Strategy Research Project

# MAKING CONSTRUCTIVE SIMULATIONS RELEVANT FOR TODAY'S FIGHT

BY

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USAWC CLASS OF 2010



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# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| **1. REPORT DATE** *(DD-MM-YYYY)* | **2. REPORT TYPE** | **3. DATES COVERED** *(From - To)* |
|---|---|---|
| 08-03-2010 | Strategy Research Project | |

**4. TITLE AND SUBTITLE**
Making Constructive Simulations Relevant for Today's Fight

**5a. CONTRACT NUMBER**

**5b. GRANT NUMBER**

**5c. PROGRAM ELEMENT NUMBER**

**6. AUTHOR(S)**
Lieutenant Colonel Stanley E. Reedy

**5d. PROJECT NUMBER**

**5e. TASK NUMBER**

**5f. WORK UNIT NUMBER**

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
Colonel James Shufelt
Center for Strategic Leadership

**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
U.S. Army War College
122 Forbes Avenue
Carlisle, PA 17013

**10. SPONSOR/MONITOR'S ACRONYM(S)**

**11. SPONSOR/MONITOR'S REPORT NUMBER(S)**

**12. DISTRIBUTION / AVAILABILITY STATEMENT**
Distribution A: Unlimited

**13. SUPPLEMENTARY NOTES**

**14. ABSTRACT**

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This paper investigates potential ways to use Army constructive simulations to help teach soldiers and leaders the intricacies of dealing with the diverse cultures of a populace, similar to what the military is experiencing today in Iraq and Afghanistan. Alternative solutions for providing these capabilities will be reviewed, concluding with a recommendation for a long-term solution to assist in training soldiers and leaders.

**15. SUBJECT TERMS**
War Games, Human Behavior, Strategic Corporal

| **16. SECURITY CLASSIFICATION OF:** | | | **17. LIMITATION OF ABSTRACT** | **18. NUMBER OF PAGES** | **19a. NAME OF RESPONSIBLE PERSON** |
|---|---|---|---|---|---|
| **a. REPORT** | **b. ABSTRACT** | **c. THIS PAGE** | | | **19b. TELEPHONE NUMBER** *(include area code)* |
| UNCLASSIFED | UNCLASSIFED | UNCLASSIFED | UNLIMITED | 26 | |

USAWC STRATEGY RESEARCH PROJECT

# MAKING CONSTRUCTIVE SIMULATIONS RELEVANT FOR TODAY'S FIGHT

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This SRP is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.



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## ABSTRACT

AUTHOR: Lieutenant Colonel Stanley E. Reedy

TITLE: Making Constructive Simulations Relevant for Today's Fight

FORMAT: Strategy Research Project

DATE: 8 March 2010 WORD COUNT: 5,014 PAGES: 26

KEY TERMS: War Games, Human Behavior, Strategic Corporal

CLASSIFICATION: Unclassified

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# MAKING CONSTRUCTIVE SIMULATIONS RELEVANT FOR TODAY'S FIGHT

Soldiers are making split second decisions as they deal with civilians during current conflicts. These decisions can have strategic level implications, as they may change the way a population views the United States. It is essential that soldiers and leaders understand the implications of their actions on the population, particularly when dealing with a country made up of multiple tribes, factions and religions.

In a recent Frontline episode, US Marines in Afghanistan were interacting with a small group of Afghanistan citizens, most of which are elderly. A Non-Commissioned Officer (NCO) is working through an interpreter who has difficulty communicating with this group since they have a different dialect. The NCO gets upset with both the interpreter as well as the civilians and begins to raise his voice to nearly a yell, telling them that he is here to protect them and he doesn't understand why they won't tell him where the Taliban are. The Afghans where not comfortable with the situation and were potentially set back by his tone of voice, not truly understanding his sincerity to protect them from Taliban intimidation.[1]

