ENGINEER

The Professional Bulletin of Army Engineers

January–April 2017

Headquarters, Department of the Army
PB 5-17-1 Approved for public release, distribution is unlimited.

U.S. Army Engineer School

(573) 563-8080/DSN 676-8080

COMMANDANT
BG James H. Raymer
563-6192
<james.h.raymer.mil@mail.mil>

ASSISTANT COMMANDANT
COL Kevin S. Brown
563-6192
<kevin.s.brown28.mil@mail.mil>

DEPUTY COMMANDANT
Mr. James R. Rowan
563-8080
<james.r.rowan4.civ@mail.mil>

REGIMENTAL COMMAND SERGEANT MAJOR
CSM Bradley J. Houston
563-8060
<bradley.j.houston.mil@mail.mil>

REGIMENTAL CHIEF WARRANT OFFICER
CWO5 John F. Fobish
563-4088
<john.fobish.mil@mail.mil>

DEPUTY ASSISTANT COMMANDANT–USAR
COL Kenneth Z. Jennings
563-8045
<kenneth.z.jennings.mil@mail.mil>

DEPUTY ASSISTANT COMMANDANT–ARNG
LTC Bryan M. Carr
563-8046
<bryan.m.carr4.mil@mail.mil>

CHIEF OF STAFF
LTC William C. Hannan
563-7116
<william.c.hannan2.mil@mail.mil>

COMMANDER, 1ST ENGINEER BRIGADE
COL Martin Dale Snider
596-0224, DSN 581-0224
<martin.d.snider.mil@mail.mil>

DIRECTOR OF TRAINING AND LEADER DEVELOPMENT
LTC H.W. Hugh Darville
563-4093
<h.w.darville.mil@mail.mil>

DIRECTOR OF ENVIRONMENTAL INTEGRATION
Mr. Robert F. Danner
563-2845
<robert.f.danner.civ@mail.mil>

COUNTER EXPLOSIVE HAZARDS CENTER
COL Charles G. Phillips
563-8142
<charles.g.phillips.mil@mail.mil>

ASSURED MOBILITY BRANCH, MSCoE CDID, RDD
LTC Larry J. Lyle Jr.
563-5055
<larry.j.lyle.mil@mail.mil>

ENGINEER DOCTRINE, MSCoE CDID, CODDD
LTC Matthew Y. McCulley
563-2717
<matthew.y.mcculley.mil@mail.mil>

ORGANIZATION BRANCH, MSCoE CDID, CODDD
LTC Leonard B. Scott IV
563-6282
<leonard.b.scott.mil@mail.mil>

By Order of the Secretary of the Army:

MARK A. MILLEY
General, United States Army
Chief of Staff

Official:

GERALD B. O'KEEFE
Administrative Assistant to the
Secretary of the Army
1634002

Engineer (ISSN 0046-1989) is published three times a year by the U.S. Army Engineer School and the Maneuver Support Center of Excellence G-37 Publications, Fort Leonard Wood, Missouri.

Articles to be considered for publication are due 1 December, 1 April, and 1 August. Send submissions by e-mail to <usarmy.leonardwood.mscoe.mbx.engineer@mail.mil>. Due to regulatory requirements and the limited space per issue, we normally do not print articles that have been published elsewhere.

POSTMASTER: Send address changes to Engineer Professional Bulletin, 14010 MSCoE Loop, Building 3201, Suite 2661, Fort Leonard Wood, MO 65473-8702.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to *Engineer* at the preceding address. Telephone: (573) 563-4137, DSN 676-4137; e-mail: <usarmy.leonardwood.mscoe.mbx.engineer@mail.mil>; Web site:<http://www.wood.army.mil/engrmag/>.

DISCLAIMER: *Engineer* presents professional information designed to keep U.S. military and civilian engineers informed of current and emerging developments within their areas of expertise for the purpose of enhancing their professional development. Views expressed are those of the authors and not those of the Department of Defense or its elements. The contents do not necessarily reflect official U.S. Army positions and do not change or supersede information in other U.S. Army publications. The use of news items constitutes neither affirmation of their accuracy nor product endorsement. *Engineer* reserves the right to edit material submitted for publication.

OFFICIAL DISTRIBUTION is targeted to all engineer and engineer-related units.

PERSONAL SUBSCRIPTIONS are available for $24.00 ($33.60 foreign) per year by contacting the U.S. Government Publishing Office, P.O. Box 979050, St. Louis, MO 63197-9000.ADDRESS CHANGES for personal subscriptions should be sent to the U.S. Government Publlishing Office at the above address.

ENGINEER

The Professional Bulletin of Army Engineers

Volume 47 PB 5-17-1 Headquarters, Department of the Army January–April 2017

Front cover: Soldiers drive M1A2 Abrams Main Battle Tanks and M2A3 Bradley Infantry Fighting Vehicles across the Imjin River on a floating bridge assembled by the 74th Multirole Bridge Company, 62d Engineer Battalion, 36th Engineer Brigade, as part of a 4-day, combined arms river-crossing exercise in South Korea in April 2016. (U.S. Army photo)

Back cover: U.S. Army photos

FEATURES

DEPARTMENTS

Clear the Way

Brigadier General James H. Raymer
Commandant, U.S. Army Engineer School

While I serve as the commandant of the Engineer School at Fort Leonard Wood, Missouri, I continuously observe lieutenants, captains, and lieutenant colonels attending the Basic Officer Leader Course, the Captains Career Course, and the Precommand Course, respectively. I often think about what should be added to, or removed from, the programs of instruction to better educate and train these officers for future armed conflict. Therein lies the ever-present military problem: How can we accurately envision the real future of armed conflict—or at least something close to reality?

