

A Funny Thing Happened on the Way to an LVC Integration: Great Training

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ABSTRACT: *The Joint Training Experimentation Program (JTEP) is a multiphase, multiyear effort to develop a distributed training capability for the California National Guard (CANG) that includes live, virtual, and constructive (LVC) training simulation to support multi-echelon training. The second JTEP demonstration was a battalion-level exercise conducted in December 2003. This demonstration linked the Joint Combat and Tactical Simulation (JCATS), a constructive simulation, the Close Combat Tactical Trainer (CCTT), a virtual simulation, the Deployable Force-on-Force Instrumented Range System (DFIRSTTM), a live, instrumented training system, and observers at the Office of the Adjutant General (OTAG). JCATS and CCTT were located at Camp San Luis Obispo, CA, DFIRST at Camp Roberts, CA, and OTAG observers at Sacramento, CA.*

Billed solely as a demonstration of a technological capability in integrating LVC systems, the December demonstration included an early realization of an eventual JTEP programmatic goal—providing real training value. This unanticipated outcome was as exciting to the program developers as it was to the soldiers participating. At the conclusion of the exercise/demonstration, soldiers and NCOs of the 3d Battalion, 160th Infantry (Mech) uniformly praised the excellent training they had received in this LVC environment. During the work-up to the actual demonstration, they quickly recognized the potential training value of the integrated LVC system and modified the original scenario to take advantage of the training value provided. For example, as a result of this linkage, armor soldiers in the Close Combat Tactical Trainer (CCTT) were delighted to be able to operate as part of a Task Force (working in conjunction with other Task Force elements modeled in JCATS), rather than only as a tank platoon, as is usually the case with the CCTT suite used by the CANG.

This paper provides an overview of the exercise, the scenario used (both the original and the modified versions), and the participants' observations about the value of the training they received and how they might use an LVC training capability in their overall training regimen. It also documents lessons learned in using an integrated LVC training environment to enhance combined arms training.

1. Introduction

The second demonstration of the Joint Training Experimentation Program (JTEP) was conducted on 11 December 2003 in Camp Roberts, Camp San Luis Obispo, and Sacramento, California. This event was intended to be a technology demonstration in support of live, virtual, and constructive (LVC)-based training. While the ultimate goal of JTEP is to provide a leave-behind LVC training system, the event was not intended to provide training per se. The demonstration resulted in a number of significant technical accomplishments, which are documented in an overview paper presented at the spring Simulation Interoperability Workshop (SIW) [1] and three companion papers submitted for this workshop [2-4]. The surprising result of the demonstration is that the participants received great training benefit. This benefit and its potential implications for LVC-based training are the subjects of this paper.

1.1 JTEP overview

The JTEP is a National Guard Bureau program managed by the California National Guard (CANG). The National Guard currently uses advanced LVC systems to support training, but each system is stand-alone. JTEP was conceived to bring to the National Guard the benefits of integrating existing or readily available training environments, and to enable LVC interaction over nondedicated wide-area networks (WANs).

JTEP is an experimentation program that will leverage the integration successes of other programs whenever possible, but will also advance the state of the art in system and simulation interoperability as needed to meet National Guard training needs. JTEP started with an initial study to determine which candidate systems and integration mechanisms will achieve the greatest training impact. After the initial study, the first demonstration, linking live and constructive training systems, was conducted in May 2003 [5]. The second demonstration, conducted in December 2003, built on the successes of the first and the results of the initial systems analysis study.

This second demonstration provided a battalion-level training capability for the CANG by linking existing live, virtual, and constructive training systems. In particular, JTEP linked two live training systems, the Deployable Force-on-Force Instrumented Range System (DFIRST), which provides instrumentation and engagement simulation for ground vehicles, and the Integrated Global Positioning System (GPS) Radio System (IGRS), which provides tracking for dismounts and interface to the Multiple Integrated Laser Engagement System (MILES) 2000 for engagement

simulation. Live entities were able to engage other live entities and constructive Joint Combat and Tactical Simulation (JCATS) entities. Additionally, the demonstration included the Close Combat Tactical Trainer (CCTT) virtual simulation, which was capable of engaging JCATS entities, and virtual-constructive unmanned aerial vehicle (UAV), which had a common view of the battlespace and all LVC entities.

