



ATEC VV&A Program

Joint VV&A Meeting
14-15 Nov 01

U.S. Army Evaluation Center
Technical Support/Methodology Division

U.S. Army Developmental Test Command
Technology Management Division

5/13/2004

Developmental Test Command

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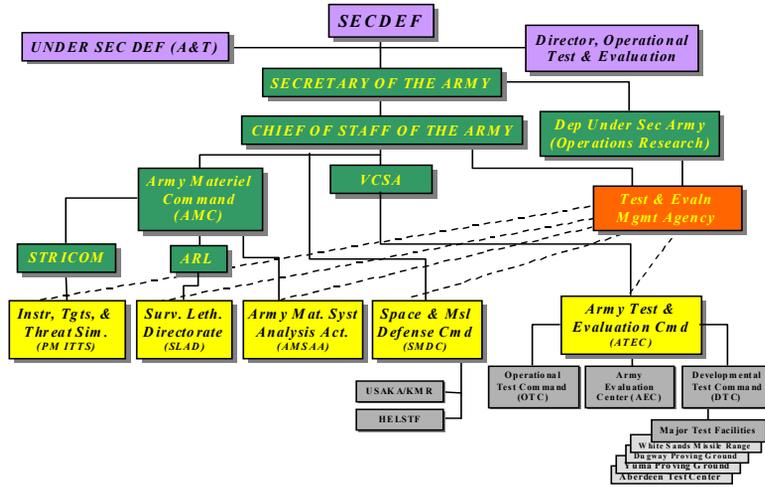
Agenda



- **Who is ATEC?**
- **Background**
- **VV&A Definitions**
- **T&E Perspectives**
- **Observations and Lessons Learned**
- **VV&A Methodology and Guidance**
- **Conclusions**



Army Test and Evaluation Community



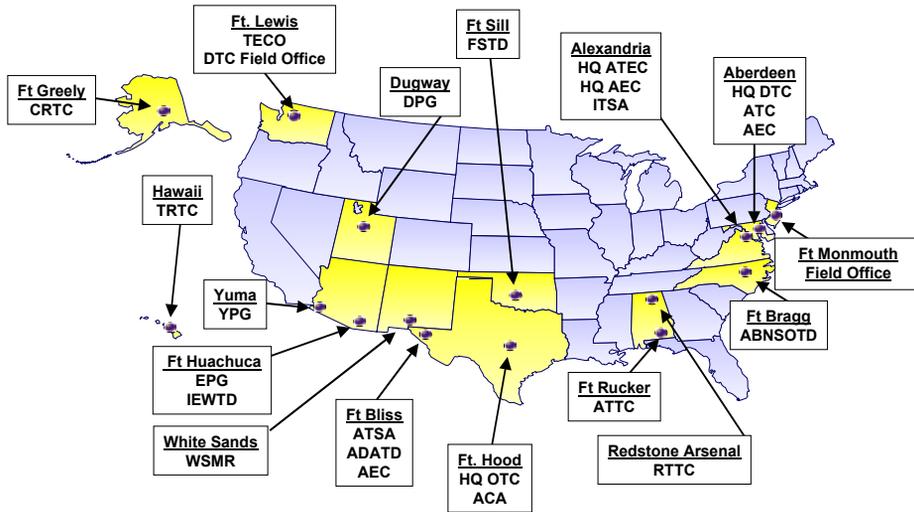
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ATEC Locations



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Background



- Jun 95 Chartered TECOM VV&A Work Group
- May 98 Published TECOM Pam 73-4, "VV&A Methodology"
- Oct 99 U.S. Army T&E Consolidation
- Sep 00 Established ATEC VV&A Work Group
- Mar 01 Charter Approved
- Dec 01 Publish ATEC Methodology version 1
- Jun 02 Finalize ATEC Methodology version 2
- Oct 02 Approve ATEC Methodology

↑ Past
↓ Future

 **Developmental Test Command**

First, I'll show you talk about our VV&A/C working group and who are involved. I'll then explain the objectives of this group and some of their accomplishments to date, and finally, layout the milestones for their effort.



Verification



- The process of determining that a M&S implementation accurately represents the developer's conceptual description and specification.
- Verification also evaluates the extent to which the model and simulation has been developed using sound and established software engineering techniques.