U.S. Army Training and Doctrine Command (TRADOC) Pamphlet (Pam) 525-3-1, *The Army Operating Concept*, identifies five characteristics of the future operating environment:

- Increased velocity and momentum of human interaction and events.
- Potential for overmatch.
- Proliferation of weapons of mass destruction.
- Spread of advanced cyberspace and counterspace capabilities.
- Demographics and operations among populations, in cities, and in complex terrain.[1]

While these characteristics are useful for imagining potential scenarios, we still need to delve deeper into our future thinking to account for the impacts of terrain and weather, to distinguish between what is and is not physically possible, to guard against personal and institutional bias in our estimate of the situation, and to avoid assumptions about ourselves and our potential adversaries that are not necessary or valid.

Past and present military thinkers have cautioned us against flawed thinking in envisioning future war. The Polish banker Jean de Bloch noted the resistance of contemporary officers to thinking clearly about the future of war in his 1901 essay, "The Wars of the Future," stating, "The steadfastness with which the military caste clings to the memory of a state of things which has already passed away is pathetic and honorable. Unfortunately, it is also costly and dangerous."[2] Senior officers have noted fallacies in the military thinking within their armies. British Army Brigadier R. G. S. Bidwell noted the *David and Goliath*, *magic weapon*, *chess*, *bloodless operation*, and *passive enemy* fallacies.[3] U.S. Army Lieutenant General Herbert R. McMaster identified the *vampire*, *Zero Dark 30*, *Mutual of Omaha Wild Kingdom*, and *RSVP* fallacies.[4] It is not the purpose of this column to define these conceptual fallacies, but rather to emphasize that they affect leaders of otherwise professional armies who become complacent about the study of, and reflection on, the future of war and instead fall back on personal, organizational, and institutional experience as the template for the future.

One recent observation by a serious military thinker has weighed on my mind for several years due to its potential application to the U.S. Army as the Army emerges from Operations Enduring Freedom and Iraqi Freedom and enters into potential conflict with a peer adversary. In his study of the 2006 Lebanon War, Matt M. Matthews quotes Israeli general and military theorist Shimon Naveh on the mindset of the Israeli Defense Forces (IDF) entering the conflict: "The point is, the IDF fell in love with what it was doing with the Palestinians. In fact, it became addictive. You know when you fight a war against a rival who's by all means inferior to you, you may lose a guy here or there, but you're in total control. It's nice; you can pretend that you fight the war, and yet it's not really a dangerous war. . . . I remember talking to five brigade commanders. . . . I asked them if they had an idea . . . what it meant to go into battle against a Syrian division? Did they have in mind what a

"No matter how much we might wish for a 'war to end all wars,' as our grandparents and great-grandparents did 100 years ago, one thing that we can state with certainty about the future is that American Soldiers will find themselves on a battlefield somewhere."

barrage of 10 Syrian artillery battalions looked like?"[5]

Likewise, when I read Dr. Phillip A. Karber's personal observations from the ongoing conflict in Eastern Ukraine, I found his concluding comments on technology and tactics to be foreboding:

There is no single technological "silver bullet" that emerges from the Russo-Ukrainian War that ushered in a new 'revolution' in military art. In some areas, this experience merely underscores the tried and true wisdom that professional military should already know by instinct—the Main Battle Tank is not dead, light infantry and light armor die in droves, top attack is the way to go for anti-tank defense. But in this mélange, there are also warning signs of a new level of battlefield transparency that, cross-fertilized with the fire intensity of area munitions and synergized with real-time targeting, augurs radical change in the wind, and it is an "ill wind that blows" on those who ignore its warning.[6]

I could lay out more examples; but this is a short column, so let's cut to the chase: Are we biased to regard the ongoing missions in Afghanistan and Iraq as the only likely scenarios for combat operations, or do we think that the decisive-action training environment scenarios as executed by the opposing forces at the combat training centers accurately demonstrate the combat capabilities—such as indirect fire—of potential adversaries such as the Russians and North Koreans? These are questions that can reenergize each of us as professionals to continue to study, reflect, and challenge each other in the debate about the nature of future war. No matter how much we might wish for a "war to end all wars," as our grandparents and great-grandparents did 100 years ago, one thing that we can state with certainty about the future is that American Soldiers will find themselves on a battlefield somewhere.

Private David Raymer (grandfather of Brigadier General Raymer) of Company L, 332d Infantry Regiment, after World War I.

Endnotes:

[1]TRADOC Pam 525-3-1, *The Army Operating Concept: Win in a Complex World*, 31 October 2014.

[2]Jean de Bloch, "The Wars of the Future," *The Contemporary Review*, September 1901, p. 305. Reprinted in *Jean de Bloch: Selected Articles*, U.S. Army Command and General Staff College, Combat Studies Institute, July 1993.

[3]R. G. S. Bidwell, "The Five Fallacies: Some Thoughts on British Military Thinking," *Royal United Services Institute Journal*, Volume 112, Issue 645, February 1967, p. 54.

[4]Herbert R. McMaster, "Continuity and Change: The Army Operating Concept and Clear Thinking About Future War," *Military Review*, March–April 2015, pp.12–14.

[5]Matt M. Matthews, "We Were Caught Unprepared: The 2006 Hezbollah-Israeli War," The Long War Series–Occasional Paper 26, U.S. Army Combined Arms Center, Combat Studies Institute Press, 2008, p. 63.

[6]Phillip A. Karber, "Lessons Learned from the Russo-Ukrainian War–Personal Observations (Draft)," The Potomac Foundation, 8 July 2015.

Lead the Way

Command Sergeant Major Bradley J. Houston
Regimental Command Sergeant Major

Greetings! With 2016 behind us, I would like to use this article to highlight a number of accomplishments in the *personnel* domain of DOTMLPF-P—doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy. The Engineer Personnel Development Office (EPDO) team at the U.S. Army Engineer School had a very busy year executing many of the initiatives necessary to move the Engineer Regiment forward in a fiscally austere environment.

