



Managing a Verification & Validation Program

A Government Perspective

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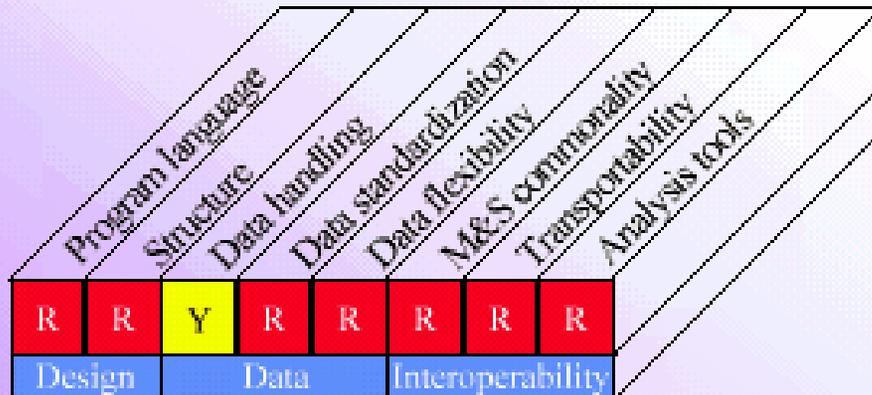
Agenda

- Joint Analytic Model Improvement Program (JAMIP)
- Joint Warfare System (JWARS)
- The JWARS V&V Contract
- The JWARS V&V Oversight Group
- Managing the SOW
- Deliverables
- Recommendations

Inventory of Current Models Used to Support Joint Analysis

Model Name	Vintage	Users	Land	Air	Naval
TACWAR Base Force ** BUR ** MRS BURU Nimble Dancer (ND) ** Desert Storm	1960s	CINCs	✓	✓	
		Joint Staff OSD/PA&E			
THUNDER USAF Analyses ** Nimble Dancer ** JAST	1980s	Air Force	✓	✓	
CEM Army Analyses ** TAA	1960s	Army	✓	✓	
ITEM Navy Analyses ** ND ** Invest Balance Review	1980s	Navy		✓	✓

Many weaknesses are caused by limitations in technical capabilities



denotes emphasis



Solution

Feb 1995 - DepSecDef directed the Director, PA&E, with participation from the Assistant Secretary of Defense (Strategy and Requirements) and the Joint Staff, to

- Initiate a phased program to upgrade existing joint analytic models and simulations (near term) and develop a set of next generation models (longer term).
- Identify an approach and management structure.

May 1995 - DepSecDef approved the Joint Analytic Model Improvement Program (JAMIP) and directed PA&E in cooperation with the Joint Staff to

- Set up the Joint Warfare System (JWARS) Office.
- Establish manpower and support for the JWARS Office with assistance from the Services.
- Develop a funding plan.

Nov 1995 - DepSecDef formally established JWARS Office.

Jun 1996 - DepSecDef designated OSD/PA&E (Joint Data Support) as primary data support agency for JAMIP.



JWARS ORD – V&V

- JWARS ORD
 - **(2) Verification and Validation**. JWARS shall demonstrate and enable the correct representation of doctrine, system and unit performance, the environment and balance among joint warfare functions for U.S. forces, Allies, coalition partners and potential adversaries (**KPP**).
 - **Threshold**. At each release the objects and algorithms in JWARS that represent doctrine, system and unit performance, and the environment shall be verified and validated in accordance with the Verification and Validation Plan. Balance shall be maintained by equitable representation of joint warfare functions, consistent with their impact on theater warfare operations, and within the context of the functionality described at Appendix C [note 1].

Note 1. The ORD Appendix C provides JWARS Warfare Functionality and is a refinement of the list of tasks at Appendix B (JWARS Prioritized UJTL Tasks) and contains descriptions of warfare functionality for JWARS releases 1 and 2 (Limited IOC and Full IOC respectively) that are constrained by cost and technical feasibility.



