DISMOUNTED INFANTRY SEMI-AUTOMATED FORCES (DISAF) 2000

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ABSRACT

The U.S. Army Simulation, Training and Instrumentation Command's (STRICOM) Synthetic Environment & Technology Management Division (SETMD) sponsors the Research and Development (R&D) project know as Dismounted Infantry SemiAutomated Forces (DISAF). DISAF is a Computer Generated Forces (CGF) application based on the ModSAF architecture. DISAF was developed to add dismounted infantry to the virtual battlefield in a realistic fashion. SAIC began developing DISAF as part of SETMD's Dismounted Warrior Network (DWN) program. The results of this effort have been integrated into the ModSAF V5.0 application.

Although the DI capabilities contained in ModSAF 5.0 are a realistic simulation of Individual Combatants (ICs) and have meet the requirements of DWN, enhancements for general IC simulation are required. An ongoing effort to enhance the current IC simulation capabilities of ModSAF 5.0 is underway. Areas to be improved include physical and mental models, weapon systems, open and urban terrain behaviors, and Multiple Elevation Surface (MES) modeling. DISAF will also be extended to support voice control of IC units. These improvements will be transferred to the simulation community though integration of code into the OneSAF Testbed Baseline (OTB).

This paper outlines the DISAF features that have been integrated into ModSAF 5.0. It also describes the DISAF enhancements currently under development and under consideration for future development. Finally, this paper summarizes current applications of this technology.

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1. INTRODUCTION

Dismounted Infantry Semi-Automated Forces (DISAF) is a Research & Development (R&D) program focused on developing IC Computer Generated Forces (CGFs). The DISAF application is based on the ModSAF architecture. DISAF supports individual to squad behaviors in open & urban terrains. DISAF was originally developed under the Dismounted Warrior Network (DWN) program to add dismounted infantry to the virtual battlefield in a realistic fashion. DISAF functionality developed under the DWN program (described as initial DISAF capabilities herein) is currently included in the ModSAF V5.0 baseline. Future DISAF enhancements will be integrated into the OneSAF Testbed Baseline (OTB).

An overall description of the initial DISAF background, objectives, and accomplishments can be found in [2]. A detailed description of the initial DISAF functionality and lessons learned can be found in [1]. Also, for more information on DISAF see http://www.asset.com/orl/disaf/home.html.

1.1 Background

Before DISAF, the infantry capabilities of simulations such as SIMNET and ModSAF had essentially been limited to the low-fidelity viewpoint of tanks, i.e., a difficult-to-see anti-tank threat.

The primary focus of DISAF has been the development of tactical behaviors for Individual Combatants (ICs). Specifically, ModSAF was modified to support military operations in rural (open) and urban terrain (MOUT – Military Operations in Urban Terrain). These (initial) modifications included:

- IC entity type definition,
- Distributed Interactive Simulation (DIS) definitions,
- body definitions,
- physical database modifications,
- physical movement and collision models,
- Plan View Display (PVD) icons showing posture, weapon state and health,
- IC behaviors for movement and weapon use
- unit level fire team behaviors for clearing buildings,
- dynamic terrain models to support blowing holes in walls.

All building clearing behaviors are based on validated military Combat Instruction Sets (CISs)[1].

[1] Ref [4]

To support Multiple Elevation Surface (MES)[2] buildings, a database development system was designed specifically to build MESs in CTDB format from OpenFlight visual databases, using a custom plug-in for AutoCAD.

1.2 Initial DISAF Capabilities Overview

The following section provides an overview of the initial DISAF capabilities included in the ModSAF V5.0 baseline.

1.2.1. Behaviors. The DISAF behaviors available via the ModSAF Execution Matrix are listed below.

Halt: an individual or unit level behavior that allows an IC, fire team, or squad to halt.

Hasty Occupy Position (HOP): a unit level behavior that attempts to place ICs using cover and concealed positions. A single line object can be used to control the position of a fire team or squad of ICs.

