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Front cover: U.S. Army photos. Clockwise from top: Engineer Soldiers train and practice their route clearance skills, combat engineers find cover behind a "blast blanket" after detonating an entryway with explosives, an engineer Soldier competes in the Best Soldier Competition at Joint Base Elmendorf-Richardson, Alaska.

Back cover: U.S. Army photos.

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Clear the Way

Brigadier General Anthony C. Funkhouser
Commandant, U.S. Army Engineer School



It is great to return to Fort Leonard Wood, the home of our Engineer Regiment! I am truly humbled and honored to serve as the 95th commandant of the U.S. Army Engineer School. As I write this, I have been the commandant for only about 3 weeks and I can say that there is a lot happening. I would like to thank Brigadier General Peter A. (Duke) DeLuca, his wife Marianne, and the entire U.S. Army Engineer School team for their hospitality and assistance in a smooth transition.

I will be assessing where we are over the course of the coming weeks, but you should know that our mission remains unchanged: to generate the military engineer capabilities that the Army needs to provide commanders with the freedom of action to win decisively as part of the joint, interagency, intergovernmental, multinational, industry, and academia (JIIM-IA) team. Major General Bryan G. Watson and Brigadier General DeLuca have brought us to this point over the last 4 years, and the Engineer School will continue to focus on leader development and brigade engineer battalion (BEB) implementation and modernization as we move toward Army 2020 and beyond. We also intend to retain our slightly modified box top as the framework to illustrate how we assure mobility, enhance protection, enable force projection and expeditionary logistics, and build partnership capacity and infrastructure. We have the finest Soldiers and equipment in the world; and our Army deserves the most agile, adaptive, and dynamic engineer leaders to provide engineering solutions and freedom of action across the force.

Much of our effort will be focused on implementing the BEB. The BEB represents the largest change to the Engineer Regiment in more than a decade, and it will be a great challenge with many moving parts. The BEB implementation will occur amidst a global environment that continues to evolve and expand our mission set. We continue to fight in Afghanistan and maintain worldwide engagements. We are about to embark on a period of transition that will require us to be more expeditionary as we consolidate our military forces within the continental United States while operating in a continually more constrained fiscal environment. The resource-constrained Department of Defense budget will be a driver for us to continually reevaluate our way ahead and make difficult decisions that will affect our force size and level of modernization.

This is not unprecedented. Three years after his inauguration, President Thomas Jefferson reduced the Army from 4,410 to 2,579 Soldiers and reduced the Army budget to less than a third of what it had been. Despite those fixed reductions, he, along with Founding Father Alexander Hamilton, recognized the need to establish a military school to train and develop engineer and artillerist competency for the core profession. This would start as the U.S. Military Academy and eventually separate its mission as the U.S. Army Engineer School. To this day, our engineers maintain a high value for our Army. While there will be fiscal challenges, our team will work to retain its quality and its great leaders to ensure that our stock remains high. Our Engineer School was born in times of fiscal austerity. Through the years, it has led numerous transitions, each time posturing us for the future.

The BEB approval has been our focus for more than 4 years, and we will need to lean forward and move out aggressively now that the Army has approved the plan. We will share information quickly (up and down the chain) and track the efforts, issues, and lessons learned through monthly fusion cell and BEB forums. Having been through a similar reorganization before modularization, we should all anticipate an accelerated schedule. Unfortunately, if we continue to reduce the size of the Army in the future, we can plan for cuts to impact all components of our Army.

Despite the fiscal challenges, we have a large number of opportunities over the coming months and years that I plan to discuss in this and other forums. I see many of these opportunities in our support to the warfighter—supporting decisive actions in the lodgment, training our engineers, implementing the BEB effort, and integrating women into all of our military occupational specialties and formations to meet the standards of Soldier 2020. We must also increase our focus on developing leaders and broadening and managing talent.

Finally, here are a few closing thoughts. I want to increase our collaborative dialogue with the field and the push of information to add to your kit bags. We are your reachback to help solve problems. We are also your reachback for the customs and traditions of the Engineer Regiment. We need to preserve our history and share it with young engineers since they are now part of that history. It binds us in a special way—past, present, and future. Send us a note, and we'll provide an answer or the information you seek. I look forward to serving as the commandant to preserve our past, train and educate to fight today, and transform and modernize for the future.

Essayons!

Lead the Way

Command Sergeant Major Butler J. Kendrick, Jr.
Regimental Command Sergeant Major



How time flies! I'm still very excited to be part of this superb team; and though it seems like I just got here, it has been 3 months since Kim and I arrived at Fort Leonard Wood, Missouri.

I was fortunate enough to celebrate the Army's 238th anniversary at Fort Leonard Wood this year. The Maneuver Support Center of Excellence team of Major General Leslie C. Smith and Command Sergeant Major Terrence W. Murphy started the morning with a 3.5-mile run. It was a great way to begin the morning and watch troops get fired up as we began the day's many events. I also celebrated Independence Day here and was entertained by the U.S. Army Soldier Show. That event was largely made possible by the installation recycling program. It was a great display of the many different talents of our Soldiers. After the performance, we enjoyed an electrifying fireworks display to top off the evening.

I also rekindled a friendship with an engineer Gold Star Family. Dennis and Teri Johnson, parents of Specialist Joseph D. Johnson, were at Gammon Field to participate in the Independence Day celebration. It was bittersweet to talk with the family of a fallen comrade who was part of the 20th Engineer Brigade when I was the brigade command sergeant major, but it was very special to see them again.

I remain extremely proud of the Soldiers in the Regiment. I recently observed training and spoke to the Soldiers of the 1438th Engineer Company (Multirole Bridge), Missouri Army National Guard, getting ready to deploy to support Operation Enduring Freedom. The 50th Multirole Bridge Company was also ramping up to provide bridge support during the operation. Even as engineers shape our world by closing out Operation Enduring Freedom and providing route clearance patrols, construction, bridge repair, prime power, plumbing, and electrical generation, they strive for and achieve excellence. U.S. Army Reserve Specialist Fromm Mitchell, a combat engineer representing the 416th Theater Engineer Command, won the 2013 U.S. Army Reserve Best Warrior Competition and Sergeant Jacob Valderrama, 555th Engineer Brigade, won the U.S. Army Forces Command NCO of the Year competition. Please congratulate these young engineers as they move forward and compete in the Army's best warrior and leader competitions.

I had dinner with the U.S. Army Corps of Engineers command sergeant major, engineer graduates from the U.S. Army Sergeants Major Academy Class 63, and a small group of students. A spokesman from the Engineer Professional Development Office described career opportunities and broadening assignments. These have changed over time, and NCOs should contact the Engineer School about their career paths and opportunities. It was a great evening for the students at the dinner and for the other "regimental elders," including me, who were able to spend time with our future leaders.

I visited Active Guard Reserve engineers in North Dakota and learned that the North Dakota National Guard 164th Regional Training Institute provides training within assigned career management fields, offers excellent training for officers and NCOs, and has some of the best trainers in the U.S. Army. Each instructor has at least three military occupational specialty (MOS) qualifications and is technically skilled in numerous other skills. I watched Soldiers from many different MOSs go through intense training that demonstrated the awesome capabilities that the engineer team brings to the fight.

I look forward to implementing the brigade engineer battalion (BEB) and ensuring that maneuver commanders understand our newly enhanced engineer capabilities. We engineer leaders—officers and NCOs—must know our craft and be able to demonstrate our skills to the brigade combat teams across the Army. I will ensure that you have the information you need about the BEB.

I ask regimental leaders to talk to their Soldiers, especially sergeants and staff sergeants, about the Profession of Arms campaign. Many young engineer leaders have no clue about being members of a profession within a professional organization. The Army exists for one reason: to serve the Nation by supporting and defending the Constitution.[1] We must determine the best strategy for leader development as we approach Army 2020. Engineers must strive to refine every area of doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) for our Regiment. Implementing the BEB will stretch us in every one of those capabilities, but we are up to the task.

Finally, I would like to introduce and welcome the 95th engineer commandant to the team. On 30 July 2013, we bid a fond farewell to Brigadier General Peter A. (Duke)

(Continued on page 13)

Show the Way

Chief Warrant Officer Five Scott R. Owens
Regimental Chief Warrant Officer



Last month, I attended the annual Chief of Staff of the Army (CSA) Army Training and Leader Development Conference. The conference brought together Army senior leaders from Headquarters, Department of the Army; U.S. Army Training and Doctrine Command; and U.S. Army Forces Command to discuss current and future challenges and initiatives within the Army. The key focus of the conference was Army plans to develop leaders and train the force to meet these challenges during the fiscally constrained years ahead. CSA General Raymond T. Odierno spoke extensively about the budgetary challenges we will face for the foreseeable future and his vision for moving forward. It was an enlightening and professionally rewarding 2 days, and I was encouraged by the direction that he outlined for the Army. A few points that General Odierno made especially resonated with me because leaders of the Engineer Regiment have been turning their attention to them more and more recently. Two of these points are: we need to develop the expeditionary mind-set, and we must increase the focus on training and leader development from the platoon level to the most senior levels in the Army.

As the CSA spoke, I thought about the role of engineer warrant officers and their responsibility to help as the Army transitions into the future. First, I will address the expeditionary mind-set. This isn't anything new to the Army; the Army has always had that focus, except when it has been engaged in long periods of conflict such as the past dozen years. But with a shrinking force and upcoming regional force alignment, it is even more critical that we redevelop that mind-set and ingrain it into training and operations. For years, we've had to focus on Army force generation rotations and deployments into mature theaters, where many things have already been set in place. With an Army based in the continental United States, we will be required to conduct early-entry operations, most likely into denied areas with poor or no infrastructure. This scenario falls squarely within the expertise of engineer warrant officer military occupational specialties (MOSs):

- Construction engineering technicians (MOS 120A) will be critical in establishing, opening, and expanding lodgments in the early stages of the next conflict. They will establish and build base camps; design, build, and connect the power grid: improve or fix existing facilities; and manage a host of construction projects. In short, they will be extremely busy.
- Geospatial engineering technicians (MOS 125D) will be equally busy. They will be critical early in the planning process, gathering geospatial data and creating data where it doesn't exist. They will produce terrain analysis and terrain visualization products to help commanders and staffs visualize and understand the terrain and its impacts on friendly and enemy operations. Once in-theater, they will directly support current operations and plan for future operations.

This leads me to the topic of training and leader development. This is where we build the foundations to better prepare ourselves and our Soldiers for the future so that they will be ready to handle whatever missions they are called on to perform. By definition, warrant officers are trainers, integrators, and maintainers of Army systems. As such, we need to ensure that Soldiers are trained and instilled with an expeditionary mind-set. We must get them to think about what it would take to prepare and move into a hostile, immature theater; what equipment they would need; what types of missions they could be assigned; and how they would survive. As we made plans for Operation Iraqi Freedom in V Corps, I thought of those things. I knew I was going into a hostile environment, but didn't know how long I would be there. I had to ensure that my team brought everything we could possibly need for the mission and for our personal use, such as music, videos, books, and personal hygiene products. That's what it will be like when we are called upon again. In addition to training Soldiers, you should take part in company, battalion, and brigade training meetings and provide input and expertise. As technical experts, you owe commanders your assessment of unit training and readiness. You should help focus training where it needs to be.

The last part of the job is leader development. The CSA charged officers to have a leader development strategy for their units. What is your leader development strategy? Take time to develop commissioned officers, warrant officers, NCOs, and yourself. Read about past conflicts, study after action reviews, and put them into the context of the world today. You'll find that there is a wealth of information and brilliant solutions to problems you may face in the future in the writings of Soldiers who faced similar situations in the past.

Until we meet again, stay safe. Essayons!



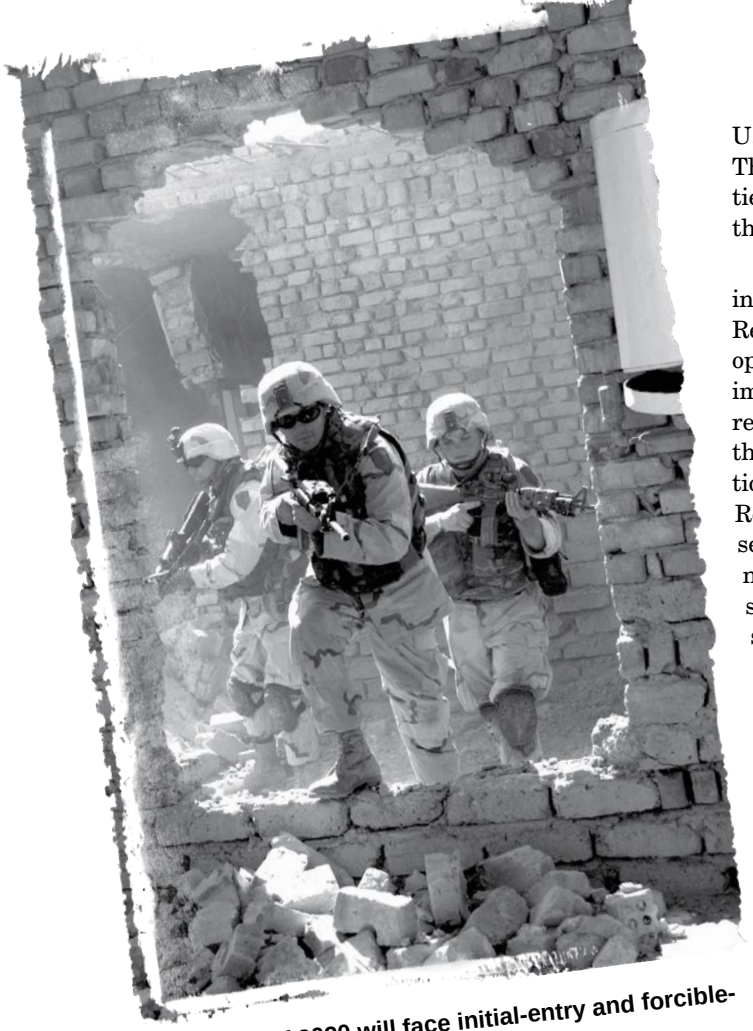
From the Theater Engineer Command Senior Working Group

In 2013, the 412th and 416th Theater Engineer Commands (TECs) collaborated to examine engineer mission command at echelons above brigade and corps. Those discussions led to the Army of 2020 Theater Engineer Command campaign plan. What follows is a synopsis of their findings and recommendations as they try to answer the fundamental question: What is the role of the TECs in support of the Army of 2020 and beyond? As the Army faces unprecedented resource constraints, there is a tremendous opportunity for this unique formation to serve as a unifying force for One Regiment. It can do so in a way that plans, prepares, and provides cost-effective solutions to the Army and serves as one of the critical regimental integrators through routinization, integration, and the cultivation of relationships.

Past, Present, and Future Operating Environments

Past and Present. The predecessors of the TECs, the engineer commands, were the senior engineer headquarters in the operational plans of U.S. Central Command, U.S. European Command, and U.S. Pacific Command. They served as a deep reservoir of technical engineering expertise and enabled direct connectivity and integration with numerous Army service component commands (ASCCs) across the globe. The engineer commands became TECs under modularity and shifted their focus toward mission command while simultaneously training and providing Title X forces to the U.S. Central Command area of responsibility supporting overseas contingency operations. One consequence of the transformation was a decrease in technical engineering positions in the TEC headquarters. Over more than a decade of persistent conflict, the employment of TEC capabilities has ranged from doctrinally defined applications of its formation (such as Operations Iraqi Freedom and Enduring Freedom, U.S. Army Corps of Engineers [USACE] Gulf Region District mission command, and the joint force engineer command in Afghanistan) to joint manning document staff augmentation. Throughout this period, the TECs have met Army requirements as needed. It is critical for the TECs to build on the experience and success of the past and continue to develop current relationships as they execute the campaign plan.