These types of interactions can have significant strategic outcomes as we try to win conflicts that occur involving a civilian population. It is possible to alienate groups due to lack of understanding of culture, dealing with them as subordinates or treating them poorly. It is important that soldiers and leaders understand that they must properly tend to the civilian population in order to influence the outcomes of counterinsurgency operations and account for the nature of irregular warfare.[2]

The United States relies heavily on computer simulations to train commanders, staffs and soldiers.[3] The Army training community has yet to field a simulation that takes

into account the multi-sided operations and interactions with complex human behaviors of the population that are an integral part of a soldiers life today. Because of the difficulty of modeling these low-level interactions, they take a back seat to more conventional training for traditional combat operations. Regardless, soldiers and leaders must understand the implications of dealing with civilian populations, human behaviors and interacting with civilians. A task as simple as providing bottled water to one tribal area and not another can have huge implications by showing favoritism and potentially turning a neutral tribe over time to becoming an enemy.

Today's Army training simulations must include provisions for training service members on use of soft factors on human behaviors to enable them to understand and implement appropriate interactions with civilian populations. However, the inability for simulations to keep pace with current requirements is recognized at the highest level of the Army, as noted by Lieutenant General James D**.** Thurman deputy chief of staff, G-3/5/7, U.S. Army, in the Army Modeling and Simulations Strategic Plan, 5 March 2008:

> Among the most urgent Army M&S capability gaps is the inability across the Army to accurately represent the current operational environment. Aspects of the current operational environment not well represented in Army M&S include rapidly developing networks (as well as potential network vulnerabilities), Battle Command systems, irregular warfare, counter-insurgency operations, dynamics of human behavior, social networks, non-lethal technologies, and other enabling capabilities. These aspects of the operational environment have rapidly become a critical component of our ability to plan and conduct successful operations and will be increasingly vital to success in the Net-centric environment of the future.[4]

It is imperative that the Army address the changes in modern warfare and update training systems to allow use of this combat multiplier to help train soldiers to be more successful on today's battlefield.

What is a Computer Simulation and its uses

Computers are a training tool found in all facets of industry across the United States, the Army is no exception. It is important to understand how the Army uses computer simulations to gain an appreciation for the use of simulations in training soldiers. The Department of Defense Modeling and Simulation (M&S) Glossary states: "A computer simulation is a dynamic representation of a model, often involving some combination of executing code, control/display interface hardware, and interfaces to real-world equipment."[5]

The Army uses computer simulations as an aid to training the force. With reduced budgets and the increasing costs of placing soldiers on their combat systems and deploying to a field site to train, it is often more economical to use a computer simulation to learn or refine basic skills from the soldier level up through the division commander and staff.[6]

The Army has established simulation training facilities, called either Battle Simulation Centers (BSC) or Battle Command Training Centers (BCTC), at most large active Army posts. These facilities house the Army's approved training simulations and support personnel and are designed to assist commanders in training their staffs, subordinate commanders and staffs, and soldiers. These centers are integral components of most units' pre-deployment training.[7]

The use of simulations facilitate individual and collective skills training in a controlled, low-risk environment. This type of training is generally ideal for the Army's crawl-walk-run methodology. The crawl and walk phase may be done in the simulated environment while the run phase is preferably conducted in the live environment of the field. The crawl phase typically focuses on entry level skills and familiarizes the trainee

with the simulation environment. Upon development of adequate skills, the level of difficulty of individual and collective skills typically increase in the walk phase. [8]

Upon completion of the run phase of training or completion of collective training at home station, units may undergo an external simulation training event. The Army has an organization that assists brigade and division level organizations in assessing a unit's readiness. The Battle Command Training Program (BCTP), a component of the Combined Arms Center (CAC), at Fort Leavenworth, Kansas, has teams that evaluate critical aspects of the brigade thru division operations.[9] BCTP accomplishes this through use of computer simulations that simulate friendly and enemy forces and communicate the threat forces and intelligence via the Army Battle Command Systems (ABCS) to the training audience in their tactical locations. The BCTP Observer Controllers (OCs) analyze the ground truth from the simulation and the training audience actions and provide relevant feedback.