Key Performance Parameters (KPPs)

- **Traceability**
 - Cause and effect relationships
 - Tracking of data sources
- **Verification and validation (V&V)**
 - Correct representation of doctrine, performance, and environment
 - Balance across joint warfare functions
- **Utility**
 - Study execution
 - ⇒ Includes *warfare functionality*
 - Stochastic modes
 - Multiple levels of resolution
 - Execution speed ⇒ *1,000 times real time*

Reference: JWARS ORD, 27 August 1998



JWARS Mission

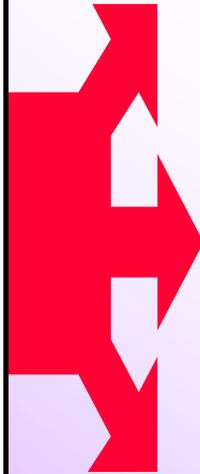
Unique aspects
of JWARS

Mission: Develop a state-of-the-art, constructive simulation that will:

- Provide a multi-sided and **balanced representation** of **joint theater warfare**
- Be able to assess current and future operational concepts, such as *Dominant Maneuver in Joint Vision 2010*
- Use **C4 and ISR as the foundation** for how entities perceive and interact with one another

Users

- Joint Staff
- Services
- CINCs
- OSD
- Joint Task Forces
- Other DoD org's
- Industry



Applications

1. Force assessment
2. Planning and execution
 - *Deliberate planning*
 - *Crisis action planning*
3. System effectiveness and trade off analysis
4. Concept and doctrine development and assessment



Joint Analytic Modeling Improvement Program (JAMIP) Management

- Overall guidance
- Decision authority

Executive Committee

- Routine guidance

Steering Committee

JWARS Working IPT – JWARS Office and V&V Agent Lead



Near-Term Enhancements
Joint Staff / J-8 lead

JWARS PA&E lead

Joint Data Support
PA&E lead

Field Support
Joint Staff / J-8 lead

JWARS Requirements Integrated Product Team (IPT) and Joint Warfare Refinement Group
Joint Staff / J-8 lead





The JWARS V&V Contract

- **Small Business Competition**
- **Cost Plus Fixed Fee Contract**
- **Defense Supply Service – Washington CO**
- **OSD PA&E COR**
- **JWARS Office Technical Monitor**
- **Awarded 5 year contract to JWARS V&V (joint venture of IMC, Inc., and BMH Associates, Inc.), in September 1997**
- **Six Delivery Orders ending in November 2002**

