The U.S. Army's Next Generation Simulation Modelling the Response to the World's Future Threat

Mr. Doug Parsons and LTC John Surdu
US Army, Program Executive Office-Simulation Training and Instrumentation (PEO-STRI)
12350 Research Parkway
Orlando, Florida 32826
U.S.A.

john.surdu@peostri.army.mil / doug.parsons@peostri.army.mil

ABSTRACT

Modelling the NATO Response Force (NRF) requires that corresponding simulation tools exhibit a great deal of flexibility. The force and equipment necessary to counter an asymmetric threat must continually evolve to remain effective. The U.S. Army is developing an entity-based simulation, known as the One Semi-Automated Forces (OneSAF) Objective System (OOS), with a composability toolkit that will provide this degree of flexibility. While the OOS represents a leap-ahead in modelling and simulation technology, its need for the U.S. Army is to provide the capability to retire several legacy simulations and foster a greater degree of interoperability. As such, the OOS will provide an integral simulation service for a wide and varied group of users to include those involved in analysis of advanced military concepts, requirements, research and development, as well as supporting training, exercises, and military operations. While the OOS is required to model up to brigade-level operations and provide a robust threat in a Contemporary Operating Environment (COE), the composability toolkit offers the ability to create NRF units with unique military behaviours through a Graphical User Interface. NRF missions that could be supported include crisis response, peacekeeping, counter terrorism operations, humanitarian assistance, initial entry force, and non combatant evacuation. This paper will discuss those OOS capabilities supporting the NATO Response Force, such as sides and forces, multiple levels of resolution modelling, operations in urban environments, and the COE. In addition, other topics covered include the ongoing interactions between PM OneSAF and joint, multi-service, and international organizations leading toward collaborative development of the OOS baseline.

1.0 INTRODUCTION

The vision of the alliance that formed the North Atlantic Treaty Organization (NATO) in 1949 was to discourage, and repel if necessary, an attack by the Soviet Union. In addition, NATO would keep the peace among former enemies in Western Europe. In forming NATO, each member nation agreed to treat an attack on any other member as an attack on itself. Indeed the philosophy was that an invasion of any one nation triggering a response by NATO as a whole would certainly not be in the interest of the attacker. In 1955, the Soviet Union and Communist nations of Eastern Europe formed their own military alliance to counter NATO, known as the Warsaw Pact. Certainly, this policy of deterrence has been effective; however, the dissolution of the Warsaw PACT in 1991 and the end of the Cold War brought NATO's purpose into question [1]. Few could dispute that NATO's involvement to resolve the conflict in Kosovo (1999) demonstrates NATO's continued relevance; however, the world has changed significantly since 1949. While the threat of one nation invading a NATO member nation still exists, the likelihood of an attack in the traditional sense is less likely.

Parsons, D.; Surdu, J. (2005) The U.S. Army's Next Generation Simulation Modelling the Response to the World's Future Threat. In *The Effectiveness of Modelling and Simulation – From Anecdotal to Substantive Evidence* (pp. 19-1 – 19-14). Meeting Proceedings RTO-MP-MSG-035, Paper 19. Neuilly-sur-Seine, France: RTO. Available from: http://www.rto.nato.int/abstracts.asp.

The enemy is well aware of our overwhelming advantage in terms of manpower, equipment and technology to counter a large-scale invasion. A new and lethal threat has evolved asymmetrically to exploit weaknesses associated with heavy forces. The U.S. military and NATO are transforming to counter the methods employed by the new threat. As such, modelling and simulation (M&S) used in concept development and training must transform or risk becoming irrelevant. According to Rear Admiral Xavier Paitard and Paul Sherland [2], the Allied Command Transformation (ACT) understands the power and potential of M&S tools to drive and enhance the transformation process. Properly used, M&S can encourage creative concept development, promote effective experimentation, and speed the delivery of valid, credible concepts and capabilities to NATO. Simulation is the tool that can provide Alliance Nationals with persuasive evidence of the benefits of adopting specific transformational concepts and capabilities. By its very nature an asymmetric threat continually changes as it perceives new weaknesses. Our M&S tools must exhibit the ability to flex as rapidly as the threat changes. Paitard and Sherland further state, "The complexities of modern warfare dictate that traditional analytical approaches are not sufficient and need to be supplemented by M&S tools. ACT envisions the increased use of simulation in mission analysis, concept development, experimentation, exercises, training, and education." The U.S. Army is developing the OneSAF Objective System (OOS) with this degree of flexibility.

