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## 1.0 PHASE I ACCREDITATION SUPPORT PACKAGE DESCRIPTION

Phase I accreditation support comprises five distinct activities: definition of the model's configuration management baseline; summarization of model assumptions, limitations and known errors; determination of the model's V&V status and usage history; assessment of available documentation; and assessment of software quality. Each of these activities is described in greater detail below.

### 1.1 CONFIGURATION MANAGEMENT (CM) BASELINE

The configuration management (CM) baseline description for a model provides prospective users with an indication of how well the model is controlled and supported. Models with poorly defined configurations and unspecified (or vague) change control procedures are likely to produce inconsistent results across their spectrum of users and applications, with the consequence that model predictions will not be highly regarded. Models whose configurations are well specified, and whose change procedures are well disciplined are more likely to have timely supporting documentation and to produce consistent, well accepted results. Moreover, well managed models have a lower risk of failing detailed V&V aimed at higher levels of accreditation.

The CM baseline for a model consists of a description of the model, its development history, current version status (including documentation), applicable change procedures, model development policy (including beta site version integration), and any configuration management policies, procedures, guidelines and support functions in place for the model. Taken as a whole, these information elements provide the prospective user with a vantage point from which to assess the discipline with which a model has been developed, the important operational differences between extant versions, and the potential impact of model management discipline on the acceptability of model results. As such, CM baseline information is essential to the basic choice of a model for further V&V or accreditation for a specific application. The CM Baseline for *RADGUNS* is found in Section 2.

### 1.2 SUMMARY OF ASSUMPTIONS, LIMITATIONS AND ERRORS

Different users typically have different applications for the same model, an application which requires that the model have certain characteristics. This section of ASP-I should help the user determine, at an early stage, whether or not the model's assumptions, limitations and errors place it outside the realm of applicability to the problem at hand. Coupled with the model's usage history, the summary of assumptions, limitations and errors can be a powerful model selection tool. This summary also provides a mechanism for integrating any assumptions, limitations, and errors discovered during V&V efforts, and for incorporating any that may be reported in the future by users. A summary of assumptions, limitations, and errors for *RADGUNS V.2.0* is in Section 3. These were compiled from a number of sources and summarized to facilitate a determination of the appropriateness of this model for a particular application by a prospective user.

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## 1.3 V&V STATUS AND USAGE HISTORY

This section conveys to the prospective model user a sense of community acceptance of model results. The tacit assumption is that if a model is widely used, it represents a de facto community standard for the subject being modeled. A model's usage history also provides an important clue to the possible limitations on model use. For example, if a model purports to simulate both RF and IR missile threats, but the user community consistently ignores the IR portion of the model, the model's usage history will suggest that this portion of the model is not trusted or requires modification. This fact alone is not sufficient to judge a model truly acceptable for a given purpose, however.

Supporting evidence for model acceptability is given by a documented V&V audit trail, indicating that the user community has enough interest in the model to conduct such efforts. Evidence for such activity may be sparse, however, given that emphasis on V&V as part of the model credibility problem is of recent vintage. It is possible, therefore, that the primary criterion by which a prospective user will judge the suitability of the model for a particular application will be community acceptance, as indicated by the model's usage history. As V&V becomes de rigeur for M&S, however, the range of applications for which model results are supported by V&V will become broader, offering a clearer picture of the degree to which model results can be trusted on the basis of prior uses of the model. Information on the V&V status and usage history of RADGUNS is found in Section 4.

RADGUNS V&V status and usage history was surveyed by the model developer and an independent evaluator for the SMART Project to establish a subjective assessment of community acceptance of model results. Approximately 113 users currently have a copy of the simulation for modeling a variety of targets and threats. The RADGUNS V&V audit trail is sparse; software test documentation and design specifications are non-existent. Extensive investigation was conducted to update the user's list and identify missing documentation.