Future. The Army of 2020 will be more than 95 percent based in the continental United States. It will be regionally aligned and focused on preparing for decisive action in support of unified land operations and supporting theater



The Army of 2020 will face initial-entry and forcible-entry operations.

security cooperation missions to build partnership capacity. As a starting point for both missions, it will be imperative for the Army to deliver engineer capability at the point of need; and the TECs are uniquely poised to serve as one of the critical regimental points of synchronization.

The next war for engineers will be characterized by the need for a strategic and operational planning capability for initial-entry and forcible-entry operations and the need to reacquire and maintain the muscle memory to execute those operations. The single greatest role for the TECs will be to become theater *enabling* commands (using the current vernacular) and to set conditions for success starting at the intermediate staging base and beyond.

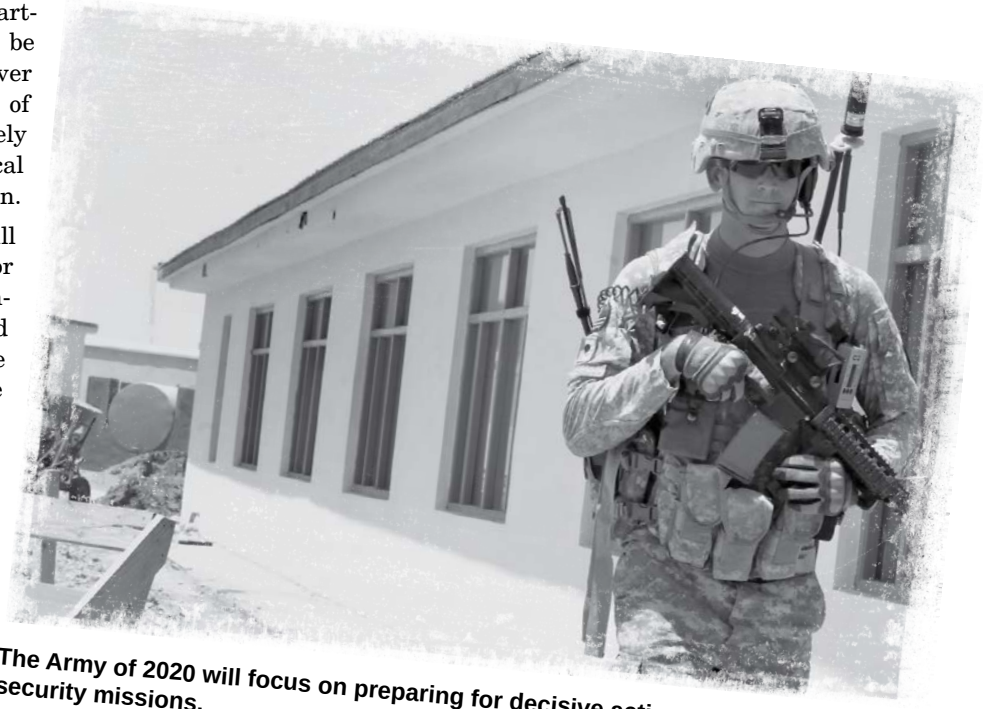
The four components of the Engineer Regiment—Active Army, Army National Guard, U.S. Army Reserve, and USACE—have unique capabilities. The TECs have the potential to synchronize these capabilities and bring them together to support the warfighter at the point of need. This is one of the key tenets of integration.

The era of plentiful resources is coming to an end, thus increasing the need for cost-effective, whole-of-Engineer-Regiment solutions. With reduced overseas contingency operations, theater security cooperation will see renewed importance. While the TECs have met a variety of mission requirements, they must do more to support ASCCs and their vital contributions to Phase 0 theater security cooperation operations. The U.S. Army Reserve established Army Reserve engagement cells at numerous ASCCs. The TECs serve as the engineer point of synchronization for that organization and for the Army National Guard State Partnership Program, the Partnership for Peace, and USACE liaison officers and contingency response units.

TECs Today

Understanding the TECs today is necessary to inform the discussion about TECs in the Army of 2020, using a modified doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) methodology.

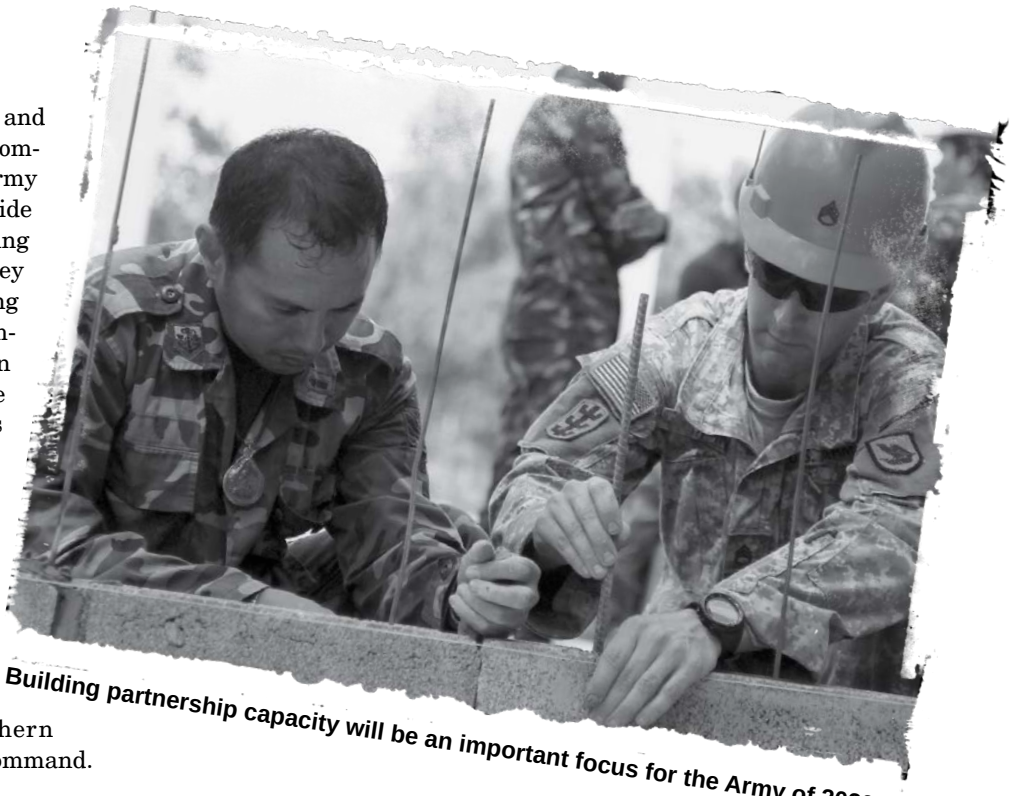
Doctrine. According to current Army doctrine, the TECs are designed to provide mission command engineer capability for the theater Army. They are the only organizations designed to do so without augmentation and can provide the joint force commander with an operational engineer headquarters. They can also augment joint task force engineer staffs. The TECs provide mission command for all assigned or attached engineer



The Army of 2020 will focus on preparing for decisive actions such as theater security missions.

brigades and other engineer units and missions for the joint force land component commander or theater Army commander. The TECs also provide support for all operational planning across all engineer disciplines. They synchronize all engineer planning and support for the geographic combatant or joint force commander. In direct support of this doctrine, the U.S. Army Reserve Command has regionally aligned TECs to each of the geographic combatant commands (GCCs)—

- 412th TEC to U.S. Pacific Command, U.S. European Command, and U.S. Africa Command.
- 416th TEC to U.S. Northern Command, U.S. Southern Command, and U.S. Central Command.



Building partnership capacity will be an important focus for the Army of 2020.

With only two TECs in the Army, their commanders emphasize mutual support in staff augmentation to provide long-term support for each GCC.

Organization. TEC commanders and staffs have critically examined their organizational structure and are evaluating possible adjustments with no change in required strength or grade growth.

TECs are modular organizations, are tailored to meet mission requirements, and can deploy as a whole or in part. The TECs have two deployable command posts (DCPs) that can deploy separately or together. A single, partial DCP may even deploy as a detachment. Doctrine allows TEC commanders to tailor the TECs as they see fit to meet the supported commander's mission.

The deployability and flexibility of these units have led some people to believe that TECs have not been employed correctly or according to doctrine. Some people think of the TECs as administrative commands that are capable of deploying ad hoc detachments which only augment joint or ASCC staffs. As the TECs reengage in reviewing and exercising the operations and contingency plans for GCCs and ASCCs, the supported commands are becoming more aware of the advantages of the doctrinal flexibility inherent in them. This routinization is another one of



The TECs seek to train and work with USACE and other staffs.



An engineer uses a chainsaw to clear downed trees from a road during exercise Ardent Sentry. Training from exercises such as this will become increasingly important to TECs in the future.

the major tenets of the TECs. The mission command elements of flexibility, scalability, and employability allow the TECs to flex resources against requirements in a time-phased fashion for specific plans. The TECs can support changing levels of intensity from Phase 0 operations that shape the environment through Phase 5 operations that enable civil authorities.

It is the flexibility of the TEC mission command that codifies the doctrine and organization of its role in supporting and enabling others. Due to its relatively robust deployable staff (up to four times larger than the staff of a deputy chief of staff engineer for an ASCC), the TECs can support the doctrinal engineer coordinator at the ASCC level and provide the mission command of engineer forces at echelons above brigade or corps within a theater. With their planning capability, the TECs can either augment or assume engineer planning at those levels, depending on the mission requirements. These capabilities enable the ASCC engineer staff to set conditions for success at the operational and strategic levels. They also allow USACE to gain support in gathering forward assessments or initiating preliminary stabilization work before a permissible environment is established. To fulfill the engineer support and mission command requirements, the TECs continually seek opportunities to train and execute tasks alongside the GCC, ASCC, corps, and USACE staffs.

Training. The TECs train through active participation in a variety of venues by exercising, executing, and learning. Engagement in a wide breadth of exercises is the key to training and maintaining the skills of the TEC staffs and their brigades, battalions, and detachments. The TECs aggressively seek out and participate in a wide array of exercises at the strategic, operational, joint, multinational, brigade, and battalion levels. The exercises include—

- Ulchi Freedom Guardian.
- Key Resolve.
- Combined Joint Logistics Over the Shore.
- Austere Challenge.
- Vibrant Response.
- Integrated Advance.
- Ardent Sentry.

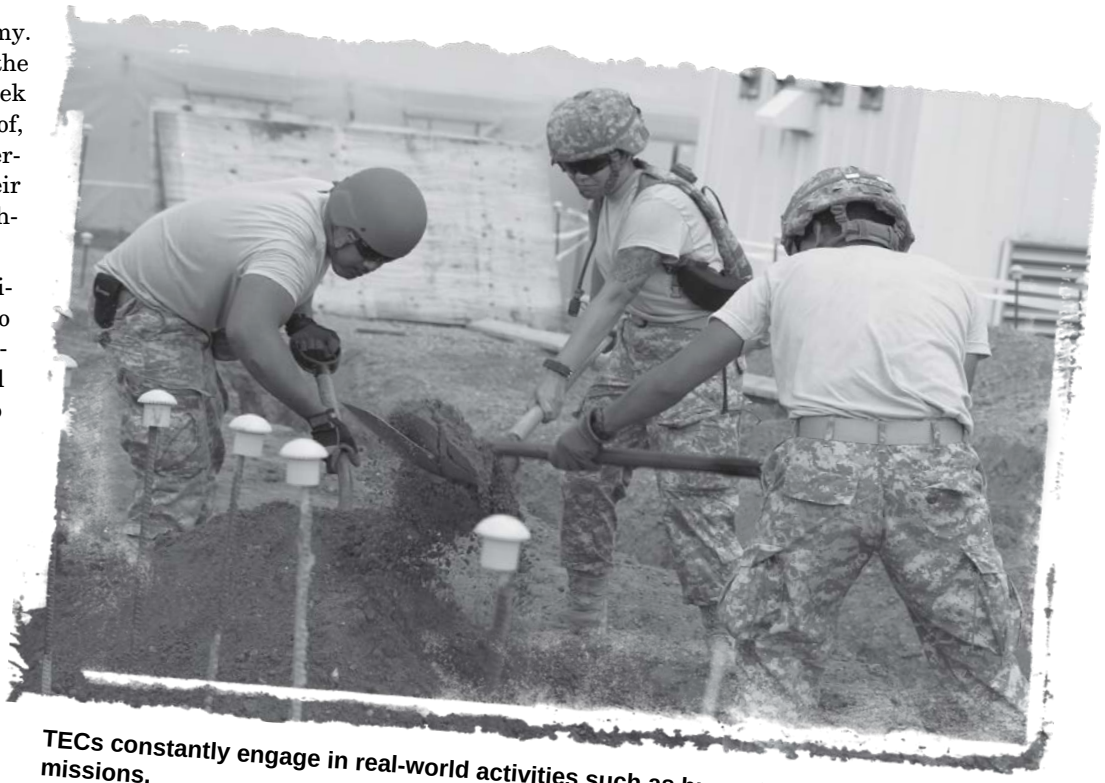
Participating in exercises at all levels enables TEC staffs and formations to build relationships, gain experience, and demonstrate their capabilities. It is important to note that the TECs are not training commands, but operational commands. Even in the current constrained fiscal environment, the TECs seek out real-world engineer support missions. Through military-to-military engagements, exercise-related construction, humanitarian assistance, defense support of civil authorities, and base construction and improvements, the TECs are constantly engaged in real-time support. To advance our personnel and develop our technical skills, the TECs look for other technically demanding opportunities to train and learn. It is through this process that the final tenet—cultivation of relationships—is realized.

Materiel. The TEC DCPs and detachments, by modified tables of organization and equipment, are fully functional and self-sustaining mission command elements. They are fielded to deploy with the technical skills, automation, field structures, and equipment needed to plug in with a field headquarters, thus relieving the stress and burden of support from a joint task force headquarters. The TECs continually evaluate this capability and update equipment packages to maintain the ability to interface with supported commands.

Leadership and education. Unlike any other formation in the Army, the TECs offer a unique opportunity to assemble a variety of technically skilled professionals who bring to bear the full weight of their knowledge and experience. In turn, these professionals serve as technical mentors

for the future of the Army. The TECs recognize the critical need for, and seek to increase the number of, technical, degreed, or certified specialists in their formations and throughout the Regiment.

Personnel. A critical role of the TECs is to plan, prepare, and provide the right technical engineer expertise to the supported command or agency at the point of need. The doctrinal flexibility of the TEC organization requires a mix of highly qualified technical engineers with a broad range of skills. They must work with and support all levels of command. The TECs, along with the rest of the Regiment, mitigate the skills gap through reachback and reach-forward teams. The TECs will execute the technical specialist recruitment and sustainment plans to provide a sustainable depth so that supported commands have the required technical engineering capability when they need it.



TECs constantly engage in real-world activities such as humanitarian assistance missions.

Facilities. The establishment of U.S. Army Installation Management Command saw a decrease in engineer unit troop construction, which had been a hallmark of engineer support. In this era of constrained resources for Army garrisons, the TECs are exploring ways to expand troop construction support to more installations and facilities. The TECs intend to forge a strategic relationship with the command to unlock that potential.

