure a focus on formalized, quality products and documentation.¹ To judge the simulation's fitness for purpose, the evidence collected must be complete, accurate, and verifiable. A lack of attention to disciplined simulation development and appropriate VV&A activities can cause considerable difficulty for the Accreditation Agent in trying to build a case for accreditation.

Example:

In one program, VV&A planning discussions identified the following items as missing or nonexistent:

- Documented configuration management plan
- Standard development process
- Configuration management log
- Proven testing tools
- Documented test results
- Software development plan

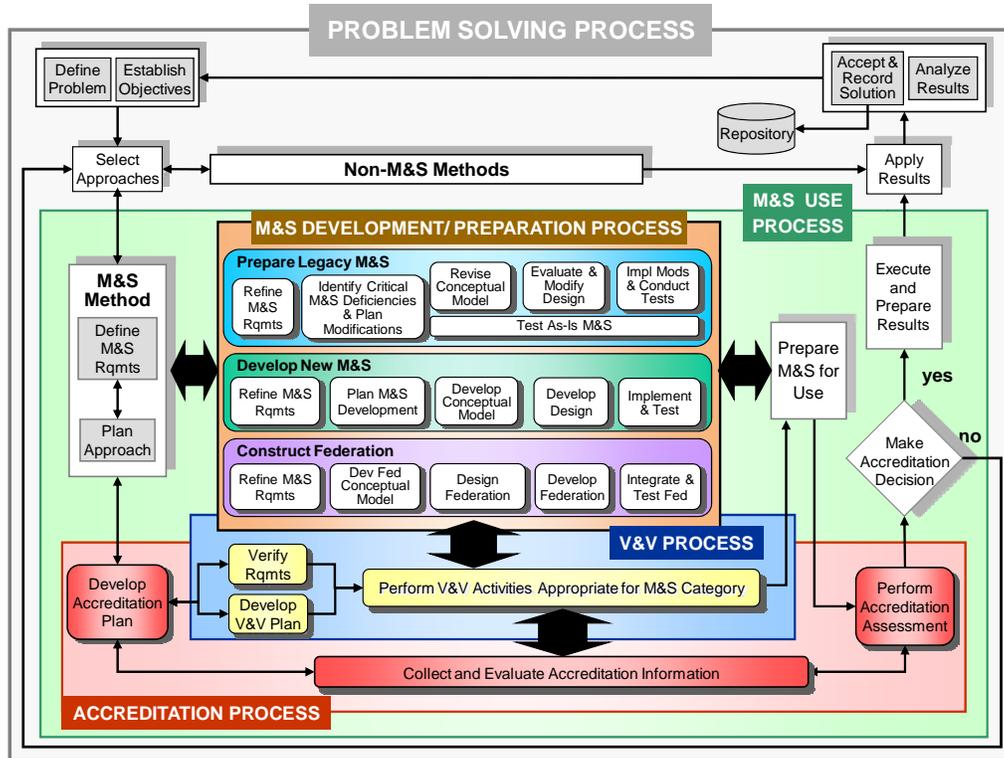
As a result, significant effort had to be expended to develop substitutes for each of these critical indicators of simulation credibility.

Role of the Accreditation Agent in the Overall Problem Solving Process

Problem Solving Process

The Problem Solving Process diagram below shows how the M&S life cycle fits into the overall problem solving process.

M&S VV&A RPG Core Document:
Accreditation Agent's Role in VV&A of New Development



The Overall Problem Solving Process

The overall Problem Solving Process diagram depicts the relationships between the **Problem Solving Process**, the **M&S Use Process**, the **M&S Development/Preparation Process**, the **V&V Process**, and the **Accreditation Process** as a series of nested boxes. Each nested process contains a series of individual boxes that represent the basic individual activities and functions considered essential to complete that process.

The overall Problem Solving Process is the province of the User. The User initiates the process by establishing the problem domain. First, the problem is defined (e.g., as a problem statement) and the overall objectives are established. Then, based on the nature of the problem and scope of the objectives, the User selects the method or methods (e.g., modeling and simulation, experimentation, statistical analysis, live testing) to use in resolving the problem.

M&S VV&A RPG Core Document:
 Accreditation Agent's Role in VV&A of New Development