The first major task that the EPDO team took on was the updating of engineer career maps and Department of the Army (DA) Pamphlet (Pam) 600-25, *U.S. Army Noncommissioned Officer Professional Development Guide*.[1] Both of these products required lots of heavy lifting due to the size and complexity of Career Management Field (CMF) 12 (Engineer). The updated career maps were approved in March 2016 and uploaded to the Army Career Tracker portal.[2] To ensure that career maps and DA Pam 600-25 are updated together, this is the only place where the career maps are displayed. This eliminates the possibility that contradictory guidance is sent to engineer Soldiers or to a centralized selection board panel.

In April 2016, we received authorization for enlisted engineer Soldiers to wear the *Essayons* buttons on their service/dress and mess uniform jackets as an optional purchase item. This initiative was originally the idea of Command Sergeant Major Robert J. Wells during his tenure as the Engineer School command sergeant major; unfortunately, the idea was not supported at that time. EPDO, sensing an appetite for change in all things related to uniforms, brought this initiative to my attention and pushed the packet forward for approval. The approval will be incorporated into the next update to DA Pam 670-1, *Guide to the Wear and Appearance of Army Uniforms and Insignia*.[3] This authorization supports our efforts to enhance esprit de corps and pride across the Engineer Regiment.

In conjunction with the release of centralized promotion board results throughout the year, the EPDO team conducts a deliberate records review of those selected for promotion. The team then publishes the board analysis to the field, using multiple delivery methods. Soldiers who are serious about managing their own careers can holistically use the career maps, DA Pam 600-25, and the promotion board analysis to ensure that they are doing the right things to get ahead.

In September 2016, the command sergeant major of the U.S. Army Training and Doctrine Command was briefed on a proposal to realign command sergeant major and sergeant major professional development proficiency codes to allow for better talent management. CMF 12 had inadvertently created an inverted pyramid within the staff sergeant major population that made true talent management impossible. We discovered that we had more positions for staff sergeants major with Additional Skill Identifier 7S (primary level sergeant major) than for those with Additional Skill Identifier 6S (initial-level sergeant major). This created an inverted pyramid that saw many U.S. Army Sergeants Major Academy graduates go straight to the 7S level upon graduation. This did two things to the cohort: It accelerated the opportunity to work at the nominative sergeant major level without common rules for everyone, and it did not allow new sergeants major to build the requisite skills and knowledge at the initial level. We are hopeful that the newly aligned professional development proficiency codes will be reflected on fiscal year 2018 modified tables of organization and equipment.

Finally, we sent draft DA Pam 600-25 updates to the U.S. Army Training and Doctrine Command Assistant Chief of Staff for Personnel for review and concurrence. This culminated a 10-month endeavor to ensure that it aligns with engineer career maps and to give credit to NCOs who were doing what senior leaders said was important. The draft highlights several initiatives. It—

- Clearly defines "key and developmental" opportunities.
- Codifies qualifying time at 18 months.
- Gives credit for rated service at the next higher rank.

Upon its approval, we will send multiple messages to the field and post the document on the Army Career Tracker

(continued on page 5)

Show the Way

Chief Warrant Officer Five John F. Fobish
Regimental Chief Warrant Officer

Greetings all! As I write this, I hope that you all enjoyed the holiday season and that you made wonderful memories with Family and friends. These are exciting times all across the Army and the Engineer Regiment. We continue to make progress in efforts to position members of our cohort to successfully execute their technical expertise and to provide added value to their commanders as they support maneuver commanders today and into Force 2025 and Beyond.

This progress is being accomplished through our credentialing and certification program efforts and our strong partnerships with several industry leaders in the areas of construction engineering and geospatial engineering. There are outstanding Training With Industry (TWI) opportunities for construction engineering technicians (Military Occupational Specialty [MOS] 120A) with the Starbucks® Corporation and for geospatial engineering technicians (MOS 125D) with the Environmental Systems Research Institute and the Harris Corporation™ in its Environment for Visualizing Images (ENVI™) software program. In this issue, I want to highlight the partnership that we have with the Starbucks Corporation and this year's TWI participant. The current Engineer Regiment TWI Fellow, Chief Warrant Officer Two Michael L. Mears, is assigned to the Starbucks Corporate Architecture Department in Seattle, Washington. His article on page 6 will give some insight into the program and describe his experiences.

Chief Warrant Officer Two Mears is a construction engineering technician who has been in the Army for more than 16 years. He holds a master's degree from the University of Oklahoma, a project management professional certification, and Leadership in Energy-Efficient Design Green Associate credentials. He is currently completing an electrical engineering program through Arizona State University. He has served in prime power and vertical construction units, as the commander of a survey and design detachment, and in an engineer brigade. His follow-on assignment will be at the U.S. Army Engineer School, Fort Leonard Wood, Missouri, as an instructor. Please read his article.

It is expected that this partnership with private industry will yield a positive technical impact on our cohort by providing experiences and opportunities that will deepen our technical expertise and help participants become agile, adaptive, and innovative as they solve the complex problems they face in the area of construction engineering. I am confident that this partnership will be a lasting one that proves to be of great benefit to the Engineer Regiment and the Starbucks Corporation.

Until next time, please be safe and continue to do great things as the Engineer Regiment's technical experts.

Essayons.

("Lead the Way," continued from page 4)

portal so that it can be used in conjunction with the career maps that are already there.