Location Fire: an individual level behavior that can be exercised directly from the GUI or utilized by unit level behaviors such as "Suppressive Fire". As an individual level behavior, it can be used with the SAW and AT8 to fire a single round at a building, door or window. Unit level behaviors use it to generate continuous fire over an area, for a specified duration in minutes or seconds.

Suppressive Fire: a unit level behavior that enables ICs to provide suppressive fire on an enemy objective. The unit's goal is to destroy or suppress the enemy and keep the enemy from firing on the assaulting force. Suppressive fires are distributed evenly over the objective. Continuous fire is maintained, even if no enemy weapons or positions are detected.

Traveling/Road March: unit level vehicle (tank) behaviors used to move fire teams and squads in formation.

Move: an individual level behavior that enables precise IC movement, posture and weapon state control.

Clear Room: a unit level behavior designed specifically for a four-person fire team. This behavior enables a fire team to enter a room and engage enemy with weapons fire. The behavior ends

[2] Ref [3]

when ICs have reached their final positions in the room to be cleared.

Withdraw: a unit level behavior that moves a fire team or squad (unit) away from the enemy, and then performs an "occupy position" until another order is given to the unit.

1.2.2. Entities & Units. The DISAF entities and units available via the ModSAF Unit Editor are listed below.

- US IC Squad Automatic Weapon (SAW)
- US IC M16A2
- US IC AT8
- USSR IC AK47
- US IC Fire Team A (AT8, M16, M16, SAW)
- US IC Fire Team B (M16, M16, M16, SAW)
- US IC Squad (M16, Fire Team A, Fire Team B)
- USSR IC Squad (AK47, AK47, AK47, AK47)

1.2.3. Point Editor and Line Editor Enhancements. The Line and Point editors previously snapped points to a one-meter grid. These editors have been upgraded to allow placement of points anywhere on the terrain. In addition, the Z value of locations is indicated in the editor to 0.01 meters.

1.2.4. Plan View Display (PVD) Enhancements. The PVD has been upgraded to support display of MES buildings and new IC icons. New PVD features include:

– The map can be zoomed in to a scale of 1:25
– A MES building can be displayed one floor at a time
– The "altitude" of an IC can be displayed to determine what floor of a building it is on
– The display can show the field of view of the sensors (rather than the "field of regard" of the search behavior)
– Building apertures are displayed in different colors depending on their "mobility" and "transparency" attributes. Thus openings, closed doors, and closed windows are displayed differently.

Figure 1 provides a view of the 2D PVD with IC icons in and around the MES building.

1.2.5. IC Postures & Weapon States. DISAF internally represents the DIS 2.0.4 life form (posture/gait) and weapon state for each IC. Figure 2 shows the twelve combinations of posture & weapon state supported by DISAF. From top row to bottom the weapon state is stowed, deployed and raised. From left column to right posture is prone, sitting, kneeling and standing. ICs also show mobility and firepower damage as well as a catastrophic kill. The bounding volume for both locally simulated and remote ICs will change dynamically as the IC changes posture.

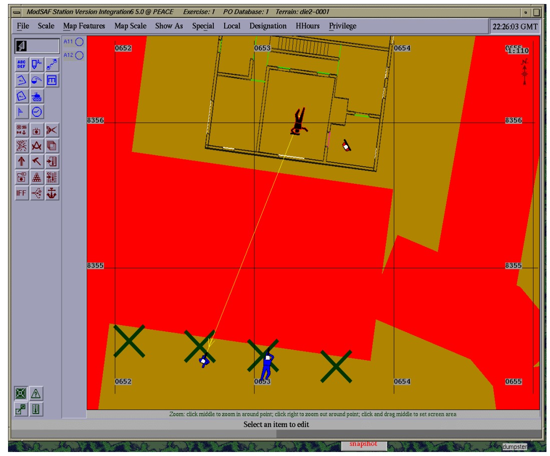

Figure 1. DISAF 2D PVD.

