STRATEGY RESEARCH PROJECT

IMPACT OF THE EMERGING TECHNOLOGIES OF DISTANCE LEARNING AND SIMULATIONS ON THE ARMY NATIONAL GUARD

BY

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ABSTRACT

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The effective and effiecient use of the emerging technologies of distance learning and simulations presents and opportunity for the Army National Guard to prepare for training and operations in the 21st century. This paper focuses on how, during a period of budget cut backs and reductions in training areas and facilities, the Army National Guard will dramatically change training methods. Training methods will become a balance of the live, constructive and virtual training domains. Training will capitalize on the capability of each of these domains so that each contributes fully to developing a comprehensive, efficient and effective training program. Use of these emerging technologies will maintaing the Army National Guard as the expanable combat base and the primary reserve of the Army.

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As the Army approaches the challenges of the 21st Century, a second revolution in training is occurring. This revolution will "translate the potential of Army XXI and the Army After Next into the lethal and versatile organization that the future demands." [1]

The first training revolution followed the Vietnam War. Intellectual and physical elements were the core of the first training revolution. Performance-oriented training provided the intellectual foundation for the revolution. Doctrinal manuals such as FM 25-100, Training the Force and FM 25-101, Battle Focus Training, outlined the scope of this intellectual change. Training standards for both soldiers and units were clearly defined. The Deputy Chief of Staff for Operations states that "for the first time in Army history, leaders, soldiers, and units know exactly what it takes to be successful in training."[2]

The physical component of this first revolution was the creation of the Combat Training Centers (CTC). Tough demanding training with an unmatched degree of realism became the hallmark of the CTCs. Training during the first training revolution established the doctrinal foundation of how we train today. The majority of this training was conducted in the live domain- soldiers deployed in the field training with their actual equipment. Simulators were available in limited numbers and often at fixed locations away from actual training areas. Those simulators that were available were generally used for division

level exercises and effective training was still conducted in the field.

A second training revolution is now occurring. Tough, demanding, and realistic live training develops soldiers, units and leaders that possess the will to fight and win under the most adverse conditions. However, budgetary cut backs and reduction in available training areas and facilities will no longer allow the Army to conduct previous levels of live training. Consequently, the Army must, therefore, focus on the constructive and virtual domains in this second training revolution. This requires a proper balance of live, virtual and constructive training domains which will allow us to prepare our soldiers to meet the demands of the 21st century. This balance must capitalize on the capability of each of the training domains so that each contributes fully to developing a comprehensive, efficient and effective training program.

PURPOSE

The purpose of this paper is to explore the virtual and constructive training domains. Further, the paper focuses on how the emerging technologies of distance learning and simulations can be used by the Army National Guard to train units in the 21st century.

ASSUMPTIONS

The Army National Guard is fully committed to implementing the joint operational concepts of dominant maneuver, precision engagement, focused logistics and full dimensional protections.[3] Outlined in Joint Vision 2010, this commitment complements our nation's current strategy of joint power projection by our armed forces from the continental United States.

The Army National Guard currently has over thirty-four percent of the Army's personnel strength, and nearly half of the combat power of the Army. In fact, seventy per cent of the Army's field artillery and more than a third of the Army's combat support and combat service support are contained in Army National Guard units. This force structure located in the Army National Guard makes it a key component in a seamless joint force that can be committed cross-dimensionally along the entire spectrum of contingencies.[4]

The traditional role of the Army National Guard as the expandable combat base for the Army will continue in the future and will not change. Integration of the Active Army, the Army National Guard and the US Army Reserve will continue to provide a quality force trained and ready to conduct the operations necessary to accomplish our nation's requirements wherever and whenever that may be. Further, the traditional role of providing assistance and support to our states and territories will also not change. Citizens of the various states will

continue to rely heavily on the Army National Guard to respond to domestic and community support missions.

These roles of the Army National Guard are based on the principles set forth by the founders of this nation of having able bodied citizens bear arms for the common defense of the nation and to come to the aid of their neighbors in time of need. The missions of the Army National Guard have, however, under gone exponential change and expansion to meet the current diverse security needs of the nation.

Early deploying units require the highest readiness and training levels possible to augment the joint power projection force. Later deploying strategic reserve divisions are also an integral part of this power projection force.

