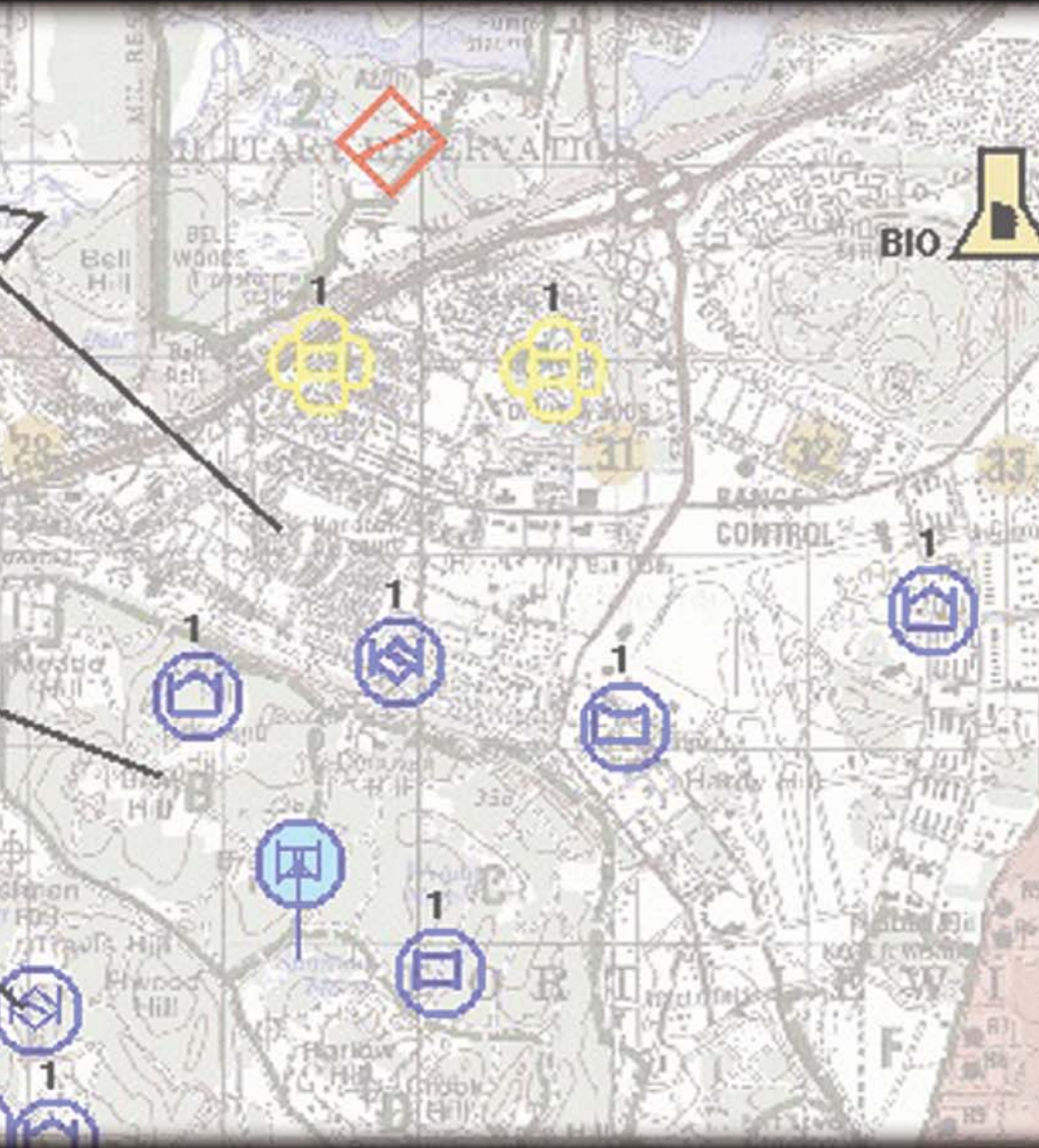


Blue Force Tracking

The Afghanistan and Iraq Experience and Its Implications for the U.S. Army





About the Author

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The fortunes of war have always favored commanders who have better and more timely information about what is happening on the battlefield, even on the other side of the hill. This is certainly true of recent conflicts in Afghanistan and Iraq, where the accomplishments of American forces have been truly remarkable.