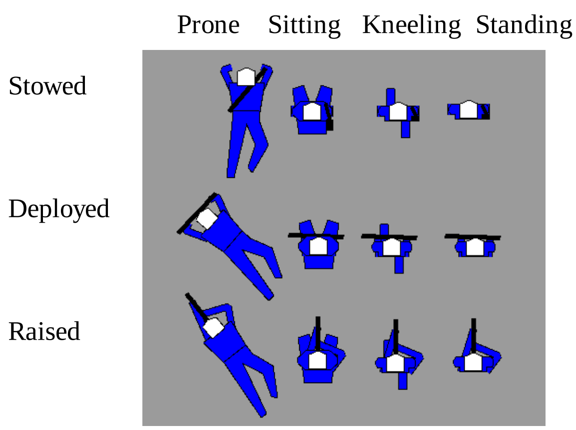

Figure 2. IC Postures & Weapons States.

The quick-kill posture, shown in Figure 3, is a specific combination of posture and weapon state used inside building during a clear room task. Posture is kneeling when stationary and crouched when moving with the weapon state always raised.

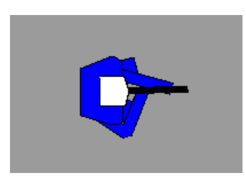

Figure 3. Quick-kill posture.

1.2.6. 3D View. In addition to the 2D PVD provided by ModSAF, a Stealth Viewer can be networked to the DISAF application to provide a 3D display of the synthetic environment. Animated human models are required to view the ICs in 3D. Figures 4 and 5 shows 3D views of ICs in and around the MES building and the terrain data base respectively.

Figure 4. 3D Display.

1.2.7. Terrain Database. DISAF supports version 7 of ModSAF's CTDB format (C7), which includes MES enhancements. A MES building with an interior is needed to conduct MOUT operations with DISAF. For 3D display, a correlated visual database of the same building is required. A database of the Ft. Benning, GA. McKenna MOUT site with one MES building is supplied with the ModSAF V5.0 release. Figure 5 shows a 3D view of the Mckenna MOUT terrain database.

Figure 5. 3D View of McKenna MOUT Site.

1.2.8. Dynamic Terrain. The DISAF dynamic terrain capability allows a hole to be created or a door to be opened within the MES structure. It is triggered by detonations with the DIS 2.0.4 result of "building hit." The AT8 generates a large building hit, the SAW a medium building hit, and the M16 and AK47 a small building hit. A medium building hit on a closed aperture will open the aperture. A large building hit on a wall will create a new aperture.

2. <u>DISAF ENHANCEMENTS</u>

The DISAF project continues to enhance DISAF after the completion of the DWN project. These enhancements have been grouped into two major phases. These two major phases of enhancements will each be integrated into the OTB. This development effort is being done via a two-year Broad Agency Announcement (BAA) contract with SAIC. This section provides a summary of these enhancements.

2.1 1st Year Enhancements.

The first phase of DISAF enhancements began December 1998. These enhancements have focused on:

– improving the IC movement infrastructure,
– terrain analysis for improved movement planning using cover and concealment,
– new weapons models for hand grenades and the M203 grenade launcher,
– open terrain behavior upgrades and additions,
– aural sensing, and
– voice recognition.

These 1st year enhancements will be integrated into the OTB Software Build B, scheduled for release November 1999.

2.1.1. Movement Planning. The goal of this task is to improve the IC movement infrastructure in DISAF. This will allow ICs to use movement alternatives that are more appropriate to the scale of ICs rather than vehicles. Improvement of this movement infrastructure includes the design of all of the fundamental mechanisms needed to:

– Allow ICs to plan obstacle-free routes both in open terrain and in buildings,
– Allow ICs to avoid moving obstacles while the entity is moving , and
– Allow ICs to move in FT formation (wedge, tactical column).

These mechanisms will allow implementation of parts of the Move, Traveling and Fire & Movement tasks. Modules for these tasks will be created, in addition to new controller tasks. The IC dynamics, low level movement control, and unit formation movement will also be modified, as necessary.