In accordance with JTEP program goals, each demonstration is designed not only to determine the LVC systems that provide useful training but also to establish an integrated LVC training capability that can serve as the basis of a leave-behind capability suitable for routine usage in training. This configuration, therefore, provided the basis for a battalion-level LVC training capability. Additional information on the JTEP program can be found at <http://www.jtepforguard.com>.

1.2 Scope and organization of this paper

This paper is focused on the training value provided during the December JTEP demonstration and the potential implications for LVC-based training in general. Section 2 provides an overview of the demonstration including the scenario and a brief description of the system architecture. Section 3 provides a background on US Army training. Section 4 discusses the training value provided, and Section 5 addresses implications for LVC-based training.

2. Overview of the JTEP LVC Demonstration

2.1 Scenario

The scenario used for the JTEP LVC demonstration is a Movement to Contact mission for a Mechanized Infantry Task Force against a Counter-Reconnaissance Element. The primary participating unit was the 3d Battalion, 160th Infantry (Mech) (3-160 IN). The original scenario called for two infantry company teams and one armor company team advancing along two axes to OBJ WASHINGTON. One infantry company team instrumented by DFIRST and IGRS advanced along AXIS BLAZERS in Camp Roberts, California, toward OBJ STUART to support by fire the main effort; the second infantry company team and the armor company team, advanced along AXIS NETS in Grafenfels on OBJ WASHINGTON.

In response to a request from the 3-160 IN, the scenario was changed after the first day of demo rehearsals to take advantage of the LVC integration and cross-attach the virtual and constructive units, represented in CCTT and JCATS, respectively, and divide AXIS NETS into AXIS NETS and AXIS KINGS. The virtual CCTT M1s and the constructive

M2s were task organized as they would be operationally. Figure 1 is a notional depiction of the eventual scenario developed. In this scenario, the movement to contact mission remained intact, but the virtual and constructive forces were task organized in order to match tactical doctrine more closely. The mission of the live forces remained as originally planned, i.e., advance along AXIS BLAZERS to OBJ STUART, then support by fire (SBF) the advance on OBJ WASHINGTON. An armor-heavy team (three CCTT-modeled M1s [company commander plus two platoon leaders] with CCTT SAF tethered M1s as the platoon elements and one platoon of JCATS-modeled M2s) advances along the main axis of advance, AXIS NETS. The remainder of the force, a company team of JCATS-modeled M2s and a platoon of M1s (modeled as one CCTT manned module and three attached CCTT SAF entities) advanced along AXIS KINGS to provide support by fire from OBJ LEE.

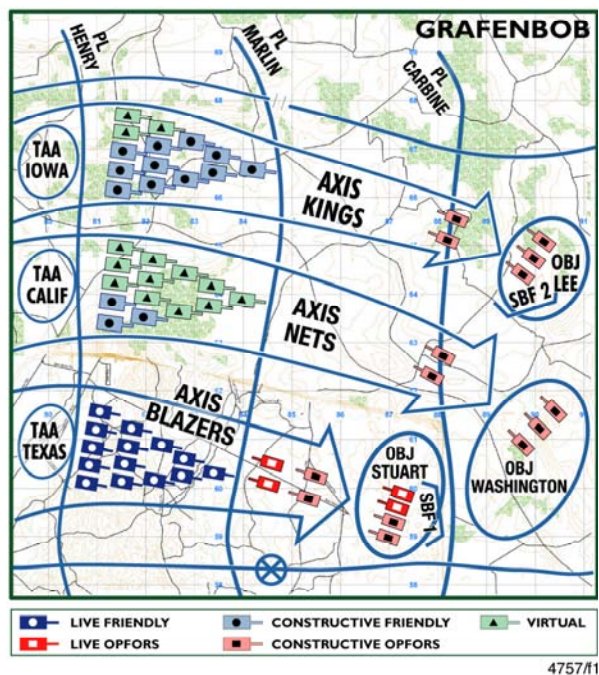


Figure 1. JTEP LVC Demonstration Scenario

As shown in Figure 1, the opposing force (OPFOR) for the live company was a mix of live, instrumented entities and constructive JCATS entities. As was done in the previous JTEP LC demo [5], JCATS entities were mimicked by pop-up tank gunnery targets to provide a visual stimulation to the live crews. The OPFOR for the virtual and constructive forces advancing along AXES NETS and KINGS were all constructive JCATS entities.