Many factors, such as high-quality personnel, technologically advanced weapons, realistic and demanding training, and innovative leadership, have powered the tremendous leap in U.S. military capabilities demonstrated in these conflicts. One technological factor stands out from the rest, because it truly differentiates U.S. capabilities from the capabilities of others – information superiority. One of the key technologies that gave U.S. land component commanders in Afghanistan and Iraq this information superiority is **Blue Force Tracking**.

A Soldier's Critical Questions – A Historical Perspective

Through the centuries, three simple geographic location questions have been all-important to soldiers and their leaders at all levels:

- “Where am I?”
- “Where are my forces and other friendly forces?”
- “Where is the enemy and what is the best route to attack him?”

The outcomes of battles, the fates of armies, and even the survival of states have often rested on the ability to answer those questions quickly and correctly.

At Chancellorsville, Va., in May 1863, Confederate General Fitzhugh Lee led General Thomas “Stonewall” Jackson to a hilltop overlooking the exposed flank of General Hooker’s Union Army. There, Jackson learned accurate and immediate answers to all three questions. Lee’s reconnaissance allowed him to tell Jackson where the key overlooking hilltop was located. Topping the hill, Jackson personally observed the location and vulnerable position of the enemy. The couriers accompanying Jackson knew where to find his subordinate commanders to carry back orders. A local clergyman and a Confederate cavalryman told Jackson the location of a concealed route that allowed him to move his corps into position to attack. The picture complete, Jackson quickly took

advantage of this information and the enemy's exposed flank. Maneuvering his corps along the concealed route, he quickly deployed it for the famous flanking attack that rolled up almost the entire Union line, resulting in one of the most impressive victories against heavy odds of the Civil War.¹

The Evolution of Blue Force Tracking

Commanders and soldiers at all levels must have timely and accurate information on their own location, the locations of their forces and other friendly forces, and enemy locations. Until the advent of the Global Positioning System (GPS) in the 1990s, most of this information was determined with a map and compass, following map-reading procedures that had changed little over several centuries. The accuracy of locations so derived varied enormously according to factors such as the map-reading and navigational skills of the soldier, visibility (determined by light, vegetation and weather conditions), recognizable terrain features and the age of the map. Picture a second lieutenant leading a patrol through a dense swamp at midnight in a driving rain and trying to determine his exact location on a 20-year-old map.

Global Positioning Systems

GPS made things much easier by providing soldiers with north-south/east-west location, accurate to about 10 meters. Once soldiers found their location on the grid printed on their maps (Figure 1), they knew exactly where they were. This solved most location-accuracy problems.

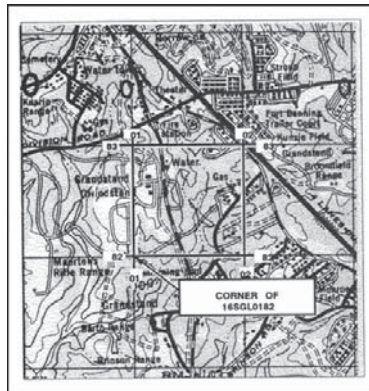


Figure 1: The Military Grid System²

Footnotes: see pages 16-17.

Commanders, however, still needed to know the location of their forces as well as other friendly forces in their vicinity. For tactical units this is essential. In an attack, for example, commanders must ensure the movements of all their elements are properly synchronized so their fires and maneuvering have the desired effect upon the enemy at exactly the right time. To use supporting artillery, attack helicopters and air support effectively and safely, commanders must know exactly where their forces and other friendly forces are to avoid hitting them with “friendly” fire.

With GPS, commanders’ subordinate units knew exactly where they were, but this information still needed to be provided to the commanders and displayed to understand the tactical situation. Units, therefore, radioed³ their location to the unit’s command post, where it was posted on the map board.

Under the best of circumstances, this system was time and effort intensive. Moreover, when a unit was moving, the scenario became more complicated. Commanders were in moving vehicles, not command posts, and had to receive and post their subordinate units’ locations on their own maps. It also necessitated frequent reports. When a unit was engaged in combat, these location reports sometimes received lower priority as the commanders passed orders and discussed the tactical situation with their subordinates. To compound these problems, moving units often crossed from one map sheet to another.