2.1.2. Terrain Analysis for Occupy Position. The position selection algorithm currently used for the Hasty Occupy Position (HOP) behavior is being modified to consider different IC postures, cover beside "vertical" obstacles such as trees and building walls, and a distributed (as opposed to point) engagement or threat area. Currently, the HOP behavior generates a list of covered and concealed positions based on the static physical dimensions of vehicle entities. The HOP algorithm will be modified to consider the dynamic nature of the various postures of an IC when generating its list of covered and concealed positions. The current HOP algorithm also considers only terrain skin contours (i.e. ditches, hills, boulders, etc.) when generating cover and concealment lists. The algorithm shall be further modified such that vertical obstacles (i.e. walls, trees, buildings, etc.) will be considered when generating Cover & Concealment (C&C) lists.

2.1.3. Movement with Cover & Concealment (C&C). This task will find covered locations and regions in the nearby terrain, and plan movement to stay in cover as much as possible. A covered position is one that provides the least amount of intervisibility to an IC in a distributed (as opposed to a point) engagement or threat area. This task will also provide another movement mode in which an IC moves in rushes across exposed terrain from covered position to covered position as part of following a route or moving in formation.

2.1.4. New Weapon Models. The following new weapons models will be added to DISAF.

<u>*M203 Grenade Launcher*</u>. The DISAF fire teams currently lack the required grenadier. A new IC weapon component will be added to DISAF to overcome this deficiency. Adding this weapon will require adding new weapon parameters and extending behaviors to use the weapon; i.e. selecting the M203 instead of the M16, and choosing targets for the M203. This new IC weapon component will be attached to another component, the M16A2, and will deploy and stow with that weapon. Threat targeting and the unit suppressive fire behavior will be modified to utilize M203s.

<u>*Hand Grenades*</u>. Hand grenades are essential weapons in building clearing operations. DISAF currently lacks several physical and behavioral models necessary to simulate hand grenades. A new entity component model for grenades will be developed for DISAF to overcome this deficiency.
This will include modeling the grenade ballistic flyout and blast effects dynamics. The "flyout" will be a ballistic trajectory, and will allow bouncing off of walls and floors. Time delay fuses will also be modeled. Blast effect shall be dependent on range and exposed (visible) area. Appropriate "indirect fire" effect and damage model framework will also be added. The grenade usage will be added to the clear room behavior.

2.1.5. Open Terrain Behaviors. Existing DISAF open terrain behaviors, included in the ModSAF 5.0 baseline, will be revised to add robustness and realism to the simulation. In addition, several new open terrain behaviors will be added to DISAF. The open terrain behaviors being revised and/or added are described below.

<u>*Traveling/Move*</u>. The ModSAF 5.0 Traveling/Move behaviors use existing tank like route planning with dynamic and static obstacle avoidance. These behaviors will be greatly impacted by the Movement Planning described in Section 2.1.1 herein.

<u>*Hasty Occupy Position (HOP)*</u>. This behavior has been modified to find covered and/or concealed positions along the battle position based on terrain reasoning task described in Section 2.1.2 herein.

<u>*Suppressive Fire*</u>. The suppressive fire behavior implemented in ModSAF 5.0 was simple and had several unrealistic characteristics. In addition, not all of the input parameters had the desired effects. The following enhancements are planned for this behavior. The operator will be able to set the posture of the ICs from Unit Suppressive Fire editor. Target locations will be selected randomly along the target line (line between TRPs). TRPs will be represented as general 3D locations so that upper floors of the MESs and points above the ground can be identified. Individual with two weapons (e.g., AT8 and M16) will choose the appropriate one to fire (M16). The timing of bursts will better reflect the user-specified fire rate. All input parameters (firing rate, duration, etc.) will be present on the editor and should function correctly. The operator will be able to have the unit Occupy Position before beginning suppressive fire.
In addition to the improvements in the suppressive fire behavior, improvements have been made in the underlying model of firing at a location. These improvements allow firing even when target location is not visible. It also makes all rounds fly out and hit an object, not detonate at target location (i.e., do not detonate in open space). In addition, it makes sure

the rounds fly all the way to, but not beyond, the first obstacle when the line to the target goes into an MES or volume feature.

