Virtual Simulations Training

How much? At what cost? Why use it at all?

by Major David S. Davidson

On November 5, 1999, Fort Knox dedicated the new Close Combat Tactical Trainer (CCTT) Building. This facility is the latest addition to the Army's virtual simulations capability and complements the older generation SIMNET facility. In the late 1970s and early 1980s, the Army embarked on a quest to acquire and use virtual simulations technology for training. SIMNET was the result of that quest. Many things have changed in the Army since the original SIMNET project, however, there are many similarities between 1979 and 1999.

The project that eventually resulted in SIMNET was developed based on the fielding of a new family of vehicles (M1 Abrams and M2/M3 Bradley). These new vehicles required more fuel and cost more to operate and maintain than the budgets of the early 1980s could support. Maneuver and operations budgets reduced unit Operations Tempo (OPTEMPO) miles to the bare minimum. Due to lack of funds, units needed a cost effective, efficient means of training maneuver tasks. It was a situation very similar to what we face today.

Unlike our current situation, in the early 1980s many of the budgetary constraints were lifted and money became available for units to go to the field and train on the equipment rather than in virtual simulation. SIMNET was fielded and operational in many locations, but instead of being the answer to low-cost maneuver training, it became an expensive toy used to fill training schedules or simply not used at all. Throughout the mid-1980s, the Army trained live in major exercises, REFORGER, Team Spirit, and two-month NTC train-ups, and used SIMNET primarily at basic and advanced courses for new officers and noncommissioned officers when *real* vehicles were not available. Virtual training never found its way into our collective training plans or became an integral part of our training philosophy. But, the *'good times'* were destined to end.

By the late 1980s, OPTEMPO restrictions and limited maneuver time were again becoming commonplace. The 1990s, with the exception of the Gulf War, were marked by shrinking budgets, limited maneuver time, and cuts in the force structure. No longer could units afford to go to the field to learn critical maneuver tasks in the dirt on the vehicles. Just as the budget forced us to find alternatives to live training in 1979, budget restrictions have forced us to find alternatives in the 1990s. These constraints forced us to evaluate our maneuver training strategies and consider how and where simulations technology fits into the overall training plan.

Experienced people such as COL (P) Guy Swan (*ARMOR,* July-August 1998) and COL (Retired) J.W. Thurman (*ARMOR,* March-April 1999) have expressed their opinions about simulations training and its impact on combat readiness. Their views and the views of others highlight the need for further discussion and consideration of the role of simulations in our future training plans. There are two categories of simulations, *virtual* (SIMNET, CCTT) and *constructive* (Janus, BBS, etc.). This article addresses *virtual* simulations.

The central premise of this article is that the Army has not answered the fundamental questions posed in the headline above: how much, at what cost, and why do we use virtual training, the very same questions posed during the original SIMNET project. In the 20 years since then, we are still fighting the same fights and will ultimately come to the same conclusion. The technology is available to effectively train maneuver tasks in a virtual simulations environment at a fraction of the cost of live training. The simulations are better than ever, the graphics are more realistic, the vehicles more closely replicate the actual vehicles, all the *'gee whiz'* stuff is there. Regardless of the simulation (CCTT or SIMNET), the missing piece today is the same piece that was missing in the 1980s. That piece is a clear plan to take advantage of the capabilities of the simulation to enhance the maneuver training plan.

In a September 1999 report by the United States Government Accounting Office to the House Subcommittee on Military Readiness, the GAO stated: "The opposing forces commander from the National Training Center, during congressional hearings in February 1999, said that the proficiency level of units arriving at the National Training Center is much lower now than in the past." Units cannot effectively execute at the platoon and company level resulting in an inability to conduct battalion- or brigade-level operations. The Virtual Training Program at Fort Knox provides a cost-effective ramp-up to improve the proficiency level of units, allowing them to enter live training events at a much higher level. In addition, it provides a feedback mechanism to determine the effectiveness of the training conducted.

This program wholeheartedly supports the continued requirement for live, "in the dirt" training, and does *not* advocate the replacement of live training with simulations. We do advocate the integration of simulations into the overall training plan. No simulation can train all the tasks required to achieve trained and combat ready units, nor can it replace the smell of cordite in the turret or the whine of a turbine on a cold morning. However, a tank crew that cannot pass the required gates in the Unit Conduct of Fire Trainer (UCOFT) to standard will likely not qualify during live fire. Similarly, a platoon that cannot execute an action drill in simulation will likely not execute it effectively on the ground.

The technology is available to train multiple tasks effectively using virtual simulations. Efficient use of the VTP as part of an overall training strategy will result in substantial savings in Operational Tempo (OPTEMPO) and Personnel Tempo (PERSTEMPO) associated with live training. For example, training a battalion that recently executed four days of VTP training covering platoon-, company-, and battalion-level missions cost approximately $16,800, while a similar exercise conducted in a field environment would have cost approximately $430,000. The unit trained for four days in simulations and retained over $400,000 in training funds to spend on a more effective three-day EXEVAL, providing a significantly

greater training payoff. The training conducted in the VTP will enhance training conducted in the dirt. These cost figures will vary from unit to unit, based on travel distance, number of soldiers, and other associated costs, but the savings and opportunities are no less dramatic.