2.2 Demonstration Architecture

The distribution of components between the Camp San Luis Obispo and Camp Roberts sites is shown in Figure 2. The Tactical Operations Center (TOC),

constructive JCATS elements, virtual CCTT elements, and virtual UAV were at Camp San Luis Obispo. Live, instrumented DFIRST and IGRS elements and pop-up targets (mimicking JCATS constructive entities) were at Camp Roberts. Communications between the Task Force (TF) commander and his staff and the constructive team commander were provided by DIS Radios.

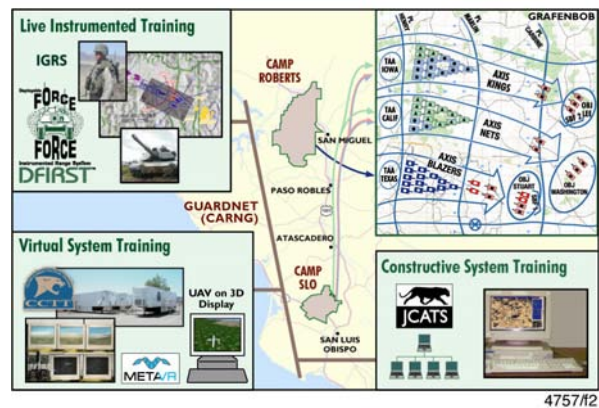


Figure 2. JTEP LVC Demonstration Components Mapped to Scenario Entities

3. Background on US Army Training

The Army assumes a responsibility to the nation and to soldiers' families to ensure those soldiers' safety and survival consistent with the exigencies of operational missions. Casualty generation, an unfortunate reality in combat, is not taken lightly by Army leaders, and part of the Army's leader ethos is defined by the responsibility that leaders owe to their soldiers.

It is axiomatic that well trained units perform well in combat. The results of the early days of the Korean War in 1950, after the North Korean (NK) invasion, remain key teaching points for Army leaders as they prepare for war. Since the Korean War, the expression, "No more Task Force Smiths!" has dominated Army thinking and training philosophy.¹ Training is the most

¹ Task Force Smith, commanded by Lieutenant Colonel (later Major General) Bill Smith, was virtually annihilated by the North Koreans very shortly after the initial NK invasion in the summer of 1950. The task force had been on occupation duty in Japan, as had much of the Army's Pacific Theater contingent, and had not conducted any combat training, including simple rifle marksmanship (they had no ammunition!), in several years. Thrown into the fray to stop the NK juggernaut, TF Smith suffered over 85% casualties in its first 72 hours of operations against the enemy. TF Smith was not the only unit to whom this happened, but it was the best known. Army leadership acknowledged that lack of training was the primary cause of this debacle, and Army leaders have vowed ever since then to make sure this never happens again.

important mission the Army has during peacetime, and Army Chiefs of Staff have echoed this philosophy now for over fifty years.

The foremost contemporary exponent of this was General Carl Vuono, Chief of Staff from 1988 through 1994. Arguably, General Vuono's greatest contribution to the Army during his tenure was the publication of *Field Manual (FM) 25-100, Training the Force*, and *FM 25-101, Battle Focused Training*. These manuals were the outgrowth of Vuono's training philosophy, forged in the crucible of the Vietnam War. During Vietnam, there were no TF Smiths per se, but the US Army came close on a number of occasions.² These close calls, in the eyes of many midlevel and junior leaders at that time, were caused by lack of proper training — in particular, effective unit training. General Vuono, having served as a major and lieutenant colonel battalion commander in Vietnam, was convinced that effective unit training would prevent unnecessary casualties and presage greater tactical success. As Vuono and his peers, most of whom shared his passion for training, gained influence in the years after the war, these beliefs became more and more commonly held throughout the Army.