AR 5-11, DA Pam 5-11, & DMSO

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Verification is the process of determining if an M&S accurately represents the developer's conceptual description and specifications and meets the needs stated in the requirements document. Ultimately, the verification process establishes if the simulation correctly performs the intended functions and the extent to which the simulation has been developed using sound system engineering. In testing, the verification of interfaces is of particular importance to ensure that modeled components are able to interact with each other and with hardware components. For example, virtual instrumentation interfaces with models and analysis tools, models interface with synthetic environments, and synthetic stimuli (e.g., HWIL simulations) interface with hardware components.



Validation



- The process of determining the degree to which a Model and Simulation is an accurate representation of the real-world from the perspective of the intended uses of the Model and Simulation.
- Methods:
 - comparison with test data
 - expert consensus
 - comparison with historical results
 - peer review
 - independent review

AR 5-11, DA Pam 5-11, & DMSO

Validation is the process of determining the extent to which M&S accurately represent the real world from the perspective of the intended use of the M&S. Validation has to do with the fidelity of the M&S. The fidelity of the M&S is judged by several factors, one of which is its ability to predict the known, or best estimate, of the behavior of the real system when subjected to the same stimuli. If the significant parameters of a real system have been properly incorporated into a model, a simulated experiment should reflect the behavior of a real system, down to some level of detail commensurate with that description.



Accreditation



– The official **determination** that a model or simulation is acceptable for use for a specific purpose.

AR 5-11 & DA Pam 5-11

– The official **certification** that a model, simulation, or federation of M&S and its associated data are acceptable for use for a specific purpose.

Defense Modeling & Simulation Office

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Accreditation is an official determination that an M&S system is acceptable for its intended purposes. It is based on experience and expert judgment and includes consideration of the extent to which V&V has been accomplished. Accreditation is a management level responsibility with assistance from the V&V team. The accreditation decision is based on the experience and expert advice provided by the V&V team. The specific use of the M&S must be considered in the context of its capabilities and limitations.



T&E Accreditation



**Any M&S Used to Support or Supplement
Testing and Evaluation
Must Be Accredited if the Results
Directly or Indirectly
Influence the Evaluation**

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Accreditation

is a process that leads to an official determination that a model is credible and suitable for a particular use

must take place for each application of a given M&S (e.g. using CASTFOREM in the evaluation of a tank is not the same as using it for a helicopter).

signature authority is approver of the document in which M&S is used



T&E Accreditation (Con't)



Two Levels of Accreditation:
**Class of Applications – V&V focus on
algorithms**
**Application Specific – V&V Focus on Inputs
and Outputs**

Both levels are needed to accredit M&S for any use in test and/or evaluation.

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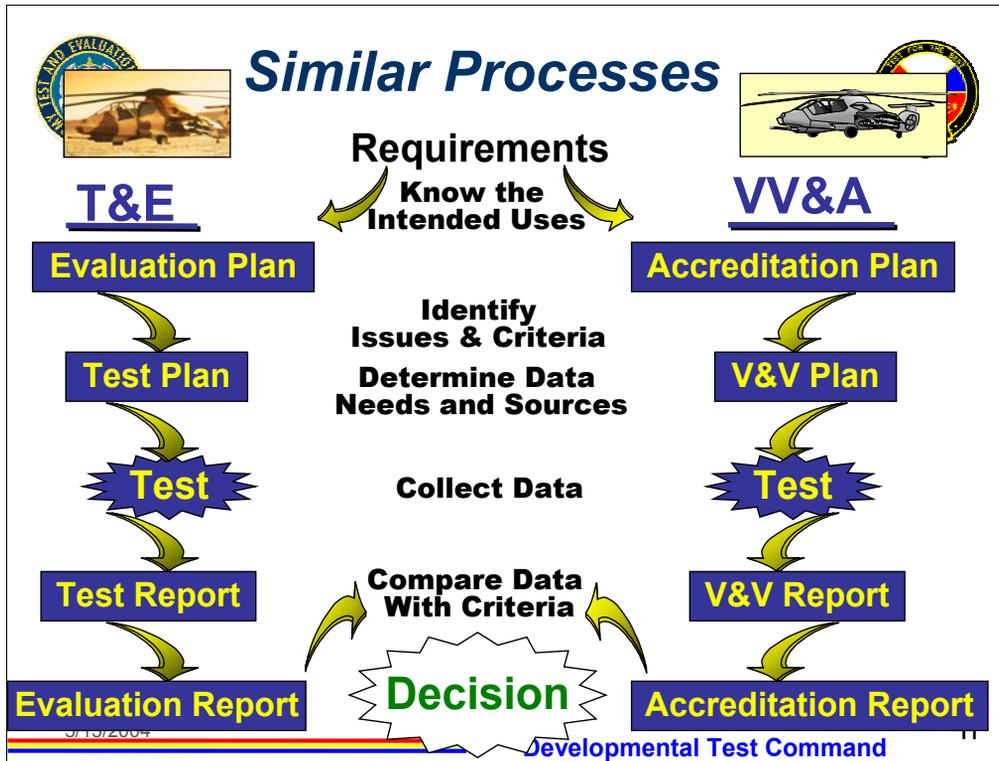
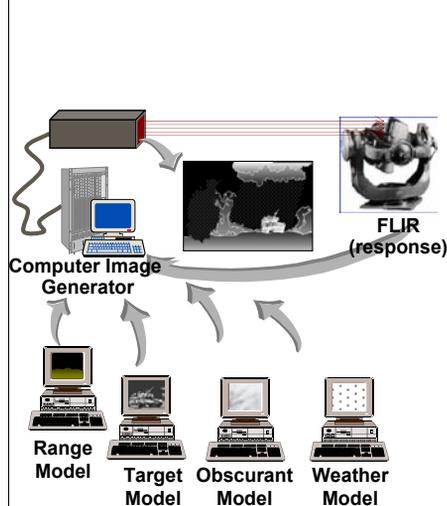