Desired End State

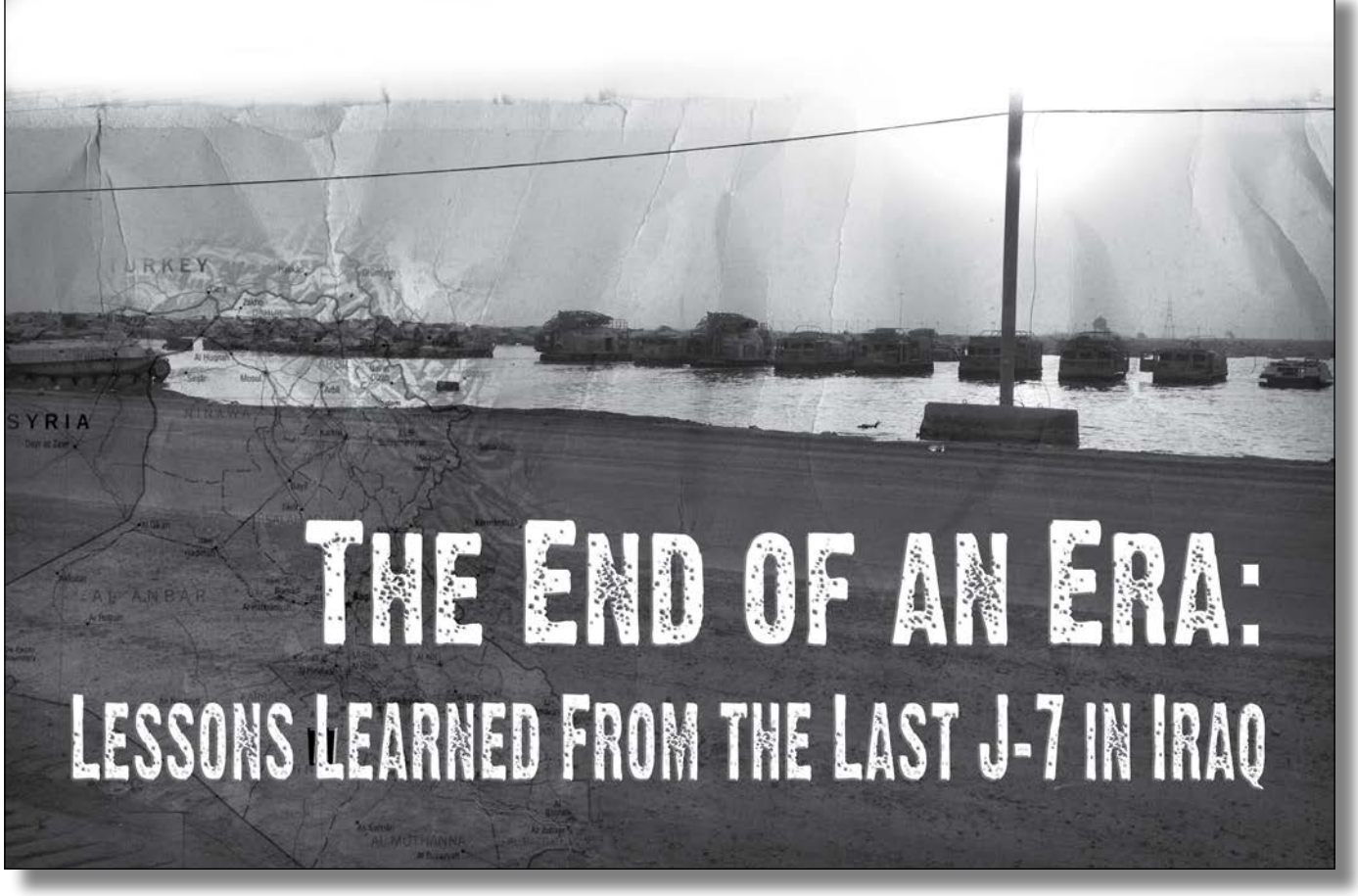
The TECs are the senior level engineer headquarters that are an indispensable Army asset. They anticipate and provide engineer capability and subject matter expertise and execute mission command for echelons above division and corps. They operate across the three disciplines—combat, general, and geospatial engineering—and four components of the Engineer Regiment to support decisive action in unified land operations.

Way Forward

The leadership of the Engineer Regiment has discussed the future role of the TECs moving forward with the leadership in USACE, the U.S. Army Engineer School, the Army National Guard, the U.S. Army Reserve, and staff engineers at ASCCs. The discussions reveal that there remains much to be done. Synchronization throughout the Engineer Regiment remains the principal goal. The chosen path to address the challenges of the future operating environment will be cooperation and partnership, through the tenets of routinization, integration, and the cultivation of relationships. The TECs provide one focus to synchronize the entire Engineer Regiment. They are situated at the nexus where the ASCCs, USACE districts and divisions, and Army National Guard engineer formations converge in times of peace and conflict. The TECs will build on valuable lessons learned from past experiences and move forward in support of the warfighter and the Nation.

Contributors from the Theater Engineer Command Senior Working Group include—

- *Brigadier General Douglas R. Satterfield, Deputy Commanding General, 412th Theater Engineer Command.*
- *Colonel Eugene J. Leboeuf, Chief of Staff, 416th Theater Engineer Command.*
- *Colonel Jared W. Olsen, Deputy Chief of Staff for Operations and Plans, 412th Theater Engineer Command.*
- *Colonel Richard L. Ott, Chief of Staff, 412th Theater Engineer Command.*
- *Colonel Adam S. Roth, Chief of Staff (Reserve Affairs), Office of the Chief of Engineers.*



The End of an Era: Lessons Learned From the Last J-7 in Iraq

By Colonel Fabian E. Mendoza, Jr., Lieutenant Colonel Benjamin M. Wallen, and Major Holli A. Bennett

Engineers have long had a reputation for being first into the fight since they have to clear breaches, obstacles, and improvised explosive devices. The engineers assigned to the engineering staff section (J-7) of the Office of Security Cooperation–Iraq (OSC-I) also assumed duties as the last out since they have the task of site closure. This assignment has reaffirmed the need for engineers to be flexible, adaptive, and innovative. Over the past year, Operation New Dawn ended and a transition to a traditional OSC took place in Iraq. It is essential to understand that no two security cooperation offices are exactly the same. For OSC-I, this means that there was a fundamental change from operating at six enduring Department of Defense (DOD) sites to operating exclusively from the U.S. embassy, while executing foreign military sales (FMS) and maintaining relations between the U.S. and Iraqi governments. OSC-I received guidance to accelerate the return of all DOD sites to the Iraqis and transition responsibility for basic life support and site security to the contractors who support the FMS cases at the sites.

Strategy

From the onset of our deployment, the objective was to include input from senior Iraqi engineer leaders to help identify gaps within doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF). This would help develop infrastructure master plans for the remote sites, including the construction of enhanced force protection systems. The objective was to eliminate containerized housing units, spot generation, and semiaustere living conditions.

Adaptation

The lines of effort (LOEs) were set, and the order was issued to close all remote sites due to a change in U.S. policy. Creative engineers designed systems management tools to get maximum output from limited manpower. The J-7 team used professional project management practices to integrate five independent project closure schedules.

An important J-7 focus was developing contingency plans for a possible evacuation of the U.S. mission in Iraq or a quick introduction of more forces to support the Iraqi government. The adaptive, agile thinkers of America's 9/11 generation also managed the following LOEs that were critical to base closure and the normalization of the remaining FMS real estate enclaves:

- Construction management.
- Facilities.
- Environmental concerns.
- Plans.
- Site closure.
- Strategic Iraqi engagement.
- FMS infrastructure.
- Normalization.

Enduring Bases: Planning, Sustainment, and Reduced FMS Footprint

The J-7 focus changed from maintaining and sustaining enduring bases to planning for the transition of sites back to the Iraqi government. With that planned transition and with a portion of each DOD site remaining for FMS contractors in their own enclave, it became clear that there was no synchronized master plan for each of these sites. The infrastructure required for self-sufficiency (such as water wells and purification units, power generation, maintenance shops, potable and black-water storage, wastewater treatment, and dining facilities) should be centrally located instead of being spread across an entire site. For example, the FMS enclave for contractors remaining at Tikrit required three T-walled areas to enclose infrastructure and allow the services to be self-sustaining. This increased security requirements and associated costs to protect three areas instead of one.

It was essential early in the planning process to determine which enduring bases would execute long-term FMS cases. These bases require a reduced final footprint to support the FMS contractors, and the conditions for that should be set early. If a commander's emergency response funds are available, they should be used deliberately to improve the infrastructure and capabilities of those sites. In future contingency operations, sites should be established with all infrastructure centrally located so that the site can grow outward as required by force flow and mission and then collapse back to a smaller footprint for the enduring use of the site. In Iraq, the ability to reduce the footprint and provide an enclave for FMS contractors was only possible with signed agreements and support from the prime minister's receivership secretariat.

Legacy Projects

OSC-I inherited seven legacy projects from U.S. Forces–Iraq worth $60 million, managed by the U.S. Army Corps of Engineers (USACE). During the team's year of deployment, three projects were completed for the Iraqi government. However, the remaining four were cancelled, mainly due to the inability of local contractors to complete them. USACE tried to reaward contracts, but no Iraqi companies could provide the required construction within the allotted time. To ensure transparency, the Iraqi government was fully informed about the cancellation. Maintaining transparency regarding construction status and challenges will help to forge and strengthen the relationship and trust with host nation senior engineers.

Construction Considerations of Site Transition

As closure dates were provided for planning purposes, all existing construction projects were evaluated based on a cost-benefit analysis. More than 25 projects (including overhead cover installations, a wastewater treatment plant, and a power plant) were cancelled at a savings or cost avoidance of more than $70 million. The cancelled projects resulted in material that was no longer required. Some material was included as part of a foreign excess personal property packet for return to the Iraqis, since that would cost less than returning it to the United States. Other material originally destined for the cancelled projects was reallocated to other U.S. interests in the region.

It was essential to provide guidance on new construction at remaining DOD sites before transition to the Iraqi government. An assessment of the previous 100 operations and maintenance projects was completed, covering life, health, safety, force protection, and quality-of-life improvements. The average processing time—from project initiation by the customer (with a letter of justification, receipt of estimate, technical evaluation, and funding approval) to a notice to proceed—was 48 days. The timeline from project initiation through project completion averaged 148 days. There-



Thorough inventories at Camp Taji were part of the turnover to the Government of Iraq.



T-walls, Hesco Bastion Concertainers,® and bunkers remain at Camp Taji as reminders of the U.S. presence from 2003 to 2013.

fore, the J-7 director published guidance to all DOD installation teams that no new projects could be submitted within 6 months of site closure. This ensured that time, effort, and funds were not expended on projects that would not be completed before site closure.

Environmental Stewardship

Environmental stewardship is everyone's responsibility from the moment a site is occupied until it is transitioned back to the host country. To ensure this, it must be a priority to develop a comprehensive, concise site-clearing checklist that all tenants on the site must follow before leaving. More than once during site transition operations, the environmental compliance officer found areas with contaminated soil or used petroleum, oil, and lubricant products left behind. Compliance should be stressed along the way; because when site transition occurs, the reduced force will not have the time or capacity to perform cleanup that should have already been completed. Sites must conduct an initial, environmental site closure survey 150 days before a planned transition date. This helps to identify areas of concern that current contractors must address and helps to capture problem areas left by a previous occupant. These areas are the primary reason for establishing a contract for environmental remediation and cleanup. The typical contract award timeline is between 60 and 90 days, so this effort must be started early.

Once all environmental corrective action plans are completed, a final environmental site closure survey must be completed to capture the initial and final conditions. Fortunately, the Iraqi government accepted most hazardous waste storage areas "as is" because the used petroleum, oil, and lubricant products, and other products will be reused. This saved the cost of removing the hazardous waste from the site. The final location and appearance of the hazardous waste storage areas, wastewater lagoons, reverse osmosis water purification units, and other areas of environmental significance were captured as part of the environmental record of return. This documentation was presented as part of the property and site record of return to the Iraqi government receivership secretariat. The relationship, trust, and confidence between OSC-I J-7 and the secretariat enabled the site transition to go smoothly.

Target Folders

Contingency plans are always essential, especially when operating in a nonpermissive environment like Iraq. Throughout the last 10 years, numerous contingency plans were developed and refined for each site, combat outpost, and forward operating base. However, these plans do no good if they are not properly archived and turned over to successors. Although we knew that contingency plans and tools existed, no one knew where to find them. Therefore, we created target folders of important information about each site. They included updated listings of all infrastructure and facilities, complete with capabilities such as water, fuel, and power generation. We included updated airfield surveys, imagery, and information for all points of entry and every border crossing into the country. This information was especially useful when planning a humanitarian aid mission for refugees in the area. These target folders must remain secure and available to the organization.

Site Closure

Units must plan for site closure from the beginning. After the large-scale drawdown of U.S. forces in 2011, six sites were left active. They became dumping grounds for containers and equipment. This became a problem when it was time to close those sites because there were no Soldiers, haul assets, authorities, or funding to retrograde the containers and equipment. While much of the remaining materiel will be turned over to the Iraqi government when U.S. forces depart, there were numerous items that could not be turned over and had to be retrograded. Now that Iraq is a sovereign nation, clearance from the Iraqi government to move equipment into, out of, or around Iraq is required. This can consume a lot of time and effort and may even be disapproved. It is better to know ahead of time what equipment cannot be turned over to the host nation and to ship it out of the country while resources are available.

To prepare for the final closeout of each site, each unit must remove its trash, documents, and anything else that cannot be left for the host nation before departing. They must also paint over memorials, unit markings, and names. In order to ensure that this is done, a clearing checklist must be published and enforced. Once U.S. forces depart, no troops will be available to do these tasks, so further cleanup would require bringing troops back or contracting outside labor. Forward planning and preparation will reap large dividends during the final phases of a drawdown.

Leadership and Professional Military Education

Serving in this complex war termination environment required a cumulative set of military and diplomatic skills, in addition to the interlocking knowledge of engineering disciplines. From a senior engineer perspective, the lessons learned from multiple combat tours in building partnership capacity served exceptionally well in designing a strategy; establishing LOEs for ways, means, and ends; understanding the complexity of Iraqi business practices; and using best practices for negotiation. Additionally, the engagement skills essential to mission success were developed through practice where trustworthy relationships are matured through time.

Language is the key to breaking cultural barriers. Future engineers from the joint community who will be assigned to security assistance teams might not have the required skill sets. Therefore, leader preparation for a postwar assignment in the FMS program will require changes in the professional military education system. The next generation will have to—

- Understand DOTMLPF in the design of an FMS case.
- Be familiar with contracting and acquisition phases and processes.
- Understand the contracting milestones that are essential to providing a realistic timeline.
- Understand the process needed to support host nation projects.

Also, the human resource management system must be disciplined to assign leaders with the right skill sets. FMS programs can have phenomenal effects beyond FMS case development and deliveries on strategic partnerships between governments. The effort requires displaying cultural astuteness, understanding the impact of DOTMLPF on a developing military FMS programs, building sustainable systems, and learning the contracting system and historical background of the region.

Final Engineer Support

With the reduction of the OSC-I, the most significant impact on the engineers was the elimination of the J-7. While the U.S. Forces–Iraq J-7 strength was more than 65 persons, the final engineer support of a nontradtional security cooperation office will be two military engineer lieutenant colonels and a strategic advisor. It is essential to keep the engineers in the infrastructure or they will become irrelevant. The OSC-I J-7 conducted two video teleconferences and exchanged numerous documents with the Afghanistan J-7 to share critical information and lessons learned as they began the war termination transition from a DOD- to a Department of State-led effort.



Colonel Mendoza is the command engineer for the Army and Air Force Exchange Service. He is a graduate of the Air War College, the U.S. Army Command and General Staff College, and the Defense Language Institute. He holds a bachelor's degree in civil engineering from Texas A&I University (now Texas A&M University–Kingsville).

Lieutenant Colonel Wallen is working toward a Ph.D in environmental engineering at the Colorado School of Mines. He is a graduate of Intermediate Level Education, the U.S. Army Combined Arms and Services Staff School, and the basic and advanced engineer officer courses. He holds a bachelor's degree in environmental engineering from the U.S. Military Academy, a master's degree in environmental engineering from the University of Texas at Austin, and a master's degree in geological engineering from the University of Missouri–Rolla (now Missouri University of Science and Technology). He is a licensed professional engineer and a certified project management professional.

