

JOINT WARFARE SYSTEM (JWARS) VERIFICATION AND VALIDATION LESSONS LEARNED

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ABSTRACT

JWARS V&V (a joint venture of Innovative Management Concepts in Sterling VA and BMH Associates in Norfolk VA) has been responsible for conducting the verification and validation (V&V) of the JWARS simulation since September of 1997. This paper describes the lessons learned during the conduct of the effort including: the JWARS V&V process, the JWARS V&V Plan, reports delivered, and results to date. Special emphasis is on the use of the DoD VV&A Recommended Practices Guide as a basis of JWARS V&V planning and procedures and the evolution of the JWARS V&V Integrated Product Team.

1 INTRODUCTION

The Joint Warfare System (JWARS) Verification and Validation (V&V) effort has been ongoing since late September 1997. Since then there has been significant activity including developing a tailored JWARS V&V process, writing a JWARS V&V plan to execute the process, and the actual conduct of the V&V along with its associated reports. This paper focuses on the lessons learned from the JWARS V&V program and is an attempt to inform modeling and simulation program managers, developers, and VV&A practitioners about what has been learned.

2 THE JWARS V&V EFFORT

JWARS V&V (a joint venture of Innovative Management Concepts and BMH Associates) is the V&V Agent for JWARS. Since September 1997 JWARS V&V has developed the JWARS V&V process, written the JWARS V&V Plan, and conducted the V&V of the first five iterations (of up to 12 planned iterations) of the JWARS simulation. JWARS is a state-of-the-art, closed-form simulation of joint, campaign-level warfare that:

- represents uniquely joint functions and processes, and component warfare operations

- is based on joint doctrine
- is capable of representing future warfare
- supports analysis.

JWARS users will include the Joint Staff, regional military commanders, industry, the Office of the Secretary of Defense, military Joint Task Forces, and the military services. Planned JWARS applications are for (1) force assessment, (2) planning and execution for deliberate planning and crisis action planning, (3) system effectiveness and trade off analysis, and (4) concept and doctrine development and assessment.

Planned JWARS Releases include:

- Release 1 (Limited Initial Operational Capability (IOC))
 - Include Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) and logistics
 - Include essential functionality to replace the TACWAR simulation as a Force Assessment tool
- Release 2 (Full IOC)
 - Replace legacy simulations TACWAR and MIDAS
 - Support applications (1) and (2) above
- Release 3 (Full Operational Capability)
 - Replace legacy simulations Concepts Evaluation Model (CEM), THUNDER, Integrated Theater Engagement Model (ITEM), and SUMMITS
 - Support all applications (1), (2), (3), and (4)

2.1 The JWARS V&V Process

The JWARS Office Director's guidance in starting the V&V process was to tailor it to the actual JWARS software development process, not ask for artifacts for V&V that don't support that process, and use the Department of Defense (DoD) Verification, Validation, and Accreditation

(VV&A) Recommended Practices Guide (RPG) as the primary reference for the process and the report formats. Immediately after contract award the JWARS Office formed the JWARS V&V Oversight group. This group, made up of JWARS developers, V&V experts from the Defense Modeling and Simulation Office (DMSO), representatives from the Service analytic agencies, and the V&V Agent developed the tailored JWARS V&V process shown in Figure 1.

JWARS .5 Release. Subsequent reports, including the most current JWARS Version 1.1 V&V Report completed in September 2000 include Iterations 1 through 5. Rolling reports for Releases 1.2 and 1.3 (Beta) are in planning. These reports will address the added functionality included in each release.

2.4 JWARS V&V Results

The JWARS V&V program has helped reduce program risk and created a set of reports for future accreditation decisions. The reports (along with other JWARS documents) are available to US Government organizations and authorized contractors via the World Wide Web from the JWARS web site maintained by US Army Training and Doctrine Command (TRADOC) at Ft. Leavenworth, KS. Requests for access to the reports can be made via the registration process at: <<http://www.jointmodels.army.mil>>.

2.5 Lessons Learned

Conducting a tailored V&V effort on a simulation in a changing development process has provided lessons that we believe can be useful to others in the simulation community. V&V in the real world is definitely an art and it is constrained by the resources available. We hope that by sharing these lessons learned in this paper and in the updated DoD VV&A we can help simulation program managers, developers, and VV&A practitioners take advantage of them in their simulation development and VV&A planning and execution. The lessons learned are divided into three areas - planning, conduct of the V&V activities, and V&V reporting.

2.5.1 Planning Lessons Learned

V&V planning shapes the V&V effort from start to finish. The DoD VV&A RPG provides an excellent resource as a basis for this planning along with the individual Service directives. Here are the key lessons we learned in the JWARS V&V planning process.

Expect conflicting directions and advice. Although the VV&A RPG provides an excellent resource and describes the VV&A processes that should be conducted, there is no community consensus on a definitive way to plan for, organize, and execute the V&V activities.

Expect resistance to V&V, not based on the planned process but how much it will cost (in both V&V labor and developer labor to support). Make sure the Program Manager understands how V&V will contribute to both development risk reduction and accreditation. Be prepared to scale back V&V to “core” processes. Expect disagreement about what those “core” processes are or how they should be done.