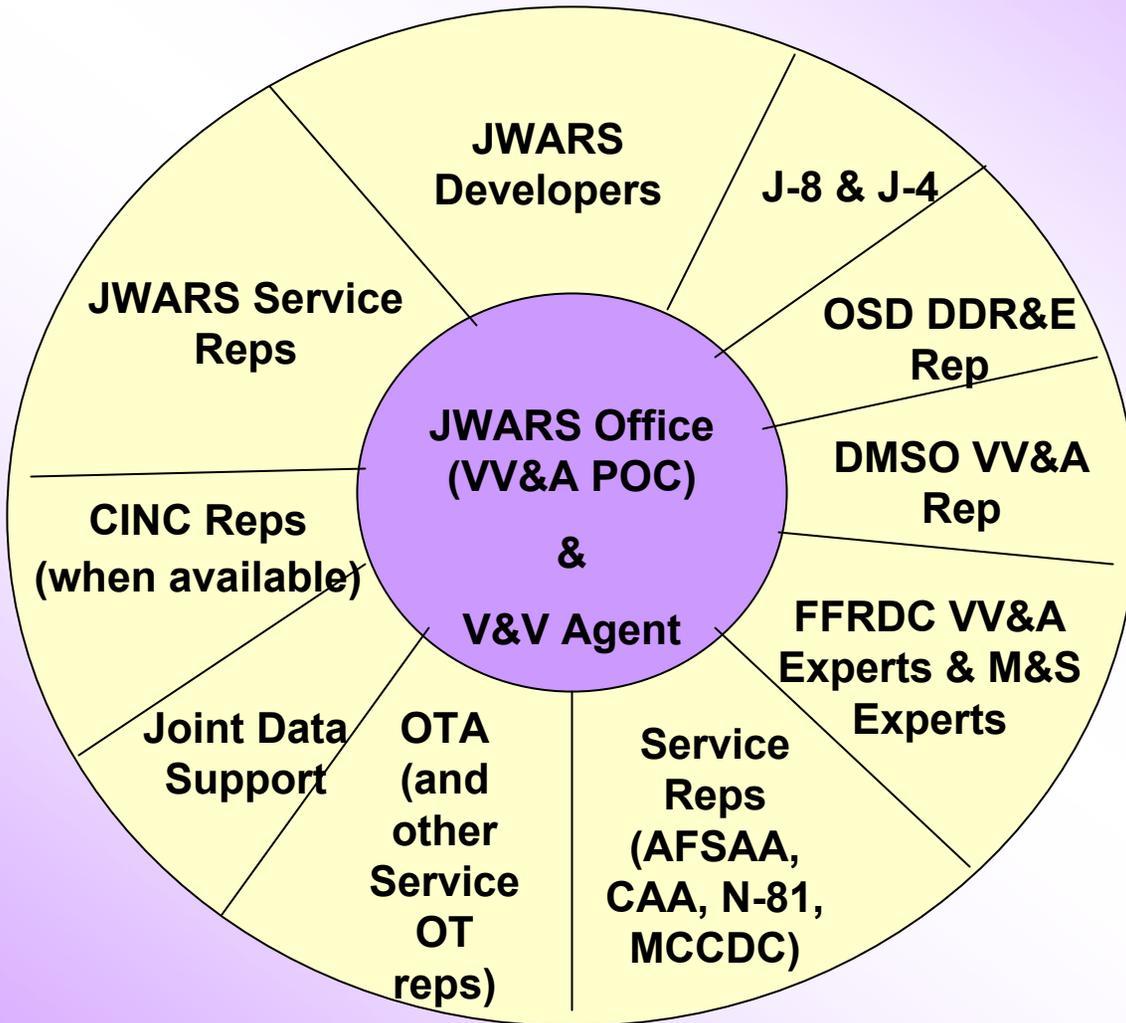


The V&V Oversight Group

- **JWARS V&V (BMH-IMC) proposed, and the JWARS Office accepted, concept of JWARS V&V IPT**
- **Early October 1997 established JWARS Oversight Group**
 - **Members included**
 - JWARS Developers
 - JWARS Office representatives
 - Joint Staff (J-8 and J-4)
 - DMSO VV&A Technical Director
 - FFRDC (IDA, Mitre)
 - Service Analysis Organizations
 - V&V Agents
 - **Initially led by V&V Agent**



JWARS V&V Oversight Group





JWARS V&V Oversight Group

(continued)

- **First Task – developing the JWARS V&V Process**
 - **Compatible with the JWARS Simulation Development Process**
 - **No deliverables solely for V&V**
- **Second Task – writing the JWARS V&V Plan**
 - **Based on the JWARS V&V Process**
 - **Limited by resources available (NTE \$2.5M over 5 years)**
 - **Identify how the JWARS V&V Process would be executed**
- **Third Task – coordinate the JWARS V&V Plan with the users**
- **Fourth Task - produce and deliver V&V Reports and Findings**