By the time he became chief of staff, Vuono was able to virtually dictate the Army's training philosophy. The publication of the two FMs mentioned above was his means of implementing his own training philosophy on the Army. Even as chief of staff — the senior serving Army officer on active duty³ and a four-star general — Vuono invested tremendous personal time on these two volumes, personally editing and rewriting large sections of them prior to publication. He invested tremendous personal capital in introducing them to the Army. The documents were well accepted and enthusiastically used at the unit level, and they have been instrumental in driving Army training for nearly 20 years.⁴

² *We Were Soldiers Once, and Young*, by LTG (Ret) Hal Moore, provides an excellent example of this type of situation.

³ Except when the chairman of the Joint Chiefs of Staff is an Army general officer.

⁴ The author met General Vuono in May 2001 at the National Training Center at Fort Irwin, CA, while undergoing a brigade-size rotation as a Tank Battalion commander just after the conclusion of Desert Storm. General Vuono visited every unit who underwent an NTC rotation during his tenure. Because of his belief in the training the NTC offered, that installation and its vaunted opposing force • at the time better than the Soviet/Russian enemy it portrayed • is credited with being the source of the US success during Desert Storm.

Times change, however. While FMs 25-100 and 25-101 are still good basic philosophy, they were prepared for an army that faced the Soviet threat in Central Europe. That enemy exists no longer, and a newer, more unstable, more technologically capable enemy has emerged since the fall of the Soviet Union. US and other allied armies now face a series of threats across a wide spectrum of conflicts in which the actors are both national and non-national. Religious and ethnic groups become potential enemies; terrorists have captured the world's attention following the attacks on the World Trade Center and the Pentagon. This is a new world with new threats, and the US Army must adapt to that change or be unable to defend the nation — its primary mission.

In reacting to the changes presented since the demise of the Soviet empire, the Army has published a new, capstone training document, *FM 7-0, Training the Force*, a large part of which discusses the value of live-virtual-constructive training and the need to participate in it whenever possible. It also acknowledges that full integration has not occurred — yet. That is about to change.

New training methods have become available to soldiers and units in the last 10 years that could not have been dreamed of when this author pinned on second lieutenant's bars in June 1970.

4. Training Value Provided

Although JTEP is a program to develop an LVC training capability for the National Guard, the JTEP LVC event was designed as a demonstration of a technological capability. Soldiers participated in the exercise as though it were a training event, but the battalion leadership was briefed that, for this iteration, the focus was on demonstrating the potential of the LVC technology for providing useful training, not specifically on providing training during the exercise. The result, however, was much more positive. The battalion commander, who originally faced the assignment of supporting the JTEP demo with skepticism, quickly embraced the system. He and his staff took over the exercise and made modifications to the scenario to maximize the training value they recognized with this system. In the end this JTEP technology demonstration provided some of the best training soldiers had ever received in the National Guard.

4.1 Evolution of Demonstration Events

From the perspective of the 3-160 IN, the JTEP demonstration began several weeks before the actual event in which the unit was tasked to participate. Unit commanders were given a crude map of the GrafenBob

playbox and asked to develop an operational order (OPORDER) for a movement-to-contact mission. They reacted with considerable trepidation to the tasking. They had seen or heard of previous examples in which soldiers were used as “training aids” to demonstrate some new technology. Past experience suggested that the technology was the star of the show and they would get no value whatsoever from their participation. Nevertheless, they prepared a simple OPORDER with live forces operating in the Camp Roberts portion of GrafenBob on one axis and the virtual and constructive forces operating on a second axis in the Grafenfelds portion.

Task force participants began to arrive at Camp Roberts and Camp San Luis Obispo on Friday night, 5 December. On Saturday and Sunday, 6–7 December, each group became familiar with the training systems it would use. Four M1 tank crews received familiarization training on the CCTTs. The JCATS company received training on JCATS,⁵ and the live company received instruction on DFIRST and IGRS. Immediately, the soldiers recognized a difference. In particular, the DFIRST, IGRS, and JCATS systems were far easier to grasp than originally thought. By Sunday evening, all of the participants were proficient on their respective training systems.

