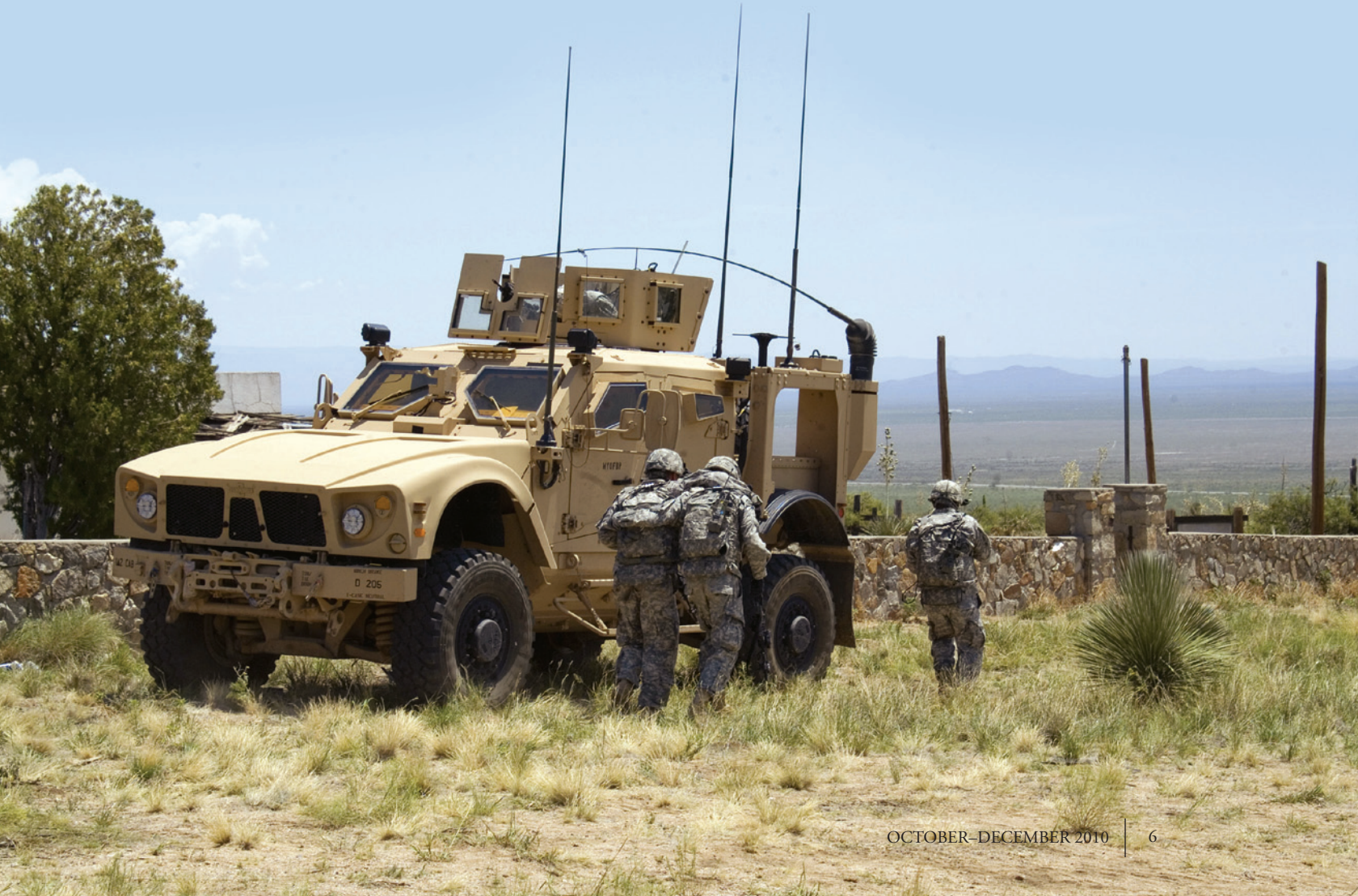
Integrated Waveforms Will Bring Battle Command to the Soldier Level

Joshua Davidson

In the deep jungles of mid-1960s Vietnam, Soldiers such as Mike Ruane became innovators as they struggled to submit reports and timely intelligence to higher headquarters. As radio signals weakened, they used other units or waited for helicopters that passed their positions periodically to relay the information to battalion headquarters.