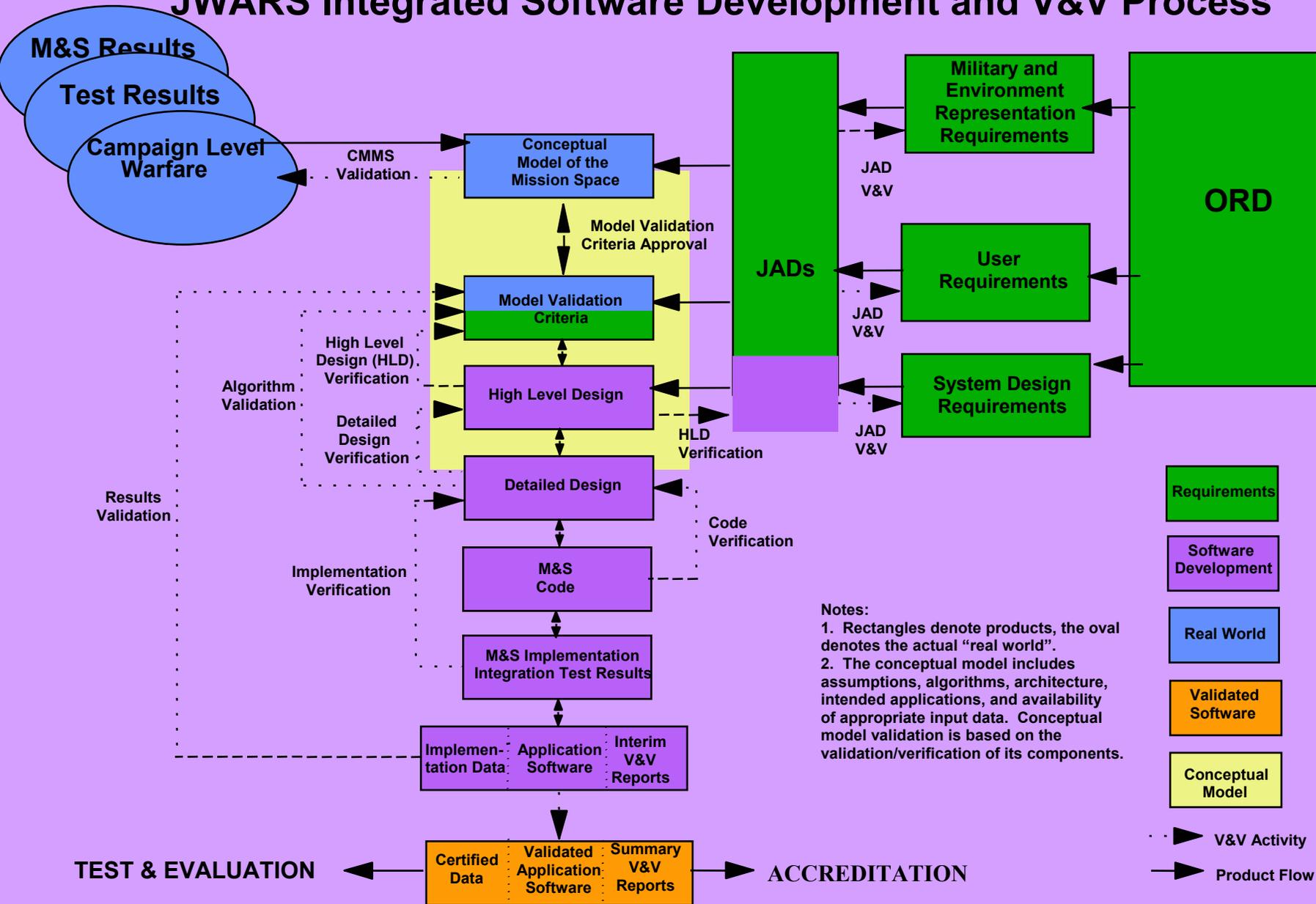


JWARS V&V Oversight Group

(continued)

- **Oversight Group Evolution**
 - Directed by Joint Analytic Modeling Improvement Process Steering Committee to include Test and Evaluation process
 - Developer Testing added to agenda
 - Became JWARS V&V – T&E Working IPT
- **Later became JWARS Working IPT with addition of**
 - JWARS External Support (JWARS Developers, TRAC Leavenworth, and J-8 JASP Contractors)
 - JWARS Life Cycle Management (J-8)
 - JWARS User Group Support (J-8 and TRAC Leavenworth)

JWARS Integrated Software Development and V&V Process





JWARS V&V Plan

The screenshot shows a Microsoft Internet Explorer browser window. The address bar contains the URL <https://ca.dtic.mil/vvte/pdflib/vvplan13.pdf>. The browser's menu bar includes File, Edit, View, Go, Favorites, and Help. The toolbar contains icons for Back, Forward, Stop, Refresh, Home, Search, Favorites, History, Channels, Fullscreen, Mail, and Print. Below the toolbar is a Links bar with icons for Best of the Web, Microsoft, Product News, Today's Links, and Web Gallery. The main content area displays a PDF document with the following text:

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Office of the Secretary of Defense
Director for Program Analysis and Evaluation
The Joint Warfare System Office

August 13, 1998

**Joint Warfare System
Verification and
Validation Plan**

Prepared by: RMH-DMC
Contract No: DSAW1-97-D-0136
Delivery Order: 01

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At the bottom of the browser window, the status bar shows "Page 1 of 45", "45%", and "8.5 x 11 in". The Windows taskbar at the bottom includes the Start button, several open applications (Internet Explorer, Exploring - C:\..., Microsoft Pow..., Acrobat Reader), and the system clock showing 10:25 AM on 6/2/2000.



Managing the Statement of Work

- **Modified each Delivery Order SOW to insure that the appropriate V&V tasks were included**
- **Worked closely with contractors to monitor each delivery orders tasks, schedule, and deliverables**
- **Made modifications when JWARS Simulation Development Process changed**
- **Made modifications based on Steering Committee or IPT directions**
- **Made modifications based on recommendations of the V&V Agent**



V&V Deliverables

- **Began with JWARS V&V Plan as the means to execute the V&V processes**
- **Initial focus was on the V&V process results for each JWARS Iteration (originally planned for 9)**
- **Changed focus to concentrate on total V&V effort for each JWARS Release (.5 for alpha testing, 1.1, 1.2, 1.3, 1.4 for beta testing)**
- **Changed deliverables to match the changes in the JWARS simulation development process**