Location reports also had to be communicated over unit tactical FM radios that required direct line-of-sight to receive signals. Obstacles such as mountains, hills and even buildings could block the line-of-sight, breaking communications between a unit headquarters and its subordinate units and preventing transmission of location reports. Furthermore, FM radios have a limited range (10-20 kilometers on flat terrain and without relay stations), so more distant units could not report their locations.

Reporting and recording enemy information followed a similar process. Subordinate units detecting the enemy determined their location manually and reported the information to the unit command post, where it was plotted. The unit intelligence officer used this information, together with intelligence summary reports from higher headquarters (sometimes hours or more old), to track enemy forces the unit might encounter.

Force XXI Battle Command Brigade and Below

Recognizing the fundamental importance of location reporting and recording, as well as other critical command and control tasks, the Army focused its “digitization” efforts in the early 1990s on leveraging the potential of new computer and communications technologies to automate them. These efforts led to the development of the digital battle command system, Force XXI⁴ Battle Command Brigade and Below (FBCB2). Begun in 1995, it is in use today.

FBCB2 normally uses GPS transponders located in ground vehicles (typically the vehicles assigned to unit commanders at various levels) to report the location of the host vehicle.⁵ The FBCB2 equipment then retransmits its location to all units in the network via the Combat Net Radios (EPLRS and the standard Single Channel Ground and Airborne Radio System (SINCGARS) radio nets). Each vehicle location is displayed as a blue icon on digital maps on computer screens mounted in the vehicles. Instead of a map covered with paper symbols, FBCB2-equipped commanders have computers that show their location as a screen icon on a digital map or overhead photograph, along with the icons of all FBCB2-equipped subordinate units and any other friendly units equipped with FBCB2 in the vicinity. This same information (along with enemy information input by intelligence staffs, operational control measures – such as unit operational boundaries – and danger areas) is displayed in command posts and vehicles at all levels of command. FBCB2 also allows users to send formatted or free-text e-mail messages – including orders and requests for support – to any other FBCB2-equipped unit simply by clicking on the unit’s icon. This freed tactical voice radio nets for higher priority messages.

The network of FBCB2 vehicles communicating over Combat Net Radios for situational awareness⁶ and command and control is known as the “tactical internet,” a self-forming network that adapts to terrain, changes in unit organization, combat conditions and transmission channel availability. As long as vehicles are within line-of-sight, the FM radio-based tactical internet serves its users.

The first units to experiment with FBCB2 in 1995 found that location reporting and command and control improved dramatically. Compared to voice radios and plastic-covered maps, the new system was like going from grainy, black-and-white photos to full Technicolor streaming video. With FBCB2, soldiers at any level knew exactly where they were. In the

midst of a blinding sandstorm on a trackless desert, they could see their own vehicles' icons moving on the digital map or overhead photograph. They also could see exactly where the rest of the unit and other friendly forces were located – without inexperienced soldiers attempting to read maps, lengthy voice radio messages, or exhausted sergeants posting information on plastic map overlays. If the intelligence staff did a good job of pulling enemy information from available sources and posting it on the FBCB2 system, soldiers and commanders also had a pretty good idea where the enemy was.

To investigate the full combat potential of FBCB2, the Army designated the 4th Infantry Division (Mechanized) as the “First Digitized Division” to receive the new capability. Through controlled experiments and testing against the “opposition force”⁷ at the National Training Center at Fort Irwin, Calif., the 4th Infantry Division quickly learned that the vastly improved situational awareness FBCB2 provided allowed commanders to operate much more quickly and accurately – and much more effectively. Furthermore, the effort and resources (including time on radio nets) previously required for determining and recording unit locations and performing other command and control tasks could now be put to better purposes, such as precisely orchestrating an attack.

Blue Force Tracking

FBCB2's capabilities were evident in the flat terrain of the National Training Center, where dense numbers of FBCB2-equipped vehicles were able to maintain the tactical internet through line-of-sight FM communications. When the Army deployed to the Balkans, however, it discovered that the mountainous terrain and relatively thinly deployed patrol vehicles in Bosnia and Kosovo imposed significant limitations on a tactical internet using ground-based line-of-sight radios. To overcome this, FBCB2 was adapted to communicate over commercial satellites using transceivers bolted to the tops of vehicles. In this “hub and spoke” configuration, each vehicle communicates with a satellite ground station that aggregates the blue force picture and transmits it to each FBCB2-equipped vehicle by satellite.