A Soldier helps another limp to a Mine Resistant Ambush Protected All-Terrain Vehicle during a training exercise at the Hal Cox Ranch, White Sands Missile Range, NM. The scenario required the Soldiers to use the network to contact their command and request a helicopter to evacuate the "injured" Soldier. (U.S. Army photo.)



"It worked; it really did," said the retired Army colonel. "Like everything else, it was something that almost all of the units did on the fly."

Almost 50 years later, at White Sands Missile Range (WSMR), NM, engineers conducted multiple launches of the Shadow unmanned aircraft system with a Rifleman Radio attached to each of its wingtips. During this Brigade Combat Team (BCT) Integration Exercise from July 12 to 16, 2010, Soldiers could pass information to the radios on the Shadow. That information was relayed to a Soldier in a separate company positioned beyond line-of-sight. In addition to the Shadow, AH-64D Apache and UH-60 Black Hawk helicopters maneuvered across the WSMR skies, serving as aerial communications nodes.

"We took a hard look at how we could get physics to work for us by getting an aerial layer in place," said LTC James McNulty, an exercise trail boss.

The exercise brought together engineers from the Army acquisition community, Soldiers from the Army Evaluation Task Force (AETF), and Army senior leaders, who experienced firsthand the Army's future tactical network from their vantage points at WSMR and Aberdeen Proving Ground (APG), MD.

During raids as an infantry company commander in Iraq, MAJ Bill Venable experienced frequent 45-minute drives to receive detailed mission orders from battalion headquarters.

Through the unprecedented combination of three separate waveforms, Soldiers at WSMR received similar information instantaneously with the click of a button.

A Shadow unmanned aerial vehicle is launched from Condron Field, WSMR, NM. The Shadow is equipped with various camera systems to provide tactical intelligence and a set of radios to help extend the wireless network's range in rough terrain. (U.S. Army photo.)

"Within a minute, we were already talking about the mission," said Venable, Assistant Project Manager Infantry BCT, Program Executive Office (PEO) Integration.

Laying the Groundwork

The exercise was designed to help the Army continue to formulate its tactical network strategy by seeking to prove the concept of an integrated tactical network available to Soldiers at all echelons of the BCT. Three separate waveforms were integrated to provide connectivity from the lowest to highest echelons.

Lessons learned during the exercise will yield decisions in the Warfighter Information Network-Tactical (WIN-T) Increment 2 program, said Pat DeGroodt, its Deputy Product Manager.

"The exercise was very powerful," he said. "I think it has a lot of potential to change the warfighter's tactics and techniques."

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The AETF maneuvered through WSMR along improvised explosive device (IED) routes, performed air assault missions, conducted raids of explosive-making facilities, and used PEO Integration's Small Unmanned Ground Vehicle robot to identify and remove simulated IEDs from a cave. The mountainous terrain of White Sands closely mirrors that of Afghanistan, where Soldiers perform similar missions.

Many radios used in this exercise, such as the Rifleman Radio, were surrogates for radios that will be used in the final, deployable waveform solution starting in 2017. In future months, the Army will examine each of the capabilities demonstrated and determine which will be included in the 2017 network.

The exercise was a "team sport," involving PEO Integration; PEO Command, Control, and Communications Tactical (C3T); PEO Aviation; PEO Soldier; Joint PEO Joint Tactical Radio System (JTRS); PEO Intelligence, Electronic Warfare, and Sensors; U.S. Army Test and Evaluation Command; U.S. Army Operational Test Command; U.S. Army Training and Doctrine Command (TRADOC); AETF, headquartered at Fort Bliss, TX; the Central

SENIOR ARMY LEADERS PRAISE SUCCESSFUL NETWORK INTEGRATION EXERCISE

Kris Osborn

The Army's Brigade Combat Team (BCT) Integration Exercise at White Sands Missile Range, NM, successfully connected Soldiers, sensors, unmanned aircraft systems, networked vehicles on-the-move, command posts, and other nodes over long distances using satellite and software-programmable radios, allowing the Army to evaluate the progress of the battlefield network, senior Army officials said.