As shown, it has been an exciting, busy, and productive year within the personnel domain of DOTMLPF-P. I ask that senior leaders make sure that they are well versed on these changes and that they educate their engineer Soldiers on the impact they will have on upward mobility. I would also like to personally thank the Engineer School EPDO team for all of its efforts in driving change forward on behalf of the Engineer Regiment. Until next time,

Essayons!

Endnotes:

[1]DA Pam 600-25, *U.S. Army Noncommissioned Officer Professional Development Guide,* 11 September 2015.

[2]Army Career Tracker, <https://actnow.army.mil/>, accessed on 10 January 2017.

[3]DA Pam 670-1, *Guide to the Wear and Appearance of Army Uniforms and Insignia,* 1 July 2015.

Engineering the Perfect Cup of Coffee:

The Army Engineer Partnership with Starbucks Through the Training With Industry Program

By Chief Warrant Officer Two Michael L. Mears

Before detailing the immense opportunities involved with the Training With Industry (TWI) Program, let's address the elephant in the room. Why should the Starbucks® Corporation be chosen for an engineering TWI Program? It is a coffee company, but it is also much more. The premise of the TWI Program is to leverage the successes and best practices of a civilian corporation or government agency while simultaneously drawing parallels between the host organization and the military. While these similarities do not always seem obvious, the program requires the ability to step outside of the engineering comfort zone and military structure and evaluate the corporation down to the process level. It is easy to qualify and quantify the training leveraged with companies like Caterpillar® Incorporated because they train students on familiar pieces of equipment. While training on how to make an awesome latte is not one of the desired outputs of the program with Starbucks, there is so much more that Starbucks has to offer.

Starbucks Construction

In fiscal year 2016, the Starbucks Corporation built a large number of new, company-owned stores and it shows no signs of slowing down construction in fiscal year 2017. Such a vast amount of global construction requires deliberate processes and keen levels of project management and construction management skills. A typical Starbucks construction manager is responsible for a large portfolio of projects during a fiscal year. Every Starbucks store is a snowflake; each store is different from the next. That requires heavy involvement from a construction manager to deliver design intent while also keeping the general contractors on track and staying within the prescribed budget. Each skill set required by a construction manager at Starbucks can be translated to a function in Army construction. The greatest learning points are how to effectively manage all aspects of a construction project across a vast portfolio of simultaneous projects dispersed across a vast region. Again, because of the nature of the work streams, the key takeaways are not always tangible tools that translate perfectly into Army functions. The takeaways are manifested in process evaluations and process improvements. Construction management, much like the Starbucks Corporation itself, is about people and the ability to influence them. Many times, that influence comes from a platform that lacks authority. This is a common theme at Starbucks and in the project management realm as a whole.

Influencing Without Authority

The ability to influence without authority is arguably one the greatest learning points while working at Starbucks. The Army hierarchy of command structures makes it relatively simple to develop a new policy or program, brief it to the decision-making authority, and implement it upon approval. Once a commander says, "yes," subordinate commands execute. Conversely, the Starbucks leadership structure is vastly different. Removing the military structure from a project management role requires employees to elevate their ability to market and sell the importance of their particular projects. Starbucks does not have an overarching playbook or standard operating procedure for the way things are done. Even if a program manager decided to roll out a new program, there is no single method of writing a policy change and ensuring that it is instantaneously obeyed. Because of this nuance of the business, cross-functional collaboration is the key to project management in a corporation such as Starbucks. Mutual consent and buy-in by all stakeholders are required to effectively implement new projects and program strategies. The type of collaboration required is vastly different from that seen in the military. Rank plays an immense role in a Soldier's level of participation on a cross-functional team. When the commander tells a Soldier to go, the Soldier goes. At Starbucks, job position and pay grade are only a small factor in the level of an individual's participation in a project. Project management at Starbucks requires a degree of finesse and interpersonal skills that can be lacking in many military personnel.

Sustainability

Sustainable building is a fundamental component of Starbucks construction. The Starbucks High-Performance Build Team, a team within the Corporate Architecture Section, has developed a volume build program with the U.S. Green Building Counsel. By the end of calendar year 2016, Starbucks had more than 1,200 Leadership in Energy Efficient Design (LEED®)-certified, company-owned stores. Sustainability is important to the Starbucks culture. The company is deeply focused on social awareness and environmental sustainability. The green-build approach is also proving to be economically sound as well. Sustainable building takes into account the life cycle costs of a product and the total cost of ownership. This approach allows for the evaluation of the product from cradle to grave. Many costs are negated when evaluating a product, based on the lowest-cost product that meets the immediate need. Sustainable life cycle assessments evaluate the costs to produce, transport, install, and dispose of a product across the projected life span. When evaluating the total cost of ownership through a product's life cycle, green-building can produce cost savings of 2 to 5 percent. The U.S. Army Corps of Engineers is another key contributor to high-volume, LEED-certified buildings in the green-build environment. With the construction world leaning more and more toward sustainable building, it makes sense for two of the top U.S. organizations to learn from each other. Furthermore, sustainable building reinforces the Department of Defense operational energy strategy by emphasizing the importance of sourcing renewable energy.

Current Projects

Before my arrival in Seattle, the Starbucks military recruiting manager evaluated my resume and communicated with store development directors to find the best position for me. Based on my construction management experience and project management professional credentials, I was assigned to a design and construction services team as a senior project manager. My primary role began to evolve once my electrical design experience became apparent. I was immediately thrust into the Standards Stewardship Team that manages all Starbucks design standards for new stores. My skill set provided the core corporate architecture team with a missing facet.