How can the Army National Guard train and equip a force that will be able to meet the missions of tomorrow while retaining the traditional elements of citizen-soldier service that has contributed to the successes of the past? As stated in the purpose of this paper, an exploration of the emerging technologies of distance learning and simulations will show that these two technologies will allow the Army National Guard to meet the missions of tomorrow.

DISTANCE LEARNING

"Distance learning is planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional

techniques, special methods of communication by electronic and other technology, as well as special organizations and administrative arrangements." [5]

HISTORICAL BACKGROUND

Distance education is not new. In the early 1800 advertisements started to appear offering courses by mail. "It was called home study by private for profit schools and independent study by the universities." [6] The development of an inexpensive and reliable mail system in the United States was the vehicle that promoted correspondence courses. The fact that students could correspond with their instructors on a regular basis allowed this form of education to become popular. In 1883, the State of New York authorized the Chautauqua Institute to award degrees through correspondence study. This recognition of the validity of correspondence study by the State of New York's action caused distance education to become widespread.

Correspondence courses, by the early 1900s were wide spread and could be found in many universities and private schools. Courses of instruction were offered in elementary and secondary education, college level courses as well as vocational courses. Institutions offering correspondence study rapidly gained a reputation of reaching out to learners that were

otherwise not provided for. " By 1930 correspondence teaching was offered by thirty nine American universities."[7]

EFFECTIVENESS OF DISTANCE EDUCATION

At this point in the development of distance education, what we don't know exceeds what we do know. Research has been conducted on the effectiveness of distance education in the civilian sector but little can be found in a military setting. One study conducted analyzed a US Army Reserve resident course converted to distance education media. This test indicated that when test scores, completion rates, student perceptions, and costs were compared to resident training and the results of the computer mediated instructions, were found to be no different from that of resident instruction.[8]

Several conclusions can be derived from this research. First, there is not sufficient evidence to show that classroom instruction is the optimum delivery method. Second, that instruction at a distance can be as effective in bringing about learning as classroom instruction. Third, that the absence of face-to-face contact is not in itself detrimental to the learning process. Finally, what makes any course good or poor is a consequence of how well it is designed, delivered and conducted, not whether the students are face-to-face or at a distance.[9]

How cost effective is distance education and is it worth the investment for the National Guard? There are differing views on cost effectiveness. One view considers distance education

requiring expensive capital investment that is no more cost effective than traditional methods. Another view is that the expense of distance learning may well be worth the capital investment cost if high quality instruction is offered in areas where the instruction would not be normally available and when used by large numbers of students. This would certainly be the case with the Army National Guard. High initial costs would be offset by the multiple subjects made available to soldiers at many locations. The same US Army Reserve study referred to above showed no significant savings for the first iteration of the training($289,600 vs 288,200). However, as multiple iterations of the course showed a 43 percent savings resulted.[10]

Cost effectiveness is reached when distance education is conducted on a large scale. The initial investment in program development and equipment is higher than traditional educational methods but costs per soldier drop as the number of soldiers receiving instruction increases.

Cost effectiveness through cost avoidance is also important factor in demonstrating the benefits of distance education. For example, the US Navy training courses conducted from FY 89 through FY 94 through the use of their Video Teletraining network saved $7,154,000 in travel costs and per diem.[11]

NATIONAL GUARD SOLDIERS AS ADULT LEARNERS

National Guard soldiers are adult learners and to make distance education feasible an understanding of adult learning is

necessary. National Guard soldiers will measure the cost of utilizing distance education in time rather than expenditure of funds. Conflicts of time between employment and family commitments and the benefit received from the distance education will weigh heavily on the degree of participation.

Soldiers must have clear and specific reasons to enter into distance learning. As adult learners, soldiers bring with them their experience from life, e.g. civilian education and work experience as well as military training and education. Distance learning techniques must take this experience into account and unless soldiers see distinct benefits they will not participate. Those that do participate will be serious about their learning, be self-motivated to learn and have the self-discipline to succeed.

Soldiers may demonstrate anxiety about their learning. This anxiety is often caused by fear of failure. Distance learning must relieve this fear of failure by demonstrating that making mistakes is an important part of learning.

Soldiers may be not experienced learners and most certainly will have little experience with distance learning techniques. Anything less than a positive experience may impact continuation and completion of a course of instruction.

Positive and timely feedback and enjoyment of the process of learning are also essential for success. The use of fax machines, e-mail and computer based communications systems at no

cost to the soldier are essential to provide rapid input of assignments as well as receipt of evaluated assignments.