1.1 Background on the OneSAF Program

The OneSAF concept originated in January 1996 following an extensive study that came to the conclusion that the U.S. Army was caught in a wasteful spending cycle, making identical or similar enhancements to legacy simulations across three different user domains. Furthermore, it was determined that none of the existing legacy simulations were capable of being extended to provide comprehensive support of emerging Army functional requirements and technical standards. Realizing this, the Army decided the best approach for overcoming the problems associated with the multitude of aging simulations was to create a single general-purpose entity level simulation. In May of 1997 the Deputy Commanding General (DCG), Training and Doctrine Command (TRADOC), approved the Mission Needs Statement (MNS) for OneSAF which stated:

"The need for OneSAF capabilities is not a response to a specific warfighting threat against the force; the need is driven by the guidance to reduce duplication of M&S investments, foster interoperability and reuse across M&S domains, and meet the M&S requirements of the future force."

To satisfy this need OOS will become the U.S. Army's next generation, composable, entity-based simulation system. The fact that the OOS is being developed from day one to serve all three of the Army's modeling and simulation domains makes it quite unique. It will provide an integral simulation service to the Advanced Concepts and Requirements (ACR); Training, Exercises, and Military Operations (TEMO); and Research, Development, and Acquisition (RDA) domains. Table 1 show examples of use cases for the three domains.

The OOS Team was able to build a simulation to meet these disparate requirements by building a modular architecture, supporting multiple levels of resolution. This allows the users to "compose" the level of resolution where it is needed. The capability to compose entities, units, and behaviours with the required resolution allows users tailor simulation to suit their particular needs. A design engineer may be willing to forego entity count in order to conduct analysis with a high fidelity sensor model to conduct component analysis. A research analyst may desire to compose a scenario with units of mixed resolution to produce data as part of an analysis of alternatives. Finally, staff training might be most effective using scenarios with tens of thousands of entities executing low resolution models. The OOS is being developed to provide a simulation solution for all these users under a single baseline.

Table 1. Types of U.S. Army M&S Domain Uses

ACR	RDA	TEMO
Doctrine, Analysis & Concepts Forces	**Equipping the Force**	**Training/preparing the Warfighters**
• Analysis of Alternatives • Doctrine Development • Requirement • Mobilization Analysis and Planning • Operational & Organizational Development • Army Transformation	• System Design • Logistical Analysis • Component Analysis & Design • Lethality & Vulnerability Analysis • Life Cycle Cost • Testing • Reliability analysis	• Collective & Staff Training • Individual Training • Mission Rehearsal • Distributed Training • Crew Training • Embedded Training

2.0 MODELLING THE NATO RESPONSE FORCE

According to the definition on the NATO website [3], the NATO Response Force (NRF) will be a coherent, high readiness, joint, multinational force package, technologically advanced, flexible, deployable, interoperable and sustainable. The NRF is expected to have a force size of about 21,000. The land component will be brigade size, and an air component capable of delivering 200 air sorties per day. This force will be tailored to the specific needs of a given operation and able to move quickly to wherever needed. It will not be a permanent or standing force. The NRF will be able to carry out certain missions on its own, or serve as part of a larger force to contribute to the full range of Alliance military operations. Table 2 shows some of the characteristics and capabilities intended for the NRF.

Table 2. NATO Response Force Intended Characteristics and Capabilities. [4]

Missions	Characteristics
• Crisis response including peacekeeping • Peace enforcement • Counter terrorism operations • Consequence management including Chemical, Biological, Radiological, and Nuclear (CBRN) events and humanitarian crises • Embargo operations: maritime, initial land, and no fly zones • Initial entry force and enabling force • Demonstrative force package • Non combatant evacuation	• Under the command of a Joint Task Force HQ • Joint and combined force • Fully trained and certified • Robust and credible high readiness force • Able to deploy quickly (5-30 days) • Participate in the full spectrum of NATO missions

The precise size and composition is under study and will be the subject of further definition and refinement. Allied Command Transformation will develop future capabilities and further refine the NRF concept. Since the NRF will be a tailored force drawing upon a composition that will evolve based on joint lessons learned, models and simulations employed to describe it must equally be flexible and easily tailored.