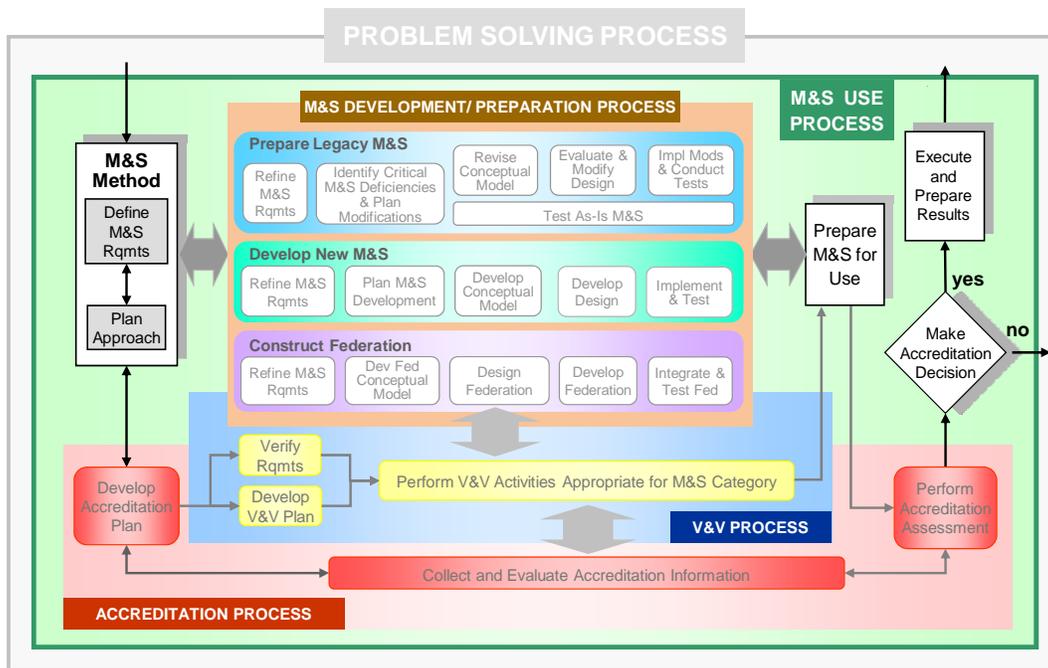
In establishing the problem domain and determining how to resolve the problem, the User addresses the following basic questions:

Problem Domain Questions
• What is the basic problem to be solved? What are the objectives? What questions need to be answered?
• What particular aspects of the problem will the simulation help to solve? What is the intended use?
• What is the scope of the problem? What boundaries or mission space apply?
• What decisions will be made on the basis of the simulation results?
• What are the risks that might result from acceptance of erroneous simulation outputs or decisions based upon them?

Answers to these questions also provide the Accreditation Agent with information needed to establish what constitutes fitness for the intended use.

M&S Use Process

Once M&S has been selected as the method to use, the **M&S Use Process**, the first nested process in the Problem Solving Process shown in the following figure, begins.



M&S Use Process in the Problem Solving Process

During the **M&S Use Process**, the M&S requirements and their associated metrics and acceptability criteria are defined, risks are identified, and priorities are established. The questions listed below help determine what information is needed from the simulation and how accurate that information should be to address the needs of the intended use.

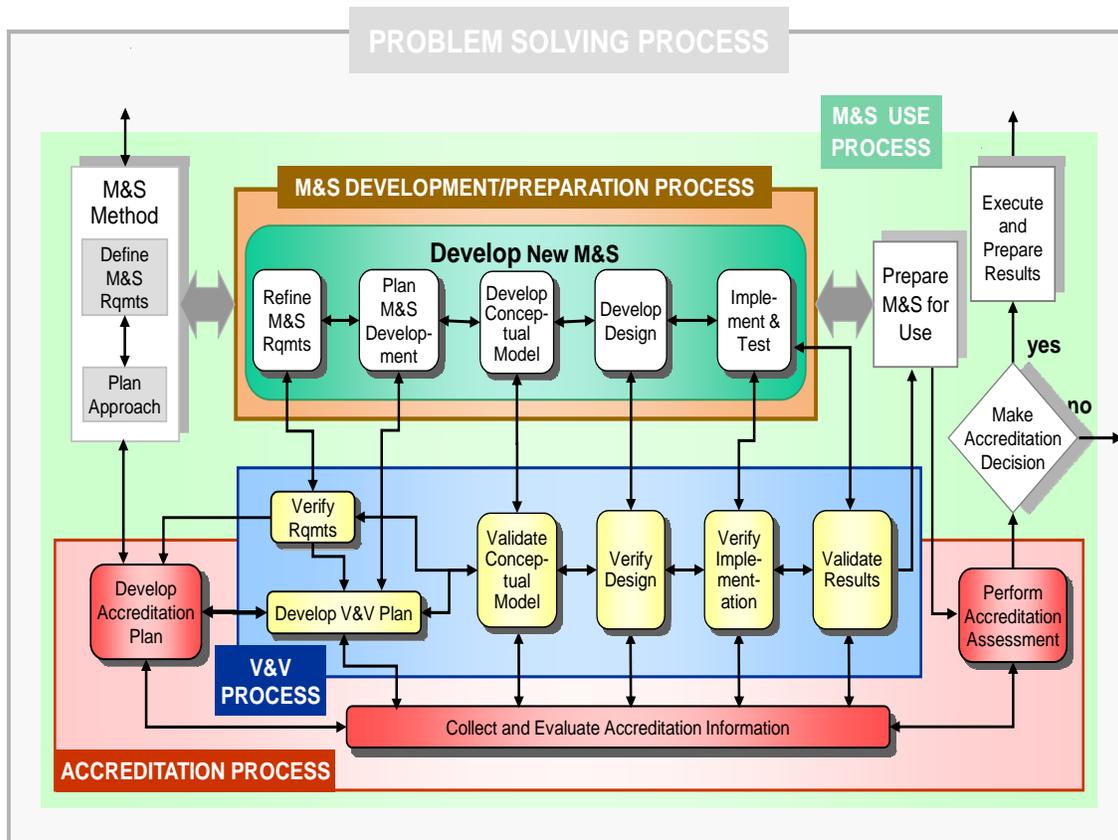
M&S Requirement Questions
• What information is needed to support the key problem decisions or to resolve the key problem issues?
• What specific simulation outputs relate to the information required?
• How good do these outputs need to be; i.e., what is the level of tolerance for uncertainty in the results?
• How will simulation output be used to produce the information needed to achieve the problem objectives, resolve the issues, and/or make the necessary decisions?