Current simulations environments focus primarily on replicating conventional conflicts, with little to no emphasis on the hybrid warfare seen in Iraq and Afghanistan. The enemy no longer wants to fight the warfare that conventional forces are best at but rather are pulling soldiers into a hybrid war that involves the civilian population.

Soft Factors in Military Operations

The design of the US military's conventional forces is for major combat operations. Traditionally, it is not part of conventional military training to establish relationships or negotiate with civilians in order to successfully conduct military operations. This interaction uses "Soft Factors", which are those human behavior elements used for non-coercive friendly interaction with people.[10] Soft factors deal specifically with human emotions and behaviors and the results or cause and effect

when dealing with other humans. The desired outcome is a positive lasting end state based on mutual trust, not a coercive distrustful relationship. Success of using soft factors when interacting with civilians can vary based on the current mindset of the person involved, age, past experiences, last dealings with an American soldier, customs, courtesies, and numerous other elements that can affect relationships with the population.

Currently, soldiers in Iraq and Afghanistan are dealing with tribes and factions that may have an intricate web of relationships based on a long history of interactions including marriages, religion and warfare. Some relationships are very sensitive and require very little conflict or perceived conflicts to turn the tribes against each other or the military.[11] Soldiers must understand how to capitalize upon soft factors when dealing with human behavior of the population and to help guide the results of their actions to reach their end state. If they show favoritism to one tribe by providing food or water, it may have a detrimental effect on a neighboring tribe's relationship. The end-state is to understand this cause and effect relationship and to mitigate items which may provoke unwanted responses. This gives rise to the strategic corporal; there is an opportunity for low ranking soldiers to have a significant effect on strategic outcomes based on their interactions with the population.[12]

It is important that soldiers receive training on soft factors since the type of warfare the military will continue to fight is what they are currently experiencing in Iraq and Afghanistan. Dr. Michael Vlahos, a member of the National Security Assessment team of the National Security Analysis Department (NSAD) at the Johns Hopkins University Applied Physics Laboratory, discusses the changed nature of warfare based

on observations of United States early success in Iraq; he argues that our success may have made conventional warfare obsolete:

> No one can hope to win fighting our kind of war, so they will make war they can win. Ironically, we have destroyed the war we do best, and we will come to ponder this recognition as we struggle to adapt to and defeat the new.[13]

Current Simulations and Soft Factors

Current Army training simulations focus on conventional warfare, moving simulated combat vehicles and soldiers across the battlefield to engage the enemy. The simulations do so by replicating the environment within the simulations. If the unit or platform in the simulation encounters terrain that should inhibit the movement of the platform, the vehicle or unit speed adjusts accordingly. The outcome of kinetic engagements are determined mathematically based on the weapon system's probability of hit, probability of kill, lethality and numerous other factors that give the results a reasonable outcome.

Even though training simulations are only representations of the real world, an outcome in the simulated environment does not exactly replicate nor predict the outcome of reality. They are a tool to help train soldiers on the processes and procedures they may encounter during combat operations, and do so at a reduced cost compared to taking the entire unit to a field environment on their combat equipment.

The current Army simulations training solution is called the Joint Land Component Constructive Training Capability (JLCCTC). The JLCCTC is a software modeling and simulation capability that contributes to the joint training functional concept and the Army training mission area by providing the appropriate levels of model and simulation resolution as well as the fidelity needed to support both Army and joint

training requirements. The JLCCTC provides the simulated operational environment in which computer-generated forces stimulate and respond to the command and control processes of the commanders and staffs. The JLCCTC models provide training functionality for leader and battle staff for the Army and the joint, intergovernmental, interagency and multinational spectrum. The JLCCTC provides an interface to Army Battle Command System (ABCS) equipment allowing commanders and their staffs to train with their go-to-war systems. [14]

To meet the need of the changing combat environment the National Simulation Center (NSC) at Fort Leavenworth Kansas developed the Joint Non-kinetic Effects Model (JNEM) as part of the JLCCTC. The purpose of JNEM is to:

> …model civilian actions and reactions which enrich U.S. Army division and corps training experience. The U.S. Army developed JNEM to improve leader training on dealing with local populations for units deploying to combat theaters. Commanders must pay attention to major population groups' feelings about security, quality of life, and religious issues, in training just as they must in real life. Commanders must consider the consequences of military unit activities and their effects on local belief in regaining local autonomy. Those commanders who do consider population concerns will succeed in reducing hostile activity and in reducing the number of enemy forces.[15]

JNEM's knowledge base was developed from interviews with "social interaction" Subject Matter Experts (SMEs), capturing this expertise and turns it into computer code for use in JNEM. The JNEM model deals only in behavior aspects, and does not serve as a ground combat model. [16]

Solutions

To come to a reasonable solution for this issue requires selection of a simulation model that has a funding stream that enables new requirements to be funded by the Army and not by the using unit. If a commander finds a training solution from outside of

the Army that will help meet his training needs and buys it from his own funds, the Army has no obligation to pay for updates or maintenance. The using unit must pay from its own funds for any changes or updates to the software.

There are currently three potential solutions to the Army's increasing requirement of dealing with civilians on the battlefield: An existing program, JNEM; a developmental program, One Semi-Automated Forces (OneSAF), and a research project SimCity Baghdad.

JNEM is a program of record, meaning it is a system developed and procured thru the Army acquisition process; the Program Executive Office for Simulation, Training and Instrumentation (PEO-STRI), in Orlando, Florida manages JNEM. This means the Army recognizes this system as a valid requirement and provides funding for its life cycle management, including development, new requirements and maintenance.[17]

The primary issue with JNEM is that it is a separate system that receives information from a ground combat simulation and provides a "read-out" of how well the commander did at satisfying the population. JNEM does not have the ability to interact directly with the ground combat simulation and change the dynamics of the civilian population enabling them to react directly in the simulated environment therefore changing the outcome of the simulated combat exercise. The feedback the commander receives during exercises using JNEM is either a verbal or written response from JNEM, not a change to the conditions within the ground combat simulation.[18]

As of FY 2010, JNEM's funding is for maintenance only, limiting it to sustaining its current capabilities and ensuring its continued interoperability with the ground combat simulation from which it receives information.[19] This situation precludes JNEM

from receiving new requirements or new functionality required by the Army to meet the growing needs of the force to react to the changing enemy. If the Army places a program on maintenance only, it is nearing the end of its life cycle and will no longer be supported in the out years. According to PEO-STRI there is no identified approved replacement for JNEM.

One Semi-Automated Forces is a relatively new Army Brigade and below entity level simulation. OneSAF is also a program of record, managed by PEO-STRI. OneSAF uses semi-automated forces, which means that when given a mission it executes the mission based on pre-established preferences, with minimal interference from operators. OneSAF has an unlimited side capability. This provides for as many or as few hostiles, tribes, factions and religions as necessary. OneSAF is not limited to one side versus another side; you can have, in theory, 100 different nations at war with each other. [20]

OneSAF has the capability to replicate civilians on the battlefield. This includes civilian traffic moving in vehicles, civilians walking to and from work, lunch, worship and similar activities. These civilians on the battlefield, whether in the countryside or the urban environment impede the movement of other civilians and military personnel. If a bomb goes off near the civilians, those that are in the effective blast area receive different types of wounds based on OneSAF's calculations. Those civilians that are outside of the blast area "run away" from the blast site; and those that are further away from the blast site move towards the site out of curiosity.[21]

Civilians in OneSAF receive assignments to different groups representing tribes, religions or factions. Users establish relationships between these different groups

representing if they are friends, enemies or neutral with other groups including military forces. Currently OneSAF has the capability to either manually or dynamically change these relationships based on interaction with each other or military forces. If the military does positive things for a faction it can change a relationship from neutral to friends, but the opposite is true, if military forces damage a mosque or injure civilians it can change a neutral to enemy. Making an enemy of a civilian element then enables them to conduct insurgent type operations against friendly forces.