2.1 Composability Toolset

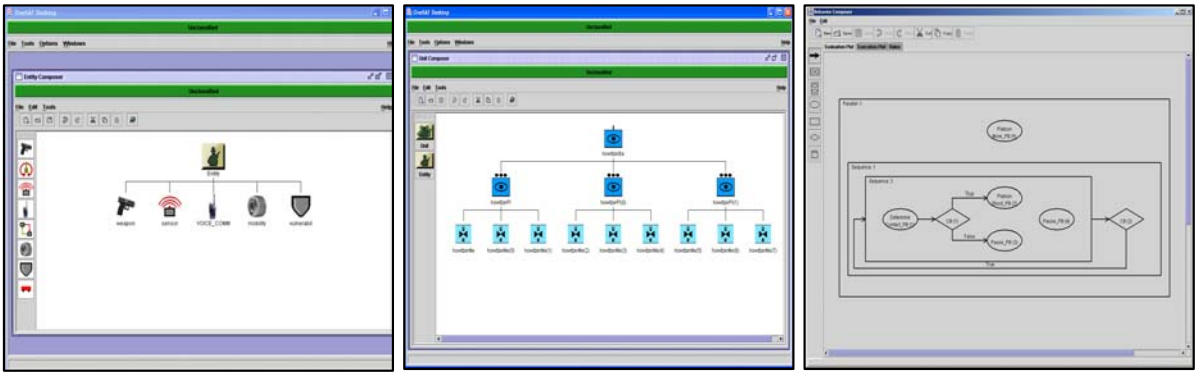
The ability for a simulation to allow for the rapid and easy creation of new and unique entities, units, and associated behaviours is critical to support the modelling of the NRF. OneSAF is providing a toolset that allows users to independently create new OOS battlespace compositions [5]. The tools use Graphical User Interfaces and support processes to remove, to a large extent, the dependency on software experts to develop new unit, entity, and behaviour model compositions. The composition tools, shown in Figure 1, use and build on existing primitive and composite models to develop new and unique entities (e.g., individual combatants, helicopters, tanks, etc.), units (e.g., organizations of entities that behave according to certain sets of rules), and behaviours (e.g., move tactically, defend battle position, etc.) that are associated with units and entities. The construction of these models may include model components that vary across a range of physical and behavioural fidelity. The following list describes each of the model composition tools.

Entity composition is handled by the **Entity Composer Tool**. The composer provides the user with a drag-and-drop capability to develop new OOS entities. For example, a user might need to create an entity model of a NATO member nation's Infantry Fighting Vehicle. The basic idea is to attach the appropriate physical models (mobility, vulnerability) to a platform (body or hull) and then associated specific weapons, sensors, and communications devices to that platform. Once saved, the entity can be modified and associated within a unit structure and have behaviours allocated to it. The tool supports the ability to create representations of existing equipment as well as to create experimental entities.

Unit Composition is supported with the **Unit Composer Tool**. This tool allows entities to be combined to form asymmetrical friendly, enemy, and neutral type organizations. A possible use of this tool would be the creation of a NRF brigade organization composed of multinational entities. Both doctrinally correct organizations and experimental/hypothetical organizations can be developed to support experimentation and concept development efforts.

Behaviour automation is what sets 'Semi-Automated Forces' from other Computer Generated Forces (CGF) simulation applications. The OOS will allow for selection from behaviours with a range of automation. At the lowest level the user controls all of the entity's or unit's actions. At the highest level, the user simply composes the scenario and allows the simulation to run to completion. The OOS **Behaviour Composer Tool** allows users to create new behavioural representations that are then associated with units and entities. For example, once the NRF brigade is created with the Unit Component, there would need to be an associated behavioural model that would dictate how it might behave when conducting its intended operations. This tool allows the creation and/or modification of behaviours that entities and units will use to guide their interactions within the simulation. It also supports continuous processes that act as background tasks such as "look for enemies" and tasks that are triggered by specific events such as "find cover when fired upon."