For more information see [Advanced Topics>Special Topics>Requirements](#).

The beginning of **M&S Use Process** is the optimal time for the Accreditation Agent to be designated, so as to ensure that decisions made during the planning phase are focused on establishing simulation credibility for the intended use. Ideally, the Accreditation Agent will be available to support the User and the M&S PM during problem analysis and risk assessment. By participating in this effort, the Accreditation Agent can help determine accreditation information needs, appropriate metrics for each M&S requirement, and V&V priorities. This information can be used to shape the plans and select appropriate tasks in both the V&V and the accreditation efforts. For more information see [Advanced Topics>Special Topics>Risk and Its Impact on VV&A](#).

M&S Development/Preparation Process

The next nested process, **M&S Development/Preparation Process**, shown in the diagram below, begins when the M&S PM designates the Developer. Then, the M&S requirements are refined, the development paradigm is selected, and the development schedule is set.



M&S Development/Preparation Process for New M&S

Regardless of which development paradigm is followed, the development process for new simulations consists of six basic phases: **Refine M&S Requirements**, **Plan M&S Development**, **Develop Conceptual Model**, **Develop Design**, **Implement and Test**, and **Prepare M&S for Use**. Associated with each phase of the development process is a corresponding V&V activity that examines and tests the progress in that phase and collects evidence of the simulation's capabilities to be used in the accreditation assessment. The Accreditation Agent's role in these V&V activities and the accreditation process is discussed in the following section.

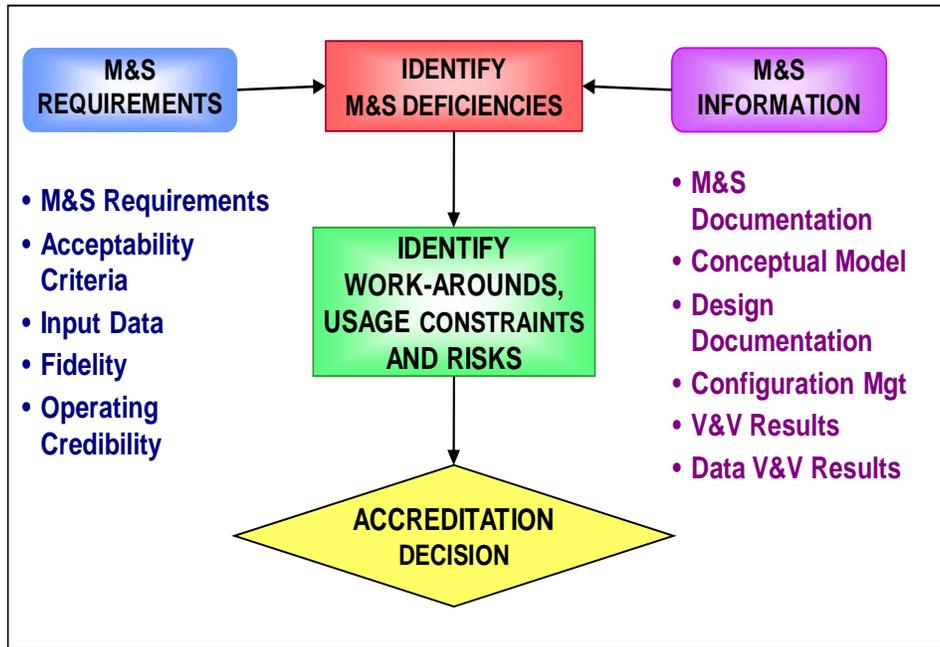
VV&A Functions of the Accreditation Agent Role in New M&S Development

The Accreditation Agent and the V&V Effort

Accreditation is "the official determination that a model or simulation is acceptable for a specific purpose."² Accreditation is always associated with a specific intended use. In fact, any time a model or simulation is used to solve even a small, informal problem, a *de facto* or implicit accreditation decision is made. For formal programs with significant concerns about cost, safety, precision, etc., however, the accreditation decision should

be explicit and should be based on knowledge of the credibility of the simulation and understanding of any risks involved.

Accreditation is a comparison between a simulation's capabilities and attributes and the M&S requirements generated by the specifics of the problem to which the simulation is to be applied. The following figure shows a logical depiction of the basic accreditation concept.



