

MODELING AND SIMULATION

SUPPORT PLAN

TEMPLATE

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# **I INTRODUCTION**

## ***Purpose***

This template outlines the recommended format for a program's Modeling and Simulation (M&S) Support Plan (herein known as the "Plan"). The template also provides a description of the recommended contents of the Plan. In accordance with Air Force Instruction (AFI) 16-1002, *M&S Support to Acquisition*, a program must have an M&S strategy included as part of the Acquisition Plan or Single Acquisition Management Plan (SAMP) and be documented as a separate M&S Support Plan. The requirement for a separate M&S Support Plan may be waived by the Program Executive Officer (PEO) or Designated Acquisition Commander (DAC). If applicable, the M&S Support Plan should be referenced in the program's Test and Evaluation Master Plan (TEMP).

The M&S Support Plan documents a program's M&S strategy and will guide the use of M&S throughout the entire life cycle of the acquisition program. The M&S strategy will be briefed at SAF/AQ portfolio reviews and other program reviews as determined by the PEO or DAC. For programs with an M&S Support Plan, the primary portion of the Plan to brief at program reviews is Section V: Approach, Strategy and Rationale. This briefing will give decision-makers insight into a program's strategy for using modeling and simulation to enhance their acquisition and sustainment process.

## ***Background***

SAF/AQ Policy 97A-004, *M&S Support of USAF Acquisition Process*, issued in Nov 97, required all acquisition programs to brief their M&S strategies at program reviews. However, no further guidance was published describing the content of these M&S strategy briefings and, consequently, Program Managers were uncertain how to report their M&S strategies at program reviews.

During the May 98 Air Force Acquisition Community M&S Summit, an action was assigned to SAF/AQIK to institutionalize an Air Force acquisition management approach to modeling and simulation and develop and publish a template for Program Managers providing guidance on how to report M&S strategies at program reviews. AFI 16-1002, *M&S Support to Acquisition*, and the M&S Support Plan Template were drafted in response.

## ***Forward***

The M&S Support Plan serves as a vehicle to effectively manage and integrate the use of M&S to support the acquisition and sustainment process and help ensure that M&S activities are planned and conducted as an efficient continuum throughout the acquisition life cycle.

A DoD-wide requirement for an M&S Support Plan such as this may be directed in the near future. The draft re-write of DoD 5000.2-R, Mandatory Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs, contains a requirement for an M&S Support Plan-like document.

## ***II PLAN FORMAT***

This section outlines the recommended format of the M&S Support Plan. The Plan consists of eleven sections. Refer to the next page, III PLAN CONTENT, for a detailed description.

### **M&S Support Plan**

- I Purpose
- II Executive Summary
  - Summary narrative of Section V
- III System Description
- IV Program Acquisition Strategy
  - Summary of the program acquisition strategy
- V Approach, Strategy and Rationale
  - What M&S is being used in the program, how it is used and why
  - M&S support to various functional areas
  - M&S used to date
  - Future use of M&S
- VI Related M&S Activities
  - Other M&S activities the program relies upon
  - Other programs that rely on this programs M&S tools
  - Any other related M&S that affects the program
- VII Management
- VIII Infrastructure Requirements (Facilities/Equipment/Software)
  - Describe infrastructure requirements for all M&S
  - Describe infrastructure provided by the program office, other Government activities, contractors
  - Schedule requirements and availability of items to support schedule
- IX Funding
  - Outline of M&S funding requirements
- X Supplemental Information/Appendices

### **III PLAN CONTENT**

This section describes the recommended content of the M&S Support Plan in detail.

Development of the M&S Support Plan involves development of an M&S strategy to support the overall acquisition strategy. An M&S strategy should be developed by: 1) determining M&S requirements derived from requirements in the Operational Requirements Document (ORD) and Program Management Directive (PMD) and other available resources, including the support infrastructure, 2) planning for development and use of M&S and 3) planning for delivery of M&S products as directed in the ORD or PMD.

Each M&S Support Plan should be a living document, updated as needed. As a minimum, the Plan should be updated prior to each fielding decision, milestone review or equivalent decision point, as well as for portfolio reviews when the M&S Support Plan contents are briefed.

The M&S Support Plan should be developed and implemented in a collaborative manner with product end-users, operational requirements advocates, developmental and operational testers, the intelligence community, industry and other programs as appropriate. Prime contractors may be asked to provide information and data and collaborate on the Plan development and execution as determined by the Program Manager.