Halt. The Halt behavior currently used in DISAF is for ground vehicles. Since the Halt behavior for ICs is different than for the ground vehicle this behavior will be revised. If the unit has been halted, the IC will seek for covered and concealed position based on engagement area the operator selected. This revised behavior will focus on finding covered and concealed position and posture based on terrain analysis, and setting the stopped posture based on terrain reasoning.

Fire & Movement (F&M). This is a new behavior that enables the advancement of a fire team by moving one two-man team at a time in a rush, until an objective line is reached. This behavior will have the Rules of Engagement (ROE) set to free. It will allow moving and stopped posture to be set on GUI. It will also default to letting Hasty Occupy, or Basic Movement determine the IC posture. It will also allow operator designation of sectors of fire, order of movement, and distance of movement

React to Contact. This is a new reactive behavior that monitors enemy activity and reacts to contact. The reaction executed depends on the number of dangerous threats that have to be encountered (dangerous threat threshold is set by the operator). The reactions that will be supported are:

- Contact Drill: Shoots at the enemy.
- Fire and Move: Creates an assault objective at the computed enemy location.
- Withdraw: creates a large distance from the enemy in the opposite direction for the unit to go to.
- Occupy Position: creates an objective facing the enemy and chooses logical target reference points with the engagement area TRP at the enemy location.
- No action.

Mount/Dismount. This is a new behavior that will coordinate the mounting or dismounting of its subordinates into a designated vehicle. The operator will be required to specify embark and disembark locations. This behavior will allow the ICs to mount and dismount to and from ground vehicles or air vehicles.

Break Contact. This is new behavior that enables the unit to move to where the enemy cannot observe or place direct fire on it. This behavior is basically the F&M behavior, but with the threat location and the unit destination in opposite directions. An appropriate interface will be constructed to allow the operator to initiate the Break Contact behavior. The operator will be able to specify the distance, direction and/or last objective rally point. During a Break Contact task, one fire team suppresses the enemy while the other fire team moves. The moving squad/team takes up the designated position and engages the enemy positions

React to Ambush. This is a new behavior that the operator can bring up when an enemy initiates an ambush with a casualty-producing device and a high volume of fire. During a React to Ambush task, ICs in the kill zone immediately return fire, take up covered positions and throw grenades. Immediately after the grenades detonates, ICs in the kill zone assault through the ambush using the F&M task. ICs not in the kill zone locate and place suppressive fire on the enemy, take up covered positions, and shift fire as the assault begins. The objective of this behavior is for the unit to move out of the kill zone, force the enemy to withdraw, or destroy the ambush.

2.1.6. Aural Sensing. Currently DISAF does not include any form of aural cue processing. Thus if a weapon is fired right behind the IC, it does not notice. A new sensor will be added to DISAF that will allow the ICs to hear. This sensor will be based on a sound generation and propagation framework. This sensor will implement a low fidelity model based on a simple attenuation formula with additional muffling due to obstacles. Such a model will allow detection of entities, the identification of some gunfire, and the masking of soft sounds by loud ones.

2.1.7. Voice Recognition. The voice recognition capability being integrated with DISAF leverages the spoken language technology developed for the Synthetic Theater Of War (STOW) program. This spoken language technology is know as Command Talk. The basic capability being integrated into DISAF will allow a human squad leader to command DI SAF entities via voice commands. Only DISAF behaviors contained in ModSAF 5.0 will be used to demonstrate this capability.

Spoken Language Interface Functionality. The Command Talk spoken language interface, was developed for the DARPA, and specifically intended for a ModSAF-based architecture. Command Talk is limited to one speaker per SAF station, and only the entities hosted on that station can be controlled. Command Talk uses a push-to-talk button to indicate the beginning and ending points for capture of the audio signal. Command Talk then converts the audio to text, forms the appropriate command, and forwards the command to the SAF application for execution. The speech recognition system used is the Nuance commercial software product and the natural language component is the Gemini natural language system.