Energy Management Systems

I now manage a project to optimize the installation of energy management systems in all new Starbucks stores in the United States and Canada. The project is focused on decentralizing the installation vendor requirements and moving to a nimble model that gives construction managers flexibility in using multiple options for installation vendors. The project team is a cross-functional group that includes construction, design, standards, and vendor relations. The work streams include updated design standards, detailed construction drawings, and process reevaluations. I started the project in August and am currently piloting the program in the Pacific Northwest regional construction office to validate assumptions and new processes. Once the pilot phase is complete, I will roll out the new process nationwide, which will affect more than 460 new stores over the next year. As part of the standards of design work streams, I worked with the vendor engineer to develop updated detail drawings that will be included in all U.S. and Canadian new-store construction drawings. A gap had been identified in the construction field scope documents used by general contractors, and the updated design details filled that gap. Drawings that I developed will live on in the construction drawings of newly constructed Starbucks stores in the United States and Canada. I also provided updates to the Starbucks mechanical and electrical design specifications, which provide guidelines for all construction drawings. As a bridging solution to fill a knowledge gap between an experienced manufacturing vendor and inexperienced field contractors, I published an energy management systems technical support installation guide for general contractors. This guide is published on the Starbucks Store Development Resource Center for access by field partners and contractors.

New-Store Electrical Design Tool

The LEED team requested an evaluation of a mechanical and electrical design tool that it used to determine the impact of new programs on a store's mechanical and electrical systems. In the evaluation, I discovered major electrical calculation errors and numerous logic errors. I developed a new tool that is focused on the base store design from a purely electrical design standpoint. Once I demonstrated how the new tool functions, the senior manager of the LEED team wanted to use the tool as part of the real estate negotiations process to determine what electrical service a landlord needs to provide before construction. The tool was valuable to the standards stewardship committee as a means to evaluate new equipment and to determine

> ***"The [TWI] Program requires the ability to step outside of the engineering comfort zone and military structure and evaluate the corporation down to the process level."***

ways it would affect the overall electrical demand of the existing service. The tool is currently available on the Starbucks Store Development Resource Center and is used by standards stewardship, facilities, and real estate partners.

Tankless Water Heaters

Tankless water heaters are an exceptional means of leveraging energy savings throughout the life cycle of a facility. Since Starbucks is a continuous-improvement organization, I was asked to prepare a cost analysis to input to a business plan focused on shifting from traditional storage tank water heaters to a tankless solution. On the surface, this seems like a simple business case. A typical gas water heater has an energy factor of 0.67, and new, high-efficiency gas tankless options offer energy factors as good as 0.96. However, jurisdictional health code requirements for retail food providers require the precise delivery of specific temperatures in a given time for certain fixtures. That requires multiple point-of-use heating solutions for critical supply locations, coupled with a centralized tankless solution for all noncritical components. The cost analysis takes into account a higher material cost for initial construction. However, the total cost of ownership is much lower because of energy savings realized over the depreciable life of the water heater. This particular project has allowed me to learn and explore a drastically different approach to design than typically experienced in troop construction.

Development Opportunities

LEED professional credentials are mutually beneficial for the Starbucks Corporation and the Engineer Regiment. Design and Construction Services funded my LEED credentialing examination, and that practice might be continued for future participants. Starbucks also exposes the participant to real project work in the green-build environment. This allows a deeper understanding of sustainable building practices in a high-volume application. The experience and certification leveraged during this program enhances a participant's ability to step into a sustainable building role with the U.S. Army Corps of Engineers, and to be an active participant in the conversation of green building.

Starbucks has partnered with Arizona State University to provide educational benefits to its partners. The university offers a wide array of online degree programs that can be taken in conjunction with the TWI Program. Conversations about the potential for a small scholarship for TWI participants are underway with the corporate veteran recruiting team. Arizona State University now offers three quintessential degrees for construction engineering technicians (Military Occupational Specialty 120A):

- Bachelor of science degree in electrical engineering.
- Bachelor of science degree in construction management.
- Master of science degree in construction management.

The programs are offered completely online, and the electrical engineering program is accredited by the Accreditation Board for Engineering and Technology, Incorporated.

Conclusion

A TWI position with the Starbucks Corporation offers an exceptional opportunity for a construction engineering technician to leverage real-world applications of project management, construction management, facilities management, and design. On the surface, it may seem that Starbucks is merely a coffee company. However, the store development process is riddled with parallel processes that would benefit any Army engineer. The design and construction processes at Starbucks are extremely fast-paced, which makes it difficult to jump in and understand the company systems and processes. The TWI Program at Starbucks is not only beneficial and rewarding, but also an eye-opening experience into construction and project management outside of standard military applications.

Chief Warrant Officer Two Mears is a construction engineering technician who has been in the Army for more than 16 years. He holds a master's degree from the University of Oklahoma, a project management professional certification, and LEED Green Associate credentials. He is completing an electrical engineering program through Arizona State University. Upon completion of his TWI fellowship, his follow-on assignment will be as an instructor at the U.S. Army Engineer School, Fort Leonard Wood, Missouri.

Training With Industry: A Noncommissioned Officer Perspective

By Staff Sergeant Michael Ethridge

In 2015, the Engineer Regiment extended the Training With Industry (TWI) Program and appointed its first noncommissioned officer (NCO) equipment operator to the broadening assignment. The experience and training are not typically available within the NCO Professional Development System.

The TWI Program offers a broad exposure to managerial practices and industry procedures in corporate America by assigning military participants to work closely with civilian counterparts. The program consists of a 1-year assignment with a selected industry partner followed by a 2-year assignment at the Maneuver Support Center of Excellence, Fort Leonard Wood, Missouri.

As a horizontal construction engineer (Military Occupational Specialty 12N), I was selected to participate in the TWI Program and assigned to work with the Defense and Federal Products section of Caterpillar, Incorporated®, at its Mossville, Illinois, facility. The plan called for me to work in each of the company's specialized groups at the Caterpillar Edwards Learning and Demonstration Center from August 2015 to September 2016.