The greatest issue with OneSAF is gaining approval of new requirements from the OneSAF users. OneSAF is the only model that serves all three of the Army's Modeling and Simulation Domains; Advanced Concepts and Requirements (ACR), Research Development and Acquisition (RDA), and Training Exercises and Military Operations (TEMO). OneSAF has a set amount of money for yearly development, however the three domains must vote on how to use the money. This often leaves a single domain short on their desired capabilities each year.[22]

OneSAF's capabilities in representation of civilian multi-sided operations are at an "adolescence" stage, and require additional funding to develop an enduring capability to adequately meet the requirements to train the force. [23] Customers of OneSAF paid for civilian behaviors representation in OneSAF, outside of the OneSAF Operational Requirements Document (ORD). One customer funded Project Manager OneSAF for human behavior representation called Continuous Entity Behavior (CEB). CEB represents the civilian clutter of the battlefield of movement of civilians to and from work, automotive traffic, going to worship and lunch. The implementation of the CEB is a simple repetitive route set up on a schedule to maintain civilian clutter. A second

organization funded the addition of the JNEM like capabilities in OneSAF to represent the human behavior dimension of conflict on the civilian population. Implementation of human behavior dynamics used part of the multisided capability inherent in OneSAF to represent multiple groups or factions. [24] The multisided capability allows establishment of relationships between groups, buildings like churches, or specific terrain that represents neighborhoods. Behaviors represent the groups and their levels of satisfaction related to other groups including military personnel. These behaviors include their satisfaction with autonomy, physical safety, cultural / religious issues, and quality of life. From these behaviors the entities display a "mood" based on their levels of satisfaction. There a total of seven moods represented: always cooperative, very cooperative, cooperative, marginally cooperative, uncooperative, very uncooperative and never cooperative. These moods influence the way the civilian populations interact with other groups including military personnel.[25]

The human behavior multisided capability in OneSAF is subject to the OneSAF Requirements Process mentioned earlier, and is yet to be "voted" as a requirement by the modeling and simulations domains.[26] Therefore it is not routinely funded and is not on a path to be a useful solution unless it is recognized as a valid requirement and funded in the future.

The third alternate, SimCity Baghdad, is predominately developed with Army funding, but was not developed as part of the Army acquisition process nor is it a program of record. This puts the burden of developing the game between the user community and the developer, the Institute for Creative Technologies (ICT), University of Southern California. SimCity Baghdad is a proof-of-concept story-driven game. To

develop the game, ICT interviewed five Army Lieutenant Colonels that served as battalion commanders in Iraq. During the interview process ICT captured 64 total stories from the LTCs. ICT used these stories as scenarios and based the actions and outcomes of SimCity Baghdad on these stories. [27]

The concept of SimCity Baghdad is that the trainee operates their force inside a portion of Baghdad interacting with the local population, insurgents and the city mayor. SimCity Baghdad's trains service members on how positive interactions can assist in completing your mission. Bar graphs continually show how the players' actions affect governance, economics, security, essential services, and the capabilities of local police and soldiers. Measure of overall success is from residents' support for the coalition and the local government. The game starts with 25 percent supporting coalition forces, 35 percent neutral, and 40 percent against.[28]

Data for SimCity Baghdad comes from gaming industry standards rather than Army verified and validated data that attempts to insure a fair fight, and is designed to reasonably replicate real world effects of munitions and weapons. The training audience using SimCity Baghdad must understand the limitations of the system so they do not use it for conventional military operations believing that the results in the game replicate real world ammunition and weapon system capabilities. This will not be an issue if the end state stays at interactions with the civilian population to assist in obtaining the military end state. However, the possibility for negative training can occur when military members train in niche type missions focusing on specific areas, while obtaining unreasonable outcomes outside the focus area. [29]

Issues in Modeling Specific Regional Human Behaviors

The current problem in attempting to model human behaviors is the intense complexity and expense of attempting to model all civilizations, and gaining SMEs for each civilization, coupled with the expense of doing so.