If any section of the Plan is not applicable to a program or any topic within a section does not apply, rationale should be provided to explain why that section or topic does not apply.

#### **Section I Purpose**

- Reference AFI 16-1002 as the requirement for this plan
- Briefly state the role and importance of M&S in the program

#### **Section II Executive Summary**

- Summary narrative of Section V

#### **Section III System Description**

- Briefly summarize the capability being developed or reference another document that gives a current description of the system

#### **Section IV Program Acquisition Strategy**

- Briefly summarize the overall program acquisition strategy or reference another document which does so

#### **Section V Approach, Strategy and Rationale**

- Discuss what M&S is being used in the program, how it is used and why:
  - Identify M&S requirements in the ORD, PMD and other sources as well as derived requirements
  - Identify what models and simulations will be delivered and to which customer (e.g., Program Office, warfighter, etc.)
  - Describe what the customer will use the delivered models and simulations for

- (e.g. training, mission support, mission planning, acquisition decisions, military utility analysis, etc.)
- Describe how the customer will use the delivered models and simulations (e.g. the process the customer will use to implement the models and simulations or how it will help in the decision or implementation of the system)
- Describe the maintenance and configuration management concepts for the models and simulations to be delivered
- Identify key Distributed Product Descriptions (DPDs) and other M&S products being delivered to the acquisition community for reuse and who will be responsible for their configuration control and support.
  - Identify available models and simulations, such as the Standard Analysis Toolkit, and other requirements definition, design, cost, manufacturing, sustainability, threat, target, Test and Evaluation (T&E), and engineering models and simulations to meet the M&S requirements and where and how these were obtained (e.g. ESAMS obtained from the M&S Resource Repository)
  - Where new M&S development or modification to existing M&S is necessary, provide rationale why existing M&S is inadequate. Estimate the fraction of code which can be re-used from previous developments for the new or modified M&S. The M&S strategy is framed around development of a DPD. Programs will be required to deliver key models and simulations, including DPDs, developed or modified during an acquisition to the acquisition community for reuse as determined by AFMC in accordance with AFI 16-1002.
  - Describe the DPD and its associated product and/or process models being developed and how they will be maintained
  - Describe the development history of the DPD. This should include specific reference to the data sets used, analysis techniques applied, known anomalies, parametric sensitivity and range of validity to provide a pedigree for future application.
  - Describe the requirements for contractors to furnish information and data into the DPD
  - Describe the collaborative environment in which this Plan is being implemented and each collaborative environment partner's role and interaction with the DPD and/or M&S tools
- Describe M&S release policy
- Describe Verification and Validation (V&V) performed and M&S accreditation status of all models developed or modified
- Describe issues and risks involved with this M&S strategy
- Also discuss M&S support to the following areas as applicable:
  - Mission area analyses
  - Operational analyses
  - Requirements trade-offs
  - Conceptual design studies
  - System engineering trade-offs
  - Cost and operation effectiveness

- Logistics analyses
- Training
- Mission Support
- Mission Planning
- Test and Evaluation
  - Use of a distributed simulation environment
  - Test-unique M&S requirements and uses
  - System characteristics needed for inclusion in the DPD
  - M&S milestone schedule that ties the M&S resources to specific Development Test (DT) & Operational Test (OT) events
  - Level (e.g., campaign, mission, engagement) and fidelity of M&S tools required for T&E
  - System data requirements to support M&S
  - Threat representation and fidelity
  - M&S related Measures of Effectiveness (MOE) & Measures of Performance (MOP)
  - Security classifications, and test VV&A documentation and requirements
- Describe M&S used to date
  - Discuss all M&S previously used to support the program
  - Discuss phase/milestones to which M&S was used
- Describe future use of M&S
  - All planned M&S for future milestones
  - How planned M&S will support future milestones
  - How planned M&S supports the Service's and DoD's M&S vision

#### ***Section VI Related M&S Activities***

- Other M&S activities the program relies upon
- Other programs that rely on M&S tools originating from this program
- Any other related M&S that affects the program

#### ***Section VII Management***

- Provide Program Office organization chart
- Identify M&S manager (if assigned)
- Describe interaction of M&S manager with acquisition community

#### ***Section VIII Infrastructure Requirements (Facilities/Equipment)***

- Describe infrastructure requirements for all M&S
- Discuss facilities and equipment being provided by the program, other Government activities, and contractors
- Discuss schedule requirements and availability of items to support the schedule