"The Army's battlefield network is showing itself to be extremely relevant to today's operational environment. The ability to connect the dismounted Soldier to networked vehicles on-the-move at the battalion level and above to higher headquarters provides an enormous advantage to the warfighting effort," said Under Secretary of the Army Dr. Joseph Westphal, who observed portions of the exercise from Aberdeen Proving Ground (APG), MD. "The BCT Integration Exercise showed that moving more combat-relevant information faster, farther, and more efficiently across the force will greatly enhance our Soldiers' ability to prevail in current and future conflicts."

The exercise, designed to help validate the concept of the objective network planned for 2017, used satellite links to connect units and extended line-of-sight radio systems through an aerial tier. With the aerial tier, units did not have to place a relay team on the top of a mountain ridge or reposition a command post to ensure communication between ground units over extended distances.

"We are building an Army that is a versatile mix of tailorable and networked organizations; the network is critical to this Army, and I am encouraged by the significant progress we have made in developing it," said Army Chief of Staff GEN George W. Casey Jr., who also observed the exercise from APG.

The idea was to connect multiple echelons and to move information from the dismounted Soldier on the tactical edge up to the platoon and company level, and all the way up to higher headquarters, said COL Michael Williamson, Deputy Program Executive Officer Networks, Program Executive Office Integration.

"This is designed not just to highlight technology, but to identify the gaps that we need to fill as we mature the network through 2017. This will help us shape how we bring networking capability to the field," said Williamson.

The exercise was aimed at informing the developmental cycle of the Army's network. The goal was to connect nodes through one seamless network wherein Soldiers, commanders, and sensors could share voice, video, data, and images across the force in real time.

"This is about the ability to move data and imagery down to the point where it is needed in a timely manner," said Williamson.

A terrestrial network of sensors sent voice, images, and data through Joint Tactical Radio System (JTRS) software-programmable radios using high-bandwidth waveforms such as Soldier Radio Waveform (SRW) and Wideband Networking Waveform. The information sent and received by the terrestrial layer was connected to Warfighter Information Network-Tactical (WIN-T), a satellite network able to send information over long distances.

Vehicles with Network Integration Kits (NIKs) served as key hubs connecting the terrestrial and satellite layers of the network. The NIKs consist of an Integrated Computer System, JTRS Ground Mobile Radio, and Blue Force Tracker display.

By connecting the echelons, with dismounted Soldiers carrying either a JTRS Rifleman Radio or JTRS Handheld, Manpack, Small Form Fit radio, the Soldiers shared information instantly across the squad, platoon, company, and battalion levels and, if needed, all the way up to commanders at higher headquarters or command posts.

"What allows this [network connectivity] to integrate is the fact that we have stable hardware and stable software," said MG John Bartley, Program Executive Officer Integration. "This is about platoons that are isolated reaching back for their support such as MEDEVAC [medical evacuation], food, water, logistics, ammunition, and resupply. How do you enable those folks so that they have assured communications moving forward?"

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Sending voice, video, and images via the SRW, sensors such as Unattended Ground Sensors, Small Unmanned Ground Vehicle robots, and Class 1 unmanned aircraft instantaneously disseminated information across the force. In addition, the NIKs showed an ability to view and share the sensor information in real time on Blue Force Tracking display screens in vehicles on-the-move. WIN-T then beamed the images over longer distances.

The data were shown on a Command Post of the Future display screen, a battle command application that organizes and displays a wealth of relevant battlefield information.

The U.S. Army Test and Evaluation Command (ATEC) assigned a 32-person team with 21 data collectors and observers to the exercise; the command is preparing an executive summary of its findings.

"We will continue to learn from this type of exercise. This is not an isolated event, and our success here provides tremendous momentum moving forward. We are going to continue this. ATEC has been a key contributor to this process," said LTG William N. Phillips, Principal Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASAALT). "This is a real Army Team effort!"