Chart shows the functions of system Test and Evaluation (T&E) and system model VV&A. Verification and Validation (V&V) is analogous to the test process, and accreditation to recommendation to field. Verification and developmental T&E are both conducted to ensure that design risks are minimized and design specifications are met. Validation and operational T&E are the processes used for determining the extent to which the model accurately represents the real world. Finally, accreditation and the evaluation report are both official determinations of the degree to which the model or system is acceptable and ready for its intended purposes. In either case, the primary objective is to ensure that the system, either conceptual model or hardware prototype, meets specifications, operational requirements, and intended application in support of a milestone decision. Based on these analogies, the basic principle and process of T&E also applies to VV&A.



Dynamic Infrared Scene Projector (DIRSP)



Input:

- Terrain Data
- Met Data
- Target Signature
- Target Motion
- Obscurant Data
- System Response

Output:

- Dynamic IR Image

Uses:

- Synthetic Test Environment
- Training

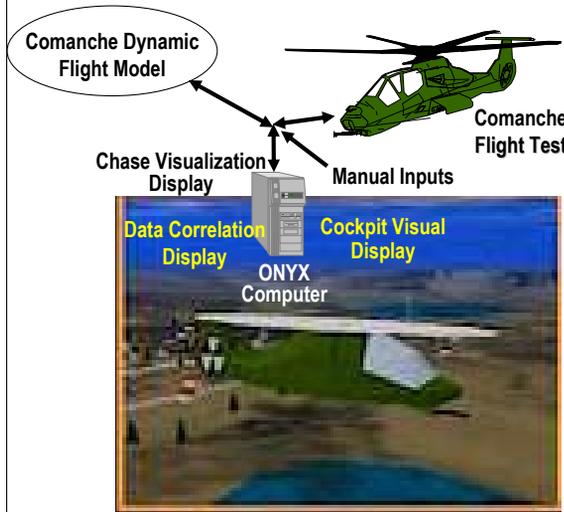
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Flight Test Simulation Station (FTSS)



Input:

- Aircraft Data
- Met Data
- Manual Control
- Flight Test Data

Output:

- Fly-Out
- Sensor Performance
- Target Effects

Uses:

- Test Planning
- Prediction

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DIRSP & FTSS Observations



- **Built/used for system development & DT**
- **Evaluator is asked to accept model output**
- **Evaluator (accreditor) needs to:**
 - **Understand model capabilities and intended use**
 - **Relate to MOPs and MOEs**
 - **Develop acceptability criteria**
- **No incentive to legacy validation**
- **Insufficient documentation of legacy M&S**
- **Lack in-house SMEs**

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The working group is striving to provide a robust, unified VV&A/C approach and critical assets required to enable the test centers to effectively and consistently:

- Conduct VV&A/C of emerging VPG components.
- Develop VV&A procedures for VPG models, simulations, and hardware.
- Familiarize VV&C process for VPG terrain, synthetic stimuli, weapon system performance data, and other critical data.
- Support VV&A of weapon system models and simulations.

The working group is also identifying skills, knowledge, and required to



Lessons Learned



- Specify roles and responsibilities.
- Must have well-defined intended use and acceptability criteria upfront.
- V&V tasks must be agreed upon by all parties before implementation.
- V&V is labor-intensive and requires stable & experienced implementation team.
- Need to establish a close working relationship between developer and user.
- Developer needs to maintain good documentation on system changes.
- Be flexible – avoid traditional acquisition approach of fixed specification to prevent acquiring obsolete technology.
- Independent peer review can be very helpful, especially at the onset for conceptual verification.