## 1.4 DOCUMENTATION ASSESSMENT

This section reviews the current status of a model's documentation with respect to standards developed for the verification of mature M&S. The standards were developed by reviewing MIL-STD, DOD-STD, JTCG/AS and service specific policies, procedures and guidelines relating to M&S development, and tailoring these standards to the problem of "V&V in reverse" for mature M&S. The results are set forth in Reference 3 and Reference 36, which specify the number, format and content of a minimum documentation set acceptable for rational use of model results, and efficient conduct of verification and validation.

In general, a well documented model will be supported by a documentation set consisting of a User's Manual, a Programmer's Manual, an Analyst's Manual, and a Software Design Document (or its equivalent). Each of these documents should contain certain information specific to its function as specified in (3 and 36). The documentation assessment task reviews each available component of model documentation for completeness and compliance with the recommended standards. Discrepancies are noted, implications for model use and V&V are summarized, and recommendations for improvement of the documentation are provided. The documentation assessment applicable to RADGUNS is found in Section 5.

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Documentation assessment consisted of reviewing the current status of RADGUNS documentation with respect to standards developed for verification. DoD, Military, and JTCG/AS standards, policies, procedures, and guidelines relating to modeling and simulation (M&S) development were tailored to apply to mature, already-developed software programs. The results were documented in References 3 and 36. These documents specify the number, format and content of a minimum documentation set acceptable for efficient conduct of verification.

RADGUNS is supported by a documentation set consisting of a User's, Programmer's, and Analyst's Manual, a Conceptual Model Specification (CMS), and Verification Source Report. Each of these documents contains certain information specific to its function as specified in References 2 and 4. The documentation assessment task reviewed each available component of model documentation for completeness and compliance with recommended standards. Discrepancies were noted, implications for model use and V&V were summarized, and recommendations for improvement of the documentation were provided.

TABLE 1-1. Software Module Compliance Template.

<b>Module Name:</b>		<b>Module Type:</b>	
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EVALUATION CRITERIA	Compliance Level		
	Poor Practice	Acceptable	Excellent
<b>MOE #1 - Use of Standards:</b>			
Criterion #1: Readability			
Criterion #2: Modifiability			
Criterion #3: ANSI standards			
<b>MOE #2 - Programming Conventions:</b>			
Criterion #1: Use of comments and headers.			
Criterion #2: Use of variables.			
Criterion #3: Use of formatted statements.			
Criterion #4: Logical I/O devices.			
Criterion #5: Variable declarations.			
Criterion #6: Variable initialization.			
Criterion #7: Variable naming conventions.			
Criterion #8: Algorithm logic.			
<b>MOE #3 - Computational Efficiency:</b>			
Criterion #1: Mixed mode calculations.			
Criterion #2: Use of library functions.			
Criterion #3: Nested computations.			
<b>MOE #4 - Memory Utilization:</b>			
Criterion #1: Dynamic allocation.			
Criterion #2: Re-utilization of variables.			
Criterion #3: Memory management.			
Criterion #4: Use of COMMON blocks.			
Criterion #5: Use of EQUIVALENCE.			

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## 1.5 SOFTWARE QUALITY ASSESSMENT

This section is intended to provide the prospective model user with an indication of the conformance of model code to accepted software development and documentation practice. The structure of the source code was analyzed from a software engineering perspective in three major areas: use of programming standards; computational efficiency; and memory utilization. Within each of these major areas are several contributing factors which are individually evaluated and aggregated into a score representing an overall evaluation of source code quality.

Software quality assessment is no substitute for actual model experience and application as developed by a user community. It does, however, focus the user community on clearly identifiable software problems in a structured way, and gives the prospective model user a feeling for the trade-off between software “maturity” and credible model use.

The software quality assessment of *RADGUNS* code presented here was performed for the SMART Project by ASI Systems International personnel (Ridgecrest, CA) without influence from the model developer or sponsoring agency. The contributing factors for each major area of evaluation, and the possible compliance levels, were as shown in Table 1-1. The results of the software quality assessment of *RADGUNS* code are provided in Section 6.