These composition tools intend to provide users the ability to extend, enhance, and share OneSAF models without direct interaction and/or support from the OneSAF software developer or the OneSAF Project Management organizations. In many cases this extension of OOS can be done without writing any software or recompiling the source code.



Entity Composer | Unit Composer | Behaviour Composer

Figure 1: OOS Battlespace Composer Tools

3.0 MODELLING A LETHAL AND EVOLVING THREAT

Paitard and Sherland [2] point out that the first decade of the new century has already proven to be a time of great challenge for the NATO alliance. Over the near term, the Alliance is likely to face increasingly diverse and emerging threats including the proliferation of weapons of mass destruction and their means of delivery and the increased risk of terrorism performed by non-state actors. It will also face the growing effects of regional instability, the impacts of large-scale humanitarian crises, and global political changes. Furthermore, these challenges will be met during times of rapid technological changes, national budget reprioritizations, and an increased emphasis on global relationship building. Because of lessons learned from the recent and on-going conflict in Iraq, the OneSAF program has focused attention on modelling the evolving threat.

3.1 Contemporary Operating Environment

The **Contemporary Operating Environment** (COE) is the environment in which our Soldiers are fighting today. It involves civilians (non-combatants, contractors, and non-governmental organizations) on the battlefield, pick-up trucks armed with machine guns and rocket launchers, roadside bombs, using children as weapons, enemies shielding themselves behind pregnant women and within historic or religions sites, and an absence of clear battle lines. Mr. Cesare Balducci, Deputy Director, NATO Standardisation Agency, indicates the following global threats are generating new operational needs [6]:

- Multiple, suicide attacks against soft civilian targets with maximum casualties.
- Increased chance of terrorist acts involving chemical, biological, radiological or nuclear weapons.
- Nationalistic demands.

To respond effectively, the NRF must be flexible and adaptive; therefore, the tools that enable such a force must include training aids, devices, simulators, and simulations that support experimentation, mission rehearsal and mission planning, and course of action analysis and development. These tools must reflect the lethal, unpredictable, ambiguous, and asymmetric environment our Soldiers are fighting in today and expect to fight in the future [5].

As a result of the involvement in OOS development by experts in the threat from opposing forces (OPFOR) from the U.S. Army's Deputy Chief of Staff for Intelligence (DCSINT), OOS will be delivered with a significantly more robust COE OPFOR representation than any existing entity-level simulation. These behaviours include modelling of improvised explosive devices, paramilitary forces, guerrilla forces, homicide/suicide bombers and car bombs, as well as the following:

- OPFOR urban detachment
- COE OPFOR terrorist organization
- Guerrilla and insurgent organizations
- COE OPFOR special purpose forces
- Non-combatant civilian groups
- Multiple variations of non-combatant civilian groups

3.2 Multiple Sides and Forces

In the past, identification of friend or foe may have been as simple as recognizing a uniform or identifying the type of tank seen through sensors. Soldiers must be aware of possible volatility associated with how the various groups in that urban setting see each other. A humanitarian task may become deadly when two opposing factions arrive at the same time to receive assistance, leaving the Soldier possibly in the middle to resolve the conflict. Regularly, new events occur and new information becomes available that cause relationships between these sides to change. The dynamic relationship between sides adds to the intricacy of any situation.

Sides and forces in the OOS are established during the planning phase and modifiable during simulation execution, where modifications are injected directly into the ongoing run-time simulation database [5]. The user will be able to change the side or force with which a unit or entity is associated. More significantly, the ability to change a unit's or entity's force or side will also be available for behaviour models to support specific behaviours/orders that support defections. The OOS modelling infrastructure will allow the creation of behaviours that may automatically change a side relationship. For example, the urban non-combatant that has been viewed as friendly or at least neutral can become hostile when an event occurs, such as the destruction of a religious or cultural symbol. Another important modelling aspect provided by the OOS is the notion of asymmetric relationship between sides. Modelling of sides in traditional simulations relates sides viewing each other in the same way; either as friends, hostiles, or neutrals. Real world side relationships are rarely so simple.