Major Bennett is the executive officer of 1st Battalion, 345th Engineer Regiment (Training Support). She holds a bachelor's degree in technology from the University of Alaska at Fairbanks and a master's degree in human resource administration from the University of Central Michigan. She is a certified project management professional.

("Lead the Way," continued from page 3)

DeLuca and welcomed Brigadier General Anthony C. Funkhouser. The Regiment remains in great hands.

I want to thank community leaders—here in the Ozarks and at every post, camp, and station—who support our Soldiers while we withdraw from a decade of combat operations. Our requirements are many, and our solutions must remain optimized to support a wide range of military operations. We must rapidly provide scalable capabilities to prevent, shape, and win the wars of our Nation. Further, I appreciate the Army spouses who unconditionally hold the line on the toughest job in the Army. Thanks for all you do. Finally, thanks to the Soldiers of the Regiment for your dedicated service. You are our future generation of champions. Engineers always lead the way.

Essayons!

Reference:

[1]Army Doctrine Reference Publication 1, *The Army Profession*, 14 June 2013.



Rehearsals: The Lost Art

Plans are useless, but planning is everything.[1]

—General Dwight D. Eisenhower

By Captain Michael P. Carvelli

A rehearsal is the most effective synchronization tool available to commanders. Rehearsals validate subordinates' understanding of an assigned mission and the higher commander's intent. They should consist of scheduled blocks of uninterrupted time when a unit can practice a specific event, standing operating procedure (SOP), or series of occurrences to ensure that the unit achieves the commander's intent within the stated mission.

An effective rehearsal reveals weaknesses, integrates actions, confirms coordination, and improves understanding at all levels. An interactive rehearsal includes a variety of roles such as leaders, drivers, gunners, medics, and fire support and logistics personnel. Engaging Soldiers at all levels to discuss, act, or explain their part confirms their knowledge of assigned tasks. It also identifies unanswered questions and knowledge gaps and establishes coordination measures that may not have been revealed earlier.

Considerations for conducting a rehearsal include time available, space required/available, classes of supply (including live ammunition), and levels of leader and Soldier involvement. Units should conduct the most involved rehearsals possible. Whatever their level of detail, rehearsals must be well planned and involve up-to-date intelligence.

The types of rehearsals available to commanders are—

- Confirmation brief.
- Backbrief.
- Combined arms.
- Support.
- Battle drill or SOP.

These rehearsals must be paired with one of the following techniques to achieve the desired end state:

- Full dress.
- Reduced force.
- Terrain model.
- Sketch map.
- Map.

The above considerations of time and space available, classes of supply, and levels of leader and Soldier involvement must be taken into account to achieve the best result. Commanders must also ensure that outside agencies and representatives from other units are present during rehearsals. In addition, logistics at any level can cripple an operation if not given proper consideration during a rehearsal.

The recent deployment of the 84th Engineer Support Company (Airborne) as a route clearance company supporting Operation Enduring Freedom taught the following worthwhile lessons about the value of rehearsals.

Precombat Checks and Inspections

Although not a part of doctrinal rehearsals, precombat checks and inspections are critical to the success of any patrol. They are reviews of individual equipment readiness and vehicle load plans. At a minimum, they must be held at the team leader level. It is important to tailor the checks to the mission and across the company. Checklists are extremely helpful, not as a way to micromanage, but to ensure that all relevant items are covered. Items on checklists can include, but are not limited to, individual kits, weapons, vehicles, enablers, and special items of equipment. Checks should not just ensure that equipment is present, but that it is clean, serviceable, and properly packed and includes the required basic issue items and extra batteries, if needed.

Troop-Leading Procedures

Following one of the steps of the military decision-making process by conducting course-of-action analysis within platoon level troop-leading procedures was helpful. Deciding to use the box, belt, or avenue-in-depth method improved the sketch map technique for various courses of action. Gathering squad leaders, the platoon sergeant, and the platoon leader around a whiteboard achieved great effects as it fit in the reduced-force, battle drill scenario.

Although confirmation briefs are usually given immediately after a platoon level operation order is issued, backbriefs can be more effective. Giving squad leaders a set amount of time to develop their own plan was an effective teaching tool. Then, they had to tell the platoon leader how their plan achieved the commander's intent and supported the platoon mission. This assured that they had received the



A squad conducts a full-dress, battle drill rehearsal.



Soldiers conduct precombat checks.

information (similar to the confirmation brief) and that it confirmed their understanding of the commander's intent. Through confirmation briefs, the platoon leader synchronized the overall plan to meet the commander's intent.

Enablers

Within the company, the following enablers were assigned across two route clearance platoons and a mobility support platoon:

- Unmanned aerial sensors.
- Handheld detectors.
- Interrogation arms.
- Biometric identification and enrollment devices.
- Explosive line charges.

Discussing the event trigger that would force the emplacement of an enabler allowed leaders and Soldiers to understand what enabler would be chosen, how and why it would be employed, and who would employ it. This allowed the enabler to be integrated without specific direction from the leaders. Rehearsing the employment reduced time, increased proficiency, and achieved the desired result.

Scenario-Driven Battle Drill or SOP

After issuing an operation order and before crossing the line of departure, a patrol (or ramp) brief should be conducted. Mirroring the five-paragraph operation order format helps Soldiers recall the items of the operation order. At a minimum, all patrols must conduct rollover and fire drill rehearsals. Some mission-specific rehearsals that proved helpful were conducting verbal rehearsals, including rules of engagement and escalation of force. Mounted gunners gathered to answer scenario-specific questions. Drivers practiced their vehicle movements using index cards and conducted full-dress rehearsals of catastrophic kills and mobility scenarios with tow bars, tow straps, and recovery vehicles. Senior medics presented medical scenarios that allowed platoon medics and platoon sergeants to react to multiple casualties and conduct casualty evacuations. Rehearsals should continue until the platoon scenario has completely moved back to the tactical assembly area, next objective, or friendly base.

Remember, the process is more important than the end product. Rehearsals are the art to the science of planning.

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[1]Public Papers of the Presidents of the United States, Dwight D. Eisenhower, 1957, National Archives and Records Service, Government Printing Office, p. 818.

Captain Carvelli is the commander of the 84th Engineer Support Company (Airborne), recently deployed to Regional Command–South in Afghanistan. He is a graduate of the Maneuver Captains Career Course at Fort Benning, Georgia.



USACE Supports the Army Family Through School Construction

By Dr. JoAnne Castagna

In 1821, the U.S. Military Academy at West Point, New York, established the first school on a military installation to serve the children of Soldiers. Almost two centuries later, the West Point community and Department of Defense are still committed to providing these children an education to take them into the 21st century, even in the current tough fiscal times.

This is demonstrated by the much-needed renovation of the historic West Point Middle School by the U.S. Army Corps of Engineers (USACE), New York District. The school, which educates 300 students in grades five through eight, needed major upgrades.

In 2011, a USACE contractor began the renovations. The project includes renovating the existing school that was built in 1934 and is designated as an historic landmark, demolishing a wing to the school that was built in 1954, and constructing a new addition of approximately 31,000 square feet.

The more modern facility will include new, state-of-the-art, general-purpose, art, science, and music classrooms that will have interactive whiteboards and wireless Internet access. The renovation will provide a digital arts lab, a clay workroom in the art classrooms, an acoustic band room, and a full digital video production studio. The school cafeteria, playground, restrooms, library, parking area, and handicapped access will be improved; and new central air conditioning, security, fire protection, and communication intercom systems will be installed.

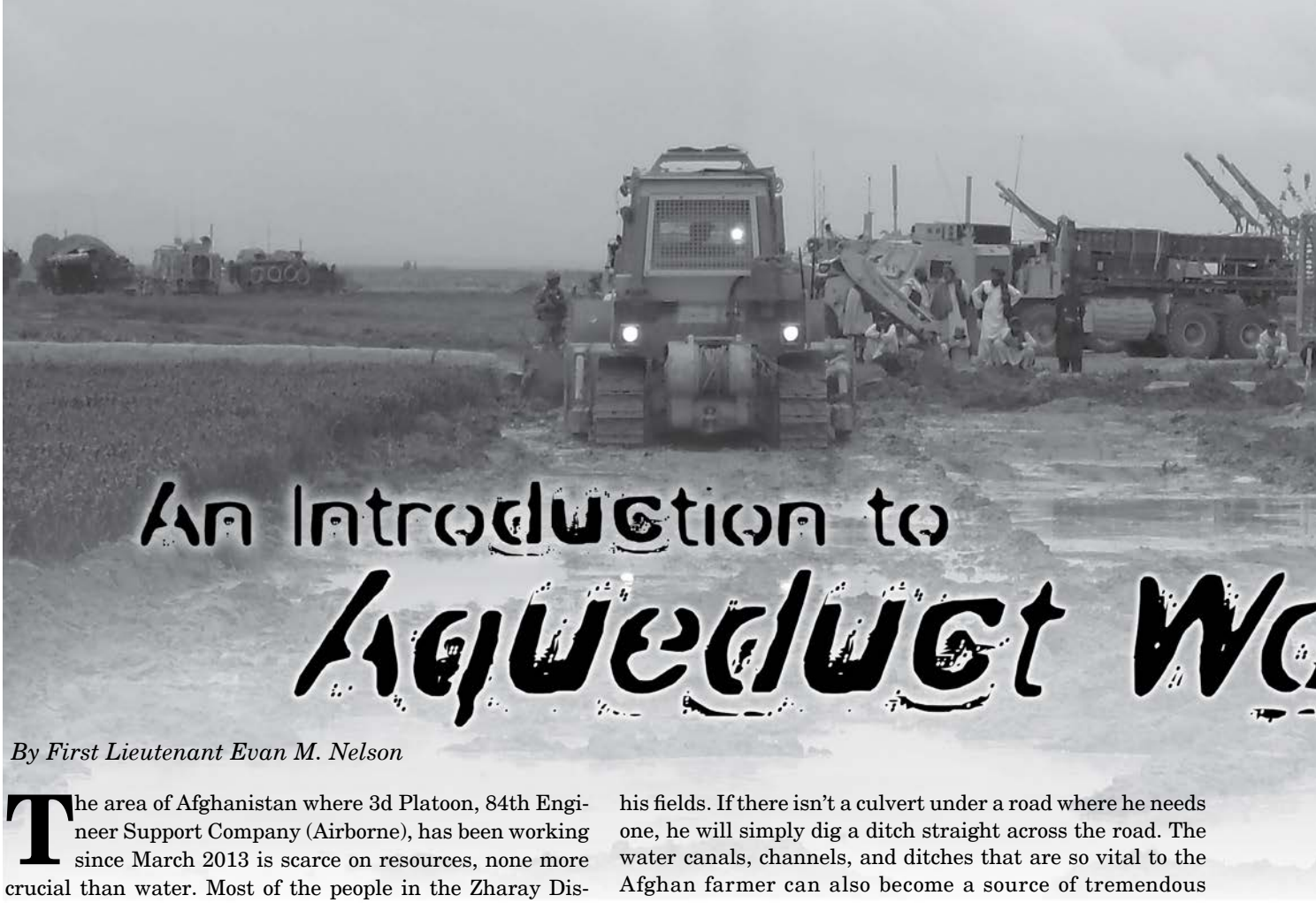
The new structure will meet the Leadership in Energy and Environmental Design requirements to be certified with a silver rating by the U.S. Green Buildings Council. It will have energy-efficient doors and windows, additional windows to make use of natural light, energy-efficient water heating and cooling systems, upgraded insulation, water-conserving toilets, and motion detector faucets.

The West Point campus is filled with historic buildings, including the 80-year-old middle school. The USACE project engineer and contracting office representative said that an effort was made to maintain the historic look and feel of the campus.

The school principal said, "The students are going to benefit greatly by this renovation. They will have access to learning spaces that are safe, modern, and efficient; and they will have a setting in which 21st century curricular objectives may be pursued. This project is also a testament to the military's commitment to provide world-class educational opportunities for the children of the men and women serving in our nation's military."

The project is being performed in phases while classes are in session, and completion is expected in 2014.

Dr. Castagna is a public affairs specialist for the USACE, New York District.



An Introduction to Aqueduct Wa

By First Lieutenant Evan M. Nelson

The area of Afghanistan where 3d Platoon, 84th Engineer Support Company (Airborne), has been working since March 2013 is scarce on resources, none more crucial than water. Most of the people in the Zharay District of Kandahar Province in Regional Command–South get their income from agriculture, even though the area gets little rainfall during the growing season. The ability to move water from its source to the fields is of great concern to the Afghan farmers. Over the centuries, they have developed numerous, creative ways to water their crops. The two main sources of water are the Arghandab River and a large aquifer that lies beneath the hard clay soil. Farmers either tap into the river upstream and channel the water down to their fields, or they pump the water out of the ground. Once the water is on the surface, it moves through a network of large canals into smaller channels and finally into the ditches that parallel the fields.

Civil infrastructure is of no importance to a farmer who wants to saturate his fields. If there isn't a culvert under a road where he needs one, he will simply dig a ditch straight across the road. The water canals, channels, and ditches that are so vital to the Afghan farmer can also become a source of tremendous frustration to U.S. military forces when they are intentionally used to stymie U.S. efforts in what has been termed "aqueduct warfare."

Early in its deployment, the platoon got its first taste of aqueduct warfare during Operation Gallant Stroll. The purpose of the operation was to clear enemy forces out of



Engineers lay a large culvert near an Afghan village.



urfare

an area while simultaneously cutting and building a new road into a Taliban stronghold. The mission was to construct 1.5 kilometers of improved road within 4 days. The first obstacle encountered was a large canal with a small amount of flowing water. The villagers had constructed a crude footbridge across the canal that served their needs, but the bridge certainly would not support an up-armored vehicle. The engineers installed and backfilled a 2- by 2-foot box culvert, enabling the main effort to push forward and allowing the water to continue flowing.

The next morning, the work crew was surprised to find that the newly cut road had turned into a soupy quagmire of mud. The cause was the canal, which had mysteriously swelled to a raging torrent of water that breached the banks and flooded the entire area, even though there had been no rain overnight. The waiting villagers complained that the culvert was much too small. The culvert denial system, which prevents unauthorized access to the culvert, had also been clogged with sticks, leaves, and debris, compounding the problem. While bulldozers cut away the top layers of saturated soil, Army officials asked local elders to turn off or divert the water upstream so that work could continue. The elders replied that there was nothing they could do about the water, since it was coming from snowmelt in the mountains several hundred miles away. The only solution would be to install a larger culvert, they said. The operation lost an entire day digging out the old culvert and installing a much larger one in its place. The following day, the canal had returned to its original flow rate and the villagers were content to watch as the road project continued. A similar situation occurred one more time during Operation Gallant Stroll, with similar problems and the same solution—a bigger culvert.

Due to delays, only about half the road was finished at the end of the operation. During a meeting with village elders, they explained that they never wanted the road built in the first place. Apparently, culvert size correlates to status in this part of Afghanistan. The larger the culvert serving a village, the more prestige it brings to that village. This explained why the farmers had pumped so much water into the canal and stalled progress until they got the larger culvert they wanted. It was an example of how aqueduct warfare can express displeasure with the presence of military forces in an area and delay their progress. This would not be the platoon's last encounter with aqueduct warfare.

Third Platoon engineers learned that insurgents can also use aqueduct warfare to deny International Security Assistance Forces access to an area. The platoon supported another engineer company effort to clear and raze a village used by the Taliban to stage improvised explosive device attacks. The only road crossed a large canal with a large box culvert before sloping downhill into the village, which was approximately 1 kilometer away. After a few days of preparation north of the village, the canal that ran under the road became flooded, washing out part of the road and making both sides of the canal soft and dangerous. We knew that the excess water had come from farmers flooding their fields. We could see pumps pulling water from underground sources and farmers using shovels to direct the flow toward the road.