A Practical Accreditation Concept

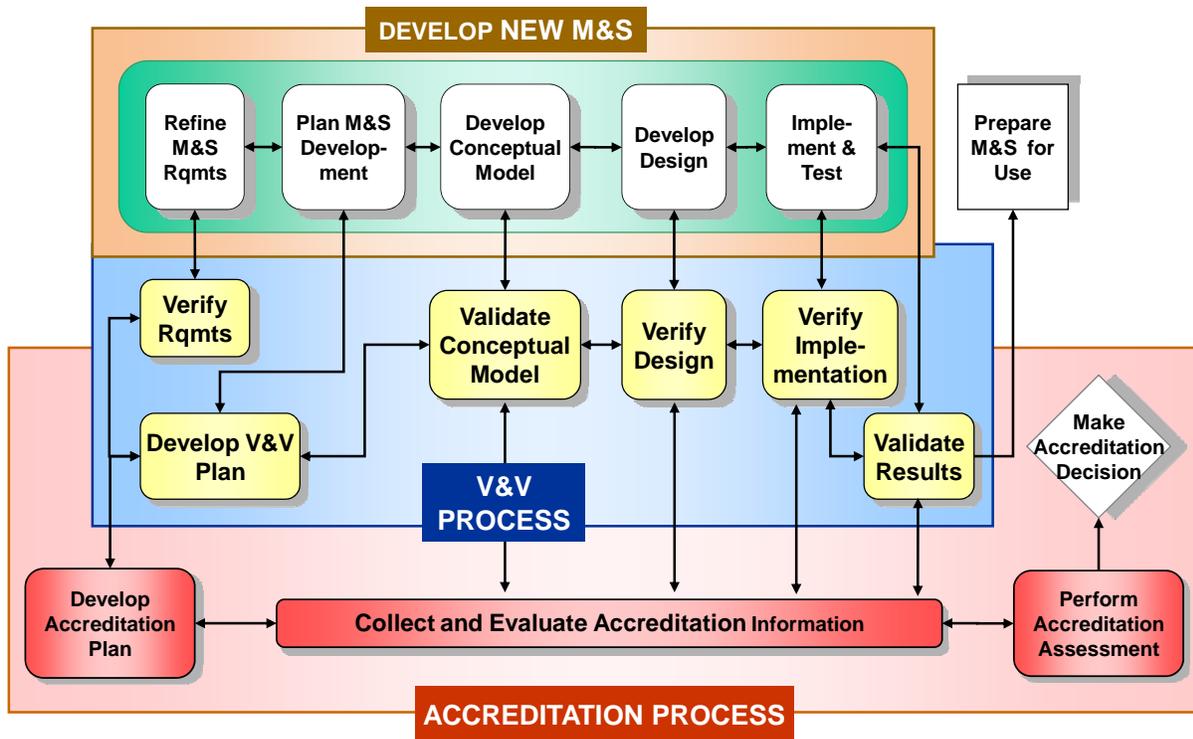
The primary purpose of the accreditation assessment is to establish simulation **fitness** within the context of its intended use. Much like building a body of evidence in a legal court case, the Accreditation Agent accumulates evidence about the simulation to support an objective judgment regarding the simulation's fitness for an intended use. This evidence generally consists of basic information about the simulation, results of the V&V effort, and metadata (information) about the input data.

The focus of the accreditation assessment is to use this evidence to obtain answers to the questions shown in the following table that serve as the basis for judging simulation fitness.

Questions for Judging Simulation Fitness
• What does the simulation do (i.e., what are the purpose and functions of the simulation)?
• How good is the software (i.e., is the software essentially free of coding errors)?
• Are the simulation outputs sufficiently realistic to meet the needs of the intended use?
• Can the simulation be operated properly and can the results be interpreted correctly?
• Are the input data sets satisfactory?

The assessment of this evidence and the resulting accreditation decision are the final steps in establishing the simulation's fitness for the intended use.

The relationships and interactions between the accreditation, V&V, and simulation development activities are illustrated in the *VV&A in New M&S Development* diagram below. The Accreditation Agent helps focus the V&V effort by providing information about what aspects of the simulation should be evaluated for the intended use and about the relative importance (i.e., priority) of each on the basis of the results of a risk assessment. During the accreditation assessment, the results of the V&V effort are combined with other factors to determine the extent to which simulation credibility (within the context of the intended use) exceeds the risks of using it in the intended use.



VV&A in New M&S Development

Accreditation Process

The accreditation process consists of the four key activities listed below. The Accreditation Agent conducts the first three. Once the accreditation assessment has been completed, the Accreditation Agent presents an accreditation recommendation to the User. The User then makes the accreditation decision. These activities are listed below and discussed in the following paragraphs.

1. Develop the Accreditation Plan

Accreditation planning should begin as soon as the Accreditation Agent is designated. Ideally, this is at the beginning of the M&S Use Process, so it can be done in coordination with planning for the M&S program. Accreditation planning should be an ongoing process, and modifications should be made as needed to accommodate program changes and evolving expectations. The accreditation plan should adhere to MIL-STD-3022, available at [Resources>Reference Documents>Documentation of Verification, Validation and Accreditation \(VV&A\) For Models and Simulations \(MIL-STD-3022\)](#).

Specific tasks involved in the development of the accreditation plan include:

- **Obtain M&S requirements** – The Accreditation Agent should obtain the M&S requirements and their associated metrics and acceptability criteria from the User. If the requirements are not sufficiently comprehensive or detailed, the Accreditation Agent should help refine and prioritize them on the basis of the simulation's intended use.
- **Identify accreditation information needs** – The Accreditation Agent should support the User in assessing the operational risks to determine the overall risk levels associated with using the simulation. Once the risks have been assessed and priorities determined, the type and scope of the information about the simulation needed to make the accreditation assessment can be defined.

