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Celebrating 150 Years of the U.S. Army Signal Corps

With 150 years of decorated history, the U.S. Army Signal Corps has gone from a support element in the Army to a trend-setting organization leading the Army into the 21st century. The Signal Corps has been at the forefront of many Army technology advances from communications to aviation, and it is defining both force and doctrine in the information age. In celebrating the Corps' 150th Anniversary, *SIGNAL* Magazine looks at its past, its influence on today's force and its preparations for the future.

Within these pages are the following articles:

1860 SIGNAL CORPS 2010

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JUNE 2010

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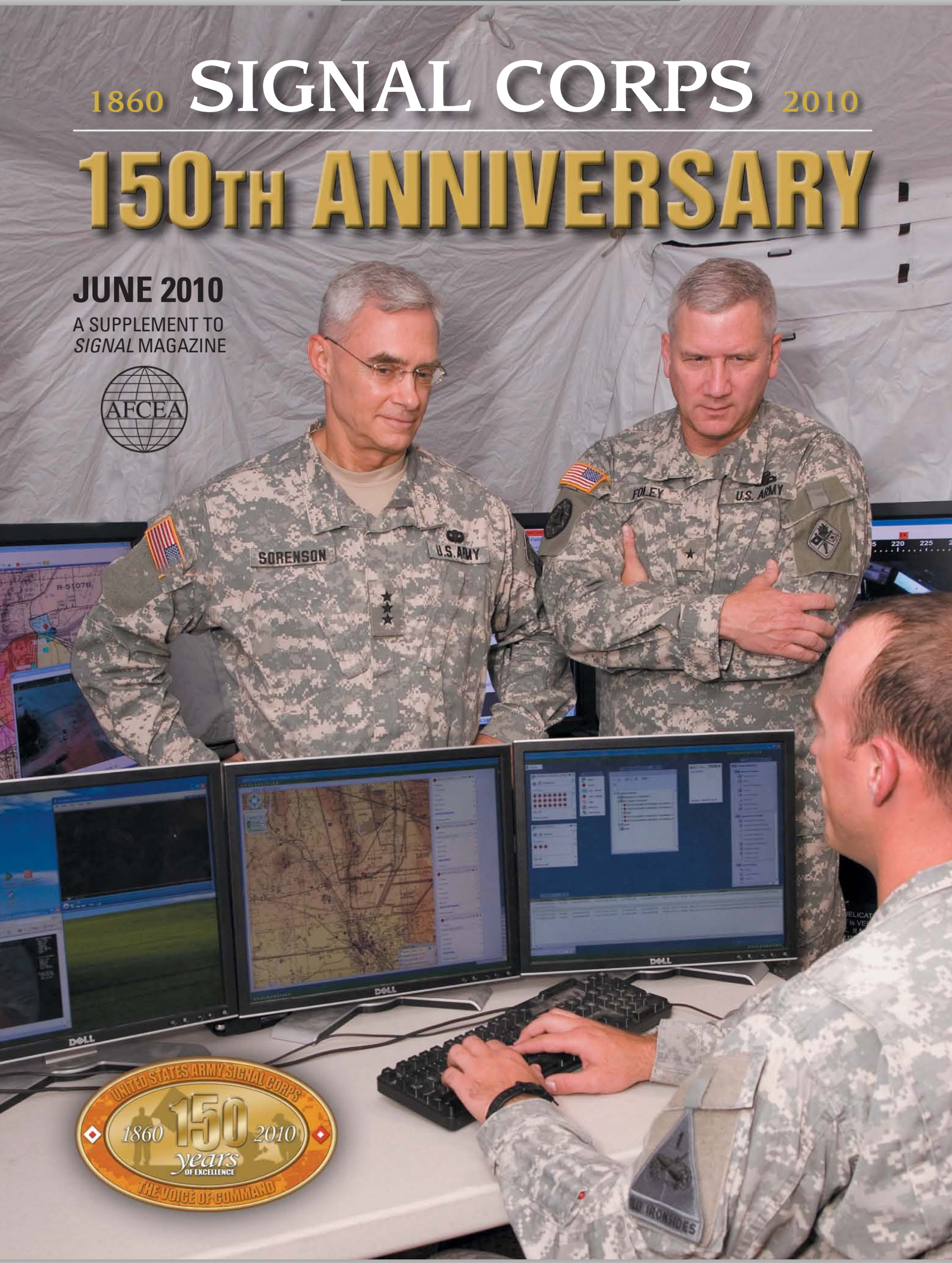

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150 Years of Signal Corps: Tradition and Leadership

On behalf of AFCEA International's 33,000 individual members and 1,850 corporate members, congratulations and happy 150th birthday to the U.S. Army Signal Corps. AFCEA is proud of its affiliation with the Signal Corps.

In 1946, when AFCEA was created, the U.S. Army was its first government partner. AFCEA was conceived to promote an ethical dialogue among industry and the Army to further understanding of the Army's direction and needs and industry's capabilities to support it. An important link between the U.S. Army Signal Corps and AFCEA was that NBC founder David Sarnoff, appointed brigadier general in the Signal Corps in 1945 and a communications adviser to Gen. Dwight D. Eisenhower, USA, during World War II, was one of the founders of AFCEA. AFCEA's mission has grown over the years to embrace all of the defense, intelligence and homeland security communities, but we have never forgotten our roots with the U.S. Army Signal Corps.

The Signal Corps has a long and distinguished history of innovation and technology insertion, along with a tenacious commitment to mission. Through its evolution from balloons and signal flags to telephony; early applications of radio, telegraphy and radar; to satellite technology and applications of automation as computers matured, the U.S. Army Signal Corps has been a leader in the application of communications and information technology to the ground warfighting and sustainment missions.

The role of the Signal Corps has grown more critical to mission success over the years. The continuously increasing capability the Signal Corps has provided to commanders and other decision makers has saved lives and improved the speed and effectiveness of intelligence and command and control at an incredible rate. Importantly, commanders' ability to operate effectively while on the move has grown tremendously and continues to become more effective today.

Much of the emphasis for the Signal Corps in the future will be to close the gap between the bandwidth and decision support that can be provided fully only when at halt today and that which can be provided when fully mobile. Making communications and information sharing transparent across the enterprise and while working in an inter-agency and coalition environment will be high priorities as well.

AFCEA is proud to have taken at least part of the journey with the Signal Corps, and we look forward to a long continuing relationship. Happy 150th, Signal Corps! Thanks for all you do every day.

Kent R. Schneider
President and Chief Executive Officer
AFCEA International

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ON THE COVER – Lt. Gen. Jeffrey A. Sorenson, USA (l), chief information officer/G-6, and Brig. Gen. Jeffrey W. Foley, USA, chief of Signal, are building on 150 years of Signal Corps excellence by leading the Army into the future of information technology dominance. Cover design by *SIGNAL* Art Director Chris D'Elia based on photography by Michael Carpenter.

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Vital Communications Links Ride on Signal Corps Agility

Messaging moves from signal flags to satellites.

By Clarence A. Robinson, Jr.

Dynamic change and ever-increasing mission responsibilities are hallmarks of the U.S. Army Signal Corps. Throughout its 150-year history, the Signal Regiment's development of communications technology led a revolution that continues today.

What began with signal flags in daylight and kerosene lanterns at night, keeping commanders informed of friendly and enemy battlefield movements, continues today with digital signals transmitted over satellites orbiting Earth.

The concept of using "wigwag" flags to visually communicate came to an Army doctor, Albert James Myer, while serving in Texas in 1856. The Signal Corps was born June 21, 1860, when the Army adopted his system. Myer, appointed a major, was the first and only Signal officer.

Within a month, Myer received orders to report to the Department of New Mexico to test his signaling system during an expedition against Navajo Indians. Arriving in October 1860 in Santa Fe, the major was quickly assigned to duty with troops in the field. A signal party detailed by the department consisted of two officers, an enlisted assistant for each officer, and a mounted escort. Detailed soldiers had to learn the "wigwag code," transmit from a vantage point, and receive and decode the message at the other end.

Signal Chief Maj. Albert J. Myer, USA, during the Civil War.

Using a single flag and a two-element code in daylight and torches at night, "the services of the signal party have been valuable in operations against the Navajos. They have conclusively demonstrated not only the practical usefulness of field signals but that they can be used under any contingences of frontier warfare," reported Col. Thomas T. Fauntleroy, USA, the Santa Fe department commander. The Navajos surrendered in February 1861, relieving Maj. Myer of field duty.

Moreover, bigger and more profound events lay just ahead that would powerfully affect Maj. Myer and his signaling system. He would be tested in a full-scale conflict—the Civil War. His signaling system was used in combat in June 1861 to successfully direct the fire of a harbor battery at Fort Calhoun (now Fort Wool), Virginia, against Confederate positions opposite nearby Fort Monroe.

In March 1863, Congress authorized a regular Signal Corps for the duration of the Civil War. However, Myer was again forced to rely on detailed personnel. Some 2,900 officers and enlisted men served with the Signal Corps during this period, albeit not all at the same time. A temporary Signal school was established at Fort Monroe creating a tiny nucleus of trained personnel who saw service in early combat engagements. Several officers and enlisted men applied their signaling skills to directing artillery fire against Confederates, making them in effect forward observers.

Myer, his Signal soldiers and visual signaling system played a critical role in famous battles throughout the Civil War, often assisting Union Army victories. Signal soldiers' courage and ingenuity proved vital in the outcome of battles. In response to Maj. Gen. George B. McClellan, USA, Myer harnessed the Beardslee magneto-electric machine for use on a field telegraph train. Relying on line-of-sight communications, the wigwag system began fading in the face of the electric telegraph.

By 1867, the electric telegraph, along with visual signaling, became a Signal Corps responsibility. More than 4,000 miles of telegraph lines were constructed, maintained and operated over the next 12 years, mostly along the western frontier.

Congress mandated a national weather service, which the Signal Corps established in 1870. By then a brigadier general, Chief Signal Officer Myer called upon Army Lt. Adolphus Greeley's assistance in forming the service. By the time of his death in 1880, Myer commanded a weather service of international acclaim. In 1891, the weather bureau became part of the Department of Agriculture, while the Corps retained military meteorology responsibilities.