The flexibility and effectiveness of this additional communications option was key to future deployments of the FBCB2 system, enabling the Army to consider deployment options involving EPLRS-equipped and satcom-equipped FBCB2 units. Although both communications options employ the same FBCB2 applications software, the satcom

configuration came to be known as “FBCB2-Blue Force Tracking” or “FBCB2-BFT” (commonly called “BFT”⁸) to distinguish it from the original FBCB2.

When Army forces began operating in Afghanistan during Operation *Enduring Freedom* and preparing for Operation *Iraqi Freedom*, the value of FBCB2 to combat units was readily apparent. Army leaders decided that as many of the units committed to combat operations as possible should be equipped with an FBCB2-like capability.⁹

Of the units considered for deployment, however, only two brigades of the 4th Infantry Division were equipped with the ground digital radio systems (EPLRS) required for the FBCB2 system. Moreover, as experiences in the Balkans proved, ground-based digital FM radios could not provide the range required to support Army units operating over the vast distances of Afghanistan or anticipated in Iraq. Consequently, the Army decided to launch a crash project to field a BFT variant based on satellite communications (satcom).¹⁰

Because the 4th Infantry Division was the only digitized force readily available for deployment to the Iraqi theater, other non-digitized units slated for Iraq – such as the 3rd Infantry Division, the 101st Airborne Division (Air Assault) and the 82nd Airborne Division – needed BFT quickly. The U.S. Marine Corps and British combat units in the theater also wanted the system so they could see the Army units and Army units could see them.

Intensive planning for “thin” BFT fielding (down to company level) took place at the Pentagon during the spring and summer of 2002. Actual deployment of BFT to land forces in Southwest Asia started in late 2002 and continued until the Iraq campaign began. Over a three-month period before the Iraq War, the Army and its contractor team installed the available equipment on combat vehicles and helicopters and trained commanders and soldiers to use the system.

Blue Force Tracking in Afghanistan and Iraq

Although only 210 BFT systems were deployed with U.S. forces in Afghanistan and 1,242 were deployed in Iraq (with U.S. Army, U.S. Marine Corps and British forces), the impact on coalition command and control capability was extraordinary. In Afghanistan and Iraq, BFT provided revolutionary improvements in tactical command and control that contributed significantly to coalition ground forces' ability to conduct decisive combat operations over daunting distances at previously impossible speeds.

In both conflicts, units equipped with BFT were able to answer the three critical questions – “Where am I? Where are my forces? Where is the enemy?” – with previously impossible speed and accuracy, even when spread over vast distances. This quantum improvement in situational awareness allowed commanders to make decisions and issue orders much more rapidly and to employ their forces to the full limit of their operational capabilities unrestrained by the limits of FM voice radio and paper map command and control.

In Afghanistan and Iraq, BFT users often commented that the system was sometimes the only accurate means of determining position location and navigating, especially under extremely poor visibility conditions, such as at night or during sandstorms. With BFT, subordinate units that might otherwise have become lost or separated – requiring the parent unit to cease operations and focus on recovery efforts – often were able to return to their parent elements on their own.

A Task Force 82 Blackhawk helicopter was on a mission in Afghanistan, close to dusk. A wind storm came up and visibility became very minimal, causing the aircraft to lose visible contact with the rest of the flight. The pilots were about to set the helicopter down in an unsecured area for the evening when the BFT operator, able to zoom in on the map, found the other aircraft. From his BFT screen, he was able to direct the pilot out of the dust and effect linkup with the flight.

Operation Enduring Freedom, Afghanistan

Constantly knowing where they were on the battlefield allowed unit commanders to focus on preparing for decisive action upon contact with the enemy rather than on the task of maneuvering their units to gain contact. Some commanders stated that without BFT they spent 80 percent of their time and effort moving their units to contact, leaving only 20 percent to prepare for combat. BFT reversed those ratios.¹¹

BFT simplified navigation immensely, even under circumstances where it previously would have been almost impossible. In many cases, it became the prime navigational capability of maneuver units.

...the infamous sandstorm of 23 March 2003. We were conducting a reconnaissance in force to find and destroy Sadaam Fedayeen forces. I was planning on using the sandstorm as cover for our movement and we would use railroad tracks as a handrail to guide us into our positions....We were all using BFT to track our movement since the sandstorm created “zero visibility” conditions. We were literally dead reckoning through the sandstorm using the BFT system.