The Warthog Observer/Controller (O/C) Team and the Virtual Training Program (VTP) was established in 1994 as part of 'Bold Shift.' The intent of the VTP is to provide professional, full-time O/Cs utilizing a cost-effective, structured training program to leverage the capabilities of SIMNET to train units from platoon through battalion on maneuver tasks. The O/C team provides training scenarios, orders, and training support packages to participating units before they arrive for training. The focus is on repetitive execution of critical maneuver tasks. The missions units can execute in the VTP are movement to contact, defense in sector (area defense), and deliberate attack for armor and mechanized units, and screen operations, route, area and zone reconnaissance for cavalry units. All VTP training is task-based, with each tactical table covering a portion of the tactical mission, and each focuses on the execution of specific tasks. The sequence of tables provides a logical progression of performance difficulty, from fundamental tables designed to train basic skills to structured missions requiring execution of complex tasks. The O/C team tailored the task list to maximize the capabilities of the SIMNET facility. The O/C can use an extensive array of battlefield effects, ranging from OPFOR vehicle types to artillery impacts and minefields to set the required conditions. This flexibility allows the unit to train to the MTP standard for each task. The O/C replicates the required MTP conditions until the unit executes the task to standard.

All structured VTP missions use the National Training Center (NTC) database. Alternate databases are available in the facility; however, the structured tables are only available on the NTC database. The training unit operates under a single tactical order and executes as the lead element, counterrecon element, or the main effort, depending on the chosen mission. The unit leadership and the O/C facilitating the training have the flexibility to stop the mission at any time and conduct a comprehensive, multi-media After Action Review (AAR). The O/C conducts the AAR using dedicated workstations capable of full audio and video playback of the entire mission. The O/C and the unit leadership can add additional tasks based on the demonstrated level of proficiency and the unit's training objectives.

SIMNET provides an effective method to train platoon-, company-, and battalion-level maneuver tasks in virtual reality. However, there is little quantifiable data to demonstrate the effectiveness of this training. No method exists to capture and compare how well a unit executes maneuver tasks before and after training using the simulation.

UNIT/Component/State:_____/____/_____ Date Pre: _____#VTP Tables Run_____O/C____EC____

Date Post: _____#VTP Tables Repeated_____

Type Unit: Circle One **Tank Mech Mix /**

VTP TRAINING ANALYSIS MATRIX (CO)

Task	Pre-Mission	Post-Mission	Difference	Comments
Total time to run table from end of table preview to COM? (make allowances for sim trouble)	ETP: RC1: MVT COM:	ETP: RC1: MVT: COM	ETP-RC1 = RC1-MVT = Total time =	
FRAGO complete and disseminated? Y/N	Y/N	Y/N		
Time elapsed between enemy contact and a contact report. Contact report given/complete? Y/N	FP: MB:	FP: MB:	FP: MB:	
Artillery request made? Y/N Grid accuracy in meters)	Y/N Dist. from enemy_____	Y/N Dist. from enemy_____		
Fratricide? Y/N If so, give bumper #s	Y/N	Y/N		
Enemy slant at COM (Tank/PC) Startex: 3/16	/	/	/	
Friendly slant at COM Startex: 14				

ETP: End of Table Preview
RC1: Redcon 1
MVT: When unit begins movement
COM: Change of Mission

FP: Forward Patrol
MB: Main Body

Turn in to 03 NLT 1 working date after completion

7 Apr 99

In the fall of 1998, the Armor Center tasked the Warthog O/C Team to design an impact analysis for the VTP to establish a simple, measurable standard to judge how well a unit performs critical combat tasks before and after executing the task-based Virtual Training Program. The O/C collects data during the execution of a pre- and post-mission executed under identical conditions.

The unit O/C initiates the pre-mission by an FM FRAGO, while the unit is stationary in the attack position. The FRAGO directs the unit to initiate movement and establish a hasty defense against a reported forward detachment. The forward detachment is moving to secure key terrain along the task force axis of advance. The O/C collects and records data on the unit's preparation and execution. The pre-mission is designed to establish the unit's baseline proficiency on the tasks of Tactical Movement, Actions on Contact, Use of Indirect Fire in the Offense, Reporting, and Fratricide Prevention.