Are these facilities available to National Guard soldiers now? The answer to that is no in most cases.

HOW WILL NG ARMORIES SUPPORT DISTANCE LEARNING

National Guard Armories must change their role to effectively integrate distance learning. The physical layout and communications capabilities as well as the duties of the unit commander and full time staff must be altered significantly to accommodate distance learning.

No longer will the armory be used for primarily weekend drills and the occasional administrative or training meeting. Access to distance learning facilities, if centrally located in the armory, will have to be made available to soldiers at their convenience and when they have the free time to participate in distance learning.

Additionally, access by other community members for Distance Learning Programs will become a significant portion of that role. An example of this change is demonstrated by the currently funded National Guard Armory on the campus of Norwich University in Northfield, Vermont. This armory is a demonstration project planned and designed by the National Guard Bureau, the Vermont Army National Guard and Norwich University.

It will contain a state of the art distance learning facility as required for Classroom XXI.

Additionally, it will also contain the necessary connectivity to support current simulations plus those to become available in support of Force XXI. This facility will transmit and receive civilian and military instruction for National Guard soldiers regardless of their location. This facility will integrate distance learning and simulation into the seamless architecture required for meeting the challenges of the 21st century.

The armory full time staff's role will require change. They will become facilitators of distance learning. Their role will become a bridge between the soldier and the distance learning source and will be critical to the success of distance learning. The attitude of the unit commander and the full time staff as well as their interest and support will be vital to the success of any distance learning activity.

National Guard unit commanders and full time staff are not trained to accommodate and facilitate distance learning. Does this mean that they will be required to become computer specialists as well as communications technicians? This is certainly not the case. Their role will be to oversee the facility and provide access to it by soldiers and other users. They may be required to conduct some minor trouble shooting with

equipment but major installation of software or hardware will be conducted by trained personnel from outside the armory.

A major role of unit personnel will encompass administration of distance learning. Record keeping and receipt and transmission of course materials between soldier and the distance learning source is required of unit personnel but are only a minor portion of their role. The overall competence of unit personnel to administer the program and provide constructive feedback to the instructor and soldiers is vital to achieve success. The administration of a distance learning program requires some instructional competence and at least a rudimentary knowledge of the subject being taught. This should not be a problem for National Guard unit training personnel but as a safeguard participation as a student in the distance learning course will provide them the knowledge to be a local extension of the distance learning instructor. Attendance in the course will also allow them to build up a rapport with the distance learning staff , be familiar with the learning objectives of the course, and facilitate the learning of the soldiers.

Unit personnel will need to develop good communications skills. The ability to communicate will determine the success or failure of a distance learning program. Communication with the distance learning instructor or facility, soldiers and the community where the armory is located is the number one priority for unit personnel. If communications between the soldier, the

distance learning instructor or community break down, the program will fail.

DEVELOPMENT OF TRAINING SIMULATIONS

A short description of the development of training simulations and the progress of the Army's control of the development of these simulations is now necessary to establish the current status of training simulations. This description will be followed by a study of what is currently available for training simulations and what is being designed based on the projected technological developments.

In the early 1970's, the first generation of training simulators were almost entirely a manual operation. These "battle boards" were mass produced and widely distributed. Dumm-Kemp, Pegasus and First Battle became the Army standard.

The twenty plus years of training simulator development has transitioned simulators from manual operation to computer assisted simulations. One of the first of these computer assisted simulations that we considered completely automated at the time was the Combined Arms Tactical Trainer Simulation (CATTS). CATTS was the first successful attempt to combine the graphic control measures normally found on tactical map boards with a television monitor showing a terrain map.[12]

The rapid evolution of inexpensive computer memory and computer operating speed allowed organizations with large

training budgets, to include the Army National Guard, to purchase simulations for use by that organization. This independent approach led to the purchase of non-standard software and hardware. The incompatibility of this equipment to link with or operate with the next generation computers and simulations made their utility short lived. These non-standard applications often came in direct conflict with the standards being designed by the Army. Exponential growth of computer capacity, budget reductions and the need for the development of a clear vision of the objective of Army computer driven simulations has eliminated these non-standard applications.