We ran into problems about halfway through the movement when we tried to navigate around the As Samawa train station. Even the 1:50,000 maps did not show all the details of the train station. Vehicles were getting stuck on the converging tracks and had to maneuver around several buildings that weren’t identified on the maps. The sandstorm made it impossible to see our surroundings and we had several breaks in contact. One of the company commanders suggested we all switch from maps to imagery and would then be able to see the details of the train station and help us get around it. We were literally maneuvering by instruments like pilots do in bad weather, but the imagery and GPS functions of the BFT system allowed us to bypass the train station in the middle of a sandstorm.

*Lt. Col. John W. Charlton, USA
Commander, 1-15th Infantry Battalion
3rd Infantry Division*

In all likelihood, the operational distances covered and the speed of ground operations in Iraq would have been difficult, if not impossible, to achieve without BFT. Maj. Gen. Buford Blount, the commanding general of the 3rd Infantry Division, said that BFT gave him the ability to see his division over a 200-230 kilometer front and to control the brigade fights.¹² By comparison, during the first Gulf War, the same division¹³ had a 30-kilometer front during its attack on Basrah.¹⁴

Confidence in the timeliness and accuracy of position reporting also contributed significantly to the speed with which commanders reached critical decisions during the war. For example, the 2nd Brigade of the 3rd Infantry Division was ordered to conduct only a reconnaissance in force to test Iraqi defenses when it first entered Baghdad. However, Col. Dave Perkins, the brigade commander, decided to stay and retain control of key locations in the city, because he was certain his soldiers, positioned as he could see they were on his BFT screen, could safely remain downtown.¹⁵ One of the most critical decisions of the entire campaign, it essentially eliminated any Iraqi opportunity to conduct a coordinated defense of Baghdad.

Because commanders at all levels were looking at the same information on their computer screens, the cohesion of the entire force was raised considerably. Junior commanders could see they were part of a larger whole. They knew higher headquarters was always watching and could send support or reinforcements immediately if they got into trouble. This raised confidence significantly.

Knowing where everyone was located also accelerated operations. For example, previously, when a lead element made contact with the enemy, it had to stop and determine its location and report to its company. The company reported this location to battalion, which would report to brigade for a decision. With BFT, commanders at all echelons knew the exact location of the lead element, so the only information necessary to report over the radio was the nature and location of the enemy that the lead element encountered.¹⁶ If the lead element used BFT's text transmission capability, that report could go simultaneously to all echelons.

Commanders at all echelons sharing the same "big picture" also enhanced self-synchronization. For example, units ordered to move on line abreast could see if they were falling behind or pulling in front of other units and adjust their speed, without exchanging a word, even when they

were out of sight of each other. Additionally, subordinate units on the flanks of larger units knew where the subordinate units of their adjacent units were and could coordinate with them directly through BFT. Previously, that exchange of information would have gone to higher headquarters to be passed to the adjacent unit higher headquarters, then down to the other flank unit. BFT allowed it to go directly, greatly simplifying coordination (see Figure 2).

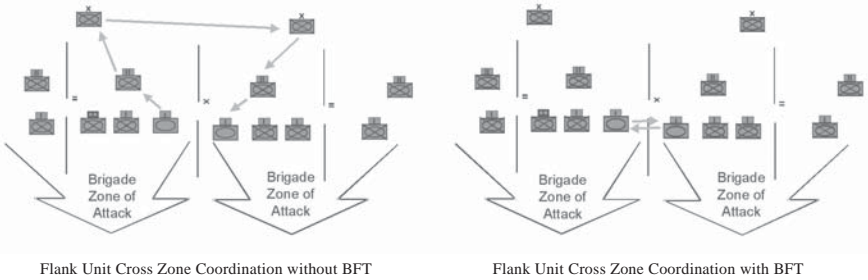


Figure 2: Cross Brigade Zone of Attack Coordination

A picture’s worth a thousand words. You can try to describe where you’re at. Just the visual advantages of seeing where you are in relation to the rest of your unit, I’m sure that’s a huge advantage.... You’re looking at BFT, “Hey company commander, you’re a little off the route,” or he’s on route but is a few minutes behind. It’s a pretty good thing when you see everybody’s in the proper attack by fire position or at the proper phase line.