Benefits for the Army

Since the recent reduction in Army deployments, the TWI Program has allowed each component to broaden the development of its senior NCOs by enabling them to work in their chosen field at minimal cost to the Army. Any cost associated with the program is incurred by the private corporation. The price for a course provided by Caterpillar ranges from $1,000 to $1,500 per person. The U.S. Army Human Resources Command reviews the amount to ensure that it remains within the legal limits of acceptable payments from nongovernment sources for expenses incurred while in an official capacity.

As part of the program, I traveled to Arizona to attend the corporation's annual Certified Dealer Instructor Conference, which included sessions presented by product application specialists for Caterpillar's major product groups. During the conference, I had the opportunity to operate the latest track-type tractor and use its integrated technology, which improves operator ability to complete a project close to finishing grade. In addition to the conference, I completed three 40-hour instructor courses that are part of the company instructor accreditation program for certified dealer instructors and demonstrator-instructors. The accreditation program is equivalent to the Army Foundation Instructor Facilitator Course, with the addition of two advanced courses. Exposure to the industry programs promotes the personal and professional growth of the TWI participant. The Caterpillar courses enable NCOs to enhance their supervisory and managerial skills while saving the Army money, since the corporation pays for travel and lodging. The experience will allow NCOs to transition into their follow-on assignments with a basic knowledge of their duty description, which will minimize the learning curve.

Benefits for Caterpillar

The TWI experience with Caterpillar demonstrates the company goal of working directly with its client base. Although Caterpillar already has notable visibility among suppliers of Army equipment, the TWI Program enhances its presence in the Army engineer community. This type of relationship helps industry personnel to better understand the role of an NCO in the Army engineering field and help NCOs learn industry practices. It allows both to learn differences in jargon and cultures while acknowledging the depth of each other's perspective. As a former Army instructor, I was able to share my experience with the way the Army trains students, which helped broaden the civilian understanding of Army training operations. This interaction allows Caterpillar developers to provide a better end product to the Army and to the commercial customer.

Benefits for the Noncommissioned Officer

This platform will give NCOs the opportunity to integrate Army techniques into Caterpillar corporate culture and, in return, bring some Caterpillar methods of operations back to the Army. The chance to work directly with a private company will give NCOs the opportunity to develop a network outside of the military. Working in the Army for years, an equipment operator's depth of knowledge is limited to military standards, which are not always consistent with civilian standards. Many Caterpillar employees have more than 15 to 20 years of experience in a given area.

Fortunately, I was able to operate industrial equipment daily while being critiqued to improve my performance. Such critiques helped me improve my supervisory skills

(continued on page 15)

Disciplined Disobedience:

Army Chief of Staff Highlights Ethics of Command

By Captain Jonathan L. Duran

Disciplined disobedience that accomplishes the commander's intent should not be ignored; but at times, should be expected from a professional subordinate. Army Chief of Staff General Mark A. Milley, speaking at the 2016 Association of the U.S. Army Annual Meeting and Exposition, said that Soldiers should have "the willingness to disobey specific orders."[1] This embodies the idea that Army professionals must be willing to do what it takes, ethically and legally, to win battles and wars. The idea of the Army Chief of Staff supporting any level of disobedience to orders and choosing not to support all the tenets of unified land operations highlights the complex relationship between military law and customs on one hand and winning the Nation's wars on the other. General Milley's message supports the unified land operations tenets of flexibility, integration, adaptability, lethality, and depth, but not that of synchronization. By understanding the framework of the tenets and recognizing that current ground conditions are probably different from what is perceived at the tactical operations center, we see that synchronization transforms to coordinated, disciplined initiative.

Fighting and winning the Nation's wars are the main purposes of all branches of the military. Unity of effort is an overarching idea under which every military action is supposed to fit, but it must be fundamentally examined to understand what it means. Joint Publication 3-0, *Joint Operations*, defines unified action as "a comprehensive approach that synchronizes, coordinates and, when appropriate, integrates military operations with the activities of other governmental and NGOs [nongovernmental organizations] to achieve unity of effort."[2] Unified action drives each branch's principles to unify its diverse capabilities to achieve unity of effort. The Army doctrinal perspective is that unity of effort is achieved through the unified land operation tenets of flexibility, integration, adaptability, lethality, depth, and synchronization.

"The Army doctrinal perspective is that unity of effort is achieved through the unified land operation tenets of flexibility, integration, adaptability, lethality, depth, and synchronization."

In General Milley's speech, he described the battlefield of the future and how Soldiers must anticipate situations in which subordinates cannot contact their headquarters due to enemy jamming and hacking. General Milley maintains that Soldiers and leaders in such situations must be willing to disobey some orders. Future conditions will require decentralized execution and the exercise of mutual trust within the team. In his book, *The Mission, the Men, and Me*, Pete Blaber sums up this idea in the lesson of always "listen[ing] to the guy on the ground."[3] Naturally, this results in more control for the commander on the ground than the overall commander, thus transforming a specifically synchronized plan into coordinated, disciplined initiative.

Due to the developing situation, the tenet of synchronization may become impossible to achieve and the ground commander might have to disobey orders to be successful. This characteristic should be expected from professional subordinates, who must remain focused on achieving the commander's intent at all times. The prudent risk accepted by the commander is not limited to physical injury. It recognizes that some degree of control could be exchanged for a better opportunity for mission success. Just as mission variables change the chosen course of action, the physical battlefield of the future will drive the Army to learn and force its publications to evolve. The evolution of Army tactics, techniques, and procedures is constant and necessary for the U.S. Army to lead the world.