The Spanish-American War of 1898 and subsequent Philippine Insurrection saw the Signal Corps' role greatly expand from the Civil War era. The Corps added the heliograph to visual signaling, supplied telephones, and provided telegraph wire lines and cable communications. The use of telephones in combat was advanced, along with combat photography and observation balloons. The Corps also introduced the first Western Hemisphere wireless telegraph shortly after the war with construction of the Washington-Alaska Military Cable and Telegraph System.

An aeronautical division within the office of the chief Signal officer was formed in 1907. Wilbur and Orville Wright made test flights in 1908 with the first aircraft built to Signal

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Corps specifications. Army aviation remained within the Signal Corps until 1918, when it became the Army Air Service.

Even though new voice radios were deemed better than radiotelegraph equipment, telephone and telegraph remained the major communications technology of World War I. During this war, the Corps grew to 2,712 officers and 53,277 men.

Chief Signal Officer Maj. Gen. George Squier, USA, worked with industry to perfect radio tubes. Early Signal Corps-developed radiotelephones were introduced in the European theater in 1918.

Between the world wars, Col. William Blair, USA, director of Signal Corps laboratories, Fort Monmouth, New Jersey, pioneered with radar. He patented the first Army radar demonstrated in 1937. Prior to World War II, mass production of two different radar sets got underway. Along with the Signal Corps' tactical frequency modulation radio, developed in the 1930s, radar became the most significant communications development of World War II. By 1945, the Corps comprised 350,000 officers and soldiers, including 5,000 Women's Army Corps members who also served overseas.

In 1946, the Signal Corps successfully bounced radar signals off the moon with Project Diana. This feat paved the way for space communications. In 1958, with Air Force assistance, the Corps launched its first communications satellite. This effort established the feasibility of worldwide communications in delayed and real time by means of simple active satellite relays.

Meanwhile, the early 1950s Korean War cut short the all-too-brief era of peace. During the Korean War, the terrain, distance and speed that communications were forced to travel limited the use of wire. The Signal Corps' very-high-frequency radio became the tactical communications backbone throughout the combat.

Requirements for high-quality telephone and message circuits during the Vietnam War led to the Signal Corps' deployment of tropospheric-scatter radio links. These links provided many circuits between locations more than 200 miles apart. Other developments involved synchronous communications satellite service and a commercial fixed-station system known as the Integrated Wideband Communications System, the Southeast Asia link in the Defense Communications System.

Today's thrust in Southwest Asia involves the heavy use of satellite communications, airborne relays, both manned and unmanned, for tactical communications. On-the-move communications to all echelons are being fielded and evolving with Internet protocol standards for voice, video and data. Challenges represented by terrain, distances between units, and fluid battlefield movements typify Signal Corps responsibilities in supporting today's Army. Approximately 65,000 Signal soldiers serve today, adroitly handling the dynamics and professional hurdles that are so familiar to the Corps—an organization adept at meeting challenges with innovation and alacrity.

• • • — • —

With appreciation to the Army's Signal Regiment's historian, Steven J. Rauch and Rebecca Robbins Raines, chief, force structure and unit history, U.S. Army Center for Military History.

Early Signal Training Legacy Lives Today

An "army of one" teaches skills, soldiers show mettle, rapidly gain battlefield fame.

President James Buchanan signed a bill into law June 21, 1860, authorizing the addition of a signal officer with the rank of major to the Army staff. That assignment went to Albert J. Myer, a former medical officer and inventor of a visual signaling system.

Confronted with building an infant organization from the ground up, the major needed a permanent training facility. He alone composed the entire Signal Corps. Operating with a meager budget of $2,000 for equipment and supplies, he found the most critical function was in training soldiers to use his signaling methods. Myer faced a challenge in finding recruits and in teaching them the Signal code as well as how to manipulate equipment to transmit messages.

Myer also doubled in brass as chief Signal officer for Maj. Gen. George B. McClellan's Army of the Potomac, then stationed in and around Washington, D.C. Myer selected a site on the heights overlooking the Potomac River in an area called Georgetown. From there, he could establish Signal stations up and down the river to monitor rebel activity. The area then was known as Red Hill. The Signal school consisted entirely of tents, both for living quarters and classrooms.

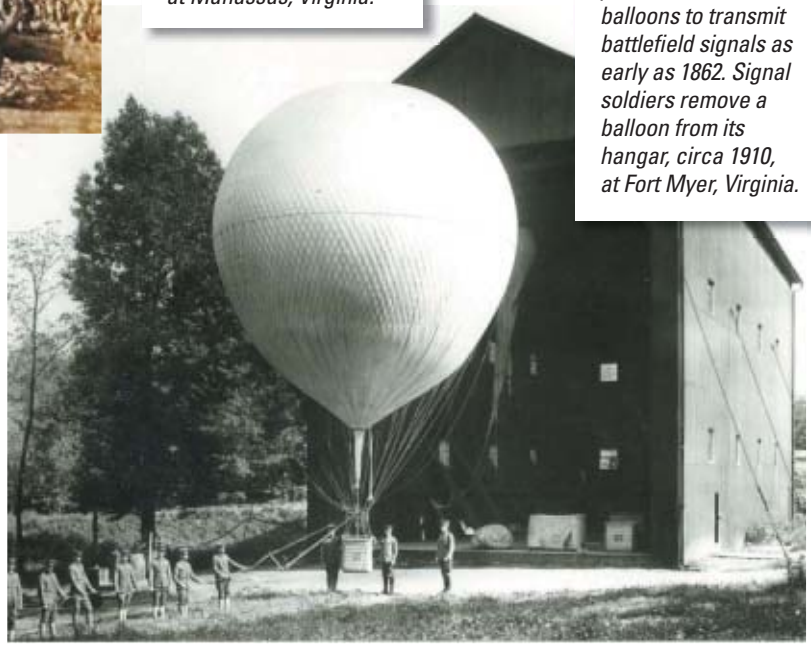
The initial student body comprised 18 officers and 45 enlisted men, most of who were members of the Pennsylvania Reserves. Additional soldiers soon joined the Pennsylvanians, bringing the school's total to 36 officers and 85 enlisted men. The Georgetown Signal camp remained open for the rest of the Civil War.

No visible signs of the Signal school exist today; however, it seems ironic that the Russian Embassy now occupies the Red Hill site. Nevertheless, the Signal school served its purpose, providing trained Signal soldiers who acquitted themselves with distinction throughout the war. That tradition endures at the Army's Signal Corps Center, Fort Gordon, Georgia. Signal flags have long since been replaced by far more sophisticated technologies but the mission remains the same—getting the message through. The legacy that began at Red Hill lives on through the men and women of the Signal Corps. —*CAR*

Scenes of Signal, 1860-2010

A Signal station on Elk Mountain, Maryland, overlooks the battlefield at Antietam. Signal soldiers atop the log rails send and receive messages.

The U.S. Army Signal Corps' 1904 version of today's high-mobility multipurpose wheeled vehicle (HMMWV) hauls soldiers on maneuvers at Manassas, Virginia.



The Army Signal Corps pioneered the use of balloons to transmit battlefield signals as early as 1862. Signal soldiers remove a balloon from its hangar, circa 1910, at Fort Myer, Virginia.

Orville Wright flies the first Army aircraft built to Signal Corps specifications in 1908. The Army's aeronautical division was formed August 1, 1907, within the Signal Corps.

Signal soldiers operate a heliograph system circa 1910. This "wireless telegraph" system uses flashes of sunlight reflected off rotating mirrors to transmit Morse code. Weather-dependent heliograph messages are effective at more than 50 kilometers.

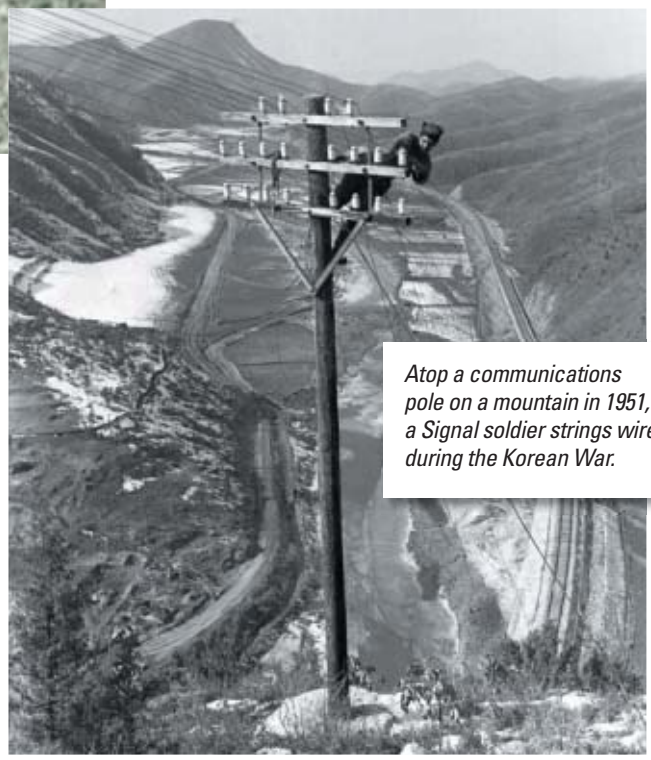
Life in the Army at Camp Zachary Taylor, Kentucky, involves Signal Corps range finding.

U.S. ARMY SIGNAL CORPS

A motorcycle dispatch rider during World War I braves heavy artillery fire to deliver carrier pigeons to the most forward U.S. position in France.

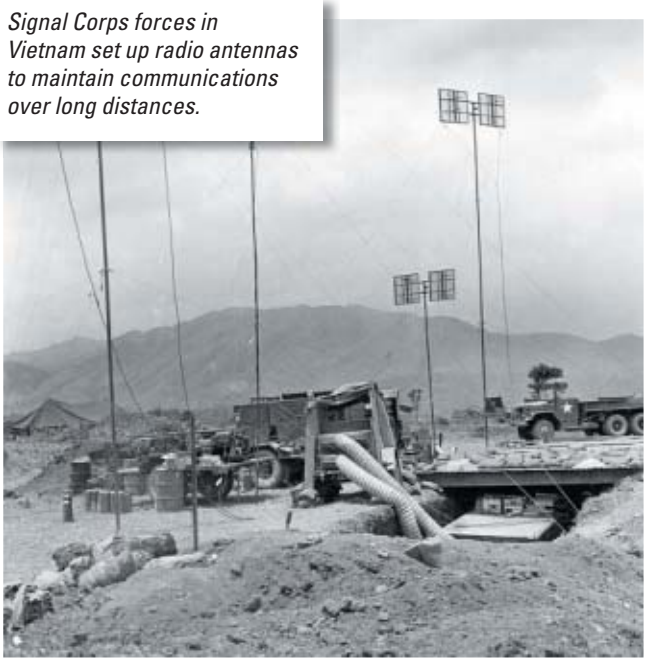
Women's Army Corps Signal soldiers embark for the Southwest Pacific area during World War II.