If the Accreditation Agent joins a development effort in progress, existing simulation development and V&V documentation and plans should be reviewed to determine if they are sufficient to meet the accreditation information needs. If not, the Accreditation Agent should work with the M&S PM and User to determine what adjustments should be made.

- **Plan the accreditation assessment activities** – Assessment activities are conducted to assess:
 - Adequacy of existing or planned documentation in light of expected operational risk levels
 - Ability of planned and/or executed V&V activities to provide the necessary information in view of the expected operational risk levels
 - Ability of the simulation to meet M&S requirements in view of the defined acceptability criteria

The Accreditation Agent should identify the areas of expertise needed to address each M&S requirement; ascertain the necessary qualifications for SMEs in each area identified; determine the number and type of assessment activities needed to complete the assessments; and select assessment team members and types of SMEs to participate in each activity.

- **Establish the assessment process** – For each assessment activity, the Accreditation Agent should specify:
 - Type of activity (e.g., face-to-face meeting, video teleconference), location, length of time
 - Types of participants to be included
 - Preparation materials (e.g., orientation steps, read-ahead materials, training)

- Activity organization (e.g., facilitator, recorder, mechanisms for capturing the results of the deliberations and methods for expeditiously resolving conflicts and gaining consensus)
- Methods for preparing an accurate report of the deliberations
- **Coordinate with V&V planning** – The Accreditation Agent should provide information to the V&V Agent regarding accreditation needs and priorities and also review the V&V plan and activities to ensure that they are sufficient to satisfy accreditation information needs.

2. Collect and Evaluate Accreditation Information

Once the accreditation information needs have been identified, the Accreditation Agent collects and reviews the information to ensure it is sufficient. Specific tasks involved in this activity include:

- **Review preliminary work** – All work (development and V&V) done prior to Accreditation Agent involvement should be reviewed for sufficiency and focus, and recommendations should be provided for any changes needed to address deficiencies.
- **Monitor development activities** – Close contact with the User and M&S PM should be maintained to ensure all changes in the intended use or the simulation can be promptly addressed. Risks should be reassessed and accreditation information needs updated as necessary. The Accreditation Agent should also coordinate with the V&V Agent to ensure that priorities are adjusted and plans modified to reflect the current needs of the accreditation assessment.
- **Monitor V&V activities** – V&V activities and tasks should be monitored to ensure that they conform to the V&V plan. The Accreditation Agent should participate in any V&V meetings with the M&S PM, Developer, and/or User to assess the adequacy of information exchange and should review all V&V products to ensure that they provide the information needed for the accreditation assessment.

In general, the V&V effort should answer the basic questions listed in the following table about the simulation and its ability to support the intended use.

Basic Accreditation Questions for VV&A
• Do simulation capability and fidelity match problem requirements?
• Is the current version of the simulation software (including the implementation of a distributed simulation) accurate?
• Are the simulation outputs sufficiently accurate and realistic to meet the needs of the intended use?
• Are the data used in the simulation sufficiently accurate and suitable?
• Does the simulation have sufficient support to make it usable by the designated personnel in the intended use?

- **Collect supplemental information** – Although the majority of the information is obtained from the V&V effort, some information is obtained from other sources to supplement the V&V information. Typical supplemental information gathered for a new simulation assessment is shown in the table below.

Typical Supplemental Assessment Information	
Supplemental Information	Source
• Model documentation (e.g., user, programmer, analyst manuals)	M&S PM or User
• Simulation descriptive documentation (e.g., specifications)	M&S PM or Developer
• Configuration management plans and implementation evidence	M&S PM
• Instance data metadata (for establishing data credibility)	Developer or V&V Agent
• Development schedule; execution deadline	M&S PM
• Operational resource requirements	M&S PM

3. Conduct Accreditation Assessment

The accreditation assessment of a new simulation is usually done at the end of the development cycle to determine if the newly developed simulation can satisfy the needs of the intended use. This assessment can take one of two forms, depending on the complexity of the intended use and/or the simulation being used. If the intended use is straightforward and the simulation is simple, the assessment can usually be done by a single person. If either the simulation or the intended use is more complex, or if the level of operational risk is relatively high, SMEs should be included in the assessment process. For such applications, an assessment team of experts is usually formed so that all aspects are addressed. An expert team is also desirable when the visibility of the problem requires unquestionable objectivity, for example, when the project is relatively large or politically sensitive.

Ideally, an accreditation assessment performed by a single analyst or by a team should produce the same basic result. However, the team approach is typically imbued with

more credibility owing to the perception of greater objectivity resulting from the increased breadth of technical expertise.

The procedure followed in a typical team assessment activity includes the following steps:

- Notify and brief assessment team members and SMEs.
- Ensure team member availability for all meetings and associated activities.
- Provide read-ahead information.
- Conduct and record assessment team meetings:
 - Document all deficiencies (in simulation and in the accreditation information), their effects, and associated risks if they remain uncorrected.
 - Identify potential workarounds for each deficiency.
- Prepare a draft accreditation report, complete with recommendations.
- Submit the draft report for review and concurrence by all assessment team members.
- Prepare the final report.
- Present the final report and recommendations to the User.

4. Make Accreditation Decision

The accreditation recommendation should be presented to the User in the same form that the final decision is to take. The range of accreditation decisions that are possible is shown in the table below.