JWARS V&V Plan, Process and Reports Documents

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Office of the Secretary of Defense
Director for Program Analysis and Evaluation
The Joint Warfare System Office

August 13, 1998

**Joint Warfare System
Verification and
Validation Plan**

Prepared by: BMH-IMC
Contract No: DSAW01-97-D-0136
Delivery Order:

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JWARS/VERIFICATION AND VALIDATION PROCESS REPORT/VER 2.0/10 MARCH 2001

Office of the Secretary of Defense
Director for Program Analysis and Evaluation
The Joint Warfare System Office

March 10, 2001

**Joint Warfare System
Verification and Validation
Processes Report
Version 2.0**

" FOR OFFICIAL USE ONLY. THIS DOCUMENT CONTAINS INFORMATION NOT FROM MANDATORY DISCLOSURE UNDER FOIA, EXEMPTION 3 APPLIES "

Prepared by: BMH-IMC
Contract No: DSAW01-97-D-0136
Delivery Order: 04

Distribution authorized to U.S. Government Agencies and their contractors, Software Documentation, March 10, 2001. Other requests for this document shall be referred to Office of the Secretary of Defense, Director for Program Analysis and Evaluation, The Joint Warfare System Office.

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7P-020131 Page 00 Joint Warfare System Release 1.1 Verification and Validation Report

Office of the Secretary of Defense
Director for Program Analysis and Evaluation
The Joint Warfare System Office

September 21, 2000

**Joint Warfare System
Release 1.1
Verification and Validation
Report (Draft)**

Prepared by: BMH-IMC
Contract No: DSAW01-97-D-0136
Delivery Order: 04

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JWARS V&V Database

- **Customized tool to support entire JWARS V&V process**
 - Provides a means of traceability from ORD through conceptual model products through design to code
 - Contains all Universal Joint Task List (UJTL) tasks and measures
 - Manages application of validation criteria to all measures
 - Provides mechanism to trace High Level Design products to requirements
 - Contains detailed textual and graphical description of algorithms
- **Developed in Microsoft Access 2000**
 - Provides synchronization of replicated databases over the Internet
 - Supports multi-user secure access to encrypted database



JWARS V&V Database

Opening Form : Form (Replicated)

Joint Warfare System (JWARS) V&V Data Base

Tasks	ORD	IPTs
Iterations	Thread Report	Metrics
Algorithms	JADs	Instruments
JST Report Formats	Results Validation	Reports
JAD Design Objects	Work Packages	JWARS Docs



The JWARS V&V New Plan and Process Guide

**Office of the Secretary of Defense
Director for Program Analysis and Evaluation
The Joint Warfare System Office**

1 August 2002

Joint Warfare System Verification and Validation Plan (Revision 3.0) (Change 1)

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Prepared by: BMH-IMC
Contract No: DSAW01-97-D-0136
Delivery Order: 05

**Office of the Secretary of Defense
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The Joint Warfare System Office**