A hand-cranked generator, right, provides power for a Signal Corps radio handset during the Korean War to call in air strikes and artillery fire.



Atop a communications pole on a mountain in 1951, a Signal soldier strings wire during the Korean War.

Signal Corps forces in Vietnam set up radio antennas to maintain communications over long distances.



Today's Signal activities aim at providing complete situational awareness information down to the individual soldier.

Historical photographs courtesy of U.S. Army Signal Center of Excellence, Command History Office, Fort Gordon, Georgia.

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Army's Network-Centric Thrust Facilitates Global Connections

Key elements of enterprise network encompass voice, data and imagery over Internet protocols.

By Clarence A. Robinson, Jr.

The U.S. Army is on the cusp of realizing a combat commander's age-old dream of constant battlefield communications. Emerging is a network that guarantees mobility over great distances without losing connectivity. This robust enterprise network promises to provide seamless, assured and secure on-the-move communications for the warfighter.

At the heart of the Army's strategy is the drive to transition the Land Warfare Network (LandWarNet) into a single integrated enterprise. LandWarNet is the Army's portion of the Defense Department's Global Information Grid (GIG). "This strategy, called the Global Network Enterprise Construct, or GNEC, enables warfighting capabilities that dramatically improve network defense and realize numerous efficiencies," explains Lt. Gen. Jeffrey A. Sorenson, USA. He is the Army's chief information officer (CIO)/G-6. "A vital element of this approach also involves leveraging industry to provide capability and savings in technology investment."

While delving into Army strategy, GNEC emerged as a critical element. "Senior leaders of the Signal Corps and top-level civilian employees gathered to develop an approach and to define the benefits of GNEC for the warfighter. Transforming LandWarNet to an enterprise activity requires globally aggregating Army networks and synchronizing with other Army activities. GNEC focuses on four principle objectives: operationalize LandWarNet; improve overall LandWarNet security; realize economies and efficiencies while improving effectiveness; and enable Army interoperability and collaboration with mission partners," the general remarks.

"Also necessary are ways to articulate this strategy to leaders, such as the secretary of the Army, Army chief of staff, members of Congress and industry. The result," Gen. Sorenson relates, "is something called 'The Soldier's Story.' Simple vignettes emerged portraying the activities that take place when soldiers deploy to a theater of operations and the networks they function with throughout every phase of deployment from post, camp or station. The vignettes also depict the training environment in preparing to deploy and in deploying.

"We began to detect a changing network through each phase of the deployment cycle, including how the soldier connects to the network, to the Internet, to a T-1 phone line and a desktop computer. Then, suddenly, the soldier deploys to a training area in the field, using satellite communications, a laptop and tactical equipment. Each stage requires the soldier to change an e-mail address and phone number. Their network connectivity during each of these phases also changes," Gen. Sorenson maintains.

The GNEC strategy group likened soldier deployment to civilians who use their iPhones, BlackBerrys or laptops. Someone entering a hotel room does not have to carry the network; the network is already there for support. "So, we began to formulate GNEC strategy—the tenets of which are making the network operational, improving the soldier's ability to plug and play, connect to the network, and improve network security over time," he continues. "The security aspect also makes

Army CIO/G-6 Lt. Gen. Jeffrey Sorenson, USA, center, visits Victory Base in Baghdad, Iraq, while touring the 11th Signal Brigade complex.

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the network less vulnerable to attacks or malicious software."

"In the past," the general reveals, "the Army and its functional components have built their own independent networks, and in many cases, we have networks built on top of networks. This is inefficient. Part of the GNEC strategy is to ensure the ability to interoperate at the joint and coalition levels," he points out. "GNEC is important to give the Army and mission partners the right information at the right time and place."

LandWarNet also provides soldiers with a secure, single identity from a home station to any deployed environment and back again. The enterprise network supports enhanced training via live, virtual and constructive modeling and simulation. It also facilitates the ubiquitous battle command and weapon system network. GNEC provides one network to both generating and operating forces, enabling warfighting competence across all phases of joint operations. "It is GNEC's strategy to build a network accommodating all of these capabilities," Gen. Sorenson maintains.

A convoy of on-the-move platforms for the Warfighter Information Network-Tactical (WIN-T) includes two point-of presence vehicles, left. The vehicles operate during increment two engineering field tests at Fort Huachuca, Arizona.

The Network Enterprise Technology Command (NETCOM)/9th Signal Command will implement GNEC and maintain LandWarNet and its components via subordinate theater signal commands. Throughout the next few years, the Army will transform LandWarNet to a centralized enterprise network. The key to making GNEC operational, the general states, involves network service centers (NSCs) to centralize network operations under a single entity, making them less vulnerable to attack.

The NSC itself is not a fixed physical place; it is composed of geographically distributed elements. Five planned NSCs consist of three major geographically dispersed area processing centers (APCs). APCs are enterprise facilities that will provide standardized global enterprise battle command and collaboration services.

Other NSC capabilities include: fixed regional hub nodes (FRHNs), high-bandwidth satellite to fiber gateways to connect expeditionary forces to the GIG, providing intratheater communications. Another NSC capability involves theater network operations and security centers (TNOSCs). These forward-deployed facilities are in each combatant commander's area to provide network operations and service-desk functions. Gen. Sorenson's visits to four of six TNOSCs exposed between 30 and 40 different network tools in use. "An analysis revealed that the Army could consolidate the tool sets to six and standardize across the entire force."

"As a result of the analysis," the general remarks, "we were able to obtain $180 million in the 2009 midyear budget review of unfunded requests for the six GNEC tool sets."

There are three GNEC priorities in fiscal year 2010. The first involves pioneering an enterprise e-mail for the Defense Department as a managed service. A request for proposal (RFP) is out to industry. This system will later transition to the Defense Information Systems Agency (DISA). Another RFP will go out to industry for APCs surpassing today's capabilities. Gen. Sorenson's visits to Hewlett-Packard, Microsoft and Amazon to determine available technologies showed truly state-of-the-art service centers, including applications in a cloud-computing environment. Cloud computing is a way to broadly share resources via the Internet instead of using software or storage on local computers. The third priority is to deploy further the six tool sets to the TNOSCs.

A critical Signal Corps operational evaluation will take place this year when an Army fires brigade from Fort Sill, Oklahoma, physically deploys and flies to Europe without its network equipment or applications. "This will be a litmus test in terms of trusting cloud computing. Upon arrival, soldiers will begin training just as at Fort Sill using GNEC strategy, the NSC and backbone network there during the deployment," Gen. Sorenson asserts.

"Some of the technologies we are beginning to use in continuing development and building the network involve systems such as Warrior Information Network-Tactical, or WIN-T. This system brings state-of-the-art technology online for everything over Internet protocol. By doing this, we become more adaptable to continuing advances with these types of systems," the general acknowledges. WIN-T is an on-the-move, high-speed, high-capacity backbone communications network, linking warfighters in tactical ground units with commanders and the GIG. WIN-T, a critical enabler of LandWarNet, is a robust system providing seamless and assured communications.

"With WIN-T, routers and modems become more capable. We are moving into an era where it is not so much what the Army is building on its own as it is in leveraging commercial systems and capabilities to access," Gen. Sorenson reports. "In addition, we are also trying to harness the advantages of wireless networks, such as 3G and 4G. We are seeking to determine how to build capabilities as an extension of the WIN-T architecture.

"We think about WIN-T as towers existing today. However, through time, our towers will move as we advance in the tactical environment. We want to afford our soldiers wireless capability. Extending the technology and taking advantage of it in the commercial sense affords us the ability to advance as the force advances across the battlefield," the general reveals. "The other aspect is to standardize our capabilities on what industry employs. An example is the XMPP commercial protocol, where today we use something called mIRC, a proprietary system as an initial capability, but it is not widely supported by industry."

WINT-T is being built and fielded in four increments: network at the halt; initial network on the move; full

network on the move; and protected satellite communications. Satellite communications are emerging today as part of WIN-T increment one, connecting battalion and above with digital voice, data and video via satellite with worldwide Internet connections. This network assures access to systems such as the Army Battle Command and other capabilities to pinpoint friendly units via Global Positioning System technology.

The first WIN-T increment also includes command and control applications as well as sensor-based video on the battlefield. Bandwidth will expand greatly with the remaining three increments of WIN-T. The next two increments will bring full on-the-move capability. The second WIN-T increment successfully has completed two engineering field tests. The final increment brings secure, anti-jam, low-probability-of-intercept satellite communications. General Dynamics and Lockheed Martin are part of a corporate team developing and fielding WIN-T.

"Rather than building our own, the Army is taking advantage of what industry provides. In some cases, ruggedized laptops are built by a number of commercial vendors. They afford the capability to access and be netted to the Iridium constellation of 66 satellites on orbit that are built for phone communications. This Iridium mesh provides true on-the-move satellite communications," Gen. Sorenson emphasizes.

"We are leveraging this pioneering, disruptive technology that currently exist to provide a capability in Afghanistan, an extension of the Iridium constellation onto a terrestrial base for improved communications in a ruggedized battlefield environment at a lower bandwidth. The Signal Corps built its own applications, accommodating a lower data rate to deliver information and intelligence. In this austere environment, access to power is a consideration, so we are experimenting with passive power sources such as solar, saving a tank of gas and easing logistics support," the general continues.

Iridium, in concert with Hughes Network Systems, is developing an access network controller in its gateway

Soldiers at Forward Operating Base Walton, Kandahar, Afghanistan connect to Operation Enduring Freedom secret Internet protocol router network (SIPRNET) via a PRC-117G radio. The connection takes place for the first time during training.

Army Delivers Network Effects to Tactical Edge

Decisive situational awareness enables locating enemy force, precise targeting.

U.S. Army combat forces depend on information and decision superiority for success on the battlefield. Bringing voice, video and data to the edge of tactical formations extends a precise battlefield overview to the lowest levels of the force. This enterprise network seeks to integrate flexibility and agility down to brigade, battalion and company.