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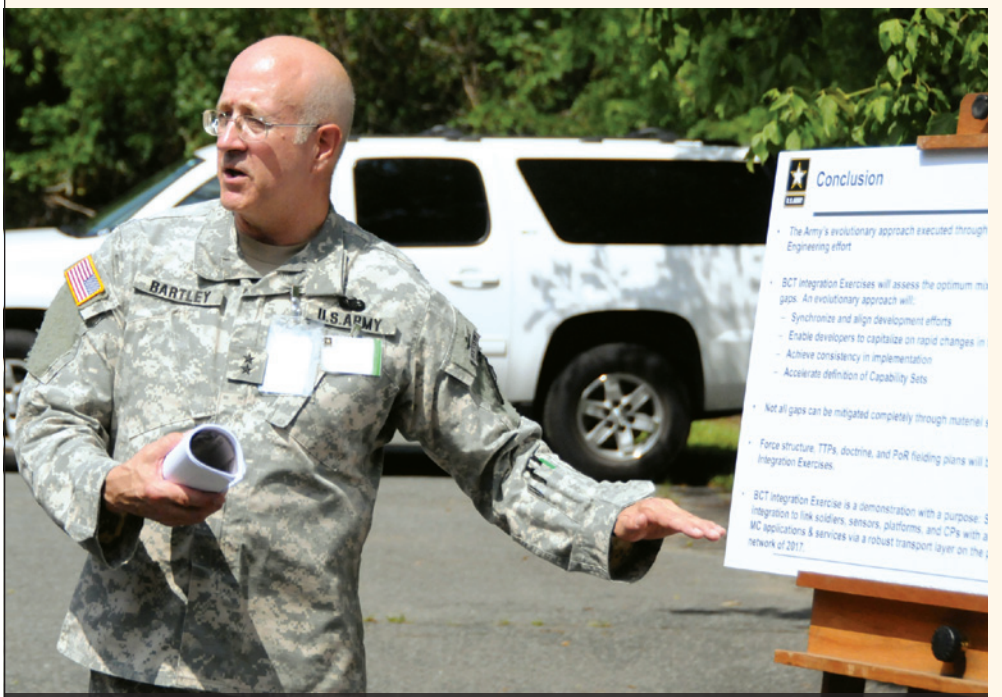
Technical Support Facility, Fort Hood, TX; the Future Force Integration Directorate; and personnel from the WSMR and APG installations.

Stressing the Network

At WSMR, Soldiers maneuvered various platforms at vast distances away from one another to see if they could maintain network connectivity. The network was stressed during the numerous operational vignettes and in the diverse temperatures, environments, and altitudes of White Sands.

The Army's three network waveforms were established based on the amount of information passed across each, said Rick Cozby, PEO Integration's Associate Director for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance Testing. Smaller echelons share less information, which reduces bandwidth requirements. This allows Soldiers to operate successfully with smaller, more portable radios than those needed at higher echelons.