A bulldozer was used to berm up the canal and divert water away from the road. A platoon of U.S. Marine Corps engineers brought in to emplace an armored vehicle-launched bridge across a canal south of the village nearly overturned a vehicle after it became stuck in the mud. Fortunately, no one was injured, the vehicle was successfully recovered, and the bridge was emplaced. However, the water continued to flow and ended up pooling in the staging area, creating a muddy parking lot and entrapping several vehicles.

Clearly the insurgents knew that if the road into the village were swamped, vehicles would either roll over or get stuck, thus delaying the operation and buying time to withdraw their forces and empty their supply caches. Whether the Taliban turned on the water pumps themselves or coerced the locals into doing so, the effect was the same. The most powerful army in the world was almost defeated by a handful of Afghans armed with nothing but shovels and gas-powered water pumps.

Aqueduct warfare can present problems to all units operating on vulnerable battlefields. While leaders may not be able to prevent aqueduct warfare, an understanding of where it can be used and its potential impacts may mitigate some of the problems it can cause.

First Lieutenant Nelson is a platoon leader for 84th Engineer Support Company (Airborne). He holds a bachelor's degree in environmental engineering from the U.S. Military Academy.

The Double Life of Brigadier General Paschal N. Strong



How One Engineer Officer Had a Lasting Impact on the Battlefield and the Home Front

By Colonel John M. Riley

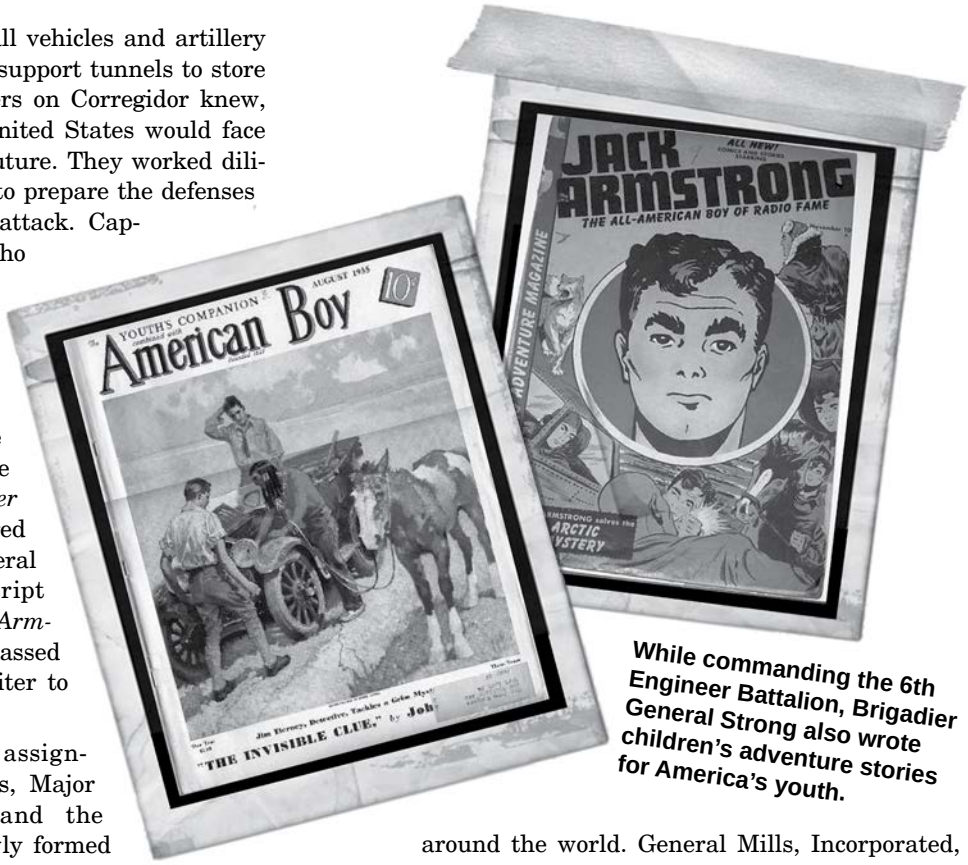
While Soldiers may joke about leaders who seem to have multiple personalities, one highly respected engineer officer who served from the 1920s through the 1950s was in fact two different people.

Brigadier General Paschal "Pat" N. Strong was an engineer officer who served with distinction through World War II and the Korean War. He wrote regularly for engineering and military publications throughout his long and noteworthy career. But he was also "Kennedy Lyons," the author of more than 75 adventure tales for children and young adults. Over a 30-year Army career, Brigadier General Strong lived a double life, delivering engineering expertise to the Army while exciting young people with tales of strange lands and thrilling adventures.

Having failed his flight physical after graduating from West Point in 1922, he was assigned to the Corps of Engineers and initially trained at Fort Humphreys, Virginia, for duties that would take him to the center of a number of significant events in U.S. military history. He captured the tales of his military career in a memoir called *Sabres and Safety Pins*, which was coauthored by his wife Mary. Written in a clever, give-and-take format, the book covers the many moves and experiences of the Strong family from the perspective of the officer, with the sometimes contradictory vantage point of his spouse.

Among his career highlights, Captain Strong supervised the construction of the Malinta Tunnel complex in the Philippines, which would later serve as the refuge for General Douglas A. MacArthur and his besieged forces. Over a 3-year period, Captain Strong supervised crews of laborers, mostly native Filipinos, as they blasted away at The Rock, as the island of Corregidor was known. The Army's mission was

to construct one major tunnel for all vehicles and artillery pieces on the island and 24 lateral support tunnels to store supplies and equipment. The officers on Corregidor knew, even in the mid-1930s, that the United States would face the armed forces of Japan in the future. They worked diligently in spite of supply shortages to prepare the defenses of the Philippines against future attack. Captain Strong was a prolific writer who focused on short pieces for *Boy's Life* and *Colliers* magazines and also penned a series of adventure books about West Point life and athletics. But the tropical scenery and exotic people of the islands gave him the inspiration for an adventure book entitled *Wings Over Wonder Island*. It was this book that captured the attention of executives at General Mills, Incorporated, when the script writer for their radio show *Jack Armstrong, All American Boy* suddenly passed away and they needed another writer to continue the tales.



While commanding the 6th Engineer Battalion, Brigadier General Strong also wrote children's adventure stories for America's youth.

After another intermediate assignment with the Corps of Engineers, Major Strong was selected to command the 6th Engineer Battalion in the newly formed 6th Infantry Division as the nation began to mobilize for the coming war. He was contacted during this assignment at Fort Riley, Kansas, and asked if he would take over writing the scripts for *Jack Armstrong, All American Boy*. He was signed to a 6-year contract and devoted his evening hours to churning out adventure stories for America's youth. Major Strong gave new life to Jack Armstrong and his friends Billy and Betty by adding a liberal mix of his experiences around the country and around the world. General Mills, Incorporated, was pleased, since *Jack Armstrong, All American Boy* helped sell a variety of popular breakfast cereals, including "Wheaties®."

After moving his battalion multiple times as the Army expanded, he trained his engineers at Fort Leonard Wood, Missouri, along the banks of the Big Piney River while his family lived in Lebanon, Missouri. It was the closest town to the fort that was able (barely) to handle the rapid influx of military families in the early 1940s. In his memoirs, Pat Strong details the struggles of battalion command at the time. The 6th Engineers were responsible for constructing the ranges and many of the support facilities of the new fort in Missouri. At the same time, they were expected to begin training alongside the units of the 6th Infantry Division in preparation for the Louisiana Maneuvers. As if those two competing missions were not enough, the recently promoted lieutenant colonel



West entrance of the Malinta Tunnel

also had to contend with a near-constant turnover in his unit leadership. The Army pulled senior commissioned and noncommissioned officers from the ranks of existing units to serve as cadre for newly forming battalions, and Lieutenant Colonel Strong continued to prepare his unit for combat by training officers and Soldiers for their mission as combat engineers. He recognized that his first priority was to train the men to fight as infantry and then train them in engineer skills.

Under protest, Lieutenant Colonel Strong was assigned to a new post in Michigan before he could take his unit into combat. However, he was somewhat placated with a promotion to colonel and an understanding that the work he was doing on lock and port facilities would benefit him in a future role.

In the fall of 1943, Colonel Strong was ordered to England to oversee the construction of airfields as U.S. and Canadian forces poured onto the island nation. By December of the same year, he was moved to the position of chief engineer of the Southern Base District with a mission to construct and maintain every support facility necessary to facilitate the invasion of Europe. Colonel Paschal Strong, at the age of 42, was placed in charge of the activities of 18 engineer regiments and a host of other support units for this monumental task. Although junior to many of the regimental commanders, Colonel Strong was posted at the "direction of the President," and all but one of his subordinates gave him their respect and best efforts. The lone detractor was quickly reassigned to the states. In his memoirs, he recounts the daunting task of uncoiling the Allied war machine from the dispersed camps to the port facilities to embark on the Channel crossing. Colonel Strong and his movement section did yeoman's work while managing changes in troop movements in the final months and weeks before the invasion, and he orchestrated the flow of logistics across the water to sustain the combat operations as they moved inland from the invasion beaches.

After the Allies secured their foothold and moved toward victory in Europe, Colonel Strong moved onto the European continent and continued his work as his engineers built up the ports and camps in places like Le Havre and Antwerp. He also continued to churn out scripts for the heroic adventures of Jack Armstrong in what little time he had to spare, admittedly plagiarizing liberally from his previous works to save time.

Returning to the United States in 1945, Colonel Strong recalled that upon landing in Washington, D.C., he remarked to fellow passenger Brigadier General Anthony C. McAuliffe, "I'm going to sit the next war out." He was wrong, but happy to be reunited with his wife and family after 2 years at war. Colonel Strong landed his dream assignment and was assigned as the commander of the Savannah District of the U.S. Army Corps of Engineers near his childhood home in Georgia. He wrapped up his association with Jack Armstrong in 1947 as he focused on Savannah, his family, and the future. However, the Jack Armstrong character would live on for decades to come on radio and in motion pictures. The popular cartoon series *Jonny Quest* was largely based on Jack Armstrong and his travels.

In 1949, Colonel Strong moved to an assignment as the staff engineer for Eighth Army and the Occupation Forces in Japan. He then went on to Korea and eventual promotion to brigadier general while tending to the complex engineer tasks—bridging, demolitions, port openings, ice breaking, and railway operations—of the conflict in Korea. He returned to Savannah in 1951 as the war in Korea churned on. He had done his best to posture American forces for success in that conflict and ensured that they had the infrastructure in place to sustain the United Nations forces fighting on the peninsula.

Brigadier General Strong entered the old Army in 1922, did his part to solidify a foothold in the Pacific as tensions with Japan were on the rise, and participated in the buildup for global war. He helped build the infrastructure that would deliver the Allies into Europe and sustain them during combat, and he even constructed the camps and ports through which they would pass to return home. All the while, he met the needs of young people around the country as he wrote stories that captivated and inspired readers and radio listeners and told them of adventures beyond American shores. Pat Strong epitomized the career Army officer who was able to achieve balance in his life. He served his country as an accomplished expert in his field, raised four children with his wife Mary as they traversed the country and the world, and pursued his own passions for writing and adventure. In his later life, he continued to serve the Port of Savannah as an advisor and operated an oyster supply company while pursuing other interests, such as flying, sports, and music. He passed away in 1988, but left behind him military and literary legacies worthy of great admiration and study. He lived the life of the All-American Man.

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Paschal N. and Mary H. Strong, *Sabres and Safety Pins*, 1954, <http://wnk.hamline.edu/sabresandpins.html>, accessed 7 August 2013.

Malou Komornicka (granddaughter of Brigadier General Strong), e-mail, July 2013.

Colonel Riley serves as the Deputy Chief of Staff for Operations, Plans, and Training (G-3), Maneuver Support Center of Excellence, Fort Leonard Wood. He holds a bachelor's degree in English from The Citadel, South Carolina; a master's degree in international relations from Troy State University (now Troy University), Alabama; and a master's degree in strategic studies from the U.S. Army War College, Carlisle Barracks, Pennsylvania.



Photo by Jon Fleshman, U.S. Army Corps of Engineers

Lessons Learned in Energy Efficiency

By Colonel Stewart R. Fearon

In an effort to improve energy efficiency and reduce greenhouse gas emissions, the 63d Regional Support Command (RSC) used the U.S. Army Reserve Center at Bryan, Texas, as a test bed for a geothermal heat pump, solar water heating, and a photovoltaic (PV) solar array. Bryan is the home of the 420th Engineer Command. The goal was to implement Executive Order 13423[1] to reduce energy intensity by 3 percent annually and implement renewable energy generation projects on U.S. Army Reserve property.

Comparatively little energy is expended on heating the building in Bryan, so cooling is the primary requirement of the heating, ventilation, and air conditioning system. With 83 wells feeding 37 heat pumps, the geothermal system eliminates the chiller unit. Compared to a typical chiller unit, the initial costs of the geothermal heat pump are more expensive, but the maintenance costs and energy savings over a 25-year life cycle make the geothermal system less expensive, while complying with the executive order.



A parking shelter also serves as an energy-producing solar array.

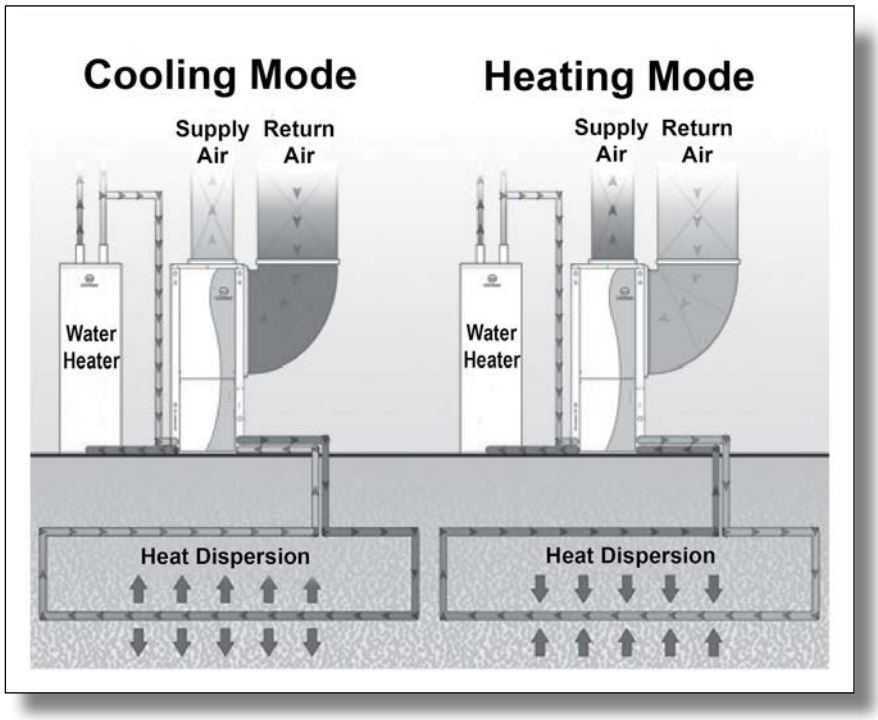


Figure 1. Geothermal cooling and heating

The geothermal heat pump cools and heats the Bryan U.S. Army Reserve Center. The ground temperature remains relatively constant year-round and averages about 68°F. The geothermal heat pump uses 300-foot-deep wells to extract heat from the ground in the cooler months and distribute it through the conventional duct system to warm the center. In the warmer months, the process is reversed; heat is extracted from the center and transferred back into the wells. Two pumps in the mechanical room circulate a glycol solution through a closed system. Eighty of the wells support the main training and administration building, while the other three wells support the base maintenance activity shop.

Geothermal heating and cooling (Figure 1) is a mature technology that has been used for decades. The components are not high-tech and do not require extensive maintenance. With periodic maintenance of the pumps and heating and cooling coils, the expected life span of the Bryan geothermal heat pump is 30 years.