The Land Warfare Network, or LandWarNet, is central to how the Army fights. This enterprise network integrates every element of Army modernization and seamlessly connects the soldier to the information he or she needs, whenever and wherever it is necessary.

"LandWarNet provides actionable intelligence and situational awareness. The Army's strategy and vision for the enterprise network brings four essential elements into the hands of soldiers at every level: the ability to know where they are; the ability to know where their friends are; the ability to know where the enemy is; and the ability to target the enemy with pinpoint fires," according to Col. William J. Scott, USA. Selected for promotion to brigadier general, he heads the Army's G-3/5/7 LandWarNet Battle Command Directorate.

"The Army is a force at war and a force in transition, guided by the force generation process. Army force generation, or ARFORGEN, is both a model and process. It is the plan for deploying troops, and it's the core process of building trained and ready forces," Col. Scott continues. "This is also true of Army network modernization, as we continue to consolidate from many networks to a federated network and, ultimately, into a single end-to-end Army network enterprise. The Global Network Enterprise Construct [GNEC] guides us to this enterprise."

GNEC provides a structure for the breadth of the network as it relates to enabling a quality expeditionary force.

ground control network. This involves state-of-the-art advanced telecommunications architecture platforms, significantly increasing bandwidth and signal processing capabilities, thus expanding capacity. Because of terrain and line-of-sight communications issues in Afghanistan, "satellite communications are imperative. Approximately six months ago, we transmitted our first digit over a landline, but everything to date has been over satellite because of terrain issues. We generally use Wideband Global Satellite [WGS] communications; however, we are reaching a point where we can access Ka-band, which is more or less a military satellite capability. Nevertheless, we will continue to use Ku-band over time because the need for satellite communications, including commercial satellites, surpasses the available supply," he adds.

The WGS offers 4.875 gigahertz of instantaneous, switchable bandwidth. Each of six WGSs in orbit will be able to download 2.4 gigabits per second to tactical users.

"Soldiers can download communications into an area of operations with the notion of netted Iridium extending on a terrestrial basis," Gen. Sorenson says. "We are also using high-capacity line-of-sight radios to share information between forces, whether moving or at forward operating bases. Tethered aerostats and unmanned aerial vehicles also provide communications relays."

Gen. Sorenson is a West Point graduate with a master's degree in business administration from Northwestern University. Commissioned in artillery, he transferred to military intelligence, served in acquisition, and then in the Signal Corps. "Of all I have done, one of the most stimulating and exciting realms in the Army is the Signal Regiment. I contend what happened with Albert Myer in 1860 continues today. An Army cannot function effectively and perform on the battlefield without communications networks—true in the Civil War era and true today. Myer used signal flags and lights to provide the capability for the combat commander to understand and communicate, as essential then for battlefield success as it is today.

"The need for Signal soldiers to support warfighters has not changed. Even then, Myer was involved with a form of information assurance, which we call cyber today. He used disks to encode messages before transmitting them—already he was making sure signals would be secure with what we now call encryption," the general continues. "Today, we use software and intelligence analysis tools. However, unless we can secure communications, just as in 1860, it does not provide warfighter value.

"Innovators are the same today as in Myer's era. The major introduced insulated telegraph wire to send portable messages, thereby greatly increasing message speed from three words a minute with signal flags. Today, throughput is in gigabits and soon to be terabits. However, just as in the past, Army Signal soldiers and civilian employees continue to be innovative, leveraging commercial technologies and applications to improve the ability to connect with the warfighter. Wherever I go, I am amazed and awestruck at Signal soldiers' ability to innovate and provide connectivity," Gen. Sorenson summarizes.

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The depth of the network is characterized by standards, transport means, services and applications along with sensors fielded across and at each echelon of Army modular force formations, the colonel explains. "The network provides situational awareness that is decisive across the spectrum of conflict, connecting to the soldier. It enables sharing a joint, combined, interagency, intergovernmental and multinational environment."

To meet the challenges, "our approach is incremental modernization, aligning the delivery of network capabilities in sync with ARFORGEN to complete end-to-end network effects required at the tactical edge. Additionally, the pace at which the network is evolving requires broadening our systems integration efforts and incorporating them earlier in the development process. Synchronizing the broad range of activities necessary to field, train, test and acquire an integrated set of network and battle command capabilities is essential to our warfighters," Col. Scott points out.

Col. (P) William J. Scott, USA, is director, Land Warfare Network (LandWarNet)/Battle Command, Headquarters, Department of the Army G-3/5/7.

The desired end state for Army network modernization is a coherent and interoperable network of command posts, platforms, sensors and soldiers linked by an integrated suite of command and control applications and services. These functions are all connected by robust network transport," the colonel emphasizes. "In the end, the enterprise network encompasses the GNEC, as defined by the chief information officer/G-6, and the mission-essential capabilities defined by the Training and Doctrine Command. Our strategy for Army network modernization ensures that every soldier will have the necessary network capabilities to accomplish myriad missions in conducting the full spectrum of operations," he confirms. —*CAR*

Students Learn Technical Skills, Expand Knowledge

Signal soldiers connect, transport, capture, manage and defend military information.

By Clarence A. Robinson, Jr.

U.S. Army leaders view the network as an essential warfighting capability. The network is critical in achieving dominant battle command. Indeed, the Signal Corps enables the warfighter to access information, the most powerful combat multiplier.

Communications are an invaluable commodity made possible by the Signal Corps, Lt. Gen. Rick Lynch, USA, asserts. The Army's former 3rd Infantry Division commander in Iraq, he operated with approximately 60 company-size combat patrol bases widely spread across an area the size of West Virginia, making effective communications vital.

Gen. Lynch calls himself "the president of the Signal Corps fan club," adding, "as another general says, 'when you are out of communications you're just camping out in the desert.'" The general now heads the Army's Installation and Management Command. He ranks the Signal Corps "at the top of the list in battlefield importance," and praises the Signal Corps for getting the message through to and ensuring the safety of soldiers. He describes Signal soldiers as "absolute heroes."

The battlefield computer network links Army sensors, decision-makers, fire support, engagement and logistical systems to achieve overriding combat success, according to Brig. Gen. Jeffrey W. Foley, USA. He is the Army's 34th chief of Signal, based at the home of the Signal Regiment, Fort Gordon, Georgia.

Gen. Foley's task is to train and educate Signal Corps soldiers to acquire the requisite skills in establishing and maintaining the network and a steady flow of time-critical information. However, his mission is not just to teach the necessary technical skill sets. He also strives for each soldier to understand the principles involved and to be able to learn and expand those skills to handle advances in equipment that might not be available today, he explains.

The Signal Center trains approximately 24,000 students a year, averaging 5,610 per day. This training includes 4,600 Army Reserve and National Guard; 823 airmen, sailors and Marines; and 261 students from 49 foreign countries.

Training soldiers to think and rapidly expand their skills in the field is essential as technology advances rapidly, accommodating areas such as on-the-move communications and leaps in bandwidth resources. Today, communications networks enable combat

and support operations at levels never imagined in Army history.

However, "all the technology in the world is worthless without dedicated men and women who make it work. This translates to leadership. We often cater to and highlight technology, but ultimately this is about humans who must be motivated and interested in learning and growing, while figuring out how to make this complicated equipment work. In many ways, there are parallels between issues facing the Army today and Maj. Albert Myer and the Signal Corps of the 1860s, when he was literally 'an army of one.'

"Signal flags on mountain tops, relays of signal flags, and lanterns at night were complicated for their time. Today, we have an exponentially more complicated world but, in many ways, the challenges are similar. Soldiers still must make all the technology work. At Fort Gordon, we are in relentless pursuit of world-class education and a training environment that inspires young men and women to make the technology work. Therefore, our focus here is on training, especially hands-on with equipment. Nevertheless, we also provide the education that teaches them to think. We are in the people business, and that is the critical element," the general, a West Point graduate, declares. He also holds master's degrees in computer systems and national security policy.

"Everything we do in our regiment is in support of the warfighter, enabling operations from post, camp or station to the foxhole. Our networks supply a steady information flow. They also allow command, control and time-sensitive targeting on the battlefield—those critical elements of warfare. The value of today's information technology [IT] enhances and changes the dynamics of warfare, and this is preeminent for the Signal Corps, involving a perpetual task in educating the Signal soldier. Every day that we operate networks on the battlefield involves compressing the timeline for sensitive targeting, and compressing the amount of information that flows from top to bottom, when a weapon system can be quickly applied onto a target," Gen. Foley adds.

The collection and transmission of information on the battlefield is burgeoning. "Individual soldiers can provide photographs or video, sending and sharing that imagery with those who know how to assess and analyze it, turning data into actionable information—information that leads to putting a weapon on a target," Gen. Foley says. "Everything we do compresses the time, and the size of the pipes, as well as the expeditionary use and efficient

Brig. Gen. Jeffrey Foley, USA, chief of Signal, is aloft in a helicopter, heading toward a forward-combat position to check on Signal soldiers, their performance and requirements.

management of information. Information in combat is flowing down to the lowest levels—to the soldier and right into the foxhole.

"Today, unmanned platforms, whether robots tossed over walls,or handheld unmanned aerial vehicles in Iraq or Afghanistan, capture imagery or video that provides information from the lowest levels up to satellites, sharing information at all command levels. Every element of information collection and distribution is enhanced by technology that Signal soldiers apply. Storing and sorting that information requires efficient search engines. These functions entail advances in technology and common applications. The Signal Regiment is the transport provider," Gen. Foley stresses.

"By definition, our Signal Regiment has a huge role in cyberspace. The regiment is responsible for providing warfighter access to the Army's application of cyberspace or more specifically LandWarNet, the Army's portion of the Global Information Grid [GIG]. Ultimately, it is our Signal soldiers, Department of the Army civilians and contractors that commanders and their staffs rely on to establish, operate, manage and defend their portion of the cyber warfighting domain," the general points out.

"IT impacts everything we do today—using radio frequency tags to track logistics, video or radio communications for telemedicine links to subject matter experts when time is crucial in treating wounded soldiers on the battlefield, and for administrative functions such as efficiency reports for promotion or combat awards—and, ultimately, assists in caring for our people," Gen. Foley offers.