Although the evolution of tactics, techniques, and procedures is practical, Army Doctrine Publication 3-0, *Unified Land Operations*, defines synchronization as "the arrangement of military actions in time, space, and purpose to produce maximum relative combat power at a decisive place and time."[4] How Soldiers, weapon systems, and equipment are arrayed on the battlefield at a given time must be mutually supportive to achieve the commander's desired end state. Synchronization is crucial for combined arms operations and is paramount during the fundamental functions of breaching operations: suppression, obscuration, securing, reduction, and assault. All offensive characteristics hinge on the organization and efficiency of breaching efforts to accomplish the mission and gather mass on the objective.

Synchronization is pivotal in all operations, cementing its place as a unified land operations tenet. However, realizing that synchronization is crucial for any mission, the environment that General Milley described is one of volatile mission variables. This may require professionals to disobey outdated orders, exercise disciplined initiative, and shift planned synchronization to coordinated execution from initiatives. No battle in the American Revolutionary War was ever completely synchronized, but goals were always coordinated to ensure unity of effort. This is why there are redundancies throughout every operation, from dual priming and initiating explosives to the succession of command. For this reason, leaders always plan for logistical coordination, not synchronization.

For every idealized plan of execution, there is an execution that suffers from an idealized plan. General George S. Patton Jr.'s maxim that "A good plan, violently executed now, is better than a perfect plan executed next week,"[5] epitomizes the need for coordinated, disciplined initiatives rather than synchronized efforts. Although General Milley's statement reinforces most unified land operation tenets, it does not validate the tenet of synchronization—nor should it, since no plan survives contact with reality.

Endnotes:

[1] Sydney J. Freedberg, "Miserable, Disobedient and Victorious: Gen. Milley's Future US Soldier," 5 October 2016, <http:breakingdefense.com>, accessed on 9 January 2017.

[2] Joint Publication 3-0, *Joint Operations*, 11 August 2011.

[3] Pete Blaber, *The Mission, the Men, and Me: Lessons From a Former Delta Force Commander*, Berkley Caliber, New York City, New York, 2 December 2008.

[4] Army Doctrine Publication 3-0, *Unified Land Operations*, 10 October 2011.

[5] The Official Web site of General George S. Patton Jr., <http://www.generalpatton.com/quotes/>, accessed on 9 January 2017.

Captain Duran is a student in the Engineer Captains Career Course at Fort Leonard Wood, Missouri. His previous assignment was with Company A, 29th Engineer Battalion, 25th Infantry Division, Schofield Barracks, Hawaii. He is a graduate of the U.S. Army Airborne School, the U.S. Army Air Assault School, the U.S. Army Ranger School, and the Sapper Leader Course. Captain Duran holds a bachelor of science degree in manufacturing and mechanical engineering technologies.

ARE YOU READY FOR THE NET ZERO LOGISTICS BASE CAMP?

By Lieutenant Colonel James R. Lockridge II

"High fuel use imposes risks to the mission and to each of us. In fact, nearly 80 percent of ground supply movements are composed of fuel, and we have lost many lives delivering fuel to bases around Afghanistan."

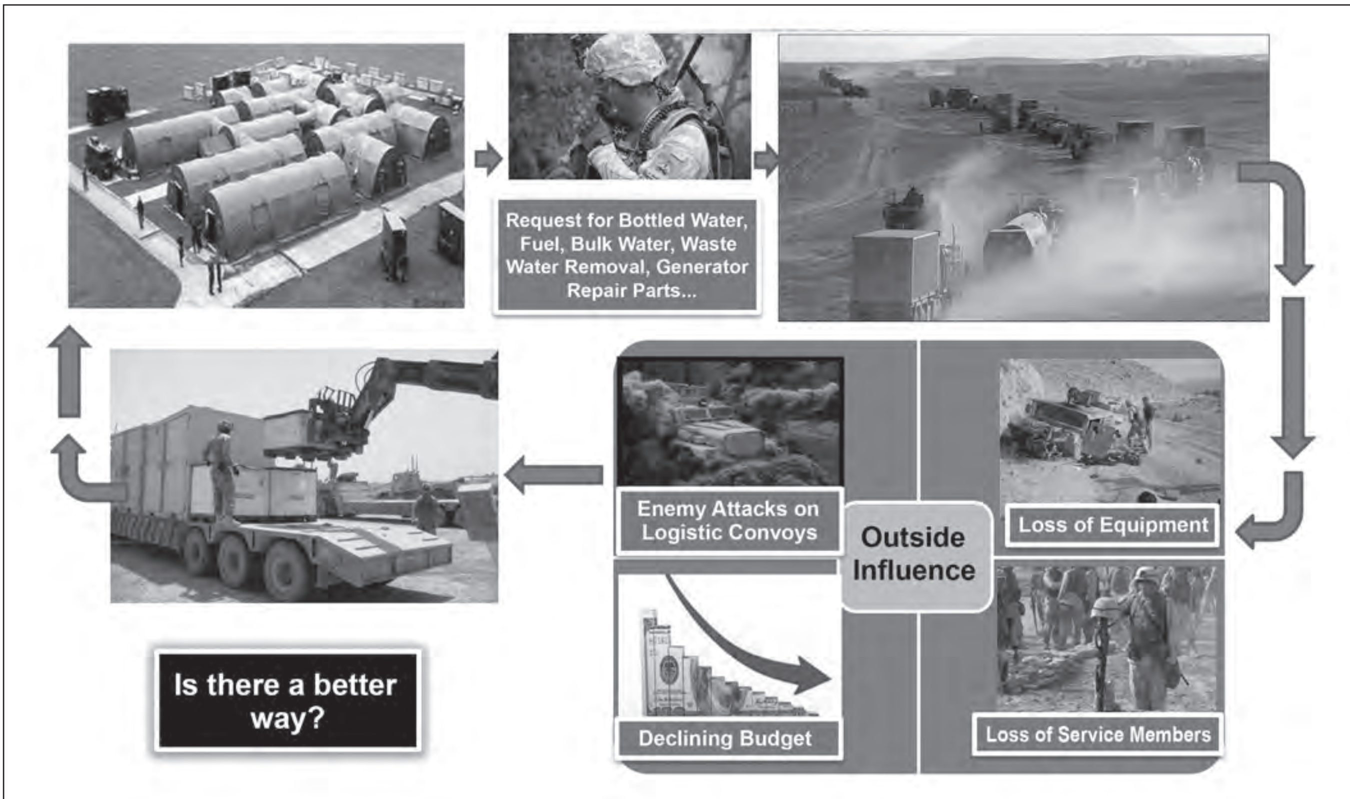
—General David H. Petraeus[1]