ATEC VV&A Working Group Members



AMSO	ATEC
AEC	OTC
TECO-FL	ATC
ATTC	DPG
EPG	RTTC
WSMR	YPG
DTC	

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We are developing the VPG as a customer focused acquisition tool which is closely integrated with other appropriate ongoing Army and DoD programs.

RTTC is our VV&A/C Working Group chair. The chair is responsible for coordination among all members. As you can see, we are not working alone. We have participants from the acquisition community, and we are working closely with program offices, OPTEC, STRICOM, AMSAA, just to name a few.



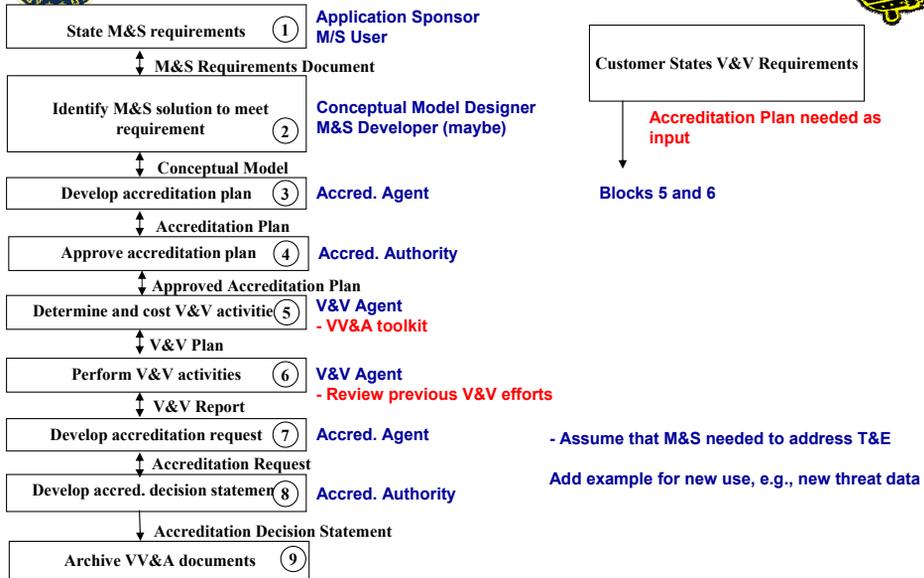
Methodology Basis



- **ATEC M&S Handbook**
- **OTC TOP and Methodology, 5-291**
- **DTC Pamphlet 73-4, VV&A Methodology**
- **AR 5-11 & DA Pamphlet 5-11**
- **DoD Directives 5000.59, 5000.61, & Recommended Practices Guide**
- **VV&A ITOP Program**



VV&A Methodology



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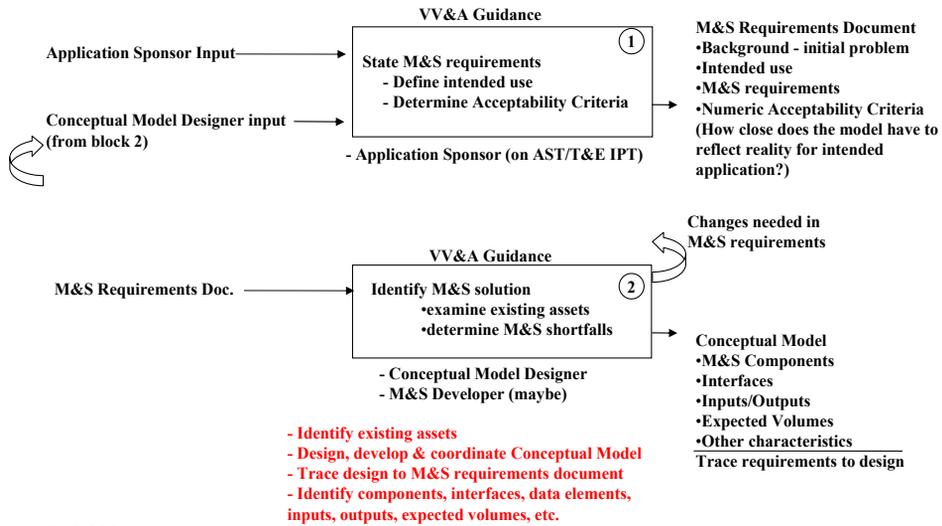
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VV&A Methodology (Con't)