"The military depends on the use of commercial IT standards and corporate partners. We would be lost without them. We could not be doing anywhere near what we are doing in Afghanistan or Iraq, if not for commercial partners and their relationships with the military. Corporate America helped us and responded to the call when we needed them, from Baghdad to Kabul. As the regiment and Army focus on migrating and accepting commercial standards, it aids us drastically with the ability to communicate in coalition and joint force environments," Gen. Foley reports.

Fort Gordon establishes numerous partnerships with academia and industry focusing on IT. "The Signal Center is in perpetual pursuit of opportunities to help our soldiers and officers learn. Training with industry is a program that has been available for decades. We send officers to our industry partners' headquarters, where they work for a year learning the latest in IT and cyber technologies." Examples of industry partners include EDS, General Dynamics, Microsoft and AT&T. "These officers return to an assignment within the Army where they can best use the skills they acquired from industry," the general continues.

Memorandums of agreement with other industry partners helped create large certified Microsoft and Cisco training academies at Fort Gordon. These academies benefit not only military students but also government civilian students. Most new information management career program functional

courses are Microsoft- or Cisco-based. Other agreements involve NetApp and Adobe corporations.

Another learning program involves universities such as Maryland, Syracuse and Colorado. Upon successful course completion, these universities certify military education courses of instruction at the Signal Center for graduate-level credits in multiple disciplines. Those students can obtain a master's degree, either on campus or virtually, from these partner universities, Gen. Foley continues. "University partnerships provide timely industry-standard training to students. This process reduces the training development cycle drastically while improving the quality of education. Industry and academic partnerships make commercial certificates and graduate degrees available to students at Fort Gordon."

The Signal Regiment plays a major role in cyberspace operations, including GIG defense. Network defense is a core competency of the regiment. This defensive capability extends down through every echelon of warfighting units to brigade and below and throughout the force-generating and sustaining base infrastructure. "All elements of cyberspace are critical, but the Signal Regiment's mission ensures, establishes, manages, defends and leverages the Army's portion of cyberspace at all levels of operation across the enterprise. This mission supports combat commanders and up to the national command authorities," Gen. Foley affirms.

Cyber defense training and education have become a center of gravity for the Signal Center. Protecting and defending networks must be on par with ultimately providing the warfighter with the right information at the right time and in the right format. Partnerships with corporate America and academia provide valuable support with this effort. "Additionally, partnerships with the Army intel center, National Security Agency, other services training centers, and Department of Homeland Security will further our goals toward a solid cyber defense training environment," the general details.

Moreover, in 2010, the Signal Center will conduct the first set of courses for the new Signal warrant officer military occupational specialty (MOS), information protection technician. The cyber defense warrant officer will have top secret/sensitive compartmented information (TS/SCI) clearances to know the cyber battlefield and also be trained to defend Army network operations and implement information assurance policies. In 2011, additional courses will spin out of information protection. Several cyber defense functional courses will cover tactical perimeter defense, public key infrastructure,

Signal Soldiers Grapple With Widgets, Warfare

Advanced training focuses on classroom skills, hand-to-hand combat, knife fighting, survival.

The Army's warrior ethos is alive and well at Fort Gordon, Georgia. Soldiers arrive at the Signal center from basic training to begin advanced individual training in their technical specialties. However, they soon find themselves involved in extremely realistic combat training.

Many of the soldiers acquiring Signal Corps specialty skills graduate from the classroom only to quickly deploy to units on the battlefield in Afghanistan or Iraq. "When Signal soldiers leave here, it is our responsibility to assure that they are suited to handle existing combat conditions when they arrive at their next unit," according to Command Sgt. Maj. Thomas J. Clark, USA. He is a 30-year Army veteran with combat experience during two tours in operation Iraqi Freedom.

"Moreover, 90 percent of our instructor cadre and those conducting combat training are veterans of the wars in Afghanistan or Iraq, many of them from second or third tours in the combat zones," Command Sgt. Maj. Clark continues. "The same holds true for the Noncommissioned Officer [NCO] Academy at Fort Gordon, generally considered as the best and largest NCO academy in the Army. Many NCO students and instructors have been on two or three rotations in the combat zone."

The culmination of the Signal Center's advanced individual training places Signal soldiers at a remote site, a forward-operating base on Fort Gordon. There, they live, work, eat and train just as if on the battlefield. Students must complete 120 hours of classroom and field activities covering control points, and managing forward-operating bases, range practice, live-fire exercises, unarmed combat and more. After weeks or months in the classroom, soldiers know that this field training helps prepare them for the unexpected chaos of combat, Command Sgt. Maj. Clark says.

voice over IP (VOIP) security, wireless security and hacker techniques, along with exploits and incident handling, Gen. Foley maintains.

Another vital element at Fort Gordon is distributed or distance learning. "I feel obligated to provide an environment 24/7, anywhere in the world, that soldiers can access to learn and stay abreast of technology. Training and Doctrine Command [TRADOC] recognized us last year as having the best distributed learning capability in their command. However, we know we still have a long way to go to train and educate soldiers anywhere on the planet, and this is a constant priority for us to stay on the forward edge of learning," the general discloses.

Fort Gordon is TRADOC's capabilities manager and the leading user representative for Warrior Information Network-Tactical (WIN-T) and the Joint Tactical Radio System (JTRS) suite of radios and other IT resources. The Signal Center also is an advocate for TRADOC requirements documentation, providing future networks to enable command and control battle command operations with on-the-move communications—"whatever user requirements might be," Gen. Foley reveals.

WIN-T is the Army's on-the move, high-speed, high-capacity, backbone communications network. Warfighters in tactical units on the ground link via WIN-T with commanders and the GIG. WIN-T is the critical element in the Army's LandWarNet, providing true satellite communications on the move and high-bandwidth radio systems that keep mobile units connected and communicating.

JTRS is a family of revolutionary software-programmable tactical radios that provide the warfighter with voice, data and video communications. JTRS provides a networked wideband waveform for mobile connectivity across the battle space, while providing compatibility with waveforms currently in use.

"As chief of my branch, my main role is providing qualified human resources for the regiment. This involves military occupational specialties that will be needed, creating professional growth in every one of the necessary skills for officers, noncommissioned officers and soldiers. This is a daunting task with 12 enlisted MOSs, three officer and four warrant officer specialties. The human capital aspect is critical, as we try to predict the future, adjust or morph, to provide absolute career paths for soldiers and officers to grow," the general declares.

"When I see Signal soldiers around the world—from Kuwait, to Kirkuk, to Kabul—being chief of Signal makes me very proud," Gen. Foley concludes.

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"Soldiers come here for advanced individual training, but we also teach them combat lifesaving skills. When I went through training at Fort Gordon some 30 years ago, we were not even issued weapons. Now, soldiers receive world-class technical training, and we add warrior tasks and battle drills. The idea is to be certain that when a Signal soldier leaves here, he or she will be able to contribute in their first unit assignment," Command Sgt. Maj. Clark illustrates. "There is no longer time to train a soldier at a tenant unit. Each soldier must be prepared for combat upon arrival, and we do our part to make them ready.

"The Signal Center keeps abreast with the onslaught of technology in its classrooms; however, the command is flexible and able to move quickly so that instruction keeps pace with industry advances. Plus, many units in combat use commercial off-the-shelf technology, making training somewhat more challenging. In many ways, today's cell phones are an example. You might own a cell phone now and along comes the iPhone. Technology moves extremely fast." Another example he cites in keeping pace is with fiber optics technology. "Our 'cable dog' students receive 80 hours of fiber optic training to be able to wire forward-operating bases around the world, not just in Iraq or Afghanistan. They also must perform in places like Kuwait with the 160th Signal Brigade."

The speed at which technology emerges also means that the Signal Regiment must teach not only the technology involved but also theory and principles. Exposing soldiers to theory enables them to cope with technical advances such as in satellite communications systems. The satellite system he or she works with in Afghanistan or Iraq may not be exactly the one

Sgt. Dazzarie Hill, USA, competing for NCO of the year at Fort Gordon, Georgia, plots points on a map during a land navigation exercise. Photo by Spc. Terysa Shaffer, USA.

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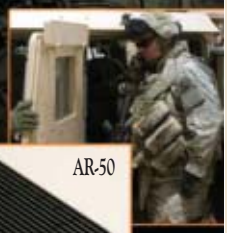

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Command Sgt. Maj. Thomas J. Clark, USA, arrives in Baghdad, Iraq, opposite Saddam Hussein's palace during an early combat tour.

that the soldier was trained to operate. Nevertheless, if the theory to acquire a satellite and operate the ground terminal is understood, the system will work, the command sergeant major points out.

"A significant change on the battlefield for today's Signal soldier is the advent of the Warrior Information Network-Tactical [WIN-T] and the Joint Network Node [JNN]. The mobile subscriber equipment [MSE] system is gone. In the recent past, we have added a new 25N military occupation specialty—nodal network systems operator. This addition helps ensure that we have the technical expertise to operate JNN and flagship WIN-T equipment," Command Sgt. Maj. Clark relates.

Another recent change is the addition of distance-learning opportunities for the Signal soldier. LandWarNet e-University is the Signal Regiment's online presence for training. Individual active and reserve soldiers, Signal units, and S-6/G-6 elements have access to Web-based tools and information. Users can request online training and conduct collaborative discussions with peers and Fort Gordon's subject matter experts—a huge reach-back capability for those who are forward deployed.

The command sergeant major and fellow Signal soldiers went into combat in Iraq, crossing the border with the V Corps in attack. They jumped off to support the warfighters with MSE on-the-move communications. They dug hasty fighting holes in the sand and seized objectives right along with the warfighters. "The soldiers who joined the Army after 9/11 are unique. They come to Fort Gordon highly motivated, telling America 'send me.' When I joined the Army 30 years ago, our country was not at war, and I wanted off the farm in Pennsylvania. I did not feel threatened that six months later I would be deployed and in the sand of a foreign country defending our way of life.

"Sometimes I hear people talk about the youth of our country and the lack of American heroes. I tell them, they are looking in the wrong places. Don't look in sports arenas or on movie screens; look right here at Fort Gordon, Georgia. Ninety days from now. these young soldiers could find themselves in units deployed for combat. These are American heroes," the command sergeant major proclaims. "The people we train here will replace guys like me, and they are ready to assume roles of responsibility. I am confident they will protect my grandchildren. I work on behalf of a nation and for the soldiers of the Signal Regiment. My name is Tom Clark, and I'm a soldier," he declares. —*CAR*

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Soldiers from the 5th Signal Command (theater), Wiesbaden Army Airfield, Germany, set up a tropospheric scatter antenna during an exercise.