M&S VV&A RPG Core Document:
Accreditation Agent's Role in VV&A of New Development

Accreditation Decision Options	
Full accreditation	<ul style="list-style-type: none"> • Simulation produces results that are sufficiently credible to support the intended use.
Limited or conditional accreditation	<ul style="list-style-type: none"> • Constraints are placed on how the simulation can be used to support the intended use.
Modification of the simulation is needed	<ul style="list-style-type: none"> • Simulation capabilities are insufficient to support an accreditation decision; modifications and subsequent clarity and completeness of objectives and requirements are needed to correct deficiencies: <ul style="list-style-type: none"> - Accuracy, completeness, and availability of VV&A documentation - Soundness of configuration management program - Delayed appointment of the Accreditation Agent - Inadequate VV&A resources - Location and use of SMEs - Lack of sound software practices
Additional information is needed	<ul style="list-style-type: none"> • Information obtained about the simulation is insufficient to support an accreditation decision; supplemental verification, validation and/or testing should be conducted to provide the necessary information before the accreditation decision is made.
No accreditation	<ul style="list-style-type: none"> • Results of the assessment show that the simulation is not fit to support the intended use.

Accreditation Agent's Relationship with Other Roles

Accreditation Agent's Relationship with the User

The Accreditation Agent serves as the User's advocate throughout the M&S development process to ensure that the User's requirements for simulation fitness for purpose (e.g., functionality, accuracy, usability) are met. The User hires the Accreditation Agent and in most cases provides the funding and resources for the accreditation effort. The User should designate an Accreditation Agent as soon as possible to ensure that decisions made during the planning phase are focused on establishing simulation credibility for the intended use.

The Accreditation Agent should work with the User throughout the initial phases of the M&S development program (e.g., M&S requirement definition, planning) to obtain information on overall objectives, metrics, tolerances, thresholds, and risk. This information is used to identify accreditation information needs and determine VV&A priorities.

As the simulation development progresses, the Accreditation Agent should continue to work with the User to update accreditation needs as necessary to ensure that the latest M&S requirements are satisfied during the accreditation assessment. At the end of the

accreditation assessment, the Accreditation Agent provides a report and recommendations to the User, who then makes the accreditation decision.

Accreditation Agent's Relationship with the M&S PM and M&S Developer

The Developer and M&S PM serve as sources of supplemental information needed for accreditation assessment (e.g., model documentation, configuration management status, data). Most of the time, however, the Accreditation Agent can rely on the V&V Agent for this information.

Accreditation Agent's Relationship with the V&V Agent

The relationship between the Accreditation Agent and the V&V Agent is critical for a successful and cost-effective VV&A effort. The Accreditation Agent should work with the V&V Agent to ensure that the V&V activities are sufficiently robust and focused to address all accreditation needs. The Accreditation Agent serves as both a guide for and a customer of the V&V Agent. As a guide, the Accreditation Agent provides accreditation information requirements and V&V priorities to the V&V Agent to shape the VV&A plan and process. As a customer, the Accreditation Agent receives information about the simulation's capabilities and limitations to use in the accreditation assessment.

Accreditation Agent's Relationships with Others

Subject Matter Experts

SMEs play an important role in accreditation assessment by serving as members of the assessment team or as temporary consultants. It is worthwhile for the Accreditation Agent to anticipate SME resource requirements and coordinate with the User, the Developer, or other outside sources to ensure that adequate resources are provided for their participation. Frequently, the M&S PM and V&V Agent will be involved in this coordination effort as well, to adjudicate competing requests on the same SMEs. In many cases, it is preferable to have consistency in SMEs throughout the program rather than assemble separate SME teams for individual tasks. This approach can be very cost-effective and technically efficient. For more information see [Advanced Topics>Special Topics>Subject Matter Experts and VV&A](#).

Documentation Requirements

The accreditation process results in two major products: the accreditation plan and the accreditation report. The third accreditation document, the accreditation decision, results from the User's review of the accreditation report.

Accreditation Plan

The essential elements to include in an accreditation plan are listed in the following table and discussed in the subsequent paragraphs.

Elements of the Accreditation Plan
• Problem (intended use) statement and objectives
• Verified M&S requirements and associated metrics and acceptability criteria
• Accreditation information needs: <ul style="list-style-type: none">- Supporting risk assessment documentation- VV&A information- Supplemental information
• Regulatory information
• Assessment plan
• Accreditation report structure and outline

This information can be included either in the plan or in other documents referenced in the plan. See [Resources>Reference Documents>Documentation of Verification, Validation, and Accreditation For Models and Simulations \(MIL-STD-3022\)](#) and [Resources>Templates>Common VV&A Product Formats](#) for additional information.

Problem Statement and Objectives

The problem or intended use statement and objectives provided by the User serve as the starting point for any accreditation. If these items are documented somewhere else, they may be summarized in the Accreditation Plan along with a reference to the source document.

