
EXECUTIVE SUMMARY

This Phase I Accreditation Support Package (ASP I) is designed to provide a potential user with a characterization of the current state of ESAMS 2.7 with respect to criteria related to its general acceptability for use. The information collected in this phase is intended to characterize the model well enough to provide an initial determination of its suitability for a particular application. It should also provide confidence that the model is well enough managed and supported to yield consistent results across its spectrum of users and applications. The information provided to characterize the subject model consists of the following elements:

- a. A description of the configuration management baseline for the model, including version history, current version status, model development policy (including beta site provisions), documentation availability, and a summary of configuration management policies, procedures, guidelines and support functions in place for the model;
- b. A summary of implicit and explicit assumptions and limitations inherent in the model because of its design and/or coding assumptions or structure, as well as any implied constraints to the use of the model that are a consequence of these assumptions or structures. A listing of known errors or anomalies found as a result of prior V&V efforts is also included;
- c. A review of the model's development, verification and validation (V&V) and usage histories, as well as a summary of prior accreditations;
- d. A review of the status of model documentation and its conformity to accepted software documentation standards, as well as a review of documentation with respect to verification requirements; and
- e. A summary of overall software quality as characterized by conformance to accepted design and coding practices.

ASP I provides the details of these information elements in a single document. The degree to which each information element is complete and current provides a general indication of whether the model is suitable for further consideration for use in a particular application.

Configuration Management Baseline: ESAMS 2.7 is a government-owned model that is managed by the Air Force Studies and Analyses Agency (AFSAA) and distributed by the Survivability and Vulnerability Information Analysis Center (SURVIAC). Included with the standard distribution is the ESAMS 2.7 source code, the ESAMS preprocessor (PREPRO) and four Ground Radar Clutter Estimator (GRACE) preprocessors: the Triangular Terrain Generator (TTG), the Site Mask Generator (SMG), the RF Backscatter Estimator (RBE), and the Environment Data Manager (EDM) which are needed to generate site-specific clutter maps. Along with the source code are configuration controlled radar, missile, and clutter data files for each of the threats and electronic countermeasure data for various Air Force and Navy aircraft. Various UNIX scripts and VMS command procedures are also provided to facilitate software compilation, linking, and execution; however, these are not formal configuration items. In addition, hard copy documentation consisting of an ESAMS User's Manual, an Advanced User's Manual, an Analyst's Manual, and classified Threat and ECM manuals are also provided.

Configuration management for ESAMS is provided via a Configuration Control Board (CCB) which consists of voting government members and non-voting contractor representatives. The CCB reviews model deficiency reports (MDRs) submitted to SURVIAC and votes on whether to accept or reject the MDR, and if accepted, whether the required code modification will go into the current version or will be deferred until the next version. The CCB meets about three times a year in conjunction with the User's Group Meeting.

Assumptions, Limitations, and Errors: A brief list of assumptions and limitations is provided in the *ESAMS 2.7 Analyst's Manual*. That list is reprinted, and expanded, in Section 3 of this document, and also includes a discussion of model use implications for each assumption/limitation. The list is generally applicable at the model level; more detailed assumptions, applicable at the functional element level, can be found in ASPs II and III.

The errors discovered for the current model baseline, version 2.7, originate from two different sources: model users, who report anomalies to SURVIAC, and V&V activities sponsored by the SMART Project. MDRs are also summarized in Section 3.

V&V Status and Usage History: ESAMS was originally developed in the mid-1970's as a flexible, more capable replacement for the old TAC ZINGER models. Approximately 20 companies and 20 government agencies are currently using the model. V&V efforts for ESAMS have been conducted by numerous user agencies including the SMART Project, which has focused on tracking performance and ECM sensitivity. References to these results and other V&V efforts are included in Section 4.

Documentation Assessment: The manual set for ESAMS 2.7 was updated and distributed in October 1995. While a User's Manual and an Advanced User's Manual are available, they are not in compliance with the recommended standards for content and are incomplete in that usage of several model functions is not addressed. Notable examples are the GRACE clutter and multipath and towed decoy capabilities. A Software Programmer's Manual (SPM) does not exist for ESAMS 2.7, but the Software Installation Guide produced by SURVIAC contains much of the required information. Required technical data on program modules and potential installation problems is not available, therefore this manual was also deemed incomplete, but adequate for most installation purposes. The Software Analyst's Manual is the most complete and adequate of the documentation set and Software Design Documentation, while incomplete, is being developed and those portions completed thus far have been deemed adequate for purposes of supporting verification efforts. This information is in the Conceptual Model Specification (CMS) sections of ASP-II.

Recommendations for improvement include development of an SPM that includes the information from the installation guide as well as detailed functional data about each subroutine, especially those known to produce error messages, such as TLUERR, a table lookup error reporting function. A combined User's Manual should be produced that contains detailed instructions (currently available in file *constx.f*) for adding program variables to any of the common blocks. Addition of model descriptions and usage instructions for the GRACE processors (i.e., TTG, SMG, RBE, and EDM) to the User Manual is also recommended.

Software Quality Assessment: The ESAMS code is well written, structured, and commented. The development team has adhered to ANSI FORTRAN -77 standards and

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practices and the software reflects their disciplined approach to continued maintenance and upgrades of model capabilities. Through examination of changes between beta and official release versions, evidence of improved configuration management practices was evident and high evaluation scores were achieved by most of the program modules examined. An initial assessment of 100 subroutines was augmented by an analysis of another 100 modules without appreciable change in average scores, which were narrowly distributed around 87 out of a possible 90 points. Code traceability can be difficult because only a few modules identified their callers, but nearly all listed the routines called. Most routines also had good descriptive headers, or preambles, that described their purpose and the variables that were used in them as well as passed to and from them.