Speech Synthesis Process. Although the SAF provides a status screen for feedback to the user, text-to-speech technology will be used for verbal confirmation from the SAF entity that the order was received. The Command and Control Speech Interface Language (CCSIL) agent will be used to deliver text-to-speech verbal confirmations. The speech synthesis process generates voice communications for the DI SAF entities, such as "all clear," upon entering an empty room. This process receives text messages from the DIS network generated by the entities within the DI SAF exercise. The messages are converted to speech samples and sent as signal Protocol Data Units (PDUs) onto the Distributed Interactive Simulation (DIS) network. The ASTi software receives the signal PDUs, and soldiers wearing headsets will hear the messages.

Grammar/vocabulary. Use of Command Talk as a role playing tool requires development of a new grammar and vocabulary. A new command and control vocabulary/grammar is being developed to use with DISAF. This vocabulary/grammar will be scenario-driven, and will be based on the DISAF behaviors currently available in ModSAF 5.0.
An initial set of sample utterances has been developed and will be expanded iteratively as a scenario is developed.

2.2 2nd Year Enhancements.

The second phase of DISAF enhancements are scheduled to begin December 1999. These enhancements will focus on:

- urban combat (MOUT) behaviors and terrain,
- improved visual sensing & situation awareness,
- autonomous OPFOR /GREYFOR behaviors, and
- additional weapon munitions and units.

These 2nd year enhancements will be integrated into the OTB V1.0 baseline, scheduled for release November 2000.

2.2.1. Urban Combat Behaviors and Terrains. DISAF will continue to develop improvements for urban combat operations and terrains. The following section describes some of these planned improvements.

Embedded Knowledge and Automated Knowledge Capture. The current DISAF/ModSAF 5.0 implementation of behaviors used inside buildings requires manual generation of route and point objects used by the IC Move and Fire Team Clear Room behaviors. A new Fire Team Clear Room behavior will be created that allows the operator to designate a single room to be cleared. Point and route data may not necessarily be compiled into the database but may be stored in a hidden overlay or even read from a configuration file. In addition, we will develop algorithms to generate the tactical information used above automatically. Computational geometry, search, and heuristics will be used to extract the information from the raw polygon data in the existing terrain database structure.

*Automate MOUT Behaviors***.** New automated behaviors for operations in urban terrain will be implemented for DISAF. These include, but are not limited to, behaviors such as Fire Team Clear Hallway and Squad Clear Rooms. In addition a kicking action will be created for DISAF soldiers. This action will cause a "detonation" and result in the ability to open doors and windows by having ICs kicking them.

Urban Combat Terrain. Further improvements in urban combat terrain will be made to provide realistic scenarios. These improvements will focus on increasing the complexity of the terrain model. For ICs, trees, rocks, rubble, and furniture (inside buildings) becomes important both as a potential hiding spot and as an obstacle. The simulation should also be able to model fences, ravines, and tunnels. The MES tools developed and used during the DWN program, to create the Mckenna MOUT Site Building A in CTDB, will be reused to create new MES structures. These new structures will add verticalness to the urban combat environment by adding floors to the existing MES (2 floor) buildings, and sub-terranean tunnels. These terrain models should provide a more realistic representation of a "city" as opposed to a "European village".

2.2.2. Visual Sensing & Situational Awareness. DISAF will enhance the existing visual sensing capability and add a situational awareness functionality to improve the realism of the IC simulation. These tasks are not required to make DISAF operational, but they become more important as Human In the Loop simulators interact more with DISAF entities and as DISAF is considered for analysis and acquisition applications.

Visual Sensing. The current DISAF acquisition model is based on tanks that search a sector for distant objects for e few seconds, and then repeat in a different section. This model does not reflect the ability of humans to quickly detect nearby objects, especially moving ones, with their wide-field peripheral vision. A new sensor with a new visual acquisition model will be added to ICs to allow this kind of detection. This new model will simulate detection with peripheral vision. This acquisition model would not be based on search, but on instantaneous detection. The peripheral sensor for an IC would have low resolution but high sensitivity to motion. The high-resolution foveal vision would then be given a small field of view. These improvements would interact strongly with the situation awareness improvements discussed below. First, the narrower foveal field of view would require more motion in the search process; and second, the peripheral field of view would often detect threats without identifying them, thus requiring a "look" with high acuity vision to identify.