4.0 MODELLING NRF MISSIONS

The NRF can expect to execute Article 5 (e.g., collective defence), as well as non-Article 5 (e.g., crisis management, stabilisation) missions. Simultaneously conducting these missions could be considered as operating in the 'Three Block War.' The **Three-Block War** is a way of thinking about contemporary military operations in which NATO forces are involved in peacekeeping, humanitarian assistance, and mid-intensity conflict simultaneously on adjacent blocks of an urban environment [7]. General Krulak, former Commandant of the U.S. Marine Corps, captured the essence of the contemporary operating environment as:

"In one moment in time, our service members will be feeding and clothing displaced refugees—providing humanitarian assistance. In the next moment, they will be holding warring tribes apart—conducting

peacekeeping operations. Finally, they will be fighting a highly lethal mid-intensity battle. All on the same day, all within three city blocks—It will be what we call the "Three-Block War." (Krulak, 1999)

Indeed, a NRF task force may find themselves facing two or more of these situations *in the same block*. The COE creates asymmetric challenges that affect military planning, operations, and decision-making.

Most current simulations were built many years ago to support training for combat in a symmetric, Cold War threat environment. By "symmetric" we mean that the enemy has roughly equal capabilities to U.S. forces. These Cold War simulations stressed large mechanized forces fighting in open terrain. Within the past ten years, there has been resurgence in interest in fighting in urban environments.

The Cold War doctrine of isolating and bypassing urban centres while fighting in rural terrain is no longer viable. In addition, enemy forces attempt to negate or reduce technical advantages by taking refuge in urban areas where they can shield themselves within civilian populations and civilian structures. Military operations in urbanized terrain are characterized by a complex physical environment (e.g., three-dimensional structures and protected sites, such as schools, hospitals, and cultural symbols), a complex human environment (e.g., heavy presence of non-combatants, multiple religious and/or cultural groups, etc.) and a complex informational environment, in which there are multiple sources or transmission paths for communications, data or information [7].

4.1 OOS Modelling Humanitarian Assistance

Humanitarian Assistance includes programs conducted to relieve or reduce the results of complex emergencies involving natural or man-made disasters or other endemic conditions such as human pain, disease, hunger, or privation that might present a serious threat to life or that may result in great damage or loss of property. Humanitarian assistance complements the efforts of a host nation, civil authorities, or other agencies that have primary responsibility. Assistance operations are normally conducted by a joint task force and in concert with non government organizations (NGOs) and private voluntary organizations (PVOs). NATO forces have been at the forefront of the humanitarian efforts to relieve the suffering of the many thousands of refugees forced to flee Kosovo in 1999. NATO troops built refugee camps, refugee reception centres, and emergency feeding stations, as well as moving many hundreds of tons of humanitarian aid to those in need [8].

OOS will simulate forces employed in humanitarian assistance roles that provide critical services and supplies to designated groups. OOS utilizes the U.S. Army Universal Task List (AUTL) to decompose and model appropriate military behaviours. The following humanitarian assistance behaviours will be supported:

- Casualty Evacuation
- Tailgate Resupply
- Equipment Repair
- Medical Treatment
- Tactical Road March
- Towing (disabled vehicles, trailers, etc.)
- Load/Unload Personnel/ Supplies/ Equipment

- Move a Casualty
- Construct Roads and Trails

Non-Governmental Organizations (NGOs) and Private Volunteer Organizations (PVOs) provide humanitarian assistance and disaster relief. There are several thousand humanitarian relief organizations worldwide, and OOS will not attempt to distinguish between each of these groups. OOS will, however, model the following representative organizational structures in support of humanitarian assistance so that users may compose specific organizations:

- Field Mission Delegate Branch
- General Support Branch
- Medical Support Branch
- Relief Work Branch
- Construction Element
- Private Security Guard Team
- Crowd Rioters

4.2 OOS Modelling Peacekeeping Operations

Peacekeeping operations are conducted with the consent of the belligerent parties to a conflict to maintain a negotiated truce and to facilitate a diplomatic resolution. The NRF may participate in peacekeeping operations under the auspices of an international organization, in cooperation with other countries, or unilaterally. Peacekeeping operations support diplomatic efforts to achieve, restore, or maintain the peace in areas of potential or actual conflict.