#### ***Section IX Funding***

- Outline all M&S funding requirements to include Verification, Validation and Accreditation (VV&A) costs
- Designate type of funding (by PE, project, etc.) and source

***Section X***      ***Supplemental Information/Appendices***

- Provide any comments on related information here
- Attach top-level program schedules and appropriate M&S schedules
- List applicable acronyms and abbreviations
- List any related standards being used here

## **IV PROGRAM REVIEW GUIDELINES**

AFI 16-1002, *M&S Support to Acquisition*, requires Program Managers to brief their M&S strategy at SAF/AQ portfolio reviews and other reviews as determined by the PEO or DAC. Programs that have developed an M&S Support Plan as outlined in Section III of this template will be well prepared for these briefings. Regardless of whether or not a program has an M&S Support Plan, Program Managers should be prepared to answer the questions listed below at program reviews. These questions fall into two broad categories: 1) general M&S questions and 2) questions regarding Simulation Based Acquisition (SBA).

### **Section I General M&S Questions**

#### **A. M&S Planning:**

- *IS THERE AN M&S SUPPORT PLAN FOR M&S USE ACROSS THE SYSTEM LIFECYCLE?*
- *IS THE M&S SUPPORT PLAN INCLUDED IN THE ACQUISITION PLAN/SAMP? HOW OFTEN IS IT UPDATED?*
- *IS THE PLAN FUNDED?*
- *DOES THE PLAN TAKE INTO CONSIDERATION:*
  - *IDENTIFICATION OF ALL MODELS AND SIMULATIONS?*
  - *THE SOURCE OF NEEDED DATA FOR THE MODELS AND SIMULATIONS?*
  - *REUSE ACROSS ACQUISITION PHASES?*
  - *VV&A?*
  - *USE OF MODELS IN SOURCE SELECTION AND THEIR RELEASE TO INDUSTRY?*
- *IS THE USE OF M&S ACCOUNTED FOR IN THE TEMP?*

#### **B. Requirements:**

- *WHAT MODELS/SIMULATIONS AND DATA WERE USED, IF ANY, AS PART OF THE AOA TO GENERATE REQUIREMENTS? WERE THEY VERIFIED, VALIDATED AND ACCREDITED?*

#### **C. Cost:**

- *DOES THE FUNDING PROFILE SUPPORT THE ROBUST USE OF M&S THROUGHOUT THE PROGRAM'S LIFECYCLE? (E.G., FRONT-LOADED?)*
- *DOES THE USE OF M&S MAKE THE PROGRAM MORE AFFORDABLE? IF SO, IN WHAT WAY?*
  - *COST AVOIDANCE/COST SAVINGS*
  - *SCHEDULE SAVINGS*
  - *OTHER*

D. Contractor Incentives:

- *ARE INCENTIVES IN PLACE FOR THE CONTRACTOR TO USE M&S?*

**Section II SBA-Specific Questions**

SBA is a re-engineered acquisition process that exploits recent advances in M&S and information technologies. It involves not only changes in the technologies and environment, it also involves changes in the culture and processes. The following questions seek evidence of those changes.

SBA enables a more robust iterative acquisition process (e.g. spiral development) versus the traditional serial process of moving through the acquisition phases. We conceive, design, manufacture, test, train, operate and sustain (in an iterative nature) concurrently in the virtual world before locking in a solution. We delay locking in our requirements in an ORD until we examine the trade space in a virtual system of systems environment. As the system is developed and produced, the representation of the new system continues to be matured in parallel with that development.

A. Shared Digital Environment - SBA Concepts That Apply:

- Collaborative Environments – An enduring collection of subject matter experts (SMEs) supported by interoperable tools and data bases, authoritative information resources, and product/process models that are focused on a common domain or set of problems. Simply put, this could be two or more programs collaborating together on a given problem and sharing and reusing models and simulations. Example: a missile Program Manager (PM) collaborating with aircraft and ship PMs for a strike warfare collaborative environment; or, several aircraft PMs collaborating across the aircraft product line.

**QUESTION: IS THE PROGRAM PARTICIPATING IN ANY COLLABORATIVE ENVIRONMENTS?**

- Distributed Product Description or DPD - the virtual representation of the system including all the associated information that makes it “smart” such as the function of the system, special manufacturing requirement, cost of system, etc. A DPD is a step beyond a virtual prototype.