*Capt. Sam Donnelly, USA
S-3 Air, 2-7th Infantry Battalion
3rd Infantry Division*

One of the greatest fears in any combat operation is killing your own soldiers. One of the greatest advantages in shared situational awareness – and one of BFT’s significant contributions – is fratricide avoidance. Commanders can see when their units are coming close to adjacent units and can warn their soldiers to look for friendly forces or order them not to fire. The enhanced situational awareness BFT provides also helped to avoid fratricide caused by the “lost lieutenant syndrome” – small units wandering into areas where they are not expected and becoming at risk of friendly fires.

April 1st east of Karbala. Company commander was going to do a passage of lines between two units and intended that upon clearing the units he would order “red free,” meaning, essentially, “fire at will.” He didn’t know that a scout platoon was also making a movement from the front left that would have placed the scouts in front of the oncoming tank company. He saw the movement on BFT and changed his order.

*A Company, 2-69th Armor Battalion
3rd Infantry Division*

During the major combat operation phase of Operation *Iraqi Freedom*, only one soldier was killed by friendly direct ground fire. This is attributable in part to the enhanced situational awareness provided by BFT. Given the size and complexity of the operation, including the conditions under which it was executed, this is truly impressive. By contrast, 35 soldiers were killed and 72 wounded by friendly direct ground fire during Operation *Desert Storm*.¹⁷

In one dimension, however, BFT was not employed to its full potential. Interviews with officers who fought in Iraq indicate that BFT’s capability to provide detailed information on enemy locations was significantly underused, probably because soldiers had insufficient time to train with the systems. The officers reported that they and their fellows submitted few enemy reports using BFT’s enemy contact reporting capability, which puts enemy locations into the BFT database; therefore, they saw very few red icons marking Iraqi units on BFT screens.¹⁸ As far as can be determined from unclassified sources, there were no automated interfaces between BFT and intelligence databases that might have automatically added enemy location data from other sources to BFT’s database.

However, because BFT provided precise information on a unit’s location, it was much easier for commanders to use terrain association or range/bearing techniques to obtain precise location information on enemy units they spotted.¹⁹ This significantly reduced the time required to call for artillery or other fire support.

“...like the night ambush, I knew the whole squadron was in column on one highway. I knew where the enemy was firing from and where I was because of my icon and because of my grid, so I processed the initial fire mission [request for artillery support] by doing the BFT screen.”

*Capt. Clay Lyle, USA
Commander, A Troop, 3-7 Cavalry Squadron
3rd Infantry Division*

In contrast to the underuse of BFT’s enemy reporting capability, its ability to support tactical communications was sometimes stretched to the limit. Communications are so essential to tactical command and control that command, control, and communications (or C³) are usually considered as parts of one whole. BFT’s satcom-based communications allowed users to exchange text messages and graphics (such as routes, phase lines, etc.) with any other BFT user or any number of BFT users over essentially unlimited distances. This capability proved to be an exceptional advantage in several ways.

First, the range allowed effective command and control over almost unlimited distances. The 3rd Infantry Division effectively controlled two separate major battles over 200-230 kilometers – almost ten times the previously possible distance.²⁰ In Afghanistan, one brigade task force operated in an area the size of Texas.²¹ In Iraq, battalions sometimes controlled companies up to 70 kilometers away.²²

Although the Army has used satcom voice communications for command and control over extended distances for years, the text and graphic capability of BFT added an entirely new dimension. Satcom voice nets suffer from the same limitation as FM voice nets,²³ and the limited number of available frequencies normally restricts use to tactical commanders at brigade level and above. BFT eliminates those problems with net-based communications. Any user at any level can send a message to any (or many) others at any time. The BFT network in Iraq sometimes experienced message queuing delays because of the high volume of traffic and the limited available satcom bandwidth, but it became a relatively reliable means for communications for all echelons and all functions. In Afghanistan, BFT was the only means for passing critical logistical information for units deployed over vast distances.²⁴ Moreover, the ability to transmit the same message and graphics to multiple

addresses greatly accelerated the distribution of orders – a major pacing event for tactical operations.²⁵

BFT also helped ameliorate some of the challenges of communicating with allies and forces from other services that often result from incompatible communications systems, lack of common doctrine, etc. Because some Marine Corps and British Army forces were also equipped with BFT, coalition forces could not only see where adjacent units from the other service or country were located but also communicate with them. This helped to resolve several dangerous situations that may well have led to fratricide.