In October 1985, TRADOC directed the Combined Arms Center (CAC) at Fort Leavenworth, KS to assume the proponencey for training simulations. This proponency included the "future concept, design, development, fielding, sustainment and enhancement of training simulations." [13]

In February 1990, the National Simulations Center (NSC) was organized at Fort Leavenworth. The NSC was charged with the responsibility to develop and field training simulations for maneuver units from company through Echelons Above Corps and to monitor the development of Combat Support and Combat Service Support Systems. Since 1993, the NSC's role has expanded to the overall responsibility for developing and operating the Army's Family of Simulators (FAMSIM) for joint and combined operations at the tactical, operational and theater levels. These

simulations must also portray mobilization, deployment and re-deployment for combat operations as well as Operations Other Than War. An important criteria of the development of these simulations is that they must meet the needs of the entire Army; Active, National Guard and Reserve.

TRAINING SIMULATIONS

Training simulations are used to train either individuals or groups and have become popular and widespread in their use. These simulations are designed to accurately substitute or simulate reality so that training outcomes and behaviors can equal the training outcome and behaviors that would have resulted from reality. This substitution should not be apparent to the trainee.

The simulation must be neutral to the decision making process. It must allow for bad decisions to occur and allow the effects of the decision to impact the operation. Exercise design and physical layout should simulate realistic combat situations where unit personnel and organic equipment are an integral part of the exercise.

This may be best described as a commander and staff conducting operations from their normal wartime environment. Execution of the mission is conducted by subordinate organizations from their computer workstations. Once the execution of the mission is initiated, the computer will create

conditions and effects that the units would experience if they were actually conducting operations over the real terrain.

EXPECTATIONS FROM SIMULATIONS

What can we expect from this type of simulation? Commanders and staffs can be trained and unit readiness can be maintained. This training can be conducted at minimal cost when compared to actually moving units in the field. Standardization of operations and the development of unit standard operating procedures manual are easily accomplished. The actual production of written and oral orders as well as the communications process throughout the command can be evaluated.

We can also expect that simulations will be realistic enough to replicate the stress of battlefield conditions and events. The effects of weather, time, space and equipment capabilities must be factored into the simulation. Real-time events such as road movement and resupply must occur in the same time period as actual conditions and provide the same effect as outside the simulation. Without realism simulations rapidly loose training effectiveness.

We cannot presently expect simulations to predict the specific outcome of an operation in a training environment. More accurate prediction may become possible as the new family of simulators is developed. Simulators must be used to assist in developing and maintaining readiness not as a validation of operational planning. Critical factors such as leadership,

morale, terrain, weather and level of training are not included in the current simulations in sufficient detail to provide the analysis needed to determine if a unit is prepared for war. We must also remember that the simulation is not the trainer but a stimulus for training. Commanders retain the responsibility to train their soldiers and units with the assistance of various simulators.

CURRENT AVAILABILITY OF SIMULATORS

PROJECT SIMITAR

SIMITAR (Simulations for Advance Readiness in Training) is a Congressionally mandated program to improve the training and readiness of high priority Army National Guard combat brigades by providing advanced technologies for their training. The Defense Advance Research Projects Agency (DARPA) began Project SIMITAR in 1991 and was designed to create a near-ideal learning and training environment.[14]

SIMITAR maximizes the use of existing off the shelf computer hardware to meet the needs of the reserve soldier. Emphasis is placed primarily on the critical tasks needed by soldiers to achieve combat readiness and meet the needs of the unit's wartime requirements. SIMITAR devices provide the capability to train and retrain on a particular task until mastery is achieved.

SIMITAR is designed to enable Army National Guard soldiers to increase combat readiness through the use of emerging technologies at their local armories or from their homes by the use of government owned computers. The intent of SIMITAR is to reduce the post mobilization training from ninety days to thirty five to forty days.

SIMITAR training devices and simulators are easily broken into three categories: individual trainers, collective trainers and battle staff synchronization systems.

INDIVIDUAL TRAINING

Desktop Reconfigureable Simulators (DRS). These systems allow the user to be immersed in the virtual world. This system is a low cost desktop that can be reconfigured to represent a different vehicle in the virtual world. Weapon controls and driver input can be varied based on the vehicle configuration. The primary focus of this simulator is to train the combat support and combat service support leader and soldier in key leader skills by using a virtual environment.[15]

Virtual reality Maintenance Training Simulator (VMAT). The VMAT provides both organizational and direct support maintenance personnel with a series of three-dimensional interactive scenarios that are adaptable and are produced by a low cost interactive PC based simulation. VMAT can be used in the classroom or maintenance shop or in the field. Training for the M1A1 Tank and M2 Bradley Fighting Vehicle is available ,as well as Direct Support (DS) level training on troubleshooting the TOW 2 missile system.[16]

Battle Staff Training System (BSTS). The BSTS operates from a multi-media CD ROM capable computer and supporting text material. The CD ROM disks provide numerous, interactive training lessons for the Brigade and Battalion staff that provide training in critical skills.