1 August 2002

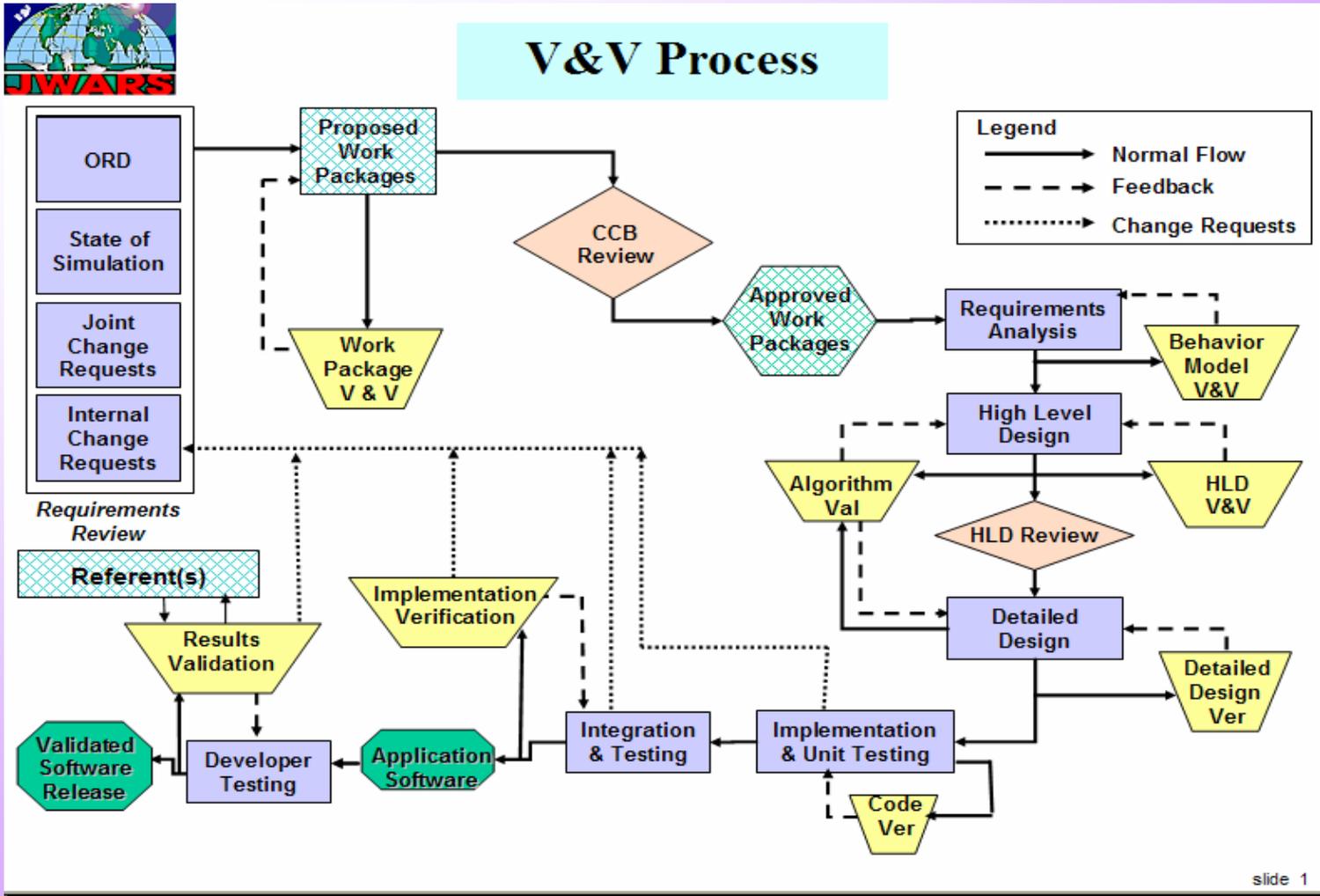
Joint Warfare System Verification and Validation Processes, Practices, and Procedures Guide Version 2.0 (w/ Change 1)

(Previous versions were titled:
"Joint Warfare System Verification and Validation Processes Report")
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Prepared by: BMH-IMC
Contract No: DSAW01-97-D-0136
Delivery Order: 06



JWARS V&V Revised Process





JWARS Delivery Orders (Scheduling and Funding)

DO #	Start	End	Value
1	30 Sept 97	9 Aug 98	\$279,254
2	10 Aug 98	9 Aug 99	\$489,674
3	10 Aug 99	9 May 00	\$387,348
4	10 May 00	11 Mar 01	\$494,566
5	12 Mar 01	12 Nov 01	\$363,099
6	13 Nov 01	12 Nov 02	\$557,050
Total			\$2.57M



Other Costs of the JWARS V&V Effort (estimates)

- **JWARS Office Technical Direction**
 - GM-15 Task Monitor (2%?)
 - Navy 0-5 V&V Program Coordinator (10%?)
 - GS-13 COR (5%?)
- **JWARS Developer Coordination**
 - Thousands of hours to work with V&V Agent to provide development artifacts, explanations
- **WIPT Member Effort**
 - Thousands of hours (DoD civilians, military officers, contractors) preparing for and attending the WIPT and working action items



Recommendations

- **Make sure that your V&V Agent understands the simulation domain and the warfare domain (is not strictly a software tester)**
- **Form and use some type of oversight group/IPT to manage the process (include as many future users as possible)**
- **Use delivery or task orders to provide mechanism for changes without contract modification (one year or less for period of performance)**



Recommendations (cont'd)

- **Keep the V&V Agent independent of the developers (V&V is not QA or CM but they support each other)**
- **Combine the testing process with the V&V process when ever possible (reduces load on the developers)**
- **Provide a person in the sponsoring organization to coordinate V&V Agent and tester interaction with the developers**
- **Generate deliverable artifacts or database for future accreditation of work**