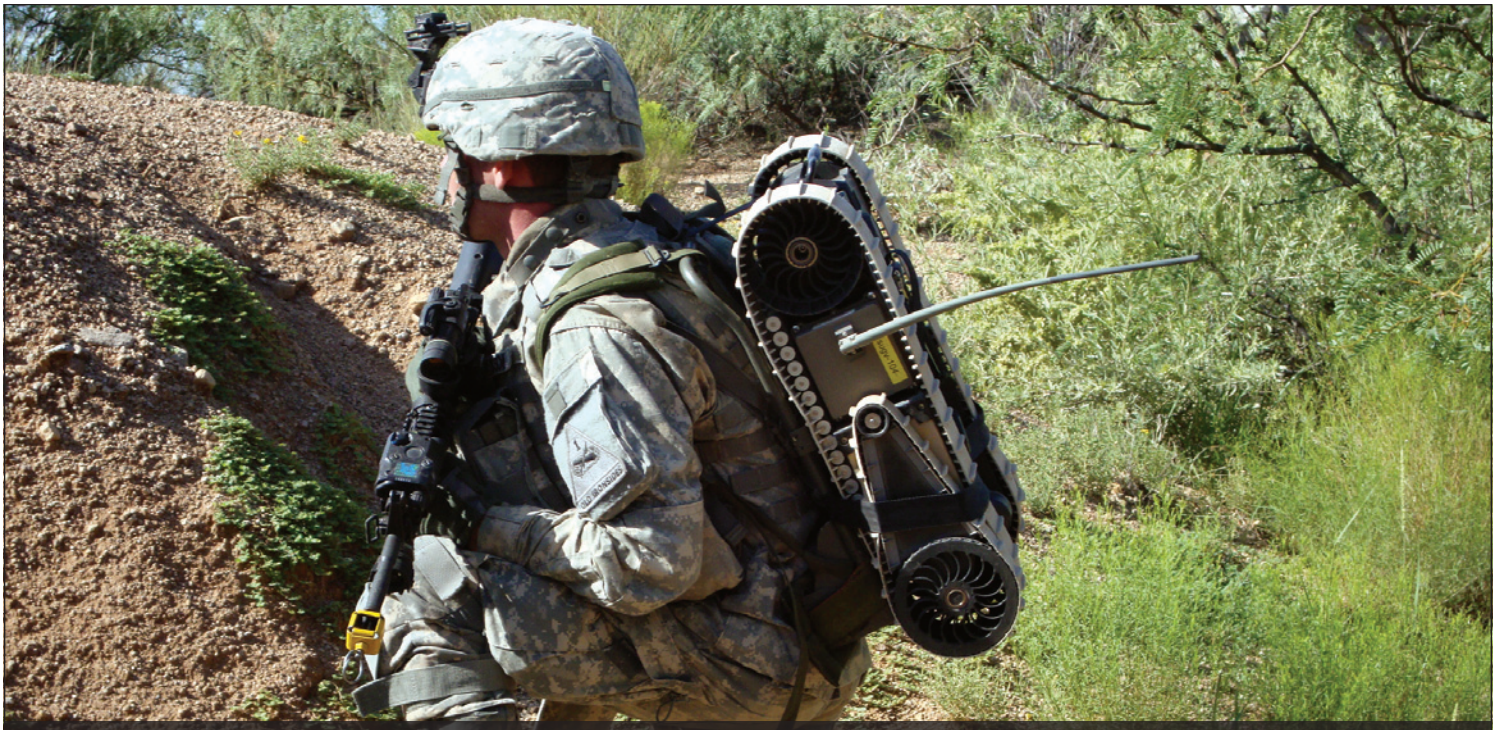
MG John Bartley, Program Executive Officer Integration, concludes a VIP tour during the BCT Integration Exercise on July 15, 2010, at APG. (U.S. Army photo by Joshua Davidson.)

In today's tactical environment, the Soldier Radio Waveform (SRW) operates at the lowest level, providing information to individual Soldiers or teams within a company.

As echelon levels increase, more tactical data are shared, and the large communications pipe of Wideband Networking Waveform (WNW) is required. Connectivity is achieved through an aerial layer using JTRS attached to unmanned aircraft systems and other components such as airships and Rapid Aerostat Initial Deployment towers.

The Network Centric Waveform (NCW) is the satellite layer. It allows warfighters to access the Internet and share voice, video, and data around the globe.

Today, WIN-T Increment 1 provides warfighters at battalion level and above with the ability to connect to the Army's digitized systems, voice, data, and video via satellite. WIN-T Increment 2 will build upon these capabilities by extending satellite communications down to the company level and providing



A U.S. Army Evaluation Task Force (AETF) Soldier waits for exercises to begin during the limited user test (LUT) Media Day Sept. 1, 2009, at WSMR, NM. In September 2010, Soldiers of the AETF completed a full-scale military exercise to test and evaluate Increment 1 during the Force Development Test and Experimentation and the LUT. (U.S. Army photo.)

increased bandwidth while on-the-move. An aerial tier will be fielded in WIN-T Increment 3, bringing a network backbone that can maintain connectivity at all times, regardless of whether a platform is moving or stationary.

Cozby noted that acquisition Programs of Record (PORs) exist to build the various waveforms and the associated radios, but that there is no POR designed to integrate them with one another. This will be accomplished by the Army's new PEO Integration, which was created in connection with an acquisition decision memorandum in December 2009 laying out the networks for 2011 and 2017. In conjunction with that memorandum, GEN Peter Chiarelli, Vice Chief of Staff of the Army, required a demonstration of the Army network.

"These emerging technologies will provide vital capability to our deployed forces and ensure that we keep our Soldiers equipped with the best kit available," said BG N. Lee S. Price, Program Executive Officer C3T.

Although the future WIN-T network will use either commercial KU-Band or military Wideband Global Satellite Communications satellites, only commercial satellites were used in the exercise, DeGroodt said.

Connecting the Company with the World

As units in Afghanistan and Iraq maneuver in a dispersed fashion, the exercise at WSMR demonstrated that the Army will be able to connect higher echelons to the rifleman and vice versa. Doing so will empower the company commander, McNulty said.