JWARS Integrated Software Development and V&V Process

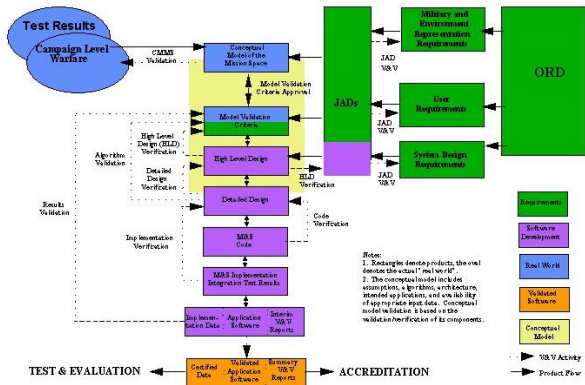


Figure 1: JWARS Integrated Software Development and V&V Process

2.2 The JWARS V&V Plan

The V&V process developed provided the basis for the subsequent JWARS V&V Plan. Using the DoD VV&A RPG as a guide, the group developed a tailored JWARS V&V Process within the constraints of the JWARS Program Manager’s guidance. The V&V Oversight Group provided the coordination and approval for the plan and continued to meet to address V&V and other issues. The group later was renamed the JWARS V&V-T&E Working Integrated Product Team (WIPT). The JWARS V&V Plan and JWARS V&V-T&E WIPT information is available from the JWARS Office.

In order to make changes required to address modifications in the JWARS software development process changes in JWARS V&V processes have been captured in a JWARS V&V Process Description document. This document is also available from the JWARS Office.

2.3 JWARS V&V Reports

Initial JWARS V&V Reports were prepared for each artifact in each Iteration and combined into an Iteration V&V Report. After JWARS Iteration 3 the JWARS Office requested that future V&V Reports be focused on JWARS Releases. The JWARS Release .5 (Alpha) V&V Report includes a summary of Iterations 1, 2 and 3 and the

Get help in formulating the plan from the V&V experts, the Users (for JWARS the Joint Staff, the Office of the Secretary of Defense, the Defense Modeling and Simulation Office, and the Service analysis agencies), the program managers (JWARS Office) and the developers (GRCI and CACI Team).

Plan value into the process up front so the program managers and the developers can see it and have a stake in your success. Make your contribute to program risk reduction visible and measurable.

Base your plan on the actual development process, not one that fits your V&V template

Determine if the planned software development process will follow accepted software development practices and will provide the artifacts required for V&V. If not, make the sponsoring organization aware of the problem so they can plan to correct the problem with the developers.

Expect your plan to change to meet changes in the developer's processes and your V&V processes. Reconfirm that the developer's software development practices still follows accepted software development practices and that acceptable V&V artifacts will be produced.

Ask for resources for Subject Matter Expert (SME) validation assistance but have a plan if they don't get committed or don't show up. Involve the User Community in this effort – they should be willing to help you increase simulation credibility through the V&V process.

Plan to coordinate your simulation runs with developer testing and/or operational testing. This cuts down on developer resources required to support assessment activities.

2.5.2 V&V Activities Lessons Learned

During the actual conduct of the V&V activities there will be opportunities and challenges. The actual effort will require the ability to modify the plan and will require continuous focus on helping reduce program risk while providing future accreditation documents. Below is a list of lessons learned to date during the conduct of JWARS V&V.

Look for opportunities to increase your value to the M&S development while conducting your V&V activities. Don't become a developer but make sure you contribute to development of the simulation. Identify the risks you see along with a proposed solution to the developers and the simulation manager.

Develop a database to keep everything; figure out how to share it with geographically separated organizations. Including all the V&V Agent Team, development sponsor (JWARS Office), developers, and Users (JWARS Users Sub Group members). Set up the database to produce quick products/reports for use by the simulation manager, the developers, and the V&V Team.

Expect problems, delays, and resource limitations to adversely affect the delivery of artifacts from the developers and their review of your products. Developer

focus is properly on developing the simulation, not supporting the V&V Agent. Have work arounds planned to deal with the delays.

Expect sponsor (and developer) concerns about reporting that can be viewed as critical or negative about the program. Don't ambush the developer – let them know what's going on as soon as possible so they can be prepared to address problems you identify. Make sure you address your concerns to the simulation manager and obtain permission to discuss them before discussing outside the program.

Expect the developers to be sensitive to the validation review comments and the verification results. Let them see them as soon as possible and respond to them. Be willing to admit your mistakes if the developers point them out in your reports

Expect uneven participation in your validation review process. Ten percent of the responders will make 80% of the comments. Many will make no comment at all and come back later with concerns..

Document and record everything.

Be as transparent as possible about your processes. The purpose of V&V is to reduce development risk and support accreditation – not to attack the simulation manager or developers. Insure that your V&V work helps build confidence in the simulation among sponsors and future users.

Make your information/reports available in multiple ways (hard copy reports, on CD-ROM, on the WWW) for future accrediters to use.

2.5.3 V&V Reporting Lessons Learned

While the V&V activities will primarily be used to help reduce simulation development risk, the reports about them will provide the foundation for ongoing or future accreditation activities. These lessons have been learned during the JWARS V&V reporting process.

Develop a template for reporting based on the DoD VV&A RPG, but don't be slavish about using it if it doesn't fit the software development process or the tailored V&V process.

Develop a reporting process that will expedite future accreditation activities, not one that is easy for you to produce.

Determine with the Program Manager how they want the reports to be scheduled to have maximum impact. Reports too much after the fact are less useful than those that can impact development.

Put your reports out for review early (use electronic mail distribution and use a web site) and accept inputs/suggestions from the developers, the Users, and future accrediters.

Keep the reporting focus on requirements (original and the validated derived set) and what the simulation is

required to produce (as output or process) and not the simulation itself. It's easy to get captured by the simulation development process and making it work rather than making it useful.

2.5.4 Summary

The lessons learned above have been collected during the three years of the JWARS V&V effort. We hope that they will be useful for others involved in simulation V&V and help them achieve the V&V objectives of reducing simulation development risk and providing a body of evidence for accreditation activities.

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