Battlefield Triumph Mandates Secure, Trustworthy Network

Combat power flows from linking sensors, decision-makers, shooters for awareness.

By Clarence A. Robinson, Jr.

Changing in fundamental ways, the U.S. Army is becoming a more versatile expeditionary force. This transformation, the largest in a century, involves performing full-spectrum operations on the traditional battlefield and in cyberspace.

Combat success depends on the ability to see and fully understand the battlespace in all its dimensions to precisely locate and track targets. The Army expects this expeditionary force to have lethality, survivability, tactical mobility and responsiveness in swiftly deploying to far-flung battlefields.

Indeed, warfighters today demand a reliable, secure network that is accessible anytime, anywhere. "This capability is essential to our modern network-dependent world, where ready access to information isn't just a combat multiplier for a squad pinned down in Afghanistan; it's the difference between success and failure on the battlefield. Achieving information access, however, requires change," Maj. Gen. Susan S. Lawrence, USA, points out. She is commanding general of the Network Enterprise Technology Command (NETCOM) and 9th Signal Command (SC).

Her command's core mission is operating and defending the Land Warfare Network (LandWarNet), the Army's portion of the Global Information Grid. Headquartered at Fort Huachuca, Arizona, Gen. Lawrence leads a geographically dispersed force of approximately 17,000 soldiers, Army civilians and contractors around the world. "Never in my 37-year history as a soldier have I seen the U.S. leadership understand the importance of what the network brings to the fight," she maintains.

Commanders in the field have learned the significance of the network in warfare, to generate increased combat power by linking sensors, decision makers and shooters to achieve shared awareness and increased speed of command and control, Gen. Lawrence observes. "Our leaders recognize they are now network dependent.

"Of course change isn't new in the Signal Corps. This year marks the 150th anniversary. During this time, we've moved from semaphore signal flags and carrier pigeons to satellite communications and cyber operations. This is, however, one of the most important periods in our history

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A soldier from the 10th Signal Brigade, Camp Arifjan, Kuwait, wires a server set together.

and it will shape the way we fight through this century," the general states. "The reshaping began last year when we were charged by the Army chief of staff to transform LandWarNet into an enterprise network.

"As the Army's single information technology provider, we, NETCOM and the 9th SC, are executing an enterprise-based plan to aggregate, consolidate, federate and modernize the network into a vehicle that supports Army needs," she continues. "With the Global Network Enterprise Construct [GNEC] strategy, we are taking a number of bifurcated, antiquated, noninteroperable, very costly and nonsecure networks and replacing them with a secure enterprise network.

"This is a tough job requiring a tremendous amount of synchronization, coordination and teamwork between the 9th SC, the Army's chief information officer/G-6, our fellow services and agencies and our partners in industry. If we could start from scratch, we could do the job cheaper and faster. But we can't shut down the network. We have been at war in excess of eight years, and the warfighters at the end of this network depend on us. What we are doing brings to mind the old, but relevant, analogy of building an airplane while flying it," Gen. Lawrence adds.

Nevertheless, "the work is paying off. By year's end, we will have streamlined our software baseline, replacing 31 network operations legacy tools with six that are state of the art. We will also enable the first brigade combat team to deploy the transformed LandWarNet into a combat zone," Gen. Lawrence says. "Further, we will introduce an active directory capability that will allow soldiers to retain the same cyber identity and e-mail address, wherever they are in the world. It's an exciting time, and we are proud to be part of the team leading this important effort. The key is in receiving the task from the chief of staff last year that NETCOM/9th SC would be the single information technology service provider for the U.S. Army."

Whenever her command receives a task, the general explains, it is broken down into four parts—technical, process, policy or people issues. "I am most comfortable in the technical area because industry is on the cutting edge today. Driven by the bottom line, the profit margin, industry has to become more efficient. I spend a lot of time with them looking at best practices. But we have a different twist—our bottom line is the soldier.

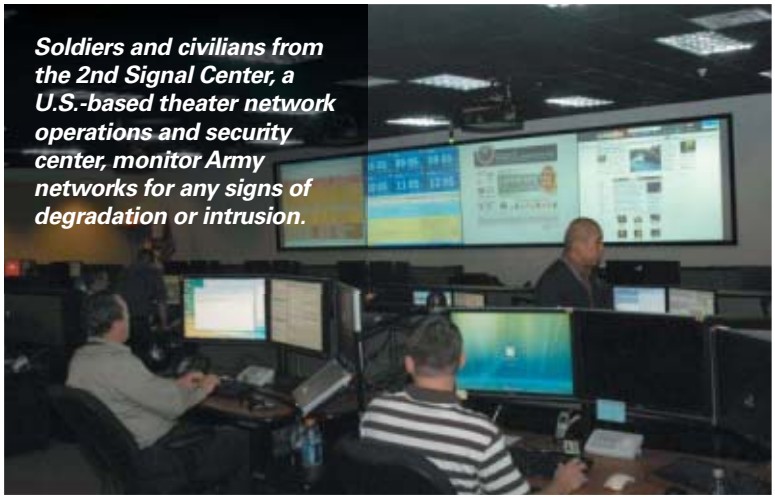
"When I speak to my own organization, to those who are a little frustrated with carrying the heavy weight to make this enterprise network happen, I remind them of the soldier who is pinned down by enemy fire on the border between Afghanistan and Pakistan. That soldier's number one protection is not his rifle; it's the network. When he runs low on ammunition, he can call for resupply and supporting fires. That's our bottom line—giving our soldiers on the point for the nation the best capability we can provide," Gen. Lawrence maintains.

In building the enterprise network, the most difficult element is the people category, the general observes. Overcoming an entrenched culture that tends to believe it must own its own network and only trust what its network can deliver is irrational, defeating what the Army is trying to accomplish.

"Our role in implementing GNEC is taking the 'as is' network, cleaning it up, setting standards and configurations, and collapsing all of the disparate networks to get us headed toward a federated state as we work through this. We are now at the proof-of-principle stage with an upcoming second operational evaluation [OPVAL II]," Gen. Lawrence reveals.

"To understand our OPVAL objectives, some background is necessary. The central technical construct of GNEC strategy is the network service center [NSC]," Gen. Lawrence relates. "NSCs connect warfighters anywhere in the world with their data and applications. These centers provide centralized and securely staged data and applications managed through a constellation of fixed regional hub nodes [FRHNs] and globally accessible satellite groundstations. These nodes are directly connected with the GIG and area processing centers [APCs], which are robust and resilient data staging centers."

APCs and FRHNs work in conjunction with theater network operation security centers. These network operations components, around the globe, ensure warfighters can access their data and applications at any time, regardless of the operational phase or location. In garrison, soldiers con-



Soldiers and civilians from the 2nd Signal Center, a U.S.-based theater network operations and security center, monitor Army networks for any signs of degradation or intrusion.

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nect to terrestrial fiber, and all the way to an austere joint area of operations through connections to the APC via the unit's organic satellite system, the Joint Network Node (JNN), according to Gen. Lawrence.

Last year, during the NSC's OPVAL I, the 9th SC supported a national deployment of the 18th Fires Brigade at Fort Bragg, North Carolina, to an east European area of operations. During the exercise, the brigade deployed its command post (CP) to a Fort Bragg training area. However, it accessed its data and applications from the APC located in Grafenwoehr, Germany, via trans-Atlantic satellite, connecting through the Landstuhl, Germany, FRHN. This connection enabled the brigade to virtually participate in the European Command's Austere Challenge 2009 from Fort Bragg.

The 18th Fires Brigade collaborated with its European partners in the early phases of the exercise while still in garrison, accessing its data from the Fort Bragg APC. Even when its own set of applications servers—the battle command common services suite—went offline simulating shipment overseas, the brigade still could access many of its applications and data. The applications had been replicated, moved and hosted from the APC in Grafenwoehr. This factor allowed the unit to maintain continuous situational awareness, participating in all planning operations. The general calls OPVAL I "an exciting accomplishment because it proved the GNEC model really works." A second OPVAL will pick up where the first left off.

Maj. Gen. Susan S. Lawrence, USA, is commanding general, Army Network Enterprise Technology Command (NETCOM) and 9th Signal Command.

"This year we will again deploy a brigade-size CP from the 75th Fires Brigade, Fort Sill, Oklahoma, to Austere Challenge 2010. The major difference is that the CP will physically deploy to Germany for the exercise, using GNEC principles and the same satellite via Landstuhl to access its data staged at Grafenwoehr. Even more of the unit's organic data applications will be exercised, resulting in greater confidence in the reliability and security of the tactical data services provided from the APC," Gen. Lawrence details.

The exercise is also intended to validate the continuity-of-operations plans between two APCs. The exercise will provide the Army with an opportunity to rehearse the actual passage of a warfighting unit and its data from one theater to another—an operation that will be executed into Afghanistan or Iraq in the coming year. "This OPVAL will be much more than originally planned. Not only will it be a validation of network enterprise itself, it will be our first mission rehearsal of moving a brigade combat team from home station to a theater of operations," the general says.

Warfighters will no longer have to drag the network with them. Using a device similar to an iPhone, they will have access to all the enterprise capabilities necessary to execute their missions.

"Defending the network, the information that resides on the network, is my top priority. Compare the cyber domain to land, sea or air operations, and I submit that some of our largest threats are in cyberspace," the general proclaims. "There are a lot of nonkinetic things an enemy can do against us that keep me awake at night. With high visibility, network security is an all-consuming topic within the 9th SC; I meet monthly with my subordinate commanders on security to measure ourselves and see where we stand. Whatever we do with the enterprise network, the first question is whether it secures our information and defends the network—the focus is on implementation and enforcement.

"Fielding new capabilities for network security, we work with the Army Global Network and Security Center [A-GNOSC] and theater signal commands." The A-GNOSC has made impressive strides in defending the network, Gen. Lawrence acknowledges. This network security organization shares the Intelligence and Security Command facility at Fort Belvoir, Virginia, and has forged strong operational bonds with professionals in the 1st Information Operations Command.