It was also at this time that the unit commanders began to realize the potential training value of JTEP. In their minds, the JTEP technology demonstration was beginning to become a training opportunity for them. Accordingly, they began to take over the exercise. The first step was to change the scenario from separated CCTT and JCATS company teams along the northern axis of advance into two separate axes. The JCATS and CCTT entities were to be cross-attached to more closely match doctrine, according to which the company teams would normally be divided between the main team along AXIS NETS with two platoons of tanks and one platoon of Bradleys, while the team along AXIS KINGS would have one platoon of tanks and two platoons of Bradleys. The JTEP technical team had not anticipated such a configuration change,

⁵ In this exercise, the soldiers became the JCATS operators; no dedicated “pucksters” were used. There was originally some concern that the soldiers would be able to become competent JCATS “pucksters” in an abbreviated weekend training session. This concern was never realized, however. The soldiers started learning JCATS with hands-on instruction in mid-morning on Saturday and were proficient for this demonstration by midday Sunday. In an extreme case, a SPEC-4, who became the JCATS OPFOR, became proficient on JCATS in 45 minutes. During the course of demo rehearsals, he became so proficient in JCATS that his OPFOR strength eventually had to be reduced to give the BLUE Forces a chance.

but with virtually no time to evaluate the ramifications, we made the change. The JTEP system was sufficiently robust to accommodate it (i.e., the correlated GrafenBob terrain enabled cross-attached CCTT and JCATS entities to work together as company teams), and the resulting impact on training value was enormous.

From Monday, 8 December, through Wednesday, 10 December, the team and the 3-160 IN conducted rehearsals of the actual demonstration, scheduled for Thursday 11 December. During this time the technical team identified and addressed any remaining issues, and the 3-160 IN used the system for real training. As a result, details of the scenario and the representative unit graphics were changed two more times. Also, unit commanders began to see the result of real training taking place. In particular, the live forces at Camp Roberts began to become familiar with the OPFOR positions and became increasingly successful in engaging them early. Commanders began to give the OPFOR players additional leeway in their initial positions and maneuver so that the exercise would be more challenging to the Blue Forces.

By December 11, the technical team and the 3-160 IN were ready for the actual JTEP demo. The demo that day consisted of two separate exercise runs, one in the morning and one in the afternoon. Still, however, the unit commanders were making slight modifications to what was now in their minds a training scenario, and directed the OPFOR to make the scenario even more challenging.

4.2 Observations from the JTEP Team

During the demonstration, several key observations were made by the JTEP team on the potential for training value being provided by this event. The first was the realization of how easily the soldiers became familiar with the training systems involved. Though not a specific goal of JTEP, having LVC training systems that are easily grasped is a clear advantage: the supporting technology is more transparent to the training audience, so they can concentrate on training rather than on making the technology work correctly.

The second observation was the takeover of the exercise, mentioned above, by the 3-160 IN. This takeover not only reflected well on the realization by the unit that JTEP provided real training value, but also reflected well on the robust nature of the JTEP architecture. The architecture was able to adapt to the revised scenario and enhance the overall training value.

The third observation during the exercise was the level of enthusiasm of the participants. It was clear from the

outset that the 3-160 IN was far from being a “training aid,” as they had originally anticipated being. The soldiers were genuinely excited about the training opportunity they were given.

Finally, we could see that the soldiers had become completely immersed in the exercise. JTEP appeared to have succeeded in providing sufficient psychological fidelity in the linkage of LVC systems that, to the soldiers being trained, this was a completely seamless training exercise.

The psychological fidelity issue is relevant to a number of aspects of the integration. First, the CCTT-JCATS integration, based on correlated GrafenBob terrain, provided sufficient realism that the participants could operate in cross-attached units and could engage entities modeled by the other federate, even though the terrain correlation provided was only to about 1 m, which still permitted slight flying and burrowing of tanks. Participants reported the burrowing and flying, but dismissed it as typical of what they saw in CCTT when using CCTT SAF as additional participants in an exercise.