**QUESTION: DOES THE ACQUISITION STRATEGY CALL FOR DEVELOPMENT OF A DPD? IF SO, WILL THE GOVERNMENT OWN THE RIGHTS? IS IT PLANNED TO EVOLVE THE DPD OVER THE LIFE OF THE PROGRAM?**

- DoD/Industry Resource Repository or DIRR – A shared repository for DPDs as well as other models and simulations to enable government and industry sharing and reuse. It is an extension of the existing DoD Modeling and Simulation Resource Repository (MSRR)

by adding an industry node. Access controls are required - example: Boeing may have a Boeing-proprietary DPD of the JSF that only Boeing and the Government can access (but not Lockheed). JSF may also use a “purple DPD” that anyone can access.

QUESTION: DOES THE ACQUISITION STRATEGY CALL FOR PLACEMENT OF THE DPD IN THE MSRR (OR DIRR IN THE FUTURE)? HAVE APPROPRIATE ACCESS CONTROLS/PROPRIETARY DATA RIGHTS ISSUES BEEN RESOLVED?

- Ultimately, when SBA is implemented as a strategy, programs, working in conjunction with each other, will use common standards and adopt a common architecture which will facilitate interoperability and reuse supporting DoD goals of reduction in cycle time and cost.

QUESTION: HOW IS THE PROGRAM LEVERAGING EXISTING STANDARDS (E.G., HLA)?

QUESTION: HOW ARE YOU USING STANDARDS TO ENSURE INTEROPERABILITY WITH OTHERS OUTSIDE YOUR PROGRAM?

QUESTION: WHAT M&S ARE YOU LEVERAGING FROM OTHER PROGRAMS?

QUESTION: WHAT PARTNERSHIPS HAVE YOU INITIATED? WHAT PARTNERSHIPS DO YOU INTEND TO SUSTAIN TO BOTH CONTRIBUTE TO THE COMMUNITY AND REDUCE ACQUISITION COSTS?

## B. Simulation Test and Evaluation Process (STEP)

- STEP is an integral part of the SBA strategy. The DoD STEP Guidelines require an evaluation strategy integrating T&E with M&S.

QUESTION: DOES YOUR PROGRAM HAVE AN INTEGRATED T&E AND M&S STRATEGY?

QUESTION: DOES YOUR PROGRAM USE A DISTRIBUTED SIMULATION ENVIRONMENT TO OVERCOME LIMITATIONS IN TRADITIONAL TESTING?

QUESTION: TO WHAT EXTENT IS YOUR EVALUATION STRATEGY IMPLEMENTING THE STEP GUIDELINES?

QUESTION: STEP REQUIRES EARLY INPUT FROM THE TEST COMMUNITY AS PART OF THE ACQUISITION LIFE CYCLE. AS PART OF YOUR EVALUATION STRATEGY, AT WHAT POINT DO THE TESTERS BECOME INVOLVED IN YOUR PROGRAM?

QUESTION: WILL OPERATIONAL TEST USE M&S FOR IOT&E?

C. Evolved Process

- Integrated Product And Process Development (IPPD) and the use of Integrated Product Teams (IPTs) with empowered Government and industry members to accomplish defined tasks are critical to take advantage of the technological advances which make SBA possible.

QUESTION: HAS THE PROGRAM FORMED GOVERNMENT/INDUSTRY PARTNERSHIPS WITH EMPOWERED GOVERNMENT AND INDUSTRY MEMBERS TO ACCOMPLISH THE DEFINED TASKS THAT ARE CRITICAL TO TAKE ADVANTAGE OF THE TECHNOLOGICAL ADVANCES WHICH MAKE SBA POSSIBLE?

D. Evolved Culture

- Incentives are required for development in the initial stages of a program to develop the integrated data environment and other infrastructure and resources for SBA.

QUESTION: HAS THE PROGRAM MANAGER PROVIDED INCENTIVES FOR INDUSTRY TO EITHER ASSIST IN OR DEVELOP THE NECESSARY PRODUCTS AND SERVICES FOR SBA TO BE IMPLEMENTED AS A STRATEGY?

- The process must build a partnership between Government and industry. The first opportunity of this is during the request for proposals and proposal evaluation

QUESTION: DOES THE ACQUISITION STRATEGY CALL FOR THE SHARING OF MODELS & SIMULATIONS EARLY ON (ALA IPPD), TO INCLUDE DURING SOURCE SELECTION, AND DURING THE LIFE OF THE PROGRAM?