Following the pre-mission AAR, the unit executes the standard VTP structured tables in accordance with their training plan. Rotation length varies from two days to two weeks and training units average between five and nine tactical tables during a rotation. The last mission of the training rotation is the post-mission. The O/C orders the unit to reoccupy the initial attack position due to diplomatic breakthroughs and a temporary cease-fire agreement. The cease-fire agreement is violated and the unit is again ordered to make contact with a reported forward detachment. The O/C team uses changes in the unit's proficiency from pre-mission to the post-mission to determine the effectiveness of the training conducted during the rotation. The O/C records unit names, training dates, and component on the data matrix in order to keep track of the data collected. This data is not included in the roll-up of performance results or trends. The O/C records the data on the matrix on Page 33.

The following tables show data from 9 company and 25 separate platoon rotations. (There is no distinction between AC and RC units).

It is important to note that the percentage of change from the pre- to post-mission is determined from the raw data and is strictly a statistical analysis. The raw data often does not tell the full story and requires additional analysis to provide useful information. In the case of platoon-level contact reporting, the raw data shows an increase in the time taken to accomplish the task. The increase in time appears to indicate the task was not trained effectively. Further analysis indicates that the platoons are actually concentrating on executing the required initial actions on contact (action and contact drills) as well as sending the report during the post-mission. This resulted in an increase in friendly survivability, an increase in lethality, and the reports are more accurate despite the increased time between contact and the contact report.

Company VTP Analysis results: 07 December 1998 through 14 April 1999.

Number of company rotations: 09

Number of total VTP tactical tables executed: 52

	Pre-mission	**Post-mission**	**Improvement (+) Decrease (-)**
Friendly Slant At COM (Start 14 Vehicles)	5	8	3 vehicles or 22% improvement
Enemy Slant At COM (Start 19 Vehicles)	4	1	3 Vehicles or 15% improvement
Fratricide (# of vehicles)	0	1	**1 Vehicle killed**
Time between initial contact and the Contact report	1.05	0.55	10-second improvement
Time-End of table Preview and REDCON 1	32.43	9.13	23.3 minute improvement
REDCON 1 to Movement	10.21	3.15	7.06 minute improvement
Use of Artillery	4 attempted	7 attempted	33% improvement **(Note: only 77% attempted)**
Accuracy of fires In meters	2075m	1067m	Improvement of 1008m **(Note: 1000m improvement in accuracy, still over 1000m off and only 2 units attempted to adjust rounds)**
Total execution time	56.26	30.23	26.03-min improvement

Although the current data sample is small, and not all measured tasks show improvement, the data collected thus far indicates that the task-based, structured use of virtual simulations has a positive impact on the training readiness of the units trained. Execution of critical combat tasks in the areas of survivability, lethality, and movement times showed improvement. Fratricide prevention, use of artillery and accuracy of indirect fires indicate the need for additional training and more emphasis by the O/Cs during the training. This data provides the training unit with valuable information to help formulate effective future training plans. It also gives the O/C team data to make modifications to the VTP focus in order to more effectively train the tasks that failed to show improvement. The arguments that better understanding of the machine and the mission during the post-mission accounts for the increase in performance has some validity. This hypothesis highlights two significant threats to the internal validity of the research, technical manipulation, and knowledge of the post-mission prior to execution. The O/C team reduces the technical manipulation threat as much as possible by combining the results of all units, regardless of simulation experience, and taking an average. Prior understanding of the mission is a difficult factor to eliminate, requiring modification of the specific conditions and location of the mission for each training rotation. This solution is impractical, and the change in conditions would cast doubt on the validity of the pre-post comparison. The O/C team reduces the impact of this threat by executing the pre-post mission at only one echelon of the scheduled training. If the unit conducts platoon and company training, the pre-post is executed at one or the other but not both. The only way to independently validate the results obtained is to design and implement a system to track and compare the results of task execution in the virtual world with the results

of execution during live training under similar conditions.

The impact analysis is a work in progress and is continually updated to better capture data and reflect the current state of the training conducted. It represents a first step in the process of quantifiably validating virtual training as an effective training tool.

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Platoon VTP Analysis results: 07 December 1998 through 14 April 1999.

Number of platoon rotations: 25

Number of total VTP tactical tables executed: 125

	Pre-mission	**Post-mission**	**Improvement (+) Decrease (-)**
Friendly Slant At COM (Start 4 Vehicles)	1	2	1 vehicle or 32% improvement
Enemy Slant At COM (Start 19 Vehicles)	9	4	5 Vehicles or 28% improvement
Fratricide (# Vehicles)	1	1	**No change**
Time between Initial contact & contact report	1.33	1.54	**21-second increase**
Time-End of Table Preview and REDCON 1	19.22	10.14	9.08 minute improvement
REDCON 1 to Movement	6.55	4	2.55 improvement
Use of Artillery	7 attempted	16 attempted	17% improvement **(Note: only 56% attempted)**
Accuracy of fires In meters	1425m	1296m	Improvement of 129m **(Note: less than 150m improvement in accuracy only 4 units attempted to adjust rounds)**
Total execution time	50.41	35.14	15.27-min improvement