



Small Arms and Dismounted Infantry Modeling with the Infantry Warrior Simulation (IWARS)

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Objectives



- IWARS Overview
- Modeling Approach
 - Equipment
 - Behavior
- IWARS Output and Analysis
- Modeling Challenges



IWARS Overview

What is IWARS?



IWARS is...

- Software Army Technology Objective...
- Constructive, agent-based, force-on-force combat simulation...
- Focused on individual and small-unit dismounted combatants and their equipment...
- Used to assess operational effectiveness across a spectrum of missions, environments and threats.





IWARS Overview

V1.0 Applications



- Through V&V and Sensitivity Analysis, IWARS Version 1.0 found suitable for use in direct-fire, small-unit engagement analyses:
 - Soldier Sensor Performance
 - Soldier Small-arms Lethality
 - Soldier Survivability
 - Situational Awareness / Battle Command (Limited)

IWARS V1.0 approved by the Army's V&V agency for small arms RDA analyses and adopted by Army and international community



Modeling Approach

Focus



- Ground soldiers and small units
 - User-defined units – not Army-centric
- Equipment
 - Items worn or carried by the Warfighter
 - Platforms for direct interaction with the Warfighter
 - E.g., U-UGS, Stryker ICV
 - Characteristics pertinent to ground soldier missions



Modeling Approach

Focus



- Behaviors
 - Use of Warfighter equipment and employment of tactics
 - Direct Warfighter interactions with other platforms
 - Decisions and actions required at individual and small unit levels



Modeling Approach *Process*



1. Identify Soldier capabilities to be evaluated
 - E.g., helmet-mounted fused sensor, NLOS firing capability, information technologies
2. Identify equipment characteristics to model
 - Focus on elements that help or hinder Warfighter's mission



Modeling Approach *Process*



3. Research behaviors and processes necessary for Soldier to use capabilities
 - Field manuals, SMEs, use cases, field experiments, existing data
 - Required equipment characteristics include both physical parameters and how the equipment affects the behaviors of the individual and small unit
4. Identify performance data elements and existing methodologies
 - E.g., weapon accuracy, lethality, sensor range, movement speed, completion time



Modeling Approach *Process*



5. Create flow chart of behavior process, identifying compound activities, actions (primitives), and conditions (rule sets)
 - Philosophy: as much as possible, use compound activities and keep relatively few primitives – gives user greater flexibility
6. Develop algorithms and code to represent new equipment methodologies, behaviors, and data
 - Algorithms based on performance characteristics, physics, input from SMEs, FMs, and relevant data



Output and Analysis

Available Outputs



- Standard combat simulation MOPs
 - E.g., casualties, rounds fired, round impact locations
- Audit trail of entity actions and reasons
 - Actions performed, battlefield conditions at time of action, information on which the entity acted
- Data useful for scenario debugging
 - Enable user to quickly build scenarios with intended flow of activity

Output and Analysis

Output Analysis Tool

- Enables user to select desired MOPs and derive MOEs
- Import all IWARS output data from one or multiple runs
- Filter and analyze output pertaining to IWARS events
- Further analysis easily performed in any spreadsheet application

Analysis Editor - C:\iwarbeta\Data Files\Output_fire at area target\fire at area target_20050616_143032.iwars

Name: Munition Hit

Event Attributes:

- Munition Hit
 - Run
 - Time
 - Environment
 - SourceHuman
 - AffectedHuman
 - Munition
 - Impact Type
 - Range
 - Impact

Analysis Attributes:

- Run
- Time
- SourceHumanName
- AffectedHumanName
- MunitionName
- ImpactType
- Range
- ImpactX
- ImpactY
- ImpactZ

Filter: Functions
 Equals
 And
 Or
 Equals
 Agent
 Terrain

Analysis Progress: Remove Move Up Remove All Move Down Run Analysis

Last Analysis Output: 3803 records in event, 3803 passed the filters.