Second, there was some artificiality in the fixed nature of JCATS entities engaging live vehicles. Since the JCATS entities were mimicked by pop-up targets, they could not maneuver during an engagement. They could, however, go in and out of defilade. Still, the fidelity provided by this approach was sufficient to provide training value.

Third, the connectivity between participants provided by DIS radio networks served to link all LVC participants with the battalion TOC and linked CCTT- and JCATS-based cross-attached company teams. The psychological fidelity provided by this linkage was evident in the soldiers’ work together during each scenario.

While the fidelity could not be claimed to be perfect, and fidelity was not measured because measurement of this aspect of the demonstration was not planned ahead of time, the psychological fidelity was sufficient to provide the enthusiasm and responses that were consistent with a great training exercise.

4.3 Response from the Unit Being Trained

The soldiers of the 3-160 IN acknowledged some of the key observations mentioned above. In particular, they recognized the potential for training value provided by this architecture and took over the exercise early on in order to maximize the training value provided. This event was ultimately the key indicator in demonstrating that the JTEP demo provided real training value.

The soldiers also commented on the ease of use of the systems, in particular the ease of use and the very short time required to install DFIRST instrumentation on the live vehicles. While such a comment is applicable only to the DFIRST system and does not reflect directly on JTEP, it does highlight the importance of ease of use of training systems. Perhaps this is an obvious lesson learned for any training system, but it should nevertheless be considered in the development of LVC training architectures. The training audience will notice the overall ease of use of an LVC environment. Conversely, an overly complex LVC system can be expected to detract from the training provided.

The unit commanders commented specifically on the value of the multi-echelon training that was provided as a result of the demonstration. For each system used, the soldiers received the training benefit associated with that specific system and level of training, but also received additional benefit from the direct interaction of soldiers in integrated systems as well as the benefit of working with the higher-level organization.

For example, armor soldiers in the CCTT were delighted to be able to operate as part of a task force rather than only as a tank platoon, as is usually the case with the CCTT suite used by the CANG. Part of the benefit came from having real human-in-the-loop controllers on JCATS operating the computer-generated forces, and another part came from working with the other levels of command involved in the exercise.

The commanders recognized that the system provided true multi-echelon training. They could train certain elements of their command in specific tasks, areas in which they needed more training, e.g., crew-level interaction in an M1 tank, while they were providing training to the company and battalion. As an operational training regimen, commanders could rotate elements through each type of system over the course of a training period to ensure that everyone received the type of training needed.

One of the comments received was noteworthy in that it revealed an understanding of the capabilities of JTEP beyond what was specifically demonstrated in December. In particular, commanders recognized the value of distributed training in turning travel time to training time. Two critical limitations of National Guard training are the geographic distribution of soldiers and the availability of training time. A typical CANG unit may have individual soldiers scattered over a 50-mile radius (or more) from the armory, and the armory may be 200 miles from the nearest training area. Since the training time available is limited to weekends and an annual two-week training period, the

time required to get individual soldiers to the armory and then to the training area can consume most of the time available for a weekend training event. Generally, a unit spends Friday traveling to the training area, trains on Saturday, and packs up and returns home on Sunday.

Units commanders realized that even though the December JTEP demonstration linked soldiers only 50 miles apart, the principle of the program enabled National Guard units to train remotely, from their armories, thereby turning some of the time required to reach the training site into useful training time, or, in their words, “turning windshield time into training time.”

Finally, perhaps the most telling comments received from the training audience involved the overall evaluation of the demonstration as a training exercise. Unit commanders called the December JTEP demonstration “a watershed training event.” Individual soldiers wrote letters claiming this to have been some of the best training they had ever received as Guardsmen.

In short, the participants felt that JTEP LVC demonstration was a confirmation of the value of LVC integration for training. LVC integration works, and it provides a training capability that participants felt was second to none.