It should be made clear that the first version release of the OOS in 2006 will not have a high degree of entities, units and behaviours that support peacekeeping operations. These modelling efforts will occur during the Pre-Planned Product Improvement (P3I) phase following OOS v1 release. PM OneSAF has initiated engagement with Subject Matter Experts to gather knowledge artefacts for later development. For example, Military Police (MP) have become increasingly important in missions involving peacekeeping operations. OOS has worked with the U.S. Army Maneuver Support Center to pave the way for the implementation of a number of Military Police (MP) tactical operations:

- Maneuver and Mobility Support (MMS)
- Area Security (AS)
- Law and Order (L&O)
- Internment and Resettlement (I/R)
- Police Intelligence Operations (PIO)

4.3 OOS Modelling Mid- to High Intensity Conflict

Mid- to High-Intensity Conflict is best described as open warfare between organized conventional military forces. The traditional “World War III” scenario with hordes of Soviet vehicles sweeping across the plains of Europe going toe-to-toe with NATO forces is an example of mid-intensity to high-intensity conflict situations.

Often mid-intensity conflict involves large military formations in what is referred to as conventional warfare in which opposing forces are in open, no-holds barred opposition. Mid- to high-intensity conflict generally is waged by military formations of battalion level and above. This kind of combat often involves significant aerial combat as well. Most extant simulations were built to train battalion and brigade staffs to fight as part of larger formations in mid- to high-intensity conflicts.

OOS provides all the required functionality to support mid- to high-Intensity conflicts. Many existing simulation applications adequately support open-field, symmetrical engagements. OOS also provides the capabilities to support these operations, but they won't be discussed here. Rather, this paper focuses upon the implementation of behaviours specific to Urban Operations (UO) and the COE. It is important to note that OOS v1 will be delivered with U.S. entities, units, and behaviours; however, the previously discussed composer tools should allow international battlespace compositions to be added with relative ease.

OOS will provide a robust ability to conduct **urban operations**. A large set of urban operations behaviours have been created. These behaviours allow the user to give orders to platoon and company formations that are executed by individual entities in a doctrinally consistent manner. Most of the behaviours that are unique to urban operations centre on enhanced dismounted infantry behaviours. Below is a list (partial) of related behaviour models that will be available:

- Squad Enter and Clear a Building
- Mount/Dismount Aircraft & Vehicles
- Move in Urban Terrain
- Urban Defence
- Platoon Assault a Building
- Unmanned Aerial Vehicle Conduct Surveillance
- Emplace Minefields and Improvised Explosive Devises (IED)
- Establish Cordon
- IED Attack
- Urban Sniper
- Execute Urban Ambush Ground
- Execute Urban Ambush Air
- COE Attack
- Conduct Raid
- Move a Casualty
- Conduct Ambush

4.4 OOS Modelling the Urban Environment

Creating an appropriate, high-resolution synthetic environment is critical to modelling any urban scenario. Today's terrain databases must have the flexibility to accommodate the density and complexity associated with an extensive cityscape. In addition, runtime simulation software must be able to handle the intricacy as well. Some of the features in the OOS that will support this type of environment include:

- Multi-resolution terrain databases
- Entity reasoning and movement planning in an urban environment
- Ray-trace Line-Of-Sight through terrain features and building apertures
- Support for subterranean structures

The representation of buildings is especially significant, particularly for the mid- and high-intensity conflict in the urban environment. The OOS provides a multi-resolution capability to support the battle both in and around buildings. At the lowest resolution, buildings consist of only the exterior shell. At the next higher step of resolution entities can enter the building and interact, through windows and through open doorways, with entities outside of the building. The highest level of resolution, called Ultra High Resolution Buildings (UHRB), will provide buildings that account for all interior geometry and features [7]. The UHRB format was designed to provide the feature and attribution information needed for SAF entities to properly reason about the environment. Some of the capabilities provided by UHRBs include:

