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Original title on 712 A/B: Infantry Warrior Simulation (IWARS) Verification and Validation (V&V)

(Please use the same title listed on MORSS Form 712 A/B. If the title was changed please list the revised title below.) Revised title:

Presented in: WG(s) # 29 ________, CG __________, Special Session ____________________________, Demonstration, ____________________________, Tutorial, ____________________________ or Focus Session # ________

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AMSAA Verification And Validation Of The Infantry Warrior Simulation


Approved for public release, distribution unlimited

AMSAA Verification and Validation of the Infantry Warrior Simulation

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Overview

- IWARS Background
- Verification and Validation of IWARS Version 1.0
  - Process
  - Tools and Techniques
  - Areas of Review
- Sample V&V Results
- Release Approval
- Current Status
IWARS is:

- Analysis driven
- Entity-based
- Multi-sided simulation
- Focused on individual and small-unit dismounted combatants and their equipment
- Used to assess operational effectiveness across the spectrum of missions, environments and threats

IWARS v1.0 Approved For:

- Soldier Sensor Performance Analyses
- Soldier Small-Arms Lethality Analyses
- Soldier Survivability Analyses
- Limited Situational Awareness / Battle Command Analyses

Army Requires Small Unit Combat Simulation Capabilities to Address Integrated “Soldier-as-a-System” Issues
Leverage Multiple Organizations’ Key Competencies

**AMSAA**
- Standard physical algorithms
- Certified weapon performance/characteristics database
- Soldier behavior representation, algorithms, and data
- VV&A experience

**ARL-HRED**
- Human system representation
- Provide critical decision req’ts pertaining to small unit ops
- IMPRINT: Emphasizes physical, perceptual, and cognitive workload

**Natick Soldier Center**
- Representation of warrior systems and systems integration
- Soldier behavior and performance representation
- Autonomous agent technology
- Modeling technology

**TRADOC**
- FACTs
- Military expertise
- Scenario development
- TTP (behavior) development
- COMBAT**

**Other efforts and organizations**
- ATOs, SBIRs, etc.
- NVESD, NPS, USMA
- FFW, PEO Soldier
- MATREX, OneSAF
- USMC, USAF, Joint CB
- Int’l Collaboration

IWARS Development & Collaboration Team

Technology to the Warfighter Quicker
Purpose of M&S V&V:
- Ensure model functions as originally conceived and designed (AR 5-11)
- Ensure the model’s credibility in its depiction of real-world functions (AR 5-11)

IWARS V&V Purpose:
- Show simulation functions properly and is easy to use
- Examine model architecture to ensure its stability and flexibility
- Examine software for correctness, efficiency, and maintainability
- Find and correct problems with the model’s implementation
- Perform pilot study to show model is ready for analyses
- Ensure documentation exists and is clear and correct
- Ensure Configuration Management (CM) process in place and functioning properly
V&V Guidance

V&V consistent with guidance provided by:

- DoD Modeling and Simulation (M&S) Management, DoD Directive 5000.59
- DoD Modeling and Simulation (M&S) Verification, Validation and Accreditation (VV&A), DoD Instruction 5000.61
- Army Model and Simulation Management Program, Army Regulation 5-11
• Verification Testing:
  • Perform tests on individual behaviors and methodologies
  • Perform Integration tests to assess model in its entirety
  • Perform limited study (e.g. weapons trade, sensor trade)
  • Review documentation for correctness

• Validation:
  • Methodologies – Reviewed by SMEs to check equations, data, procedures (Mounted Combat Team, Target Acquisition Team, Infantry Warrior Team)
  • Behaviors – Reviewed by SMEs to assess tactical correctness of soldier behaviors (USAIC, US Marine Corps, Infantry Warrior Team)

• Pilot Study:
  • Employ IWARS as it will be used for analyses
  • Identify problems not discovered during testing
  • Show that IWARS output varies appropriately to changes in scenario (weapons/equipment, behaviors, situations, etc)
  • Demonstrate IWARS suitability for Army studies
    • Soldier Sensor Performance Analyses
    • Soldier Small-Arms Lethality Analyses
    • Soldier Small-Arms Delivery Accuracy Analyses
    • Soldier Survivability Analyses
    • Limited C4I/SA

IWARS V&V Will Ensure IWARS Analysis Capability
Runtime Viewers
- Viewers reflect mission actions
- Known Agents list populated
- Active skills displayed
- Shot Lines show status of engagement
- Agent location, speed, posture tracked

Output Analysis Tool
- Track acquisitions, engagements, communications, behaviors
- Evaluated conditions correctly begin/end skills
- Events filtered for in-depth post-processing
- Events saved in CSV format for follow on processing

Custom Logs / Script Files
- Flexibility to track items not in Output Tool
- Formatted to support follow on processing
- Automatic running of study cases by batch file

