

AIR FORCE EFFORT TO IMPROVE MANAGEMENT OF ATE SOFTWARE DEVELOPMENT

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ABSTRACT

The Air Force is launching certain efforts under the auspices of the Modular Automatic Test Equipment (MATE) Program to improve its management of ATE software development. The overall effort is entitled the "MATE Software Verification and Validation Task" and is divided into four major subtasks:

- The subtask for providing Test Program Set (TPS) Contracting Techniques and Documentation.
- The subtask for providing Software (S/W) V&V tools and procedures.
- The subtask for providing a cost trade model for TPS S/W V&V.
- The subtask for providing TPS cost tracking tools and procedures.

INTRODUCTION

The business of managing the development of ATE Software is indeed a complex one. Improvements are needed in the manner in which we contract for ATE software, track its cost, and measure its quality.

The efforts described in this paper will be accomplished as part of the MATE program. Some of the efforts will apply to ATE in general (i.e., to both MATE and non-MATE ATE developments) and others will apply only to MATE developments.

The purpose of this paper is (1) to inform the reader as to what efforts the Air Force is planning in order to better manage ATE software developments and (2) to solicit ideas from industry on how we can mutually better manage software developments.

The effort is entitled "MATE Software Verification and Validation Task" and is divided into four major subtasks:

- The subtask for providing Test Program Set (TPS) Contracting Techniques and Documentation.
- The subtask for providing Software (S/W)

V&V tools and procedures.

- The subtask for providing a cost trade model for TPS S/W V&V.
- The subtask for providing TPS cost tracking tools and procedures.

The subtasks will be addressed and scoped one at a time along with the need that each subtask will satisfy.

Two terms will be used throughout this paper and are defined below:

1. A Test Program Set (TPS) includes three major items: the Test Program, the Interface Test Adapter (ITA) and all the documentation needed to test the Unit Under Test (UUT) and to maintain the Test Program and the ITA.

2. Units Under Test (UUTs) include digital, radio-frequency, analog, hybrid, pneumatic, electro-optical units, etc. They include Line Replaceable Units (LRUs) and Shop Replaceable Units (SRUs). UUTs vary in complexity from very simple to very complex. UUTs also include ITAs and the Automatic Test Equipment (ATE) itself when these items are the subject of the test.

SUBTASKS

The Subtask for Providing TPS Contracting Techniques and Documentation. This subtask although being done as part of the MATE program, will apply to all TPSS (that is, to TPSS that will be used on MATE and to those that will be used on other ATEs).

1. TPSS for use on ATE have become major contributors to the Life Cycle Costs of Air Force weapon systems. Each Air Force procuring agency, including, in particular, each major Weapon System Program Office, develops its own method of contracting for and managing the development and formal acceptance of TPSS. Oftentimes important parameters such as Fault Detection and Fault Isolation capability are unspecified or poorly specified and are untested or poorly tested. Also, oftentimes the Air Force has only limited visibility and control over the TPS development process because of the manner in which TPSS are contracted for. There is the need, therefore, for the following effort to correct this situation.

2. There is the need to have developed a set of contracting documentation, i.e., Specifications, Statements of Work (SOWs), Military Standards, Data Item Descriptions (DIDs), Contract Data Requirements List (CDRL) items, etc. that can be placed on contract to insure that TPSSs are adequately specified (and thus adequately developed, verified and validated, and formally accepted). This includes insuring that the necessary documentation on the UUT and on how the UUT should be tested is provided by the UUT supplier to the TPS developer and then to the Air Force. The set of contracting documentation from this subtask in conjunction with the cost tracking tools and procedures provided by another subtask must also provide the basis for tracking the cost of TPS software development. This subtask will require (among other things) revising/replacing the present military standards and DIDs on Test Requirements Documents (TRDs) to recognize the present state-of-the-art and to allow for future state-of-the-art in electronics.

The Subtask for Providing V&V Tools and Procedures. The V&V tools and procedures to be provided by this subtask will be for TPSSs (MATE and non-MATE) and for the MATE control and support software.

1. TPSSs. There is the need for tools and procedures to aid in the verification and validation of TPSSs during and after development. These tools and procedures will be used to check out the TPSSs from two points of view.

a. The agency (be it a contractor or an Air Force in-house agency) developing the TPSSs has to be able to tell when the TPSSs are of sufficient enough quality so that development can cease.

b. The Air Force representative must have some means of evaluating the quality of the TPSSs so that he can accept them for the Air Force.

One measure of TPS quality is the capability to detect and isolate faults (usually expressed in terms of Percent Fault Detection (FD) and Percent Fault Isolation (FI) to a specified ambiguity group). Another measure is the ability of the TPS to run error free on its intended ATE. Still another measure is the ability of the TPS to test the UUT in the manner intended by the UUT manufacturer as stated in his Test Specification for that UUT. All three measures are important and must be included in the V&V process. Thus, the term V&V is used in its broadest sense to mean whatever testing is necessary throughout all phases of the development and operational effort to insure that the software will meet its specifications.

2. MATE Control and Support Software. A set of tools and procedures is needed to aid in the V&V of the MATE Control and Support (C&S) Software.

a. In order to assure that each MATE System

remains an integral system, the MATE C&S Software will have to be V&Ved whenever:

(1) there is a hardware change to the MATE System,

(2) there is a change to the MATE C&S Software,

(3) a new MATE System is configured/reconfigured from existing MATE modules,

(4) a new hardware or software module is made available to MATE.

b. In addition, each new/modified MATE module will have to be V&Ved as a module before it is V&Ved as part of the MATE System.

These V&V tools must be versatile enough to keep pace with the evergrowing MATE. It should not be necessary to develop new V&V tools each time new MATE modules are introduced.

The Subtask for Providing a Cost Trade Model for TPS S/W V&V. There is the need to have defined and developed a cost trade model to enable the Air Force to determine to what confidence level the Fault Detection and Fault Isolation capabilities of each TPS should be measured. Procedures and techniques need to be defined and developed along with this model to enable the user to determine how much V&V should be done and how the V&V should be done in order to achieve the confidence level recommended by the model. This model will be applicable to both MATE and non-MATE TPS software.

The Subtask for Providing Cost Tracking Tools and Procedures. Tools and procedures are needed for tracking the cost of the various elements of TPS development. The cost data will be used to help control the TPS development as well as to predict the costs of future TPS developments. These tools and procedures will be applicable to both MATE and non-MATE TPSSs.

CONCLUSION

It is hoped that both the Air Force and the industry will benefit from this effort.

1. Standardized requirements and definitions for TPS developments should provide a fairer basis of comparison among companies who are bidding on TPS development efforts.

2. Companies should have better insight into how the quality of their software development efforts will be measured before they even bid on the efforts.