Basic situation awareness. In addition to sound & visual processing, DISAF needs a situation awareness model that can accommodate threats that are heard but not seen. Currently in ModSAF threats are either visible and thus, subject to weapons fire, or forgotten. To address this deficiency, The "spotter" behavior in DISAF will be extended to allow entities to represent threats that they cannot see. The "search" behavior will be extended to make entities look toward known threats to try to identify them. The search behavior would also be modified to rotate ICs' bodies to look around. With this capability, an unseen threat will be remembered indefinitely by an IC, and will trigger behavior to pursue the threat, defend using cover oriented in a particular direction, and/or to move using cover rather than moving quickly in the open.

2.2.3. OPFOR & GRAYFOR . Currently, the DISAF OPFOR has very limited intelligence. We plan on developing an autonomous OPFOR & GRAYFOR capability that provides realistic situations for the BLUFOR. This effort will leverage the Computer Controlled Hostiles & Neutrals (CCH/N) work done on the Team Tactical Engagement Simulator (TTES) project [5, 6]. The CCH/N system generates fully autonomous hostile riflemen or neutral civilians and communicates their actions via DIS protocols. These CCH/N are given a "mission" by the operator when the simulation starts to determine their general behavior. They perform their mission using situation awareness and threat detection logic.

2.2.4. Weapon Munition and Units. The current DISAF does not represent the full complement of weapon systems needed to flesh out doctrinally correct Army units. We plan to identify the most important weapon systems and units needed by the users, and then extend DISAF to incorporate these weapons and units. Existing and new firing behaviors will be modified appropriately. Potential weapon munitions and units that will be added to DISAF includes, but is not limited to, the following:

- Force XXI Weapon Systems such as the Land Warrior (LW) Weapon sub-system or the Objective Individual Combatant Weapon (OICW).
- M60 machine gun for use within the platoon.
- Platoon units complete with machine guns, mortars, and other support units. Traveling, assault and defensive behaviors would be created for these units.
- Man portable Anti-Tank (AT) missile launcher such as a Dragon or Javelin.
- Sniper Rifle
- Shotgun
- M4
- Hand Held Laser Pointer

2.2.5. Physical and Mental Models. Although the current DISAF contains some new models of human soldiers that distinguish ICs from tanks and other vehicles, many physical and mental models in DISAF are still inappropriate for ICs. These kinds of shortcomings are blatantly obvious to soldier trainees in a training exercise, and reduce the usefulness of DISAF in analysis and acquisition applications. This section identifies some of these DISAF models that could be change or extended to improve the models for ICs.

Suppression . A comprehensive model of the effect of suppression would be developed in terms of DISAF behaviors and physical models and applied consistently across all of them.

Target Selection. DISAF currently lumps together several factors when trying to select a target at which to shoot. A new target selection algorithm would be developed that evaluates factors such as threat, inherent target value, mission-specific target value, and target vulnerability separately and then combines them in a principled way to select a target.

Inferring Threat Locations. In addition to aural sensing, ICs can use inference to detect threats without seeing them. For example, threat existence and location could be inferred from friendly weapon fire, fire impact locations, and friendly casualty locations. The approach here is to develop a list of such cues and create or modify a software module to monitor them. Threats detected in this way would be added to the "spotted" list, which must have been modified as described above to include unseen threats.

Head Model. A new component will be defined for ICs that modeled the head. The head model will be loosely based on a turret, in that it could rotate to change the direction of sensor gaze. Modeling the head will be especially effective with the visual sensing improvement (with a narrowing of the field of view of foveal vision), because body rotations would not always be required when the IC looked around. Modeling the head will also make it easier to place the eyes in the correct position when the IC changed posture. This capability will provide trainees in virtual simulators important visual cues about where other entities are looking.