The role of A-GNOSC in protecting the network was displayed during a recent incident associated with a rapidly spreading worm across the LandWarNet. During the event, A-GNOSC quickly located, halted and eradicated the malware. When information operations conditions levels were raised, the A-GNOSC issued a customized order directing Army forces worldwide to make emergency configuration changes and close down approach vectors to potential adversaries, the general continues. These efforts contained and quickly neutralized the threat, ensuring secure, continuous network operations.

Building security into network capabilities and operational procedures, a core 9th SC competency, is foundational to GNEC and to effective cyber operations.

"The team working to implement GNEC strategy is the most professional and technically qualified I have ever worked with. What we ask of our men and women every day—both soldiers and civilians—has brought unbelievable performance. I look at 9th SC reenlistment statistics as one measurement to determine stress and how fast and hard we are running to implement the network," Gen. Lawrence reveals. "We were first in Army reenlistment in 2008 and 2009. Already in 2010, we have met all annual reenlistment requirements. I'm proud of the men and women who want to stay on the team and of our civilians who hustle as hard, making it not just a 9 a.m. to 5 p.m. job.

"Through GNEC, we will enable our Army to fight on a single, secure and sustainable network, fully capable of supporting an expeditionary force in all phases of operations. The network empowers soldiers to train as they fight, to deploy with little or no notice into austere environments, and fight upon arrival. The network creates a decisive advantage over any enemy they may face," Gen. Lawrence emphasizes.

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Senior Officers Tout Digital Development

Clear battlefield picture emerges from modern information technology for audio, visual, data.

By Clarence A. Robinson, Jr.

The Signal Regiment faces daunting challenges in providing and maintaining an always-on network for widely scattered U.S. Army forces. Commercial Internet protocol for voice, data, video and network operations is essential to both combat prowess and the Army's transformation into an expeditionary force.

The modern-day history of the Signal Corps, as seen through the eyes of senior Signal officers, reflects the wave of digital technology advances washing over the Army and U.S. industry alike.

Moreover, innovative approaches and the human element can be harnessed to provide situational awareness that is so critical for successful battlefield operations, according to Lt. Gen. Steven W. Boutelle, USA (Ret.). A nation at war marked his tenure as the Army's chief information officer (CIO)/G-6 from July 2003 to July 2007. "This climate presented many opportunities to get things done at an accelerated pace," he observes. "Many of the senior general staff officers had an established rapport and credibility. Never overlook the importance of the human element," the general cautions. "We all had a history together and we were extremely focused after 9/11."

Earlier proof-of-principle efforts were followed by demonstrations at the Army Training Center to determine digital system interoperability and investment strategy, Gen. Boutelle reveals. "The 4th Infantry Division [ID] was already being digitized, when Army Chief of Staff Gen. Eric Shinseki called for acceleration of digitization. He also ordered operationalizing Army Knowledge Online [AKO] within a year, with both Internet protocol [IP]

Lt. Gen. Steven W. Boutelle, USA (Ret.), Army chief information officer (CIO)/G-6, looks over Kabul, Afghanistan, from a plateau above the city.

router and nonclassified IP router networks. Gen. Shinseki wanted AKO access for every soldier. Encrypted e-mail was added later."

When the 3rd ID went into Baghdad, communications systems included mobile subscriber equipment (MSE), tri-service tactical (TRI-TAC) "and anything else we could pull together," Gen. Boutelle explains. "However, on the next rotation in Iraq, the new 3rd ID commander told us MSE did not meet his requirements, issuing an operational needs statement. Convergence on a commercial IP backbone network soon followed."

The joint communications support element (JCSE), the unit first to deploy for any contingency, and a Signal battalion in the 82nd Airborne Division offered equipment models. The JCSE's initial entry package is essentially a command and control system in a box, giving commanders Internet access and a small satellite dish to connect to Defense Department networks, Gen. Boutelle continues.

These models were the genesis of the joint network node (JNN). "However, the JNN was a commercial package and a lot of support was necessary to meet 3rd ID requirements, moving high-speed, high-capacity IP to division, brigade and battalion," the general maintains. "We really stretched in following the models. The JNN was made available in Iraq within six months, but it was not a full production item. While there were technical issues, the division was willing to work with us. General Dynamics, Cisco and other contractors helped clean up and modify the system in Iraq while in use," the general points out.

Using lessons learned from Iraq, the next JNN iteration went to the National Guard and Army Reserve, which by now were part of the operational force rotating into Iraq just as regular Army units. This required the Signal Corps to upgrade equipment compatible with systems converging on voice, data and video over IP. In Afghanistan, Blackhawk helicopter-transportable small point-of-presence and JNN loads were lifted to command posts.

Northrop Grumman blue force tracking (BFT) also emerged from earlier demonstrations and was in high demand after fratricide incidents in Southwest Asia. The chief of staff ordered this capability across the entire Army using Force XXI battle command brigade and below (FBCB2) equipment over satellite for BFT. MITRE Corporation provided a script allowing the use of approximately 55,000 BFT sets now deployed. "If we had built the Warfighter Information Network-Tactical [WIN-T] in one year, the model would have rolled out of BFT and JNN," Gen. Boutelle asserts.

Lt. Gen. Peter M. Cuviello, USA (Ret.), served as chief of signal from 1998 to 2000 and, subsequently, became the CIO/G-6. While at Fort Gordon, he was heavily involved in developing WIN-T and Joint Tactical Radio System (JTRS) requirements. An architecture also rapidly evolved toward an enterprise system encompassing WIN-T and JTRS.

Lt. Gen. Peter M. Cuviello, USA (Ret.), served as chief of Signal and commanding general from 1998 to 2000 and, subsequently, as the Army's chief information officer (CIO)/G-6.

Lt. Gen. Peter A. Kind, USA (Ret.), became chief of Signal and commander of Fort Gordon, Georgia, in 1990. He became Army DISC4 from 1992 to 1996.

During this period, virtual training became a priority so soldiers did not have to return to the classroom to upgrade with the newest technologies. This effort also enabled federated training, as opposed to local command schools at places like Fort Bragg, North Carolina; Fort Hood, Texas; Fort Huachuca, Arizona; Europe and Korea. Many of these information technology schools involved computer and network training, the general explains. Training programs were also put online so each location could download them for soldier refresher courses with specific pieces of equipment or military occupational specialties.

Originally assigned to the Pentagon as the director, information systems for command, control, communications and computers (DISC4), Gen. Cuviello reported to the secretary of the Army. Seeing a clear need to be part of the Army staff, he convinced both the Army secretary and the chief of staff to create a billet aligned with the Army general staff, reporting to both the secretariat and the chief of staff.

The terrorist attack on the Pentagon "was right in our work spaces. We brought ourselves back together and went full-scale in preparing for combat, supporting the buildup in Kuwait, maintaining command, control, communications, computers, intelligence, surveillance and reconnaissance [C^{4}ISR] on the move in Iraq. This took a lot of effort by some great folks with the ability to be flexible, tailorable, adjustable and malleable—all the adjectives one might use. This was a very different kind of war, and it took a lot of initiative, innovation and imagination by our soldiers to move forward with combat forces and maintain constant communications. This period was also stressful from the standpoint of doctrine, training and implementation," Gen. Cuviello reports.

The general also created an architecture group to interface with user commands at corps, division and brigade levels and visited Iraq and Afghanistan in concert with this effort. Simultaneously, AKO, in a developmental stage with 30,000 users, was expanded to become the Army's portal. Army knowledge management became inclusive of AKO, architectures and communications under one umbrella.

Lt. Gen. Peter A. Kind, USA (Ret.), spent three tours at the Signal Center in four different assignments before becoming the chief of Signal and commander of Fort Gordon in 1990. He became the commander after serving as the program executive officer for command and control systems at Fort Monmouth, New Jersey, providing experience as both a material developer and requirements commander. He previously served as Signal Center deputy and as acting commander in 1985 to 1986 as a brigadier general, when the commanding

general was assigned for a year to lead MSE source selection at Fort Monmouth.

The Signal Regiment was established during this period and, in a formal ceremony, inductions began for second lieutenants in the basic course. This took place only after a rigorous field exercise involving both Signal operations and unit-level tactics. Lieutenants signed the regimental roster atop a 60-foot tower that they were required to climb as a final part of physical testing.

A month into his chief of Signal tenure, the buildup began for the first Gulf War, mobilizing 27 units and deploying most of them along with two active Fort Gordon units. Reserve components also were processed at the installation. A new military occupational specialty was created for tactical computer operations and maintenance.

Gen. Kind was DISC4 from 1992 to 1996, reversing the downward budget spiral for Army core information technology when technology changes were urgently needed. He spearheaded the development of enterprise operational capabilities, creating a vision, goals and framework for discussion. The chief of staff signed the enterprise architecture, and within a year the Army technical architecture became the joint technical architecture with only a few words changed. Tactical, steerable satellite antennas were quickly pushed forward from engineering development for convoy support in Bosnia. The DISC4 also influenced telecommunications switches and e-mail for Somalia operations. Twelve software development metrics became mandatory throughout the Army.

With a strong airborne background and the use of lightweight satellite communications equipment, Lt. Gen. Robert E. Gray, USA (Ret.), brought experience to Fort Gordon as commanding general and chief of Signal, from 1991 to 1994. His earlier involvement with MSE as a colonel and director of C^{3}I for the combined arms development activity, Fort Leavenworth, Kansas, proved an advantage. MSE was being fielded at Fort Hood and involved a significant training base requirement. "MSE allowed the Army to move away from static command posts and move more rapidly across the battlefield to provide communications, keeping pace with the battle," Gen. Gray states.

The Signal Center was key to MSE training and fielding. Enhanced simulation for various technical courses proved realistic and was employed in the Fort Gordon schools. Heavy use for MSE was important, but simulation also proved beneficial in other signal courses.

Another priority involved the Single Channel Ground and Airborne Radio System (SINCGARS) being readied for fielding; however, the system could not meet the required 2,500-hour mean time between failure (MTBF) rate. Both the Signal Center and the Training and Doctrine Command (TRADOC) were prepared to halt the program unless the contractor could meet the threshold. The equipment had to be reengineered, but SINCGARS then exceeded MTBF requirements.

Lt. Gen. Robert E. Gray, USA (Ret.), brought airborne experience with light equipment to Fort Gordon as commanding general and chief of Signal from 1991-1994. He subsequently served as chief of staff, U.S. Army Europe.