Verified M&S Requirements and Associated Metrics and Acceptability Criteria

M&S requirements is the collection of requirements that the User, M&S PM, and Developer derive from the objectives to define the capabilities of the simulation. During problem analysis the User, assisted when possible by the Accreditation Agent, identifies appropriate metrics (e.g., measures of effectiveness, measures of performance) by which each can be measured and standards (acceptability criteria) that define how well the simulation must accomplish each requirement in order to be acceptable for the intended use. Documentation reporting the process for determining the metrics and the acceptability criteria should be referenced. More information on these topics can be found at [Advanced Topics>Special Topics>Requirements](#), [Advanced Topics>Special Topics>Measures](#), and [Advanced Topics>Special Topics>Acceptability Criteria](#).

Accreditation Information Needs

A risk assessment should be conducted to determine the type and scope of the information needed about the simulation to make an accreditation assessment. In

addition to the list of information needs, the accreditation plan should include or reference a description and results of the risk assessment. This description should include a list of risks addressed, their impacts, and the probability that their occurrence would give erroneous simulation output.

Another product of the risk assessment is a prioritization of the functions within the simulation that have the greatest impact on the simulation outputs of interest to the User. This prioritized list of functions should also be documented in the accreditation plan, either directly or by reference to another document.

Accreditation information needs can be separated into information to be obtained from the V&V effort and information to be obtained elsewhere to supplement that obtained from the V&V effort (i.e., supplemental information).

- **V&V information** – The V&V information needed to make a reasonable accreditation decision depends on the risks associated with the intended use. It is included in the accreditation plan to help the V&V Agent prepare the VV&A plan and to serve as a basis for the accreditation planning.
- **Supplemental information** – The accreditation assessment also needs information that cannot be acquired directly from the V&V effort. This information is obtained from a variety of sources, including the User, M&S PM, Developer as shown in the following table.

Supplemental Information	Source
• Model documentation (e.g., user, programmer, analyst manuals)	M&S PM or User
• Simulation descriptive documentation (e.g., specifications)	M&S PM or Developer
• Configuration management plans and implementation evidence	M&S PM
• Instance data metadata (for establishing data credibility)	Developer or V&V Agent
• Development schedule; execution deadline	M&S PM
• Operational resource requirements	M&S PM

Regulatory Information

Each Service and Department within DoD has unique VV&A policies and governing requirements. This section of the accreditation plan should identify the policies and regulations governing the program and describe the steps that should be followed after the accreditation assessment is done to accommodate them. Any procedures to be followed or requirements calling for a review of the assessment, either before or after the accreditation decision is made, should be listed. Any requirements for posting or archiving the accreditation report and the supporting information should be detailed.

Assessment Plan

A detailed plan for conducting the accreditation assessment should contain:

- Type of assessment (single person or team effort), with supporting rationale
- Types of people needed for performing the assessment
- Assessment method(s) to be used
- Assessment procedures to be followed

If a team approach is to be used, the preplanning steps to be followed to make the assessment meeting(s) efficient should also be outlined.

Accreditation Report Structure and Outline

The outline or template for the accreditation report provided in the accreditation plan can help focus the assessment team on the **fitness** of the simulation for the intended use instead of on the simulation's **capability**, and it can provide a framework for assessment meetings. It can also serve as a checklist to ensure that the supporting plans (i.e., V&V plan and assessment plan) include activities that will provide the necessary information.

Accreditation Report

The essential elements of the accreditation report are listed in the table below and discussed in the following paragraphs.

Elements of the Accreditation Report
• Annotated list of simulation acceptability criteria
• Description of simulation capabilities, assumptions and limitations
• Results of the accreditation assessment and supporting documentation
• Accreditation recommendation

These elements can be contained either in a single report or in multiple documents. The Accreditation Agent should ensure that the User recognizes the importance of archiving this information; should coordinate with the M&S PM to develop appropriate formats and techniques for capturing it; and should determine that adequate resources are available for preserving it. See [Resources>Templates>Common VV&A Product Formats](#) and [Resources>Reference Documents>Documentation for Verification, Validation, and Accreditation For Models and Simulations \(MIL-STD-3022\)](#) for additional information.

Acceptability Criteria List

A description of how the acceptability criteria were derived from the basic problem objectives and parameters should be included, both to demonstrate that they are complete, and to allow others to review and validate them if necessary. In addition, this type of explanation facilitates the process of updating acceptability criteria as new requirements and applications emerge.

Simulation Capabilities, Assumptions, and Limitations

All simulation assumptions and limitations identified during the development and associated V&V efforts should be documented. Simulation capabilities should be included in the validated conceptual model developed as part of the new model development process.

Accreditation Assessment Results and Supporting Documentation

The assessment results should present evidence showing how well the simulation meets the acceptability criteria and what risks are associated with the simulation's limitations. If one or more criteria are not met, this document should include or reference an assessment of the impact of not meeting the specified criteria and a listing of potential workarounds and their associated risks. These impact assessments allow tasks to be reprioritized and resources redistributed objectively to meet simulation acceptability criteria.

The assessment results should also include:

- Appropriate references and explanations for each conclusion so that the rationale can be traced back to original sources and supporting information (e.g., accreditation plans, risk assessments, requirement reports, V&V plan, a specific V&V report)
- Evaluative comments and recommendations regarding the adequacy of simulation configuration management and the credibility and accuracy of the data being used
- Discussion, when appropriate, of the suitability of the operators and analysts necessary to properly run the simulation and interpret its results (e.g., training simulations, human-in-the-loop simulations)

Accreditation Recommendation

The accreditation recommendation is typically a concise (one-page) summary that includes:

- The accreditation option recommended by the Accreditation Agent
- A synopsis of the rationale for the option recommended

- A list of the limitations and recommended constraints on the accreditation

The accreditation recommendation is prepared by the Accreditation Agent for consideration by the User. It may be prepared as part of the accreditation report or as a separate document to be used as the accreditation decision.