- Anterooms, atriums, balconies, closets, elevator shafts, escalators, hallways, fire escapes, ramps, stairs, ventilation ducts/shafts
- Apertures: breach holes, doors, skylights, trapdoors, ventilation openings, loopholes
- Enhanced attribution: length, width, height, lighting characterization, railing type, aperture state, interior wall construction, floor construction, exterior wall construction
- Enhanced route planning within buildings to include routes through apertures
- Ray-traced line of sight through apertures
- Bullets/munitions fragments passing through walls
- Underground structures
- Building damage and rubble of building

4.5 OOS Modelling Non-Combatants and Crowds

The emergence of civilian and paramilitary threats to US forces has brought about the need to model and simulate combatant forces and the interaction with crowds of civilians. OOS modelling will include the dynamics of crowd movement as individuals move together, flowing around obstacles and through restricted areas. The model will simulate the decisions of the crowd to perform routine activities, to collect together, to move toward attractive events and run away from frightening events. Emotional states and the actions of the nearby crowd will play roles in governing each individual's choices of action. Finally, the crowd 'milling' behaviour model will incorporate parameters that will allow users to set the initial attitude of the crowd and the sensitivity of the crowd to events, thus allowing the simulations to create various situations or different cultural contexts for the crowd. The crowd behaviours can be used in many situations. The following scenarios can give an example of how the crowd simulation may be used. There are any number of ongoing

crowd modelling efforts; the crowd modelling being done in OOS will likely not provide the full solution for all users and all use cases when the software is initially released, but the infrastructure will be in place to support future enhancements.

5.0 INTERNATIONAL ENGAGEMENTS

PM OneSAF has worked with multiple international organizations to develop capabilities, provide tech support, and establish simulation centres. It should be noted that the simulation involved has primarily been the OneSAF Testbed Baseline (OTB), rather than the OOS. The OTB is not discussed in this paper, as it will be replaced by the OOS in 2006. To date the most significant OOS involvement has been through the American, British, Canadian, and Australian (ABCA) Act efforts and a Project Agreement with the United Kingdom; however, a number of central European and Asian countries have been involved with OneSAF Testbed Baseline development for years, and we expect them to become part of the OOS development effort as well. There has been a significant increase in interest by the international community to establish programmatic relations with PM OneSAF. These relationships take the form of Foreign Military Sales, Data Exchange Agreements, and Project Agreements [9]. Because of international laws there are a number of steps that must be satisfied in order to request and receive the OOS baseline by each of these approaches.

Foreign Military Sales (FMS) involve a country's request for goods or services from the U.S. Government. This mechanism differs from Data Exchange Agreements and Project Agreements because funds are provided to the implementing agency. Initial discussions are conducted primarily between the U.S. Security Assistance Office (SAO) personnel and Ministry of Defence (MoD) officials in the host country. Follow-on discussions to further define a country's military requirements may include U.S. contractors, U.S. military departments and U.S. Department of Defense (DoD) headquarters representatives. The process usually involves the host country generating a Letter of Request (LOR) for defence articles and/or services. The LOR is then routed either through the U.S. State Department or directly to the Implementing Agency depending upon if the request is for "Significant Military Equipment (SME)" or other non-SME. The Implementing Agency will prepare and return a Letter of Offer and Acceptance (LOA). The Implementing Agency for OneSAF related requests is the U.S. Army Security Assistance Command (USASAC).

PM OneSAF currently has FMS cases with the Czech Republic, Slovakia, and Canada. Pending FMS cases include Australia, Denmark, and Korea. In general FMS cases provide funding to gain OneSAF services as specified by the country that may include, but are not limited to, software installation and training, development of country-specific entities/units/behaviours, support of experimentation, establishment of simulation centres, and leveraging technical support.