Implications of Combat Experience with Blue Force Tracking

Combat experience in Afghanistan and Iraq shows that BFT-equipped forces became “networked” forces that can add strength to the network and also draw strength from it. Commanders of these forces have immediate and accurate answers to the three critical location questions that have always been – and always will be – essential to decisive military operations.

To date, the Army has fielded satcom-based BFT capabilities only in units that are about to deploy to combat or, as in Afghanistan, are engaged in combat operations. Therefore, these units had insufficient time to train with BFT, to understand its full potential, and to adapt their tactics, techniques, and procedures to fully exploit BFT’s capabilities before going into combat.

From the Afghanistan and Iraq experiences, it is clear that the high level of situational awareness BFT provides makes units significantly more effective and capable. But BFT can do more than that. It can also serve as an important “intellectual catalyst” for Army transformation.

The critical terrain for transformation lies in the minds of our present and future leaders. To convince them of the power of the information revolution, they must experience this power not only in operations but also in training to gain confidence in the capabilities of digital battle command. If soldiers are not already familiar and confident with a system, they will not use it in combat.

For example, one of the lead battalion task force commanders in the 3rd Infantry Division reported that although he had BFT installed in his command vehicle, he crossed the berm into Iraq with a bustle rack [outside rack on the turret of a fighting vehicle] full of paper maps and plastic overlays that he relied on for the first several days of the war. He turned to BFT only when he received orders to fight in a built-up area for which he had no paper maps or imagery. Convinced, he abandoned his paper maps and came to rely entirely on BFT after using it to maneuver his battalion through another urban area during a blinding sand-storm.²⁶

Leaders of the Army's transformed Future Force will develop and mature in the current force. To conduct operations with an information-age force, leaders must understand the capabilities and the limitations of digital battle command. They should not have to develop this understanding – and confidence – while leading soldiers decisively engaged with an enemy. Nor can they develop it in the classroom. They must develop an appreciation for an information-age, networked force through training experience. Only then will soldiers have confidence in the system and in their ability to employ it in war.

Combat experience in Afghanistan and Iraq has shown that BFT is more than a force multiplier that allows soldiers to do better at what they did before. Instead, it allows them to fight in new, more effective ways – ways that previously were almost impossible. By providing decisive information superiority, BFT becomes another weapon in the commander's arsenal.

This is not to say that BFT, as fielded in these two conflicts, is the “be all and end all” of a digital battle command capability. The system has a way to go yet. It needs to be made truly joint, to provide a common ground picture to both ground and air forces. It also needs to include additional capabilities:

- A reliable, accurate and timely enemy-force picture
- Tools for collaborative battle planning and monitoring progress against that plan
- Enhanced satellite communications to pass greater volumes of traffic and improve reliability

- A light-weight, man-portable unit to support dismounted operations
- Fielding at least down to platoon level to support small-unit operations in a counterterrorism/counterinsurgency environment

Nonetheless, BFT moves the Army's future digital battle command effort pretty far down the right path.

The Army cannot afford to wait until BFT is perfected. Soldiers who fought with it in Afghanistan and Iraq vow they would never, if at all possible, fight without it again. "Thin" fielding is also not a good option. As one British officer stated, "You cannot half digitize the army."²⁷ Units equipped with BFT are networked forces able to strengthen and draw strength from other elements in the network. Units without digital battle command capability are non-networked forces in a networked world. Attempting to operate without the situational awareness the network provides makes units "invisible" to others in the network; they can quickly become a danger to themselves and others – a liability rather than a strength.

Today, the U.S. Army faces significant challenges. As worldwide operational commitments stretch the force, the Army must remain prepared for combat in unexpected locations under unanticipated conditions. At the same time, it must transform to be better prepared to fight and win tomorrow's battles. Blue Force Tracking is a capability that is here today, ready to help soldiers meet present and future challenges. The Army needs to move forward and seize the benefits Blue Force Tracking offers. Its soldiers deserve nothing less.