The Bryan U.S. Army Reserve Center project also uses solar water heaters. This proven technology is used extensively in homes and businesses in temperate climates with high levels of sun exposure. Instead of heating the water from about 68°F to 125°F with gas or electricity, the solar water heaters use solar panels on the roof. On a summer day, the sun will heat the water to the point where additional heating is not required. Small pumps continuously circulate the hot water from the collector to storage tanks. When the sun goes down or is not shining, the pumps stop circulating the water back into the collectors, where it would cool the stored water. During the winter, when temperatures can drop below freezing, sensors signal the pumps to drain the solar panels to prevent them from freezing.

There are two types of active solar water heating systems: direct and indirect. In a direct system, the water runs through a collector to be heated. In an indirect system, water or another fluid runs through a collector and then heats the water in a storage tank. The indirect system requires a heat exchanger and more extensive piping than a direct system. The Bryan U.S. Army Reserve Center has two 119-gallon solar water heaters for domestic water in the main training and administration building and one solar water heater for the base maintenance shop, with an electrical backup for days when the sun does not shine or temperatures are below freezing.

For an initial cost of $1.48 million, the array of 682 solar panels, each 77 by 30 inches, covers 14,220 square feet. Each panel can generate 280 watts and has a maximum power of 190.9 kilowatts, though the inverters can only capture 175 kilowatts. Part of the negotiation between the U.S. Army Corps of Engineers and Bryan Texas Utilities resulted in 50 percent of the renewable energy credits going to the utility company.

One of the lessons learned is that each utility company manages the renewable energy added to its grid differently. Bryan Texas Utilities does not simply give the 63d RSC



Solar collectors heat water at the Bryan U.S. Army Reserve Center.

credit for the energy it produces and deduct it from the bill (called *net metering*). Instead, the 63d RSC is required to sell the solar power to Bryan Texas Utilities based on the current grid pricing schedule. This price fluctuates and is tied to the seasonal demands for the region. Then, the 63d RSC has to purchase the power back from the power company at the normal rate. Table 1 shows the Bryan U.S. Army Reserve Center power consumption and the power generated by its PV array.

		Consumption		Generation	
Service From	Service To	Kilowatt-hours	Cost	Kilowatt-hours	Cost
18 Jul 12	16 Aug 12	41,856	$2,583.71	33,067	$1,453.32
17 Aug 12	17 Sep 12	40,320	$2,489.70	29,636	$935.30
18 Sep 12	16 Oct 12	31,104	$1,918.21	22,872	$707.76
17 Oct 12	14 Nov 12	27,648	$1,701.80	22,599	$780.15
15 Nov 12	14 Dec 12	24,960	$1,538.92	19,044	$482.02
15 Dec 12	15 Jan 13	26,880	$1,655.27	15,141	$360.25
17 Jan 13	14 Feb 13	23,808	$1,845.30	18,743	$438.73
	Total	216,576	$13,732.91	161,102	$5,157.53

Table 1. Generation and Consumption

Table 1 shows that the power output of the PV array predictably declined from a high of 33,067 kilowatt-hours in August 2012 to a low of 18,743 kilowatt-hours in February 2013 as the days grew shorter. Table 2 shows that the energy credits the utility company paid showed a surprising drop from 4.4 cents per kilowatt-hour in July to 2.3 cents in January. At the same time, the price of electricity paid to the utility company increased from 6.2 cents per kilowatt-hour to 7.8 cents.

If the energy credits from the first 6 months are matched in the next 6 months, the PV array would pay for itself in 143 years. Although Bryan is in an excellent location to generate renewable energy, the cost of electricity there is relatively low compared to other states such as California. This increases the time for the savings to offset the cost of the PV array. However, solar power reduces the 63d RSC reliance on petroleum-based energy and reduces its overall energy consumption.

The 63d RSC is working with the Army Reserve Installation Management Directorate to eliminate the requirement to sell its unused solar power to Bryan Texas Utilities. One idea is to add on-site energy storage for the power generated by the PV array. This would allow the 63d RSC to use 100 percent of the energy generated instead of selling it to Bryan Texas Utilities and then purchasing it back at a higher rate.

The 63d RSC is leading the way in implementing Executive Order 13423. By reducing energy consumption through the use of geothermal and solar water heaters and generating energy from renewable sources, the 63d RSC is working to meet the goal of reducing energy consumption by 3 percent annually, while creating renewable energy generation projects for the U.S. Army Reserve.

		Delta Factor		
Service From	Service To	Cost per kilowatt-hour	Credit per kilowatt-hour	Delta per kilowatt-hour
18 Jul 12	16 Aug 12	6.2 cents	4.4 cents	1.8 cents
17 Aug 12	17 Sep 12	6.2 cents	3.2 cents	3.0 cents
18 Sep 12	16 Oct 12	6.2 cents	3.1 cents	3.1 cents
17 Oct 12	14 Nov 12	6.2 cents	3.5 cents	2.8 cents
15 Nov 12	14 Dec 12	6.2 cents	2.5 cents	4.0 cents
15 Dec 12	15 Jan 13	6.2 cents	2.3 cents	3.8 cents
17 Jan 13	14 Feb 13	7.8 cents	2.3 cents	5.4 cents
		Average cost	Average credit	Average Delta
	Total	6.4 cents	3.1 cents	3.4 cents

Table 2. Credits and Costs

Endnote:

[1]Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, Federal Register, Volume 72, No. 17, 26 January 2007, <http://www.gpo.gov/fdsys/pkg/FR-2007-01-26/pdf/07-374.pdf>.

Colonel Fearon serves as the director of public works at the 63d RSC. He holds a bachelor's degree in mechanical engineering from the U.S. Military Academy and master's degrees in strategic studies from the U.S. Army War College and business administration from National University.

Engineer Doctrine Update

U.S. Army Maneuver Support Center of Excellence
Capabilities Development and Integration Directorate
Concepts, Organizations, and Doctrine Development Division

Publication Number	Title	Date	Description (and Current Status)
Publication Revisions			
FM 3-34	*Engineer Operations*	Aug 11	This revised version contains the "box top" as our doctrinal framework; integrates the three engineer disciplines of combat, general, and geospatial engineering; and introduces the four lines of engineer support for decisive actions. **Status:** The revised version has been approved by the U.S. Army Engineer School (USAES) commandant. Anticipate publication 1st quarter, fiscal year (FY) 2014.
ATP 3-34.22 (FM 3-34.22)	*Engineer Operations—Brigade Combat Team and Below*	Feb 09	This is a revision and conversion of FM 3-34.22, *Engineer Operations—Brigade Combat Team and Below*, to Army Techniques Publication (ATP) 3-34.22. It is under development and will include information on the brigade engineer battalion (BEB). **Status:** Anticipate the final draft to be sent for worldwide staffing 2d quarter, FY 14. To be published 4th quarter, FY 14.
ATP 3-34.23 (ATTP 3-34.23)	*Engineer Operations—Echelons Above Brigade Combat Team*	Jul 10	This is a revision and conversion from Army Tactics, Techniques, and Procedures (ATTP) 3-34.23, *Engineer Operations—Echelons Above Brigade Combat Team*, to ATP 3-34.23. **Status**: Anticipate the final draft to be sent for worldwide staffing 2d quarter, FY 14. To be published 4th quarter, FY 14.
ATP 3-90.61 (FM 3-90.61)	*Brigade Special Troops Battalion*	Dec 06	This is a revision and conversion from FM 3-90.61, *The Brigade Special Troops Battalion*, to ATP 3-90.61. **Status:** Anticipate the final draft to be sent for worldwide staffing 3d quarter, FY 14. To be published 1st quarter, FY 15.
Combat Engineering			
ATP 3-34.20 (FM 3-34.210)	*Explosive Hazard Operations*	Mar 07	This is a multi-Service manual and conversion from FM 3-34.210, *Explosive Hazards Operations,* to ATP 3-34.20. **Status:** Staffing of the final draft is complete, and the final approved draft is being prepared. To be published 2d quarter, FY 14.
ATP 3-37.34 (FM 5-103)	*Survivability Operations*	Jun 13	This is a multi-Service manual with the U.S. Marine Corps (USMC) and provides an integrated systematic approach to survivability operations. This manual is a compilation of tactics, techniques, and procedures (TTP) found in doctrine, lessons learned, and other reference material. This manual falls under the umbrella of the protection warfighting function and supersedes FM 5-103, *Survivability*. **Status:** Current
ATP 3-90.4 (ATTP 3-90.4)	*Combined Arms Mobility Operations*	Aug 11	This is a multi-Service manual and conversion from ATTP 3-90.4, *Combined Arms Mobility Operations*, to ATP 3-90.4. **Status:** Anticipate the final draft to be sent for worldwide staffing 2d quarter, FY 14. To be published 4th quarter, FY 14.
ATP 3-90.8 (FM 3-90) (FM 5-102) (FM 90-7)	*Combined Arms Countermobility Operations*	Jul 01 Mar 85 Sep 94	This will be a full revision that includes the consolidation of FM 3-90, *Tactics;* FM 5-102, *Countermobility*; and FM 90-7, *Combined Arms Obstacle Integration*. This will be a multi-Service manual that discusses countermobility and combined arms obstacle integration and their relationship to the combined arms defense and warfighting functions with regard to wide-area security. **Status:** The final approved draft has been approved by the USAES commandant and is now awaiting USMC approval. To be published 1st quarter, FY 14.

ENGINEER DOCTRINE UPDATE

U.S. Army Maneuver Support Center of Excellence
Capabilities Development and Integration Directorate
Concepts, Organizations, and Doctrine Development Division

Publication Number	Title	Date	Description (and Current Status)
Combat Engineering (Continued)			
ATP 3-90.37 (FM 3-90.119)	*Combined Arms Improvised Explosive Device Defeat Operations*	Sep 07	This is a conversion from FM 3-90.119, *Combined Arms Improvised Explosive Device Defeat Operations*, to ATP 3-90.37. **Status:** Staffing of the final draft is complete, and the final approved draft is being prepared. To be published 2d quarter, FY 14.
General Engineering			
ATP 3-34.5 (FM 3-100.4)	*Environmental Considerations*	Feb 10	This is a conversion from FM 3-100.4, *Environmental Considerations in Military Operations*, to ATP 3-34.5. **Status:** Staffing of the final draft is complete, and the final approved draft is being prepared. To be published 2d quarter, FY 14.
ATP 3-34.40 (FM 3-34.400)	*General Engineering*	Dec 08	This multi-Service manual is a conversion from FM 3-34.400, *General Engineering*, to ATP 3-34.40. **Status:** Staffing of the final draft is complete, and the final approved draft is being prepared. To be published 2d quarter, FY 14.
ATP 3-34.45 (FM 3-34.480)	*Power Generation/ Distribution*	Apr 07	This multi-Service manual is a conversion from FM 3-34.480, *Engineer Prime Power Operations*, to ATP 3-34.45. **Status:** Anticipate the final draft to be sent for worldwide staffing 2d quarter, FY 14. To be published 4th quarter, FY 14.
ATP 3-34.81 (FM 3-34.170)	*Engineer Reconnaissance*	Mar 08	This is a conversion from FM 3-34.170, *Engineer Reconnaissance*, to ATP 3-34.81. **Status:** Anticipate the final draft to be sent for worldwide staffing 3d quarter, FY 14. To be published 1st quarter, FY 15.
Geospatial Engineering			
ATP 3-34.80 (FM 3-34.230)	*Geospatial Engineering*	Mar 08	This is a conversion from FM 3-34.230, *Topographic Operations*, to ATP 3-34.80. **Status:** Staffing of the final draft is complete, and the final approved draft is being prepared. To be published 2d quarter, FY 14.

Notes:

1. Current engineer publications can be downloaded from the Army Publishing Directorate Web site at <http://www.apd.army.mil>. The manuals discussed in this article are currently under development and/or recently published. Drafts may be obtained during the staffing process by contacting the Engineer Doctrine Branch at commercial (573) 563-0003, DSN 676-0003, or <usarmy.leonardwood.mscoe.mbx.cdidcodddengdoc@mail.mil>. The development status of these manuals was current as of 10 September 2013.

2. Items in parentheses are publication numbers of current publications, which will be superseded by the new number at the top of the entry. Multiple numbers in parentheses indicate consolidation into one manual.

3. Currently, all 30 Army doctrine publications/Army doctrine reference publications have been published. Every Army professional should have a basic knowledge of our fundamental principles since they rarely change quickly. They can be downloaded from the Army Publishing Directorate Web site at http://www.apd.army.mil.



Alaska District Takes Prominent Role in New Defense Strategy

By Colonel Christopher D. Lestochi

With the nation's defense strategy focus shifting to the Asia-Pacific region, the expanding involvement of the U.S. Army Corps of Engineers, Alaska District in that part of the world has taken on new and increasing importance. In partnership with agencies such as U.S. Pacific Command (USPACOM) and the U.S. State Department, the district has executed more than 200 projects and gained broad experience throughout the region. Work that started in Bangladesh, Cambodia, Laos, and Vietnam has expanded to India, Mongolia, Nepal, Sri Lanka, and Taiwan.

In fiscal year 2013, the district's workload under the Department of Defense Humanitarian Assistance Program and U.S. Agency for International Development consisted of 70 projects valued at $31 million, while programs supporting the U.S. State Department for security assistance and foreign military sales featured three projects valued at $91 million.

The district began its work for USPACOM through the Department of Defense Humanitarian Assistance Program in 2009. Despite many obstacles, the district has managed 140 projects in this program and the workload keeps growing. Most of the projects are schools, medical facilities, flood management centers, and cyclone shelters constructed in Bangladesh, Cambodia, Laos, Mongolia, Nepal, Sri Lanka, and Vietnam. Nepal has four projects that are vital to disaster preparedness and response, including a blood center and airport structural upgrades to withstand earthquakes. Mongolia is the latest entry, with the renovation and construction of tuberculosis clinics. Although customers have requested more complicated projects, such as communications centers and helipads, most work continues to focus on medical and educational structures, with an emphasis on multiuse facilities. The district is also conducting a Koshi River drainage study in Nepal.

Department of Defense humanitarian assistance activities were established by the federal government in 1986 to assure support to selected friendly nations and allies and to provide basic humanitarian aid and services to populations in need. The goals of the Department of Defense and combatant commanders, are to help avoid political and humanitarian crises, promote democratic development and regional stability, and enable countries to recover from past conflicts. In noncrisis peacetime settings, the program supports combatant commanders by providing access to, and fostering goodwill for, the U.S. military.

USPACOM provides humanitarian assistance to 36 countries across the Asia-Pacific region. In protecting and defending the nation, the Alaska District plays a leading role in setting the conditions with nations in the Pacific and Asia so that the U.S. government has access there in

case of a national emergency. The district may seem like an unlikely candidate for this role, but the work it is doing in the region is similar to what it performs in Alaska. Alaska is located in the USPACOM area of responsibility, and Alaska District employees have an expeditionary mindset that has always been part of the district's culture. Its employees are accustomed to working in remote locations on projects that support communities in rural and coastal Alaska and many of the more than 200 federally recognized tribes of Native Americans in the state. The district is part of the long history of the Department of Defense and Department of State working together to achieve common goals. It is a flexible, adaptable, and high-performing organization. As the priorities of the Army and the Nation are changing, the district is in a position to take advantage of new opportunities in the Asia-Pacific region, including humanitarian assistance.

Project managers set their sights on continual improvement by increasing standardization and efficiency, but this improvement is complicated for many reasons, including cultural and language differences. Project sites in the Asia-Pacific region are usually located in rural areas, where the help is needed most. Travel from Alaska can take up to 2 days, so visits are normally scheduled several times annually and cover multiple countries to minimize expenses. Once they arrive, team members need to work effectively, coordinating with foreign dignitaries and U.S. embassy personnel and interacting with host nation businesses that are contracted for design, construction, and quality assurance.