Collection of Tools and Results Used to Verify Model
Problem Identification

• Single POC at AMSAA to coordinate submissions and filter redundant requests
• Type of issue identified (Incorrect Functionality, Feature Enhancement)
• Severity and priority of issue determined

Problem Reporting Process

• AMSAA/Natick identify and document issues
• Issues entered through web-based product (Test Track Pro)
• Contractor reviews and assigns issues for correction
• Contractor completes fixes and logs status
• New software drop received and installed by AMSAA/Natick
• AMSAA/Natick retest fixed entries and either close or re-open issues for further work
• Review addressed required capabilities delivered in v1.0
• Review depends on nature of required capability:
  • Methodology: numerical results of IWARS compared to stand-alone model or equation results
  • Behavior: skill must alter data structures, be reflected in viewers, and be correctly represented in the database of output events
  • Documentation: rated on clarity, accuracy, usability
  • Architecture: analysis of software structure, flexibility, maintainability
    Usability - input/execution/output assessed for setup time, runtime, ease of access, audit capability
• Number of scenarios developed: ~130 (does not include pilot study scenarios)

• Number of test cases run: ~600 (does not include pilot study runs)
  • Parameters varied from run to run to test performance over wide range of inputs/conditions
  • A particular run was often used for multiple tests

• Number of items reported: 117 (only significant outstanding problems were highlighted during the final presentation)

• Specific examples of results presented are representative of tests performed in that V&V area

• Results present summary of findings based on numerous runs, test cases, varying inputs/conditions etc.
• IWARS V&V Results organized by Soldier functionality:
  • Mobility
  • Lethality
  • Search and Target Acquisition
  • Communications
  • Suppression

• Integrated approach combines results from the major capability areas:
  • Methodology
  • Behaviors
  • Data
Agent Mobility capabilities in IWARS:

- Movement to waypoints and along paths
- Movement into and within buildings
- Ability to choose path within nodal networks (based on user selected criteria)
- Take correct position in formations (according to soldier role) and maintain that position while moving
- Maintain correct speed as a function of posture, terrain and fatigue
- Avoid collisions
Navigation

- Verify agents can navigate to points, along paths, and along node networks
- Ensure navigation can be done in open terrain as well as interior structures
- Verify agents can determine and maneuver across terrain
- Make maneuver decisions based on force strength

Results

- Agents successfully navigate to points, along paths, and along node networks
- Navigation successfully done in open terrain as well as in rooms, stairwells, towers
- Agents maintain contact with terrain skin during movements
- Agents also have ability to traverse tunnels and ladders
- “Dead force counts and percentages” not working - force strength decisions cannot be used
Monitor Speed
- Determine if movement speeds are adjusted due to terrain or fatigue
- Verify maximum speeds per posture are not exceeded

Results
- Movement speeds are not adjusted due to terrain or fatigue
- Movement speeds remain constant to the next waypoint
- Agents do not exceed maximum speeds per posture
Avoid Collisions

- Determine agent ability to detect possible collision during movement
- Determine agent ability to avoid or recover from collisions

Results

- Agents successfully determine collisions with terrain features and other agents
- Agents use simplistic collision recovery methodology (move along random direction vector until past obstacle)
Align with Unit

- Verify agents align themselves properly in various unit configurations (Buddy Team, Fire Team, Squad, Platoon)
- Ensure agents know unit roles and movement responsibilities

Results

- Agents successfully aligned in various unit configurations (Buddy Team, Fire Team, Squad, Platoon)
- Agents know unit roles and take correct spot in formation
- Agents set FOR according to location in formation
Move in Formation

- Verify model supports correct infantry formations (Column, Diamond, File, Line, Wedge)
- Verify relative agent positioning and offsets during formation moves
- Verify agents maintain correct speeds
- Ensure agents execute correct Field of Regard searches according to role in formation

Results

- Model correctly represents infantry formations
- Relative agent positioning and offsets maintained during formation moves
- Individual agent speeds adjust to maintain relative position
- Agent spacing is static and cannot be altered dynamically
- Agents undertake correct Field of Regard searches according to role
Based on the results of the current AMSAA IWARS V&V and Pilot Study, IWARS is suitable for use* in the following types of direct-fire, small-unit engagement analysis applications:

- Soldier Sensor Performance Analyses
- Soldier Small-Arms Lethality Analyses
- Soldier Survivability Analyses
- Limited Situational Awareness / Battle Command Analyses

IWARS is Ready to Start Aiding in Army Infantry Analyses

* Certain assumptions and limitations apply
Sample studies being performed
  • Close Combat Armament System (CCAS) comparison study
  • Two-sided engagement enhancement to CCAS study
  • Joint Chemical Agent Detector (JCAD) utility study

Development for next release continuing
  • Expanded capabilities list being finalized
  • New missions, threats, environments being prioritized

Ongoing Development to Provide Additional Capabilities
Questions?

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