Competing proponents for developing functionality for conventional combat operations and modeling soft factors in simulations generally side with conventional combat. Conventional combat operations are a well understood and practiced art. Results from conventional warfare are seen, touched and generally measurable. Weapon systems replication in simulations is straightforward, effective ranges and destructive capabilities are known, and the Army has the data to support it. The Army has been implementing representations of these weapon systems into simulations for decades and has a single source to receive the data from, the US Army Material System Analysis Activity (AMSAA).[30] There is a defined standard on how to ingest the data from AMSAA into a simulation to accurately represent the weapon system. This process provides a cost savings benefit and reasonably comparable results from all the disparate and competing combat simulations in the Army inventory. However when dealing with human behaviors and soft factors, it is something that cannot be seen nor is there a US Army organization to provide the required data. This information is not readily available like weapon systems data. This makes the process difficult, requiring long lead times and potentially with unknown results from the simulation as engineers learn to implement the human behaviors into the simulation. As work progresses through the issues of implementing the customer's requirements into the simulation it is possible that they lose interest in continuing a process that cannot fulfill their requirements in a reasonable amount of time or money. The time portion relates to

understanding how to implement the design of human behaviors into the simulation, and the money aspect is gaining the knowledge for the many different human behaviors.

Gaining this human behavior knowledge requires finding an appropriate SME for the population of interest. Software engineers must interview SMEs, and gain information, transforming it into data suitable for use in the simulation. In the case of Afghanistan there are at least 13 tribes, potentially requiring 13 SMEs to generate the necessary information. In addition, the designers would need an SME who is a regional expert to provide insight on the relationships between all 13 tribes to establish the baseline for the simulation product. Culture has a huge impact on human behavior. Human behavior varies significantly depending on the region of the world.[31]

An example of data that is necessary for implementation of human behaviors for each tribe, faction or religion is located at Table 1.

| ***Description:*** | ***Artifact 1:*** | ***Artifact 2:*** | ***Artifact 3:*** |
|---|---|---|---|
| Religion | Muslim | Christian | Catholic |
| Education | None | High School | College |
| Mood | Subdued | Angry | Happy |
| Age | Young | Military Age | Elderly |
| Tribal Status | Elder | Leader | Youth |
| Political Aspiration | Member | Leader | None |
| Tribal Affiliation | Tribe A | Tribe B | Tribe … |

Table 1: Example Human Behavior Factors

The process of extracting the data from the SMEs is difficult and time consuming. Using the data in a simulation when there is no precedence or standards for implementing human behaviors in a military computer simulation are even more challenging.

Additional Requirements to Implement:

The US Army's pending implementation of "Design" as a process to replace or augment the Military Decision Making Process make it necessary to look for linkages or relationships in the Political, Military, Economic, Social, Infrastructure, and Information Systems (PMESII) when dealing with opposition or conducting nation building operations.[32] It is important to understand the linkages and relationships of each of the PMESII but to also include the tribal relationships into the consideration. Important considerations include the tribal affiliation of key leaders in government and representation of tribes in all levels of government. These relationships help determine where fragile relationships exist or possible areas to influence tribal leaders.[33]

Recommendation

The Army has an immediate need to train leaders and soldiers, particularly those assigned to the Brigade Combat Teams, on interactions between military and civilians. The interactions of these soldiers with civilian populations can have strategic level impact on the outcome of counterinsurgency operations. Until the Army culture responsible for computer simulation training changes to fully embrace this new training requirement as part of the daily training of soldiers and leaders, the soldiers must learn on-the-job while in a combat zone, which is not the preferred method. These immediate problems require immediate solutions.