Pen-Based, Electronic Network for Command Information Linking. (Pencil). This system is based on a laptop computer that is capable of high speed graphic production and high speed data transmission. These laptops are issued to commanders from company to brigade as well as all the primary staff officers in a brigade or brigade equivalent. The laptops have high speed modem capability to a central server. Commanders and staff are able to access maps of various training areas and use the map to make overlays for training purposes. These maps and overlays as well as formatted messages are sent electronically to the commanders and staffs involved in the training. The laptops also have e-mail and basic data transmission capability. This allows the rapid transmission of written and printed materials to those involved in the exercise.

Using this system commanders and staffs are able to communicate when required, not just during the scheduled drill period. This system allows continual training and preparation for the scheduled drill without the requirement to travel to the armory. Available training time during scheduled assemblies, when soldiers are present, can be maximized by the use of this system.

COLLECTIVE TRAINING SYSTEMS.

The Conduct of Fire Trainer (COFT) provides a training vehicle for the M1 series tank and the M2 Bradley Fighting

Vehicle. This is the primary simulator that has been used by the Army since the early 1980's and trains the vehicle commander and gunner

The COFT is either stationary or vehicle transportable. It does require a permanent concrete pad and special electrical connections if used in the portable mode. The COFT tracks by computer the scores for each of the simulated engagements and lists procedural faults. A trained evaluator controls the system and selects the scenarios based on computer generated evaluations. The audio coordination is recorded on tape and is used by the evaluator to conduct a critique of the exercise in conjunction with a replay of the computer generated engagements.

The COFT is an excellent trainer to improve the vehicle commander and gunner training level but does little to integrate the other crew members. Live fire with armored vehicles requires close and continuous coordination between all member of the crew.

The COFT although quite effective for what it was designed to do is an expensive piece of hardware. The initial cost of over one million dollars coupled with a maintenance contract and transportation costs limits the current distribution to one per battalion. Training time available to a tank battalion must be shared and operational costs limit the effectiveness of this device.

The development of the Full-Crew Interactive Simulator Trainer (FIST) was conducted to reduce the training shortfall of not training the complete crew. The FIST is a full crew vehicle appended training simulator. The simulator is connected to a powerless, stationary, sheltered M1 or M2. Computer monitors in front of the vision blocks provide a view of the scenario to each of the four crewmen. Cables from a master computer attach to the vehicle fire control system. A trained evaluator operates the master computer and selects the scenarios to be conducted and scored. Similar to the COFT, the evaluator records the communications between the crew and utilizes it to conduct an AAR.

The inclusion of the entire crew in the exercise coupled with the use of an actual vehicle provides a distinct training advantage over similar training devices such as the COFT. The crew is required to conduct their duties in coordination and in the confined space of an actual vehicle. This system still has drawbacks. The vehicle commander is not able to fire the .50 caliber machine gun and the loader training is limited. This is not a significant shortcoming and is easily trained immediately prior to actual range firing.

The cost of the FIST prototypes are approximately two hundred thousand dollars and are expected to be cheaper once production begins. In comparison to a COFT, a battalion could be issued at least four times the number of simulators for the price

of one COFT. FIST provides an improved training system that will recover the initial expenditure of training dollars in ammunition savings alone.

Engagement Skills Trainer (EST). This device is also an interactive computer and video system that accommodates as many as fifteen infantry individual and squad weapons from the M9 pistol to the M-60 machine gun. Indirect fire weapons such as the 120mm mortar can also be used with the EST. A classroom or other facility where direct sunlight can be blocked out, a wide screen image projection, and actual weapons modified with eye-safe lasers emitters compose the basic hardware. Individual scores plus collective weapons effects are scored and are available for individual and group AARs.

EST allows many of the small arms qualification tables to be fired without traveling to a firing range. Repetitive training on small arms skills for individuals plus squad fire control and distribution will allow soldiers to again maximize available field training time. Collective training begins upon arrival at the training site rather than requiring individual training to be conducted prior to the onset of collective training. As with other devices the one hundred fifty thousand dollar cost is rapidly recovered from savings in ammunition, travel and range operations costs.