The district's military contingency contracting team administers contracts. This reflects an effort across the Corps to assign Soldiers to districts in the acquisition career field so that they can gain design and construction contracting experience with an emphasis on applying those skills in a contingency environment. Humanitarian assistance projects fit the criteria for gaining that kind of exposure, and the Alaska District uses military contingency contracting teams as they were intended to be employed.

By developing standard designs, the district controls costs. Easily adaptable designs also streamline efforts with contractors. For instance, school layouts are similar, except for the number of rooms and toilets. Typically built for 40 pupils, classrooms have tile floors and ceiling fans. Since sanitation is a primary objective of the program, restrooms are provided for all facilities. Water is drawn from a well, while a rain catchment supplies a backup source. Desks and chalkboards are installed to complete the project and make it fully operational.

Medical buildings are more complicated because of their diverse uses. Most countries have multiple layouts developed by their health ministries, depending on the population to be served. With the aid of local designers, the district evaluates which type of facility is appropriate for humanitarian assistance and uses existing layouts to develop standard designs that are right for the program, whether it is a clinic or hospital.

Besides getting the right type of facility, the nations receive a high-quality product that is focused heavily on structural design. District engineers developed country-specific structural requirements based on the International Building Code®. Designing buildings to handle austere conditions and serve local populations is also emphasized. Providing elaborate features could result in facilities that clash culturally or are difficult to maintain, so designs are simplified. Developing nations have little money for maintenance, and schools and hospitals usually have no maintenance staff. To mitigate the difficulties of upkeep, the district requires construction contractors to provide operations and maintenance manuals and to train the end users.

USPACOM and host nations have expressed their satisfaction with the finished construction projects, and that success has led to more customers. The U.S. Agency for International Development gave the district more than $40 million to manage and construct as many as 100 cyclone shelters in Bangladesh. The work is planned over 5 years and is modeled after the district's accomplishments for USPACOM. The district is coordinating with the Bangladesh Coast Guard to assist with natural disasters and build coastal crisis management centers that are full-time stations to protect local populations and waterways. These buildings will help Bangladesh and the international community respond more effectively during crisis and recovery.

The district also participates in the Global Peace Operations Initiative sponsored by the Department of State. The district manages construction projects in Mongolia and Bangladesh to renovate and expand facilities that train host nation peacekeeping forces. Another avenue of support to the region is through foreign military sales. The district is constructing facilities and infrastructure worth $299.6 million in India and helping to plan, design, and construct infrastructure to support rotary, heavy lift, and fighter aircraft sales throughout the USPACOM area of responsibility.

By containing costs and adding value for customers in Asia, the district can help make a difference for the people of developing countries and support the U.S. mission abroad. Multiple projects and programs in the region allow the district to leverage resources and products to meet customer needs. Opportunities to assist the national defense focus in the Asia-Pacific region are likely to increase as the war in Afghanistan winds down. Resources may concentrate on humanitarian assistance, security cooperation assistance, foreign military sales, or a new opportunity still to be discovered. As federal budgets decline, programs like the one that the Alaska District supports on behalf of USPACOM are a cost-effective way to advance U.S. strategic interests in the region.



Colonel Lestochi is the commander of the U.S. Army Corps of Engineers, Alaska District. He holds a bachelor's degree in architectural engineering and a master's degree in civil engineering from Penn State University. He is a licensed civil engineer in Alaska.

Study Offers Guidance for Using Indigenous Materials and Methods to Build Base Camps

By Dr. Ghassan Al-Chaar

Research conducted under the Army Study Program assesses the feasibility of using local materials and techniques to construct base camp facilities. The strategic, informed use of indigenous construction materials (ICM) could reduce the Army's logistics burden while promoting practices that are resource-efficient and reducing adverse impacts on the environment, host nation cultural resources, and local populations.

The U.S. Army Engineer Research and Development Center (ERDC) is conducting the study for Headquarters, Department of the Army. Using ICM and indigenous methods of construction can cause problems for engineers accustomed to working with U.S. standards and specifications, such as the Unified Facilities Criteria. The ERDC goal is to propose realistic standards that allow the inclusion of ICM building designs into the Joint Construction Management System, which supports the Army Facilities Components System program. By associating costs with the life cycles of some common semipermanent construction, the research team is developing matrices that allow decisionmakers to compare and contrast ICM with traditional materials and methods.

Local Materials Used

In recent U.S. contingency operations, the greatest vulnerability of a contingency base is its supply line. A base depends on liquid fuels and other classes of supply, including construction materials, most of which must be brought in by air or by highly vulnerable ground convoys. The Army is making great efforts to reduce its resource footprint and studying ways to reduce energy demand, decrease the use of fossil fuels, and build more efficient facilities.

Although guidance exists on specific Army goals related to the sustainability of contingency bases, the Army Facilities Components System offers only wood frame construction designs for standard military facilities, whether or not that type of construction is appropriate for a particular theater of operation. This study will recommend ICM and indigenous techniques that can be adapted to standard military designs and are suitable for several climate zones, including arid and tropical. Evaluation factors for these materials and techniques will include the cost of materials, cost and risk of transportation of materials, construction labor costs and availability, potential energy efficiency improvements, durability, and force protection characteristics.

"The Army is making great efforts to reduce its resource footprint and studying ways to reduce energy demand, decrease the use of fossil fuels, and build more efficient facilities."

Traditional Definitions	Realistic Definitions for This Study
Indigenous materials must be found in a specific place or area.	Materials may be found within a reasonable distance.
Materials can be used in their raw, untreated form.	Materials may be treated in a basic form to make them ready to use.
Materials do not require a major, improved transportation system.	A local traditional or improved transportation system may be used.
Construction tools and equipment are basic and primitive.	Construction tools and equipment can range from basic to advanced.
Construction is labor-intensive and performed with unskilled labor.	Construction may be labor- or capital-intensive and performed with unskilled to advanced labor.

Table 1. ICM definitions

In addition to reducing the cost to transport materials, it may also be possible to use skilled local labor to reduce the number of contractors who must be brought in and supported at a base. This may also result in positive effects for local economies. Local construction is often more suitable for the regional climate, potentially reducing the energy required to heat and cool the structure. At the end of an operation, facilities are much more likely to be culturally suitable for turnover to the local community.

ICM Definition Tweaked

Previous experience has shown that traditional definitions of ICM can be limiting and unrealistic for existing conditions in a host country. Table 1 lists definitions revised for the study.

Qualitative and Quantitative Features Compared

The ERDC Construction Engineering Research Laboratory developed metrics that allow semipermanent structures to be compared qualitatively and quantitatively when constructed with ICM versus traditional materials. The structure types under consideration include—

- Barracks hut.
- Adobe.
- Compressed-earth block.
- Soil cement.
- Concrete/brick masonry.
- Mortarless masonry.
- K-span.
- Hesco Bastion Concertainer®.
- Containerized housing unit.
- Foam.

Qualitative building features under consideration include—

- Safety (fire rating).
- Structural integrity.
- Constructability.
- Scalability.
- Force protection rating.
- Material durability.
- Compatibility.
- Environmental suitability.
- Economic, efficient construction.
- Quality-of-life rating.
- Reuse or disposal possibilities.

Qualitative location features under consideration include—

- Climate/weather effects.
- Quality of transportation available.
- Hostility.
- Land acquisition.
- Earthquake/hurricane potential.
- Power, water, and sewage available.
- Labor available.
- Location of resources and equipment.

For quantitative comparisons, the Construction Engineering Research Laboratory developed a new system called

the *indigenuity index*. This index provides a rating system for structural types. Each structure is rated based on the following factors:

- **Material factor.** Describes how difficult it is to form or retrieve the material for the structure.
- **Transportation factor.** Incorporates the variables involved in moving resources.
- **Construction factor.** Includes the variables needed to construct the structure.
- **Functionality factor.** Provides variables for rating the structure throughout its U.S. military use.
- **Disposal factor.** Describes how the structure will be dealt with after U.S. military use.

Some of the qualitative features under consideration cannot be easily measured, and information on others cannot be easily found. Because of this, the variables that make up these factors (shown in Figure 1) will be used to compare structural types. The variables are associated with quantitative—but not dollar—costs. They are entered into an algorithm that accounts for overlaps in costs and interaction between costs. The algorithm produces a single value based on how indigenous and sustainable each structural type would be in a given location. The smallest value will be the best structural solution for a designated region and requirements.

Figure 2 demonstrates how each material is ranked, based on the results of the material factor portion of the algorithm. The algorithm would similarly rank the other four factors for each material. After the factors are determined, they would be combined to produce an indigenuity index value for every material being compared.

An example for how such rankings are determined will be provided using the material factor. The material factor is made up of the cost of the material or the energy, work, and time required to transform it into a useful construction material. This factor includes the steps of manufacture for materials not occurring naturally in the area, such as steel or thermoplastic material. In general, the more indigenous a material is, the lower its cost will be. The equipment and tools required during formation of the

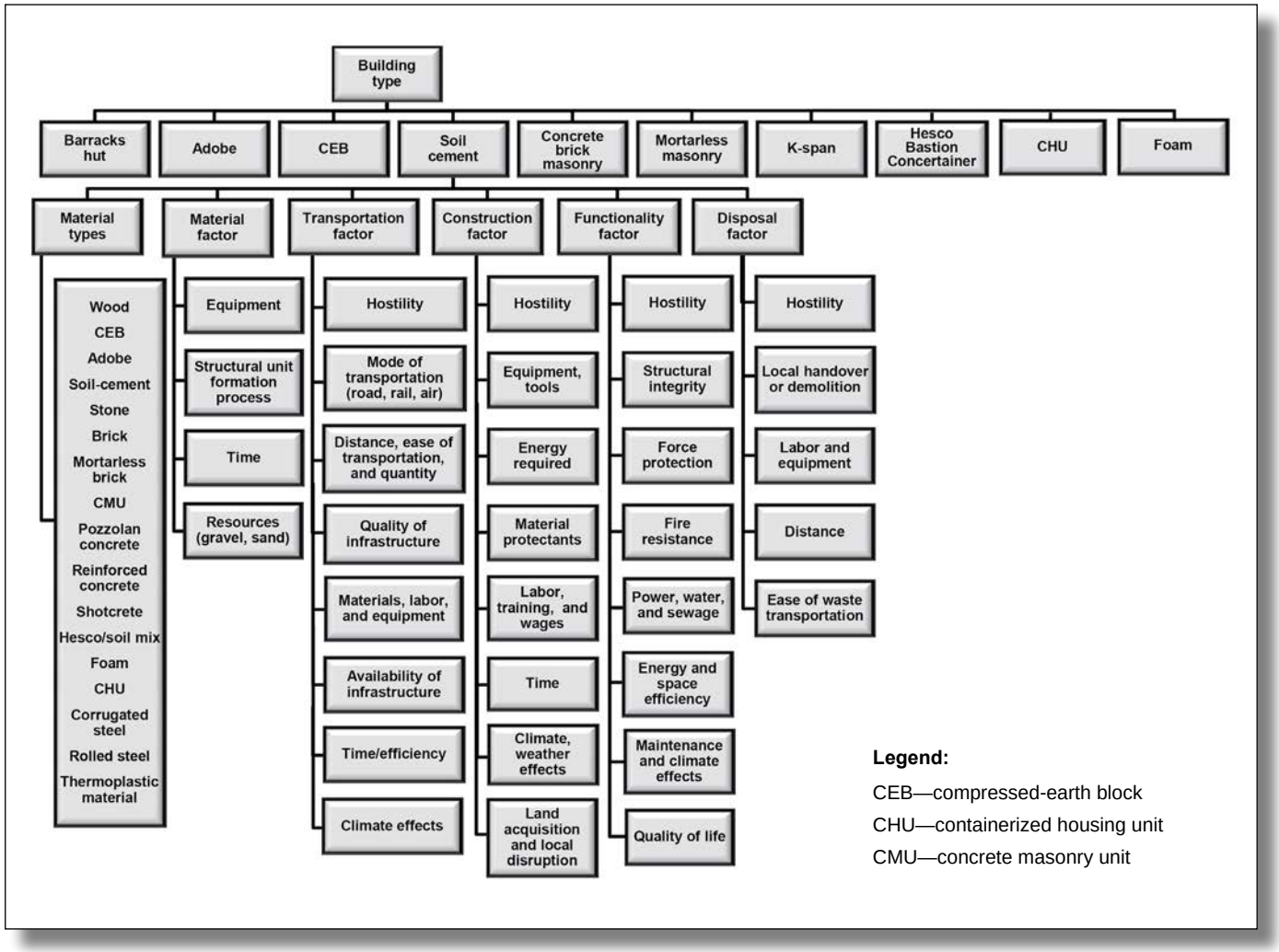


Figure 1. Indigenuity index breakdown

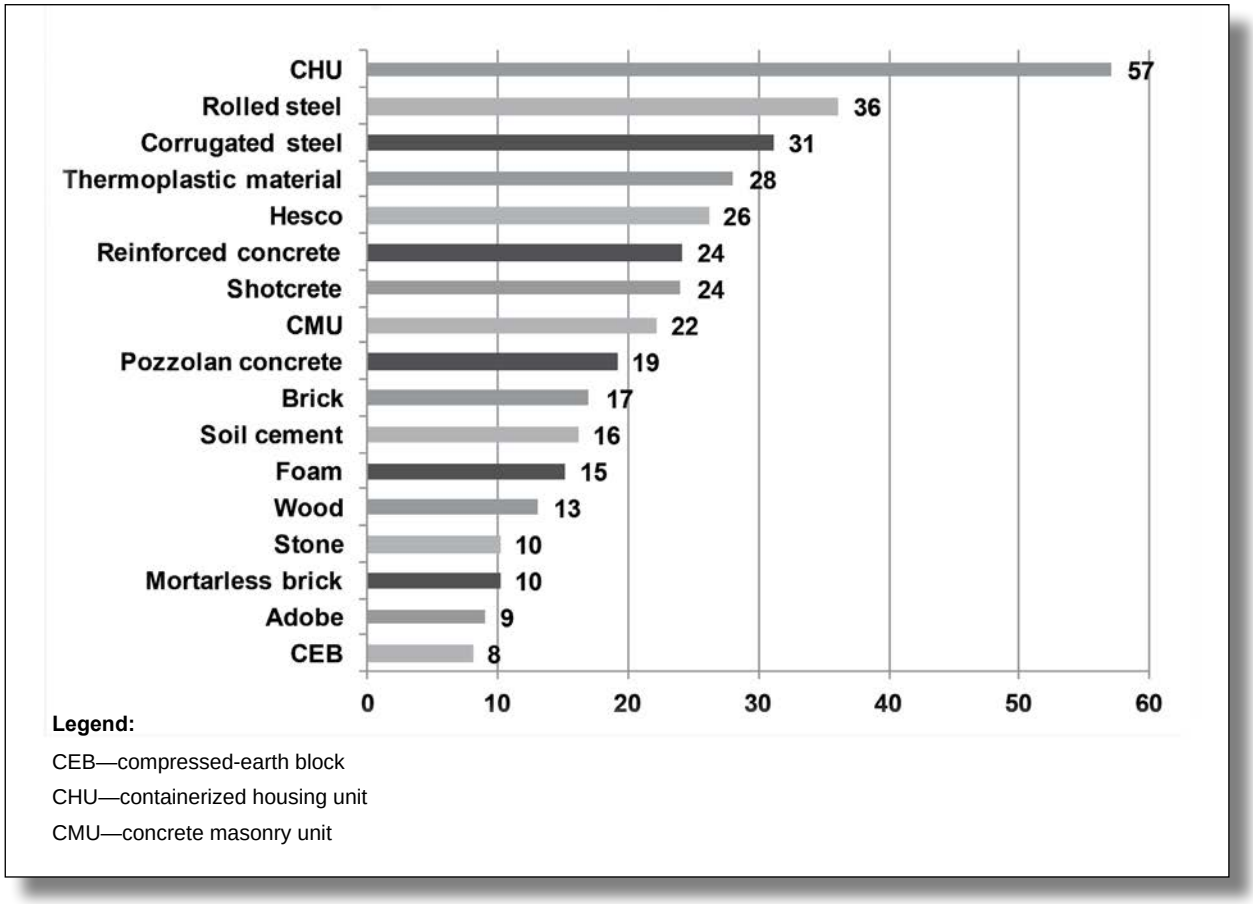


Figure 2. Material factor scores

construction material is one variable that is rated. The ratings are based on the amount and complexity of equipment required. Simple equipment (such as molds) is scored a value of 1, basic equipment (such as a mixer) gets a value of 2, highly complex equipment (such as a compression block machine) gets a value of 3, and advanced machinery (such as factory equipment) gets values of 10 or 15, depending on complexity.