"Providing the company commander with situational awareness and real-time actionable intelligence is critical to allowing the rifleman to conduct the mission," he said.

This marked the first time that the waveform technologies of SRW, WNW, and NCW operated together, said Robert Wilson, Director of Tactical Radios for PEO C3T. It also was the first of many exercises that will build upon the established network thread, so that this solution can be incorporated in the future. The network thread means taking separate communications capabilities and networking them together as one to establish communications among separate units or echelons.

McNulty cited the example of how a battle captain at APG was able to use WIN-T Increment 2 to send an operations order of nearly six megabytes to a company commander at WSMR. This company commander was able to share information with adjacent companies and their platoon leaders via WNW and SRW. This capability will increase the speed of operations and prevent casualties, McNulty explained, noting that a Soldier today might have to drive 50 miles to deliver this information.

In the triple-canopy jungle of Vietnam, Ruane used a method known as triangulation to achieve what Global Positioning System technology does today. Ruane began by firing an artillery round at a 200-meter height-of-burst at different grid locations. Then, he would use

those sounds as a reference point to obtain a back azimuth on his compass. By triangulating the sound of the artillery, he was able to check the accuracy of his location on his topographical map, which was covered with grid squares.

"Most times, we were close enough," said Ruane, Fort Monmouth, NJ, Force Protection Representative. "It wasn't always totally accurate because the sound would be distorted through the jungle, but it was better than going 200 meters or a mile through the brush and not knowing where you were."

At White Sands, the Soldiers within a company could communicate with their own platoon and even with the battalion. Inside their command posts, company commanders exchanged text messages and e-mails, tracked simulated IEDs, and collaborated on the battle using the Command Post of the Future system. They planned fires with the Advanced Field Artillery Tactical Data System. They tracked automatically populated friendly forces' movements and manually added enemy and hazard locations with Force XXI Battle Command Brigade-and-Below/Blue Force Tracking. They also used WIN-T Increment 2; the Network Integration Kit; other Army Battle Command System Suite 6.4 applications; JTRS Handheld, Manpack, Small Form Fit radios; and shared intelligence through the Distributed Common Ground System-Army.

Today, most of this information is accessible only at the brigade and battalion levels, said LTC John Matthews, also a trail boss for the exercise. Pushing these data to lower echelons allows the company commander to share the information with platoon and team leaders and to coordinate the battle during direct enemy contact. During the exercise, information was also exchanged digitally using aviation platforms, a critical tactical advantage for rapid and accurate close air support.

Video feeds are received in a command post at APG from WSMR on July 15, 2010, during the BCT Integration Exercise. (U.S. Army photo.)

One Soldier used the Land Warrior system to request a medical evacuation (MEDEVAC) to the company command post. Using the Shadow-connected system, which allows Soldiers to see battlefield information through an eyepiece attached to a helmet, Soldiers initiated calls for a medic and pushed information almost instantaneously to medical evacuation crews.

"That 9-line request for a MEDEVAC … was sent back to the battalion and then to the brigade at APG," McNulty said.

Developing the Future Battlefield Network

Throughout the exercise, engineers from the separate PEOs and TRADOC met in working groups to determine how to integrate the terrestrial waveforms with the satellite communications capabilities of WIN-T Increment 2, said Clifton Basnight, a system-of-systems engineer with Project Manager WIN-T. In just a few days, they carefully developed a "straw-man architecture," laying out how each would operate in conjunction with the others, he said. The group held technical interchange meetings once a week to discuss and develop solutions for routing challenges. Decisions were made as a team.

"Before we went down a path, we had some level of consensus," Basnight said.

Engineers such as Basnight forged new relationships with those from sister PEOs. Many traveled to separate regions, providing their expertise at each stop.

"We put into play things that, even though they might not have been the total solution, were vetted and had engineering rigor to them," Basnight said. "It wasn't done in a vacuum."

"It was really a fantastic exercise of teamwork," DeGroodt said. "Everybody was out to make the exercise successful."

This integrative effort demonstrated the importance of reducing stand-alone developmental efforts, Basnight said. "We left with a sense that we made the impossible possible," he said. "But this is just the beginning."

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