Simulation Network- Mobile (SIMNET) This system utilizes two semi-trailers containing four simulated M-1 interiors. The purpose of SIMNET is to train tactical skills instead of gunnery training. This device is adaptable for training missions from individual crew through battalion level. Battalion level training is generally conducted from fixed sites rather than the semi-trailer configuration. SIMNET is an effective training device and has been used to replace Tank Gunnery Table XI which is training for live fire Table XII. To accomplish this however other simulation devices must be incorporated.

The advantage of SIMNET is it's mobility which allows support to units at home station. ARNG SIMNETs have been modified to allow linking numerous SIMNETs across the nation through the Defense Simulation Internet(DSI).[17] In this configuration, SIMNETs allow separate ARNG units to conduct command and control exercises concurrently with other geographically separated units.

Deployable Force on Force Instrumented Range System (D-FIRST). This is a satellite based, Global Positioning System (GPS) that provides position location and engagement simulation for live maneuver exercises. D-FIRST not only integrates firing vehicles into the scenario but provides locations and kills of non-combat vehicles such as trucks requiring combat support and combat service support activities.

An AAR capability that includes audio and video recordings of the exercise makes this an effective training device. The system can also be linked to other locations by the DSI network and greatly enhances the quality and manner of training.

BATTLE STAFF SYNCHRONIZATION SYSTEMS

JANUS is a computer based, high resolution, interactive simulation that uses color graphics to illustrate realistic events in simulated combat. It is able to detail individual soldiers and weapons systems as well as units from squad to brigade.

The system allows simultaneous training of combat leaders from platoon level through brigade on tactical and decision making processes. Simulated atmospheric and battle effects are integrated into the simulation.

JANUS can support twenty four hour operation and it has the capability to record major activities on a large television monitor greatly enhancing After Action Reviews.

JANUS can also be networked to remote sites via a telephone modem.[18] This remote capability allows brigade sized elements to conduct exercises that include subordinate battalions and companies without the subordinate units leaving home station.

Brigade/Battalion Simulation (BBS) and the Corps Battle Simulation (CBS) are both systems that are networked computers that provide the computer generated scenario that drives a two-

sided, free play, real time training environment. BBS provides brigade and battalion commanders and staffs the computer supported training device to train at the tactical level.

It provides tactical simulation in air and ground warfare between opposing units and the resupply, medical, and maintenance required to support the conflict.[19] This high resolution model can be linked to other simulation systems and illustrates weapon and support systems at the item level.

CBS is quite similar to BBS but is designed for training Corps/Division Commanders and staff. The Battle Command Training Program (BCTP) uses this simulation to train corps, division and brigade staffs. CBS supports the Warfighter Program and can be linked to other remote systems such as SIMNET. This allows integration of subordinate levels of command into exercises without displacing these units to the training site.

Battle Staff Training System (BSTS). The BSTS is a computer based multimedia training system with training support packages for the commanders and individual staff officers of armored and mechanized infantry at battalion and brigade level. The training support packages use multimedia lessons consisting of text and computer-based instruction to train staff officer on tasks required for the various staff functions at battalion and brigade.[20]

COBRAS Brigade Staff Exercise. Combined Arms Operations at Brigade Level Realistically Achieved Through Simulation (COBRAS)