The process and the time the process takes are also variables that affect the final value of the material. The more difficult the process is or the more labor required in forming the material, the higher the assigned value for that material. Materials that only require mixing and pouring, such as adobe, would get a value of 1, while the process of mixing and firing clay bricks would get a value of 2. A more difficult process, such as cutting stone, would get a value of 3. The most intensive formation processes, such as forming thermoplastic material and steel, would get values of 4 and 5 respectively. The time that these processes take are rated as quick, average, or slow. For example, forming a compressed-earth brick would be rated quick, forming a traditional brick would be rated average, and forming steel would be rated slow.

The next variable is based on the amount of resources needed to produce a useful construction material. Each resource is assigned a value based on how easily it can be converted into a useful resource to produce the material in question. Water, clay, and sand would be readily available and require no work, so they would be assigned a value of 1. Materials such as cement and steel would be assigned values of 7 and 10, respectively, due to their cost to the environment and the manufacturing processes and amount of energy that go into their production.

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Book Reviews

Self-development is a major pillar in the growth of Army leaders. One tool to aid in this is the "Engineer Commandant's Reading List" at <http://www.wood.army.mil/usaes/library/documents/ENGR_CMDT_READING_LIST_2012.pdf>. It includes a variety of books on history, politics, and culture that are appropriate for Soldiers and civilians in the Engineer Regiment. The list is not all-inclusive and will be updated over time.

Book reviews will be a feature in each issue of *Engineer*. Authors will summarize the contents of books of interest and will point out the key lessons to be learned from them. Readers who wish to submit book reviews may forward them to <usarmy.leonardwood.mscoe.mbx.engineer@mail.mil>.



The Price of Glory, by Sir Alistair Horne, Penguin Books, 1964, ISBN-13: 9780140022155.

Reviewed by Lieutenant Colonel Brian E. Bart

The Price of Glory, by Sir Alistair Horne, provides voluminous details of the Battle of Verdun, the French and German leaders involved in it, and the decisions they made before and during the bitter 10-month battle. His descriptions of battlefield conditions, the weaponry used, and their effects on troops paint a vivid picture of the hardships faced by soldiers on both sides.

The author, a World War II veteran and noted European historian, provides the necessary backstory, with an emphasis on the French senior leaders that adequately frames the events leading to Verdun in February 1916. The book describes the ineptness of the belligerents' senior military leaders, who seemed perfectly willing to throw endless numbers of soldiers into the fray, regardless of the number of casualties sustained. Military leaders were unwilling or unable to grasp the lasting impacts of the battle and their demoralizing effects on both armies. The Battle of Verdun nearly rang the death knell for the French Army.

The French Army's death grip on Verdun can be traced back to its stunning loss to Germany in 1870. So humiliated was France, her army, and her officer corps that the military leaders sought to reinvent the army into a model of its former self from the glory days of Napoleon. The need to hold on to every inch of French soil and to immediately counterattack to regain any lost ground—regardless of cost—was drummed into every officer's psyche.

Before the outbreak of the war, senior French Army leaders lacked the vision to recognize the importance of changes in technology. Intense study of the 1870 loss to Germany focused on the belief that a lack of offensive spirit—*élan vital*—was the main reason for France's defeat. The philosophy of the offense became the mantra of the French Army. It was a group-think effect of élan that overrode the few remaining rational military thinkers. The generals didn't want heavy artillery because it would slow them down and didn't want machine guns because they were too complicated and cumbersome to maneuver in the field. Politicians focused on cost-saving measures, so not having to pay for these new weapons easily drew support. As a result, the French Army lacked the offensive punch required to break through German defenses.

French engineering would play a pivotal role in the defense of Verdun, allowing the French Army to fight tooth and nail for key terrain (its forts) long enough to outlast the German attackers. With a keen understanding of the topography, a French sapper general by the name of Raymond Adolphe Serre de Riviere had properly sighted positions that allowed interlocking sectors of fire and provided excellent observation points to cover dead space with indirect fire. Properly sighted positions allowed defenders to pour murderous enfilading fire on densely packed infantry formations

advancing through restrictive ravines and belts of barbwire entanglements.

Germany's strategy to defeat the Allied coalition focused on knocking out France once and for all. With the operational objective of bleeding the French Army dry through attrition, the Germans had massed superior firepower and troop concentrations focused along a narrow front. Achieving initial surprise and harnessing the shock effect of the opening assault, the German Army planned to quickly overwhelm French defenders. At the tactical level, the German main effort focused on dislodging the French Army from the massive field fortifications that served as strongpoints. A combination of overwhelming firepower, immediately followed by infantry assaults, would overrun defensive positions quickly. With the fortifications neutralized or in German control, the combination would defeat Fort Douaumont, the linchpin in the French defensive lines. The so-called Gibraltar of the French defenses, Fort Douaumont dominated the terrain and became the focal point for both armies. It traded hands more than once, and each army became fixated on possessing it. If lost, it would deprive the French Army of the advantage in defendable terrain. If the Germans could capture and hold the fort, they would break the crust of the French defensive belts, open up the vulnerable interior to further penetrations, continue the attrition of French reserves, and open avenues of approach to Paris itself.

"Military leaders were unwilling or unable to grasp the lasting impacts of the battle and their demoralizing effects on both armies. The Battle of Verdun nearly rang the death knell for the French Army."

French senior leaders should be considered woefully inadequate at best; at worst, they were outright incompetents with delusions of grandeur. French Marshal Joseph Joffre seemed completely detached and unimaginative, indifferent to the suffering and loss of life that his army was enduring at the front. The ranks of his senior staff officers were plagued with sycophants focused on advancing their own careers at any price. A league of *chateau generals* managed the war from far behind the lines, giving little thought to the soldiers dying in the trenches.

General Philippe Petain proved to be the exception at a critical moment in the battle. He understood the modern battlefield and espoused a firm belief in the effectiveness of firepower. Gleaning lessons learned from the American Civil War, the Boer Wars, and the Russo-Japanese War, General Petain understood the proper use and deadly effects of modern weapons, especially the machine gun. He instituted unit rotations for the first time, moving battered units out of the frontlines and replacing them with new ones. He eventually rotated 70 divisions through Verdun, seasoning his force with units that had frontline combat experience. He provided a touch of sanity and care for the frontline soldier, saving the army from dissolving at the pivotal moment of the battle.

The book details how reverberations from the Battle of Verdun were felt through the end of the war and would influence decisionmakers in the next war. The battle was a watershed moment when Germany could have won the war outright. In the end, it would cripple France for the remainder of the war, push Britain into the role of lead Allied nation, and finally draw America into the conflict. More than 700,000 French and German soldiers were either killed, captured, wounded, or missing.

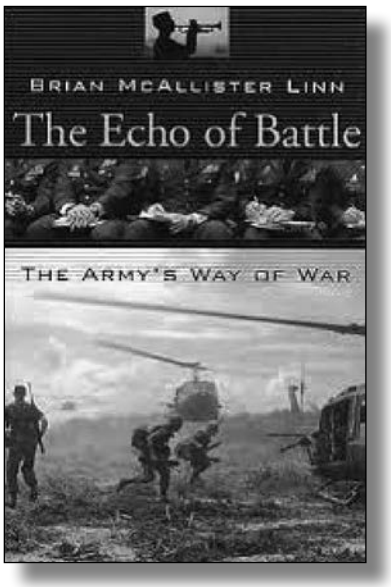
We have the advantage of time to look back and review the battle, the belligerents involved, and the end result. By today's standards, this battle and its cost in human lives are unpalatable to modern military professionals or Western society. How both countries absorbed and dealt with this level of loss is hard to fathom. I agree with the book's opening quote from F. Scott Fitzgerald that "This western-front business couldn't be done again, not for a long time. The young men think they could do it again but they couldn't."[1] No one today would have the stomach to willingly sacrifice so many for so little.

The Price of Glory is an excellent read for anyone interested in the history of World War I or looking for insights into the decisionmakers of the war and the period. Decisions should be analyzed in their historical context. The book provides valuable lessons learned for the engineer leader today and shows the impact of understanding terrain and its impact on a battle.

Endnote:

[1]F. Scott Fitzgerald, *Tender Is the Night*, Scribner, New York, reprint edition 1995.

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The Echo of Battle: The Army's Way of War, by Brian McAllister Linn, Harvard University Press, 2009, ISBN-13: 9780674034792.

Reviewed by First Lieutenant Kevin N. Braam

Leaders in the U.S. Army learn throughout their careers to be adaptable, flexible, and open to new concepts and new ways to accomplish a mission. One tool that the Army uses to facilitate and encourage this is the after action review, which is conducted by the smallest formations immediately after training events. A more formal process conducted by the Center for Army Lessons Learned features a large group of personnel dedicated to collecting and disseminating the latest information. Despite the common goal of improving upon past performance and ensuring better preparation for the future, military intellectuals and strategic planners often fall into three martial traditions that govern their outlook on training for armed conflict. In *The Echo of Battle: The Army's Way of War*, Brian McAllister Linn provides an insightful discussion of these three schools of thought, which he terms *Guardians, Heroes*, and *Managers*.

In the prologue, Linn says that an officer or planner may occasionally encompass aspects of each, but that the three traditions are usually distinct and separate from each other. Linn takes the reader on a journey through American military history from the post-Revolutionary War period up to the War on Terrorism. His focus is not on tactics, decisive leadership, or discussion of a uniquely American way of fighting. Instead, he incorporates each tradition into understanding how the Army applied lessons learned from the war it just finished as it prepared for the next war.

Linn shows that advocates of the Guardian tradition adapted their strategic planning based on the most dangerous enemy course of action and used data from a previous conflict as justification. Army engineers initially comprised the Guardians. During the 1800s, the greatest perceived threat was a coastal attack by a European navy and Guardians responded by stressing coastal defense. However, the necessary infrastructure and manpower needed to implement the plan was never fully realized. As the Industrial Revolution produced larger, more capable naval forces in the years leading up to World War I, Guardians continued to validate and redefine their strategic plans. Following the war, Guardians argued that the number of casualties in future conflicts could be reduced by increased emphasis on coastal defense and less American involvement in European affairs.

Decades later, when the Soviet Union became a nuclear power, planning for atomic warfare became the new focus of the Guardians. The tradition is also linked to the Powell Doctrine of the late 20th century, which stated that if a country posed a threat to the United States, then America should attack with a preemptive strike. For the time after the Civil War and the period of the two world wars, Linn illustrates that the elaborate defenses needed to withstand an enemy attack on U.S. soil were never realized. Notwithstanding the intellectual insight and lessons learned from past conflicts, Guardians substantiated their strategic plans with piecemeal evidence. That does not mean that a nuclear strike against the United States could not have occurred, but that the preparation and planning that went into nuclear deterrence kept other forms of warfare from receiving the necessary attention. Linn makes it clear that planning for unconventional warfare was always an afterthought, despite its prevalence on the battlefield. Unconventional warfare, with its focus on the individual, was more suited to the Hero tradition.

Heroes, like Guardians, used the evidence from past conflicts that best suited their worldview. Heroes emphasized the warfighter mentality of every Soldier. They advocated values such as personal courage and honor, made clear that war is unpredictable, and believed that no rigid formula or method could determine its outcome. Linn explains that the Hero tradition became well established in the time between the Civil War and World War I. Unconventional warfare then seemed to be the norm and not simply an anomaly. The Army was fighting American Indians on the western frontier, confronting guerillas in the Philippines, and had troops committed to Reconstruction in the South. Despite this, senior U.S. officers and military intellectuals of the late 1800s and early 1900s believed that an Army which was well prepared to fight a conventional war could be easily reorganized to fight an insurgency. Linn also states that a Soldier with the Hero mentality could easily adapt from conventional to unconventional warfare. Following

World War I, little doctrine was published or written concerning unconventional warfare. Heroes adapted by developing a code of nine principles that are not unlike the seven Army values of today. Heroes also continued to embrace the human element of warfare as the most important factor. They did not accept the significance of technology, specifically the development of the tank. During and after the Vietnam War, Heroes saw the need to have Soldiers who could adapt to the conditions of the native environment and were capable of training indigenous forces on their own land.

"The preparation and planning that went into nuclear deterrence kept other forms of warfare from receiving the necessary attention. Linn makes it clear that planning for unconventional warfare was always an afterthought, despite its prevalence on the battlefield."

Like the Hero tradition, the Manager tradition took hold after the Civil War as warfare became more complex, technology improved, and greater manpower was needed to fight and win wars. Unlike Guardians (who generally viewed warfare as an engineering project) or Heroes (who saw warfare as a test of honor), Managers looked at war as an organizational problem. Managers constantly tried to improve administrative systems, incorporate technology, and enhance the Army through better business practices. Manager concepts of how to improve the Army are still alive today and are recited regularly. One of these concepts was that every task a Soldier performed could be evaluated, graded, and standardized across the military and that corresponding doctrine would provide the necessary framework for training.

The Manager tradition flourished after World War II and throughout the Cold War. The Soviet Union and atomic warfare were the greatest threats of that time period, and doctrine development reflected those threats. This was evident in the hours spent on atomic warfare instruction at the U.S. Army Command and General Staff College during the 1950s. It was also apparent in the focus on conventional war with the Soviet Union as the U.S. Army Training and Doctrine Command developed and the National Training Center at Fort Irwin, California, began operations in the 1970s. Still, unconventional war always seemed to take a backseat. As the book progresses, Linn's tone changes. Early in the book, he describes what the Army was doing, while the last few chapters are more like a description of what the Army was ***not*** doing.

The Echo of Battle provides a detailed account of how doctrine developed and transformed in the decades following the Vietnam War. The doctrine of active defense evolved into AirLand Battle; Field Manual 100-5, *Operations*,[1] was continually revised in an effort to stay current; and institutional training became more standardized. The Army appeared prepared for conventional war against the Soviet Union. What was missing, according to Linn, was any formal training in unconventional warfare. The lessons learned from fighting guerillas in Vietnam and interacting with the local populace were lost. The Army had again defined the most dangerous threat as the Soviet Union and concentrated its efforts to prepare for war in Europe. Leaders were taught that they needed to be more flexible and adaptive, yet were evaluated on the rigid system that prepared all regular units for combat with the Soviet Union. While trying to avoid the negative, Linn's description of how the Army prepared for war after Vietnam leaves the reader feeling as though Army strategic planning was misguided and that training only prepared units for the ideal scenario.

The Echo of Battle presents a unique explanation of how the lessons-learned process was applied throughout American military history. Linn does not focus on combat action but instead gives attention to the processes the Army used and the different martial traditions that exist among strategic planners and intellectuals. The book is an excellent choice to understand how the United States prepared for future conflicts during peacetime and what it neglected in the collection and understanding of lessons learned.

Endnote:

[1]Superseded by Field Manual 3-0, *Operations*, 14 June 2001, which was superseded by Army Doctrine Publication 3-0, *Unified Land Operations*, 10 October 2011.

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