The recommended interim solution, though focused on a very narrow set of stories and set on the culture and experiences in Iraq, is SimCity Baghdad. SimCity Baghdad provides a low cost, low overhead solution that can teach the basics of dealing with civilians on the battlefield and how to potentially work successfully amongst them. The time required to navigate through a scenario, which equals a day in simulation time, is 2 hours real time. This is a relatively small amount of time to commit to beginning to gain an understanding of these complex operations in the urban environment. However, the current limitations of the “stories” that SimCity Baghdad is built around may have little transferability to the other conflicts, such as Afghanistan. An additional challenge with this recommendation is getting this useful tool into the hands of the training audience. SimCity Baghdad is not part of the Army’s training simulations package that is managed by the Army’s training simulation source, PEO-STRI and does not have a dedicated funding stream to keep it relevant.

The end state solution should be OneSAF with its demonstrated, although currently rudimentary capability to integrate civilian behaviors as part of the battlefield. OneSAF’s models are based on AMSAA data and have been verified and validated. OneSAF is part of the acquisition process and managed by PEO-STRI as part of their simulations solutions and is available now and is present at most division level Battle Simulation Center and Battle Command Training Centers, with most centers having already received training on how to operate OneSAF. OneSAF is a brigade and below ground combat computer simulation. This provides the capability to conduct up to brigade level operations, conducting the hybrid warfare of conventional operations with the counterinsurgency missions currently being experienced in Iraq and Afghanistan.

OneSAF allows the training audience to use their fielded Army Battle Command Systems (ABCS) to interact directly with the simulation. OneSAF enables the training audience to train on a wide range of missions without federating with other computer simulations or systems. The Army has an expectation that OneSAF is an enduring capability, selecting it to serve as the replacement simulation engine for the Aviation Combined Tactical Trainer (AVCATT) and the Close Combat Tactical Trainer (CCTT).[34] However, the Army must provide dedicated funding in order to fully mature the human behavior components in OneSAF to meet the operational needs of the force.

The Army placed JNEM on maintenance only funding, not allowing it to be updated to meet the growing requirements from operations in Iraq and Afghanistan, or future conflicts. JNEM has additional complexities requiring the use of an Army ground combat computer simulation to serve as the driver for combat operations to generate the civilians on the battlefield human interactions. JNEMs relevance decreases each year that it is unable to address new requirements from the force. If JNEM is not allowed to be relevant then funding should be pulled and applied to an alternative that can meet the needs of the force.

## Conclusion

In order to assist soldiers and leaders to better understand requirements to engage the civilian population, the Army must develop solutions that are embedded in routine training paradigms. Within division and below units, leaders and soldiers at all levels participate in computer simulation driven exercises. During these computer simulation exercises is an opportune time to begin training the civilians on the battlefield human behavior interactions.

In today's modern warfare, overwhelming the enemy with combat power and holding key terrain does not guarantee success. Modern warfare is taking place in urban areas alongside a mix of military forces, insurgents, different religious groups, factions and tribes. This warfare focuses on the will of the populace who are key to insuring military success. Leaders must understand the strategic implications and cause and effect of their military operations on the disparate groups. Damaging or destroying homes, religious facilities, injuring or killing civilians all can have significant effects on these groups' relationships with each other and the U.S. Military.

Successfully training our soldiers and leaders requires a training simulation with a robust multi-sided capability that replicates multiple tribes, groups and factions. This enables soldiers and leaders to better understand the dynamics of dealing with multiple groups that have established relationships that may change easily based on the interaction with soldiers. Human behaviors, if handled improperly, can have a detrimental impact on the military's ability to conduct missions and can even turn civilian populations completely against them.

With the ever increasing complexity of combat operations and changing dynamics, it is difficult for the computer simulation community to keep up with changing requirements. This situation provides a flourishing environment for commercial vendors to develop niche solutions that attempt to meet the needs of the military but do so outside of the acquisition process and therefore have no funding stream for support or lifecycle costs.

As the world population continues to increase at an alarming rate, the military will continue to be involved with conflicts amongst the population. The military must be

armed with the appropriate training tools to prepare them to deal with and understand the population they must work with. The best way to provide this tool is to ensure OneSAF is appropriately resourced to develop and provide the type of capabilities demonstrated in the SimCity Baghdad effort.

Endnotes

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