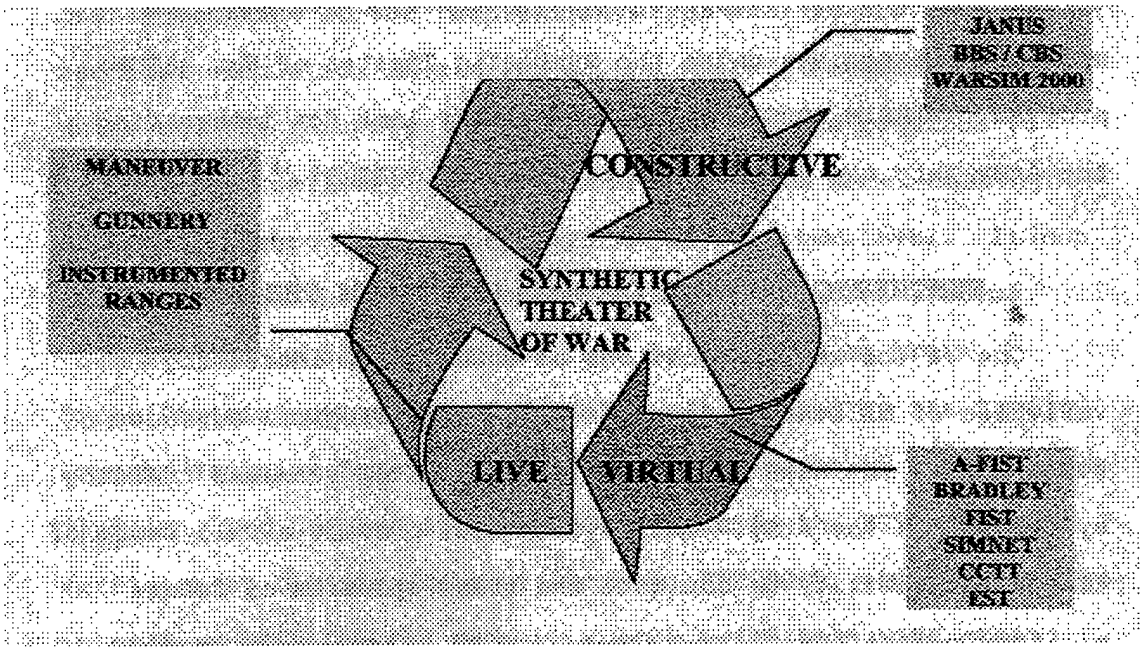
is designed to provide command and control training for selected members of the brigade staff. It is a structured, simulation-based, scenario embedded program that requires integration and synchronization among the staff in order to accomplish the mission. Twenty four staff vignettes are included in this simulation. These vignettes are a series of independent, controlled exercise that allow brigade staffs to isolate a small group from the staff in order to practice integration and synchronization in the context of a single mission. [21] These vignettes use the Janus and BBS system and can be integrated with other training exercises through these systems.

Warfighter Simulation 2000 (WARSIM 2000). This computer system will be the primary contribution from the Army to the Joint Simulation System (JSIMS). WARSIM 2000 will provide a high quality environment where commanders and battle staffs can train. Increased realism over existing technology will be achieved by allowing units to interact with the simulation using TOE equipment. This training will be normally conducted in field conditions, not in simulation centers. It will replace most of the existing simulation systems but will also interface with any legacy systems.

SYNTHETIC THEATER OF WAR (STOW)

This paper has devoted a great deal of thought to describe the emerging technologies of distance learning and simulation. As previously stated, TRADOC is developing a seamless training system with the Army that includes both the AC and RC. The distance learning component of this system has become well accepted and is now widely used.

Simulation devices must become as widely available and as accepted as distance learning. This is possible through the use of STOW. STOW incorporates the three training domains-live, virtual and constructive.



Integration of Virtual and Constructive Domains[22]

INTEGRATION OF VIRTUAL AND CONSTRUCTIVE DOMAINS

STOW allows the integration of simulation devices into a seamless training architecture. Virtual training device linked through a distance learning network, the Internet or a local network allows unit members to be trained simultaneously on the same task and to the Army standard.

Linkage to constructive trainers such as JANUS or SIMNET incorporates higher levels of command into the training exercise. With enough virtual systems available, it is possible to train company to brigade or higher level units.

INTEGRATION OF LIVE TRAINING

Live training exercises remain the foundation of training in the second training revolution. Simulation, therefore, must be balanced against the actual conduct of maneuver and live gunnery as well as field training conditions. All soldiers must train in the field under simulated combat conditions not just in the virtual or constructive environment. STOW can provide seamless integration of the three training domains by linkage of live maneuver and gunnery training to virtual and constructive training. For example, linkage of JANUS and SIMNET to company level maneuver and gunnery will seamlessly integrate company through brigade level training. Brigade and battalion staffs would train on JANUS (constructive domain), company cells on SIMNET (virtual domain) and at least one company conducting live

maneuver and weapons firing. The constructive and virtual domain need to operate from the same terrain data base as the live maneuver/weapons training. Unit movements, simulated combat events as well as sustainment activities would appear transparent and seamless to all echelons of the command.