Data Exchange Agreement (DEA) (also Information Exchange Agreement (IEA)) is an agreement between the U.S. Government and another nation to exchange mutually beneficial data. DEA's are conducted as *quid pro quo* as typically no funds are involved in the transfer. Any training or technical assistance services desired by that nation from the U.S. in conjunction with the transfer will be requested through FMS. PM OneSAF currently holds DEA's with a variety of nations to include Canada, Australia, United Kingdom, France and Netherlands. It is worthy to note that DEA relationships with PM OneSAF do not come with technical support. For this reason, current PM OneSAF policy is to NOT release OOS through DEAs.

Project Agreements (PA) are initiated between the U.S. Government and another nation's government to collaboratively develop a system. Each party agrees to contribute resources to the project that ultimately benefit both nations. PM OneSAF currently has a Project Agreement with the United Kingdom.

6.0 CONCLUSIONS

The U.S. military has recognized the criticality of transforming our forces to engage and destroy those who mean us harm. Our forces need to exhibit increased speed, agility, and lethality to defeat today's global threat. Mr. John Garstka, Assistant Director for Concepts and Operations, U.S. OSD, indicates that successful military transformation requires that military organisations purposely create and nurture warfighting innovation as a core competency [10]. With a new command structure in place, NATO is pulling alongside the U.S. in this philosophy. The NRF will offer an opportunity for making transformation a reality. The NRF will be a rapid-reaction, self-sustaining force ready for operations worldwide. The recent conflicts in Iraq confirm the enormous impact for strategic, operational, and tactical warfighting. Today's military simulations have focused on traditional combat and combat support elements; however, there is a growing need to implement units, behaviours, and effects to account for a more flexible and adaptive threat. This threat uses tactics that are unpredictable, ambiguous, asymmetric, and highly lethal. Unless military simulations develop accurate representations of the threat, they risk becoming irrelevant in support of training and analysis. The OneSAF program is working with subject matter experts throughout the U.S. Army, as well as engaging with the international community, to develop a robust set of COE units and behaviours operating within a high resolution synthetic environment. The OOS open architecture is being developed with a high degree of composability and extensibility to enable the software to flex and evolve, just as future threat most certainly will.

7.0 REFERENCES

[1] "NATO: History of NATO: Information about NATO", retrieved on 25 August 2005 from http://members.tripod.com/more_tra/1e_nato_txt.htm.

[2] Paitard, Xavier, and Sherland, Paul, "The Role of Modeling and Simulation in NATO's Transformation Process", MS&T Magazine, Issue 3, 2005, retrieved on 15 August from http://mst.texterity.com/mst/2005-3.

[3] "The NATO Response Force: At the centre of NATO transformation", retrieved on 13 August 2005 from http://www.nato.init/issues/nrf.

[4] Klaus Kleffner, "The Alliance After Prague", Presentation to SMI NATO Transformation Conference; 27-28 Oct 04, Brussels, Belgium, SMI Conferences Ltd.

[5] Parsons, D., Surdu, J. & Jordan, B. (2005). "OneSAF: A Next Generation Simulation Modeling the Contemporary Operating Environment." Euro-Simulation Interoperability Workshop 2005, 05D-SIW-030.

[6] Cesare Balducci, Deputy Director, NSA, *Interoperability and Standardization within NATO*, Presentation to SMI NATO Transformation Conference, 27 Oct 04, Brussels, Belgium.

[7] Parsons, D., Surdu, J. & Tran, O. (2005). "The Three Block War in OneSAF." SimTecT Conference 2005, Sydney, Australia, SMTW67.

[8] "NATO's Role in Relation to the Conflict in Kosovo", retrieved on 25 August 2005 from http://www.nato.int/kosovo/history.htm.

[9] Parsons, D., Wittman, R. (2004). "OneSAF: Tools and Processes Promoting and Supporting a Distributed Development Environment for a Multi-Domain Modeling and Simulation Community." Euro-Simulation Interoperability Workshop, Edinburgh, Scotland, 04E-SIW-004.

[10] Mr. John J. Garstka, Asst. Director for Concepts and Operations, Office of Force Transformation, Office of the Secretary of Defense, *"A Perspective on Defense Transformation",* Presentation to SMI NATO Transformation Conference, 27 Oct 04, Brussels, Belgium.