Lt. Gen. Bruce R. Harris, USA (Ret.), served as commanding general, Army Signal Center, from 1986 to 1988. He subsequently served as the Army's DISC4. His aviation and tactical experience proved a boon.

As Signal officer for XVIII Airborne Corps, Gen. Gray introduced satellite communications; however, Fort Gordon had yet to make use of the capability. The Signal Center introduced changes to the Army's table of organization and equipment, ensuring satellite radios were in place. This became a distinct advantage during Desert Storm for control of small units dispersed across the battlefield. Multichannel satellite radio communications from operational areas anywhere in the world to the United States were distributed via military and commercial networks. This capability exists today without large amounts of communications equipment in a theater. Satellite radios later became a hub-and-spoke arrangement for the entire Army and were institutionalized as doctrine, the general notes.

After seven tours of duty in Army divisions, including serving as the 9th ID's assistant commander, Lt. Gen. Bruce R. Harris, USA (Ret.), served as commanding general, Army Signal Center from 1986 to 1988. "When I came to Fort Gordon, we were preparing to field the next-generation tactical communications equipment, SINCGARS, the enhanced position location reporting system [EPLRS], MSE and other command, control and intelligence systems," the general explains.

Gen. Harris' emphasis at Fort Gordon was on tactical communications—especially SINCGARS. Also an aviator in fixed- and rotary-wing aircraft, he remarks that, "SINCGARS was my most important initiative because soldiers would use it to fight. The other systems we had were for staff and senior commanders and didn't reach down to brigade. EPLRS and SINCGARS became the backbone of the tactical network and some of this equipment is still in the field today."

The MSE source selection came shortly before his Fort Gordon assignment, and Gen. Harris had the task of moving all the training associated with MSE into Signal Center classrooms. "The MSE fielding schedule was very ambitious, and we had to put together field training teams in concert with procurement people. Training quickly took place on-site at Fort Hood; Fort Stewart, Georgia; and in Europe, where equipment would be issued

Lt. Gen. Clarence E. McKnight, USA (Ret.), became deputy commandant and commandant of the Signal Training Center and commanding general of Fort Gordon in 1976.

first. MSE was a five-year fielding program. Meanwhile, development continued with EPLRS and SINCGARS," Gen. Harris reveals.

Proponency for automation was finalized, and the general set out to convince the Army to move the computer science school from Fort Benjamin Harrison, Indiana, to Fort Gordon. Automation was already embedded in equipment such as TRI-TAC switches and MSE. The school moved from batch processing and mainframe orientation to a small desktop personal computer environment, Gen. Harris states.

Moving up to become the DISC4, Gen. Harris soon learned MSE switch operators had not acquired necessary skills. The follow-on test and evaluation was halted to identify shortfalls. Then Brig. Gen. Alfred J. Mallette, USA, who had been the 7th Signal Brigade commander in Europe, went to Fort Hood to identify problems and solutions.

Army requirements for operational concepts were being developed; however, MSE and other systems were never designed to advance 100 kilometers a day, as the Army did in Iraq.

Lt. Gen. Clarence E. McKnight, USA (Ret.), headed both tactical and strategic communications commands before becoming deputy commandant and commandant of the Signal Training Center and commanding general of Fort Gordon in 1976. After 18 months, he became the first three-star commander of the Army Communications Command, Fort Huachuca, with more than 33,000 soldiers and civilians spread throughout 14 countries. At Fort Gordon, he witnessed the merger of tactical and strategic communications. There was a huge gap in tactical equipment, which had to be procured incrementally and had become bulky and plagued with interoperability problems, Gen. McKnight explains.

Also at the Signal Center, Gen. McKnight was appalled to find many soldiers lacking mathematical and reading skills. The self-paced curriculum mandated remedial study. His next assignment was commander, 5th Signal Command in Europe and deputy chief of staff for communications-electronics, U.S. Army Europe. Again, he witnessed the merging of tactical and strategic equipment. SINCGARS was in the pipeline and MSE was in source selection. He became the J-6, director of command, control and communications in the Office of the Joint Chiefs of Staff.

The Army was moving toward the regimental system, and Gen. McKnight strongly supported the concept, making the Signal Corps a single regiment. He was inducted in 1990 as a distinguished member of the Signal Regiment.

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Network Access Follows Signal Chiefs' Pathway

Historians would be hard pressed to find better-qualified experts with greater experience, technical acumen and educational backgrounds than three former chiefs of Signal. These flag officers presided over an era that saw rampant advances in digitization, miniaturization and transformation to network warfare.

The Army Signal Corps became more versatile, responsive and focused on providing top-notch network communications to soldiers in the field during their watches. Their command experience helped lay the groundwork for Army-wide strategy, leading to Land Warfare Network, a conversion from many loosely affiliated independent networks.

The transition from analog to digital technology involved Maj. Gen. Leo M. Childs, USA (Ret.), chief of Signal from 1988 to 1990. He reports that the biggest impact during his tenure was the Army's shift to tri-service tactical (TRI-TAC), very heavy gear that was part analog and part digital, to interface with legacy equipment. The Army could not afford all-new digital equipment. Gen. Childs also served as the Signal Center's chief of staff and deputy commanding general before becoming commanding general and chief of Signal.

Maj. Gen. Leo M. Childs, USA (Ret.), chief of Signal from 1988 to 1990. He started the Signal Corps Noncommissioned Officer (NCO) Academy, with a sergeant major as commandant and run entirely by NCOs.

The Signal Center contracted with GTE Corporation, the TRI-TAC vendor, for schools and training at Fort Gordon, Georgia. Instructors were mostly retired officers and noncommissioned officers, who understood the requirements of an Army in the field, Gen. Childs explains. "TRI-TAC functioned well but was cumbersome. Continuing the move from analog to digital, the Army selected mobile subscriber equipment [MSE], and my top priority became fielding this new system and converting the TRI-TAC school to an MSE school, still run by GTE, also the MSE contractor."

With the Defense Department's acceptance of Internet protocol (IP) as the basis for data transport, the ser-

vices rapidly converged on digital commercial off-the-shelf equipment. "Signal Corps soldiers could no longer remain technically proficient in communications skills only, but had to know ever-evolving information technologies, especially computer networking," Gen. Childs notes. During this era, he also started the Signal Corps Noncommissioned Officer (NCO) Academy, with a sergeant major as commandant and run entirely by NCOs. Today, this academy is considered the foremost in the Army. Fort Gordon's responsibility also included Army area contingency missions for a rapid reaction force in support of the nearby Savannah Nuclear Power Plant. Mobilization of Army National Guard and Reserve units also took place at Fort Gordon.

In an effort to stimulate junior high school student interest in science and mathematics, a national science center was built at Fort Gordon along with a joint Army and civilian science museum. Arriving soldiers often required remedial education before beginning 50-week technical courses. The center's concept involved interactive displays to generate enthusiasm in science and technology early enough so students would pursue mathematics and science in high school. An offshoot involved transmitting course materials via satellite so educators could download and use the material in teaching, Gen. Childs relates.

The Army needed soldiers completing technical training and arriving in the field faster when Maj. Gen. John "Pat" Cavanaugh, USA (Ret.), became chief of Signal from 2000 to 2002. "Soldiers also required training to a higher standard, causing a close look at technology to determine what might be accomplished in a virtual setting. Simulation included realistic equipment displays with an amazing look, feel and sound of actual hardware, allowing self-paced study. Many soldiers were computer literate, and this approach cut weeks off training. Students soon became more interested in learning, trained to a higher standard, and retention rates rapidly increased," the general states. "Virtual environments, also available on compact discs, were forwarded to the field to continue instruction."

Maj. Gen. John "Pat" Cavanaugh, USA (Ret.), chief of Signal from 2000 to 2002, used simulation to train Signal soldiers faster and to a higher standard.

Maj. Gen. Janet A. Hicks, USA (Ret.), Signal chief and commanding general from 2002 to 2006. She hosted a global network summit at Fort Gordon, Georgia, leading up to the Global Network Enterprise Construct (GNEC).

Facing reduced budgets and increasing pressure from combat arms organizations to accelerate equipment and system deployments, Gen. Cavanaugh drew upon his experience heading the 5th Signal Command to provide much greater bandwidth and service using smaller packages. "Switches and routers via satellite communications required only six or seven Signal soldiers to operate smaller rigs and provide greater bandwidth, while increasing service," the general points out. "The service was similar to the type employed in garrison but was now available in the field environment. We could build off that to employ larger switches or satellite dishes for a headquarters, with a smaller footprint and higher-quality service for the warrior."

Technical advances also allowed downsizing equipment and the number of signalers while achieving an exponential increase in bandwidth for deployed warriors. "Changes in technology also meant we were looking at network-centric warfare. We were in the midst of developing techniques to handle technology advances when 9/11 hit. Priorities immediately shifted to protecting the installation and people—high-value targets. The Signal Center quickly turned attention toward supporting deployments for actual combat operations," Gen. Cavanaugh emphasizes.

Maj. Gen. Janet A. Hicks, USA (Ret.), Signal chief and commanding general from 2002 to 2006, hosted a global network summit at Fort Gordon. "This summit led up to the Global Network Enterprise Construct [GNEC]. The conference brought in all the constituents from Training and Doctrine Command, corps and division units that could lay claim to existing bandwidth," the general states.

"The conference helped us figure out where we needed to allocate bandwidth, where it could be increased, and where it could be reduced, based on mission requirements. This was perhaps the only time when we could get that many constituents around a table. We were able to follow the string back to the person who answers the phone, who the caller needed to speak with, and how soon it must take place. This was a real eye-opening look at network use and what would be necessary to satisfy bandwidth requirements," Gen. Hicks reveals. "Many flag officers attended the final debriefing."

Standing up the joint network node (JNN) training and fielding the system became priorities for Gen. Hicks and the Signal Center. "JNN became a cradle-to-grave program, the way divisions integrated their communications between brigades. This program presented a new way of doing business with a lasting impact on the Signal Corps. Industry helped with all aspects, including fielding and instruction in the schoolhouse," she maintains.

JNN, a rapidly deployable system, is a joint communications package allowing the warfighter to use advanced networking capabilities. The system, mounted in a shelter on a high-mobility multipurpose-wheeled vehicle, provides a suite of voice, video and data communications from division down to battalion command posts. JNN is a high-speed and high-capacity backbone network. *—CAR*

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