Accreditation Decision

The accreditation decision is the signed document that describes the accreditation option selected by the User. It should include the actual accreditation option with details of all caveats, qualifications, constraints, and limitations to be addressed. When the decision has been made and signed, the accreditation decision is normally included in the accreditation report before distribution.

Standardized Documentation

If all VV&A documentation can be prepared according to a standardized structure, such as is defined by the MIL-STD-3022, then the information captured would be much more understandable and usable for both current and future Users. Using standard formats and structures to prepare the V&V and accreditation reports can benefit both those preparing the reports and those reading them (e.g., Users, Accreditation Agents, V&V Agents). They reduce preparation time and cost by helping to ensure that the information provided is complete and consistent, which decreases the amount of time needed for review and revision. They aid document readers by providing easy access to information and ensuring that the information included in the various documents is consistent and current.

MIL-STD-3022 is available at [Resources>References Documents>Documentation of Verification, Validation, and Accreditation For Models and Simulations \(MIL-STD-3022\)](#).

Cost Implications and Resourcing

The Accreditation Agent is not usually the primary driver behind the VV&A program for a new M&S application and thus has little control over the overall cost involved. The only costs of the VV&A program that the Accreditation Agent directly controls are those associated with the accreditation assessment. However, by ensuring that the V&V effort includes only those tasks absolutely necessary for accreditation, the Accreditation Agent can ensure that resources are not wasted chasing matters of low importance or relevance to simulation fitness for the specified use.

The major cost driver in a VV&A program is the V&V effort. The scope and depth of the V&V tasks are typically driven by the need to determine if the simulation can meet the M&S requirements of the intended use. When the V&V effort is successful, the accreditation effort, which relies on information provided by the V&V effort, costs comparatively little. When the V&V effort is not focused on the accreditation needs,

however, the cost of the accreditation assessment rises because of the need to research and (when necessary) reproduce key information.

Four major factors that affect the cost of the accreditation assessment are time, the requirements for planning information, the requirements for accreditation information, and the team member selections.

Time

The cost of the actual accreditation assessment is a function of the amount of time available and the number of people involved. Normally, a team of SMEs is selected and appropriate face-to-face meetings are scheduled. The time required to plan and arrange each meeting, to prepare and disseminate read-ahead packages, and to prepare the results add to the expense of the accreditation assessment.

When time is short, SMEs with extremely high levels of expertise regarding the simulation's representations and intended use may need to be called in to avoid lengthy "learning curves" leading up to an accreditation assessment. When more time is available and there is sufficient time for training and gaining experience, the SMEs may initially require less specific knowledge about the simulation and its intended use.

Planning Information

Normally, the Accreditation Agent relies on inputs and reviews either from those who perform the planned tasks or from those who evaluate or approve the final accreditation package (e.g., User, M&S PM) to provide the information needed to scope the accreditation problem and plan the assessment. The cost associated with accreditation planning is inversely proportional to the Accreditation Agent's level of understanding of basic accreditation principles and requirements and directly proportional to the amount of support and involvement of the User, M&S PM, and V&V Agent in defining accreditation needs based on requirements and risks.

Accreditation Information Needs

To ensure that VV&A planning focuses on elements of greatest impact to the credibility of the simulation, accreditation information needs must be defined and articulated as early in the development process as possible. Without appropriate accreditation information needs, the VV&A effort may tend to overemphasize minor activities "just in case" or underemphasize potentially important activities.

Team Member Selection

In planning the assessment effort, it is important that the Accreditation Agent carefully select the team members. Team members who do not have the right experience and background, or who do not have the time to invest in preparing for and attending all the team sessions, can cause time to be wasted in the assessment deliberations. This can lead to unnecessary work in trying to achieve consensus and prepare a report, or worse

yet, may necessitate additional meetings. Besides selecting the right team members, the Accreditation Agent should ensure that they are adequately prepared and that they accept the methodology and criteria to be used in the assessment. Again, without adequate preparation and “buy-in,” there is a good chance that meetings will be delayed or disrupted.

References

1. Software Engineering Institute (SEI), *Capability Maturity Model for Software*, Carnegie Mellon, <http://www.sei.cmu.edu/cmms/>
2. Department of Defense Instruction, DoDI 5000.61, DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A), December 2009.

Acronyms

DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
M&S	Modeling and Simulation
MIL-STD	Military Standard
PM	Program Manager
RPG	Recommended Practices Guide
SEI	Software Engineering Institute
SME	Subject Matter Expert
V&V	Verification and Validation
VV&A	Verification, Validation, and Accreditation

The appearance of hyperlinks does not constitute endorsement by the DoD, M&S CO, the administrators of this website, or the information, products or services contained therein. The DoD does not exercise any editorial control over the information found at these locations. Such links are provided consistent with the stated purpose of this website.