Footnotes

- ¹ Gen. Fitzhugh Lee, “Chancellorsville: An Address before the Virginia Division, A.N.V. Association, October 29, 1879.” Southern Historical Society Papers, Vol. VII. Richmond, Va., December 1879, No. 12.
- ² U.S. Army Field Manual 3-25.26, *Map Reading and Land Navigation* (Washington: Headquarters, Department of the Army, 20 July 2001,) Figure 4-21.
- ³ Each tactical unit, regardless of organizational level (platoon, company, battalion, brigade, etc.), is usually assigned a single radio frequency (or set of frequencies for frequency-hopping radios) to control its operations. The commanders and staffs of the unit and its subordinate units all have to talk on that one frequency, called the command or operations “net.” When someone is transmitting on that frequency, everyone else can hear but no one else can talk. In combat, these nets become very busy.
- ⁴ The 1990s term for the Army’s Future Force.
- ⁵ As a backup to GPS, FBCB2 also uses the Army’s new battlefield FM digital radio link (the Enhanced Position Locating Reporting System or EPLRS) to obtain location information.
- ⁶ Situational awareness is a military term that refers to an individual’s or organization’s ability to sense and comprehend the environment in which it operates, including the friendly and enemy tactical situations, terrain, weather, etc.
- ⁷ OpFor, the highly skilled and trained “enemy” force at the NTC.
- ⁸ Although the FBCB2-BFT system was most common in Afghanistan and Iraq, some elements had other Blue Force Tracking systems. These were more limited in functionality and did not provide true digital battle command capability. As used in this paper, BFT refers to FBCB2-BFT.
- ⁹ Otto J. Guenther, Vice President and General Manager, Northrop Grumman Mission Systems, Tactical Systems Division, “Industry Interview,” *Military Information Technology*, August 9, 2003, p. 44.
- ¹⁰ Guenther, *op cit*.
- ¹¹ Comment by Brig. Gen. Robert Durbin, Assistant Division Commander, 1st Cavalry Division.
- ¹² Neil Baumgardner, “3rd Infantry Division Commander Praises C2V, Communications During OIF,” *CAI News*, May 29, 2003.
- ¹³ Then designated the 24th Infantry Division (Mechanized).

- ¹⁴ Brig. Gen. Robert H. Scales, Jr., *Certain Victory: The United States Army in the Gulf War* (Washington: Office of the Chief of Staff, United States Army, 1993), p. 307.
- ¹⁵ Statement by Col. Curtis L. McCoy, Program Manager, Combat Systems, U.S. Army Tank and Automotive Command, at the National Press Club, Washington, D.C., July 17, 2003.
- ¹⁶ Based on debriefing of Capt. Stewart James, Commander, A Company, 2-69 Armor Battalion, 3rd Infantry Division
- ¹⁷ Frank Tiboni, "Force XXI Proves Mettle by Saving Lives in Iraq," *Defense News*, June 9, 2003, p. 42. During major combat operations in Iraq, a total of 13 American, 5 British, and 18 Kurdish soldiers were lost due to friendly fire from all sources. [Dawn S. Onley, "Systems help avert friendly fire deaths," *Government Computer News*, July 28, 2003.]
- ¹⁸ Interviews with Capt. Stewart James, Commander, A Company, 2-69 Armor Battalion, 3rd Infantry Division; and Capt. Tim Terese, G-3 Current Operations, 3rd Infantry Division
- ¹⁹ Terrain association is the use of terrain features to identify locations. For example, if a commander knows he is just south of a known large hill and the enemy is firing at him from the top of the hill, he can click the top of the hill on his BFT map to get the enemy's exact location. Using the range/bearing technique he can lase the enemy with a laser rangefinder to determine the enemy's distance from his location along a compass bearing. He can then use BFT's graphic software to plot this on the digital map and determine the enemy's exact location.
- ²⁰ See note 9.
- ²¹ Interview with Lt. Col. Anderson, Commander, Logistics Task Force 307, Afghanistan.
- ²² Lt. Col. John W. Charlton, "Digital Battle Command Baptism by Fire," Battle Command Training Center, Fort Hood, Texas (<http://bctc.hood.army.mil/download.asp?docid=396>)
- ²³ See note 4.
- ²⁴ Interview with Lt. Col. Anderson.
- ²⁵ Interview with Capt. Stewart James.
- ²⁶ Charlton, pp 1-2.
- ²⁷ Interview with Maj. John Cunningham, Aide-de-camp to Brigadier Binns, 7th Armoured Brigade (UK).

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