5. Potential Implications for LVC-Based Training

Ideally, in a technical paper we should be able to present concrete evidence of the training value provided by the JTEP demonstration. Unfortunately, this demonstration was intended only as a technology demonstration, so no provisions were made to collect quantifiable data on training value. Only from the observations made by the JTEP team and the participants can we derive some sense of the training value provided by this exercise and then extrapolate that to the broader issue of the overall training value of integrated LVC exercises. Nonetheless, the qualitative data obtained from participants was so strong that its value cannot be overlooked. This data proved to be a tremendous user validation of the architecture and process, and serves to strengthen the underlying philosophy of the LVC linkage.

From another similar-size exercise conducted by the Guard we do have a source of evidence of good training value. Operation SUMMER THUNDER, conducted in August 1997 at Fort Dix, New Jersey [7], was a training exercise involving live and constructive elements of TF 1-114; however, they did not have the level of technical integration present in the December

JTEP demonstration. This exercise was designed specifically to be a training event, and a considerable amount of detailed planning was involved in staging it. As a result of the Planners’ attention to detail and strict adherence to Army training doctrine, the exercise was considered a major success. Measures of success were similar to those witnessed in the JTEP demonstration. In particular, the author noted a sense of excitement, positive attitudes, and motivation on the part of personnel. Commanders felt satisfied that their soldiers had achieved a necessary level of readiness as a result of this exercise.

The participants in the JTEP exercise also exhibited a level of excitement and enthusiasm that indicated that they had received truly great training value. Indeed their comments after the exercise confirmed these indications. The fundamental difference between the two exercises was that the work-up to SUMMER THUNDER included considerable and detailed attention to providing an excellent training experience, while the JTEP demonstration concentrated on the technical aspects of training system interoperability; the JTEP team devoted relatively little effort to developing a comprehensive training plan. One might conclude that the training value of the technical LVC integration could be comparable to that of a comprehensive training plan, but clearly more work is needed to validate this conclusion and confirm the quality of training value provided.

The responses from the unit commanders, however, are perhaps the best indication of the training value. They saw the value of multi-echelon training, the benefit of distributed training (turning windshield time into training time) even though they did not directly benefit from this exercise; ultimately, they expressed the view that this demonstration was a watershed event in the training of their units.

Another lesson learned concerns the issue of psychological fidelity. JTEP used nonmaneuvering JCATS entities to engage live vehicles, 1 m correlated GrafenBob, and DIS Radio networks to provide command and control. Though these steps are technically significant, obvious technical improvements could be made. Nevertheless, these mechanisms did provide sufficient psychological fidelity to support good training value. This result suggests that LVC integration need not be perfect in order to provide good training; it need only to be good enough to meet the needs of the training audience.

6. Summary and Conclusions

The JTEP LVC demonstration of 11 December 2003 was billed as a technology demonstration to illustrate how linked LVC training systems might be used in

Guard training. Instead, in a matter of days, the demonstration evolved into a great training exercise for the commanders and soldiers of the 3-160th Infantry (Mech). The participants took over the exercise almost immediately and modified the scenario to maximize the training value to the unit. From an observer's standpoint, the excitement was palpable, but the comments received from the soldiers provided the best evidence of a worthwhile training event. They saw the benefit of multi-echelon and distributed training and were able to conduct a battalion-level exercise with about 100 personnel, a critical benefit to the National Guard because so many units are being mobilized. They participants called this a "watershed event," and some called it the best training they had ever received in the Guard. In short, linking LVC training systems does provide great training value.

armor officer who has commanded armor and cavalry units through brigade level. He has over 33 years of experience as an Army trainer and training manager and was the operations officer for the 40th Infantry Division, Mechanized, during the Los Angeles riots of 1992 and the Northridge earthquake of 1994.

JOHN SHOCKLEY, Senior Research Engineer at SRI International, has 20 years of experience in test and training range instrumentation systems for the Army, Navy, and Air Force. He began working on modeling and simulation aspects of these systems and has since participated in DIS/HLA standards development activities for over 11 years, concentrating on integrating live and virtual systems. He is the JTEP project leader.

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Author Biographies

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