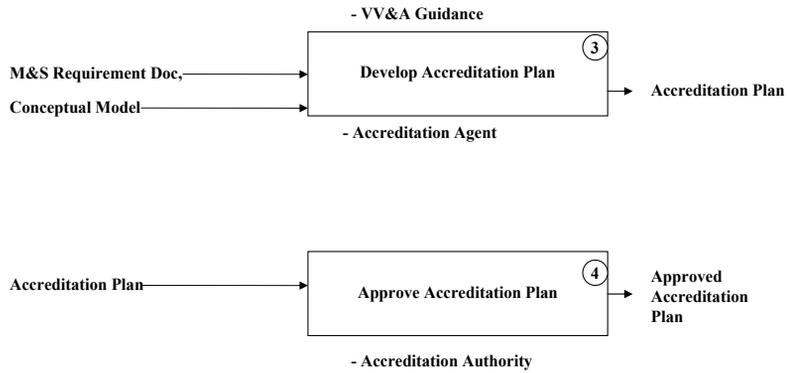
Assume M&S needed for T&E effort
Assume risk analysis has been completed



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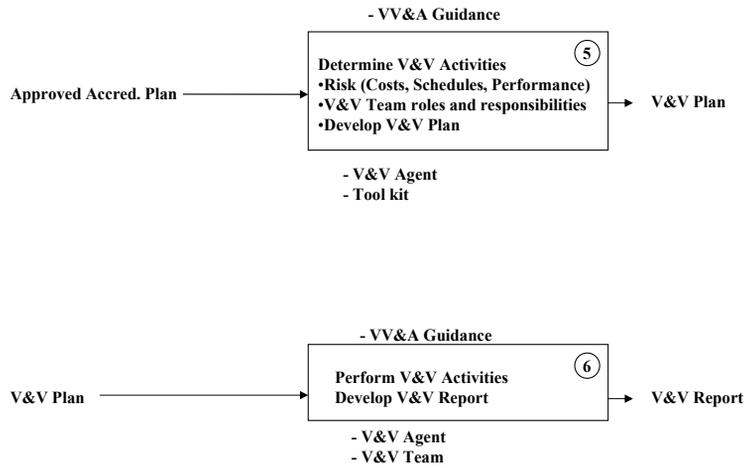


VV&A Methodology (Con't)



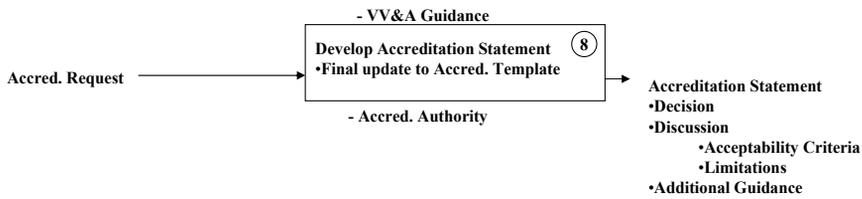
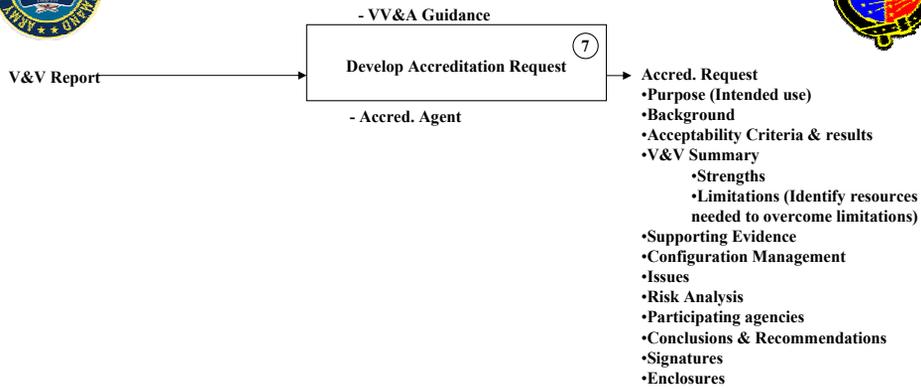


VV&A Methodology (Con't)





VV&A Methodology (Con't)



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Conclusions



- Capturing lessons learned to revise methodology.
- Striving for an accepted methodology to ensure that all M&S elements are developed & maintained as a fully accredited system.
- Identifying assets needed for successful VV&A program.
- Developing one Command-wide VV&A guidance.
- Seeking for your participation.