3. APPLICATIONS OF THIS TECHNOLOGY

The main objective of the DISAF R&D program is to create realistic performance of computer-controlled dismounted friendly and enemy soldiers. STRICOM's SETMD is committed to addressing this technical challenge. The driving force behind this technical challenge is described as one of the objectives on the IC STO/DTO. The purpose of these IC STO/DTO is to develop an IC simulation system that supports Research, Development and Acquisition (RDA), Advanced Concepts and Requirements (ACR), and Training Exercise and Military Operations (TEMO) domains.
One of the main objectives of the sponsor of this DISAF R&D program, STRICOM's SETMD, is to transition this DISAF technology to programs and users that have requirements related to IC CGFs. Some of the specific uses and users of this technology, and the CGF requirements they would like to meet with the DISAF application are described below.

3.1 OneSAF.

OneSAF will be a composable, next generation CGF that can represent a full range of operations, systems, and control process from individual combatant and platform to battalion level, with a variable level of fidelity that supports all modeling and simulation (M&S) domains.
Due to high technical risk associated with the development of the objective OneSAF system, the OneSAF Testbed Baseline (OTB) is being developed to provide a vehicle for integration, test and user feedback of technology developments for the objective system. A variety of locations representing the Army's modeling and simulation domains, combat developer, and materiel developer have been designated as user lab sites. These sites, chosen for their unique and varied capabilities, will provide assessment for each of four OTB developmental builds.
The OTB is one of the main targets where the DISAF R&D program is transitioning its' technology. As mentioned above, the initial DISAF capabilities have been integrated into the ModSAF V5.0 baseline. The second phase of DISAF enhancements, described herein, are targeted for two separate OTB releases. For more information on OneSAF see http://www.onesaf.org/.

3.2 Dismounted BattleSpace Battle Lab (DBBL).

The US Army is in the process of fielding a Squad Synthetic Environment (SSE) at the Land Warrior Test Bed (LWTB) located at Fort Benning, Georgia. This state-of-the-art virtual simulation facility consists of nine Dismounted Infantry Simulators, OPFOR and BLUEFOR SAF simulators, and two Reconfigurable Ground Vehicle Simulators. The OPFOR and BLUEFOR SAF Simulators will be using the OTB. Specifically, the DISAF functionality contained in the OTB, will be a major component of this SSE. STRICOM's SETMD is working closely with the DBBL and the US Army Infantry Center (USAIC) to meet their specific SAF requirements. The SSE will be used to support the Army's DI Modeling & Simulation (M&S) needs across all domains, from TEMO to ACR and R&D.

3.3 Army After Next (AAN).

A potential user group interested in the DISAF technology is the AAN community. DISAF technology could particularly be useful in providing an urban operations virtual environment capability. This urban environment would be composed of a terrain DB with tall buildings and sub-terrainian structures. DISAF would develop advanced behaviors and capabilities to support specific AAN training approaches and performance measurement methods. In addition DISAF could model likely AAN capabilities such as a micro Unmanned Air Vehicle (UAV), and others.

3.4 Rapid Assessment Initial Detection (RAID) Teams.

The National Guard has formed a number of RAID Teams to support local First Responders combat a terrorist's employment of Weapons of Mass Destruction (WMD) in the U.S. The RAID Team mission is to assist First Responders locate and identify the type of WMD released, predict its movement, assess its destruction, determine assets to contain, and advise local officials of appropriate actions to initiate.

The DISAF will be modified to create a Virtual RAID simulation module that supports and simulates exercising of METLs and Battle Tasks of the Survey Team Leader and Survey Sections. This work is leveraging existing and future DISAF functionality.

4. CONCLUSION

DISAF capabilities have just recently been available to the public, via the ModSAF 5.0 release. As we continue to enhance DISAF to meet specific user needs this R&D product will become more stable and mature. We look forward to receiving feedback on how this R&D technology can be further developed to meet different user requirement.

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