IMPACT OF SIMULATION AND DISTANCE LEARNING ON ARNG DEPLOYABILITY

The use of the emerging technologies of distance learning and simulation provides many benefits. One of the most important is the ability to conduct training and sustainment of unit and individual skills. When this training is compared to live training or attendance at schools away from the unit armory, it is more cost effective and allows for repetitive training until standards are met.

Gunnery simulation, regardless of weapons system, provides an effective and efficient method of increasing individual and crew proficiency. The majority of tasks required for qualification can be accomplished using a simulator. Cost savings in vehicle maintenance, ammunition and fuel as well as other costs are realized making this type of training well adapted for Army National Guard use.

Distance learning and simulations also increase the available training time at unit annual training periods. This increased training time allows for many post mobilization tasks

to be completed prior to mobilization. As an example, a RAND study conducted in 1996, recommended that post mobilization gunnery for ARNG heavy Enhanced Brigades consist of firing all gunnery tables up to and including Tank Table XII.[23] Tank table XII is now accomplished by ARNG units during Annual Training. The use of simulator training during the training year allows these unit to successfully fire Tank Table XII during Annual Training . Based on this same RAND study, units able to successfully accomplish Tank Table XII reduce post mobilization training by eleven days.

The effectiveness of using emerging technologies is possibly best demonstrated by the achievements of several of the ARNG enhanced brigades. The post mobilization time for two of these units have been reduced from 90 plus days to forty two days to achieve tactical proficiency. This assessment of post mobilization training is stated in the Training Assessment Model for these units completed by their associated AC division commander or Regional Training Brigade Commander. [24]

Simulation does not however replace all training that is needed to prepare units for combat. Soldiers and units still need to operate in a field environment using individual and unit equipment. Actual use of individual and unit equipment coupled with qualification with individual and crew served weapons gives soldiers the confidence in their ability to fight and win. Unit commanders must be able to command and control their units in a

field setting. They must be able to meet real world problems associated with training in the live domain. The use of virtual and constructive training devices prior to live training frees up the necessary training time to let unit commanders and staffs deal with the actual problems of conducting and sustaining unit training in the live domain.

CONCLUSION

This paper has examined how the ARNG can integrate and utilize distance learning technology and simulation devices to improve the combat readiness of ARNG soldiers and units. It would appear that by simply acquiring the hardware, the software and the connectivity to link a myriad of systems together that the ARNG could overcome all training constraints. This is not the case however. What has been illustrated in this paper is an optimum solution that has been portrayed from a positive perspective. There are many obstacles yet to be overcome.

An obstacle that is essential to overcome is the linkage of these systems. JANUS and WARSIM 2000 are designed to be linked to the emerging Army C4I systems and JSIMS but require an architecture that will "simulate" real world command and control systems. Developing these linkages is a complex challenge that must be taken on.

Funding of not only the acquisition of these diverse systems to support distance learning and simulation requires a major

shift in resources. Training funds saved by the use of these emerging technologies will not be immediately available to offset the additional acquisition costs. Over time, savings from reduced ammunition expenditure, vehicle maintenance and travel will "repay" the up front costs of acquisition.

The firm commitment of the ARNG leadership at both the state and national level is necessary to not only redirect resources to fund these emerging technologies but also to realize that these technologies are viable and unique ways to train soldiers. Acceptance by the ARNG leadership that distance learning and simulation are effective training tools will enable units and soldiers to receive the simulations needed to maintain combat readiness.

Simulators cannot fully replicate all aspects of the live training environment. Additionally, with the exception of conduct of fire trainers, the number of simulators available to the National Guard remains small and they are generally limited to a few installations.

Despite the obstacles, the Army National Guard has made enormous strides in using emerging technologies to conduct the highest level of training and increase unit readiness. The Army National Guard must continue to provide its members the toughest, most demanding and realistic training by the use of these emerging technologies. A skillful balance of the three training domains, live, constructive and virtual will provide this

demanding and realistic training. If we lose this balance we will not only deprive our soldiers of quality training but enter the 21st century without realizing the enormous potential of these emerging technologies.

ENDNOTES

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[3] "Army National Guard Vision 2010," National Guard Bureau:2.

[4] Ibid.,2.

[5] Michael G. Moore and Greg Kearsley, Distance Education (Belmont, California: Wadsworth Publishing Company, 1996. 2.

[6] Ibid.,20.

[7] Ibid.,23.

[8] Ibid.,63.

[9] Ibid.,73.

[10] Ibid.,65.

[11] Ibid.,74.

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