## V REFERENCES

DoDD 5000.1, *Defense Acquisition*, Mar 96

DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs), Major Automated Information Systems (MAIS) Acquisition Programs*, Mar 96

DoDD 5000.59, *DoD Modeling and Simulation (M&S) Management*, Jan 94

DoDD 5000.59-P, *DoD Modeling and Simulation (M&S) Master Plan*, Oct 95

DoDD 5000.59-M, *DoD Glossary of Modeling and Simulation (M&S) Terms*, Jan 98

DoDI 5000.61, *DoD Modeling and Simulation Verification, Validation, and Accreditation (VV&A)*, Apr 96

*DoD Verification, Validation and Accreditation (VV&A) Recommended Practices Guide*, Nov 96

AFI 16-1002, *Modeling and Simulation Support to Acquisition*, 16 Nov 99 (DRAFT)

AFI 63-123, *Evolutionary Acquisition Process for C2 Systems*, Jun 98 (DRAFT)

USD(A&T) Memo, *DoD High Level Architecture for Simulations*, Sep 96

## **VI TERMS**

**Accreditation** Official determination that a model or simulation is acceptable for use for a specific purpose.

**Air Force Standard Analysis Toolkit** Part of the AF/XOC Legacy Model Transition (LMT) Plan, created in an effort to establish a standard toolkit of models for the analysis community. The plan identifies a suite of current models, called Toolkit Models, which are considered the Air Force standard for modeling various activities in combat.

**Architecture** Structure of components in a program/system, their interrelationships, and the principles and guidelines governing their design and evolution over time.

**Behavior** For a given object, how attribute value changes affect (or are affected by) the object value changes of the same or other objects.

**Campaign** Simulations that attempt to emulate all elements of aerospace power over the duration of a conflict and across the theater or theaters of operations. Time scale is normally in days to weeks. Represents the strategic and operational levels of warfare.

**Configuration Management** Application of technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a model or simulation, control changes, and record and report change processing and implementation status.

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

**Digital System Model (DSM)** Software representation of a system, used to characterize dynamically the expected effects of changes in assumptions, design, tactics, or doctrine. DSMs embody system requirements and characteristics such that they can be actively evaluated in a common digital environment starting with concept exploration and progressing throughout the system life-cycle including analysis, design, test, training, and logistics.

**Distributed Product Description (DPD)** A distributed collection of product-centric information that is interconnected via web technology into what appears (to the user) to be a single, logically unified data base. DPDs are composed primarily of three types of information: product data, product models, and process models. Product data specifies the characteristics of a product at any point in its development cycle, manufacturing data, and test data. Product models are authoritative software representations of a product that have been developed to operate within specific simulations or other analytic environments (e.g., JMASS, JWARS, JSIMS, etc.). Process models are used to describe/document the business operations necessary to define, develop, manufacture, deploy, and dispose of the product throughout its life cycle. DPDs may also

contain other relevant product-related information, such as functional descriptions of product behavior and various categories of applicable metadata (e.g., VV&A status).

**Engagement (Sub-mission)** Simulations which provide measures of effectiveness at the system level by evaluating system effectiveness against enemy systems.

**Mission** Simulations of one or more interacting elements of aerospace power across all or part of the theater of operations. Time scale normally in hours. May represent the operational and tactical levels of warfare.

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

**Object** Physical or logical structures (models) that keep their characteristics and behavior together.

**Process Model** Provide detailed definitions of the engineering, development and evaluation processes used to design and develop the product. Specifically, process models provide information and knowledge on how to use various tools and resources to perform the numerous scientific, engineering, development and evaluation tasks associated with technology and product development.

**Product Model** Authoritative representations of product behavior and performance. Each product model referenced in a DPD reflects an actual software implementation of the product (data and methods) that has been developed to operate in a specific static analysis tool or dynamic virtual environment. Each product model is based on a common functional and operational description (included in the DPD) that provides the basis for verification and validation of the model. Digital System Models (DSMs) are product models.

**Requirement** An established need that justifies the timely allocation of resources to achieve a capability to accomplish approved military objectives, missions, or tasks.

**Simulation** A method for implementing a model over time. Also a technique for testing, analysis, or training where real-world systems are used, or where a model reproduces real-world and conceptual systems.

**System/Subsystem/Component** Detailed engineering or scientific simulation of a single system, subsystems, and components across ranges of operations and environments. Time scales range from microseconds to minutes or more. May represent the tactical level of warfare.

**Validation** Rigorous and structured process of determining the extent to which M&S accurately represents the intended "real world" phenomena from the perspective of the intended M&S use.

**Verification** Process of determining that M&S accurately represent the developer's conceptual description and specifications.