Run	Time	SourceHumanName	AffectedHumanName	MunitionName	Impact Type	Range (m)	ImpactX	ImpactY	Impact Z	Count
5	5.2	Red Grenadier 8		M805_L_224	Terran	68.8917	1506.3212	1699.8912	130.0196	1
5	5.2	Red SAW Gunner 3	Blue Fire Team Leader 10	M805_L_246	Agent	85.0012	1528.3107	1702.8894	130.1556	1
5	5.2	Red SAW Gunner 7		M805_L_247	Terran	73.4751	1524.976	1690.6661	130.0038	1
5	5.3	Red SAW Gunner 3	Blue Fire Team Leader 10	M805_L_250	Agent	85.0012	1528.3107	1702.8894	130.1556	1
5	5.3	Red SAW Gunner 7		M805_L_251	Terran	73.4751	1524.976	1690.6661	130.0038	1
5	5.4	Red SAW Gunner 3	Blue Fire Team Leader 10	M805_L_252	Agent	85.0012	1528.3107	1702.8894	130.1556	1
5	5.4	Red SAW Gunner 7		M805_L_253	Terran	73.4751	1524.976	1690.6661	130.0038	1
5	11.6857	Red Squad Leader 1		M193_L_256	Terran	66.8529	1513.0024	1712.1175	130.0154	1
5	11.6857	Red Fire Team Leader 2		M193_L_257	Terran	65.5295	1511.2419	1701.245	130.0157	1
5	11.6857	Red Rifleman 5		M193_L_258	Terran	59.0492	1515.7538	1694.986	130.0116	1
5	11.6857	Red Fire Team Leader 6		M193_L_259	Terran	83.4638	1522.6242	1714.3054	130.0078	1
5	11.6857	Red Rifleman 9		M193_L_260	Terran	88.5528	1522.744	1712.6071	130.0069	1
5	11.7714	Red Squad Leader 1		M193_L_261	Terran	65.8529	1513.0024	1712.1175	130.0154	1
5	11.7714	Red Fire Team Leader 2		M193_L_262	Terran	65.5295	1511.2419	1701.245	130.0157	1

Analysis Editor - C:\iwarbeta\Data Files\Output_fire at area target\fire at area target_20050616_143032.iwars

Name: Red SAW Gunner 3 - # of agents hit ea

Event Attributes:

- Munition Hit
 - Run
 - Time
 - Environment
 - SourceHuman
 - AffectedHuman
 - Munition
 - Impact Type
 - Range
 - Impact

Analysis Attributes:

- Run
- SourceHumanName
- ImpactType

Filter: Functions
 Equals
 And
 Or
 Equals
 Red SAW Gunner 3

Analysis Progress: Remove Move Up Remove All Move Down Run Analysis

Last Analysis Output: 3803 records in event, 37 passed the filters.

Run	SourceHumanName	ImpactType	Count
1	Red SAW Gunner 3	Agent	12
4	Red SAW Gunner 3	Agent	12
5	Red SAW Gunner 3	Agent	6
6	Red SAW Gunner 3	Agent	7



Modeling Challenges

- Computational complexity
 - Simulating a complex system on a desktop PC
 - Sometimes difficult to balance need for “good” representation and fast simulation runs
- Most important next-generation product is a moving target
 - Analysis priorities can change rapidly during development period



Modeling Challenges

- Representation of the human system
 - Each human is different
 - Existing methodologies often are either too detailed or not detailed enough for our purposes
- Availability of data
 - Conceptual next-generation equipment not always well-defined
 - Characteristics and data difficult to obtain during (and after) hardware development process
 - Methodologies for next-generation tools do not exist, and data does not exist for conceptual items



Summary



IWARS...

- Focus is analysis of ground soldier systems modeling
- Complex model of individuals and combat environment
- Continued development is important to provide RDA analyses of current and future small-arms and small-unit equipment and tactics
- Recognized by Army, NATO and others as useful tool for acquisition analyses
- Leverages existing efforts to enhance the representation of equipment and capabilities of ground soldiers