In the fall of 2005, Company E and the rest of 2d Battalion, 7th Infantry Regiment, was tasked with denying improvised explosive device emplacement along a section of Iraqi Highway 1 outside Tikrit that was frequently attacked by enemy forces. There were 27 improvised explosive device attacks in October in our area of operations and another 15 that were prevented. The attacks nearly shut down the main supply route that was responsible for all materiel going from Baghdad to Mosul. In one night, 20-vehicle U.S. military convoys passed our location every 15 minutes, carrying supplies to forward operating bases north of our position. Since that night, I have wondered if there was a way to reduce the U.S. logistics tail so that the Army could focus more on its mission and less on resupply. According to an Army estimate from fiscal year 2008, the approximate average annual load allocation, by volume, for in-theater convoys for Operation Iraqi Freedom and Operation Enduring Freedom was—

- 50 percent fuel.
- 20 percent water.
- 30 percent other.

What if the U.S. military did not need fuel or water deliveries? How could this be achieved? Could the military reduce its logistics tail by 70 percent? Could hundreds of lives be saved in the next war if such large shipments of fuel and water were not required?

This solar panel array allowed a 60-kilowatt generator to be turned off.



Resupply Cycle

Energy security is paramount to mission success. America has the most technologically advanced military in the world, but its technology requires energy. Soldiers now read maps from electronic tablets, not pieces of paper. They navigate with digital trackers instead of compasses. They communicate with encrypted systems that require high energy loads to operate and to keep cool. The list of items that require energy includes—

- Unmanned aerial vehicles.
- Weapon systems.
- Air conditioning and heating for tents.
- Security lighting.
- Detection systems.
- Indoor lighting.
- Personal electronic devices.

The military requirement for energy is not disappearing and will probably actually increase. Does this necessarily equate to more fuel deliveries, or is there a better way?

From 2012 to 2015, the Office of the Command Engineer for U.S. Special Operations Command, Africa, developed a net zero logistics base camp model to reduce or eliminate the military logistics tail in Africa. With a limited budget, no logistics unit on the continent for support, and the likelihood that its logistics lines would be cut or compromised at any time, the command needed to devise a new way of doing business. A fuel delivery to a deployed special operations team illustrates the problem. A pickup truck carrying two 55-gallon drums arrived with fuel that the team desperately needed to power its generators so that they could work, communicate, and operate air conditioning systems, allowing them to rest during times of intense heat. The delivery driver had been on the road for 3 days and had been stopped by numerous groups of outlaws or corrupt local officials, all of whom siphoned off part of the fuel supply. By the time he arrived, he had the equivalent of only one full barrel of fuel. Thieves could have taken more of the fuel, or the driver could have been killed or captured along the way. The team's energy supply was at risk, which put the mission itself at risk. Deploying more Service members to secure the logistics routes or paying to have fuel flown in would be cost-prohibitive and might have caused the mission to be cancelled.

A Better Way

In the spring of 2015, U.S. Special Operations Command, Africa, conducted its annual Flintlock Exercise in N'Djamena, Chad. To prepare for the exercise, a team of 30 U.S. Navy Seabees from Naval Mobile Construction Battalion 14 set up a temporary encampment to support U.S. forces for the exercise. The camp would later be used to house a special operations team while training Chadian partner forces. With Boko Haram fighters actively engaging with America's partners from Niger, Chad, and Cameroon, the logistics tail needed to be eliminated or operations would be at risk of being forced to halt. With support from the Army Rapid Equipping Force, U.S. forces secured two portable solar panel systems and energy-efficient tents. The highly energy-efficient tent set, known as a *lite camp*, requires 50 percent less energy to cool than the tents from the Seabee unit stockpiles. Even with these tents, hundreds of gallons of fuel were needed daily to run generators, primarily to cool the tents as daily temperatures typically exceeded 110 degrees. Seabee electricians began working on ways to cut energy demands.

Smart, Renewable Energy

The peak power demand of the base was 120 kilowatts, but inefficient spot generation was supplying 240 kilowatts. Establishing a miniature power grid immediately resulted in savings of more than 200 gallons of fuel per day, or more than 80,000 gallons per year. It also allowed two 60-kilowatt generators to be turned off, making them available for redundancy. Next, two solar panel systems were set up. All the required batteries and inverters were included in the kits. Once the panels were set up and plugged in, they started charging the batteries, which supplied power to the camp. The panels provided 60 kilowatts, allowing another 60-kilowatt generator to be turned off. Total savings then equaled 330 gallons of fuel per day, or 120,450 gallons per year.

After reducing fuel consumption by 75 percent, engineers looked elsewhere for cuts to the logistics tail. Could trash pickup be eliminated? Was there a way to provide even more energy and reduce fuel demand even further? We started with water.

Clean, Renewable Water

Drinking water. If reliance on bottled water were eliminated, the logistics tail could be substantially reduced, while force protection was increased. It cost less than $10,000 to have a contractor dig a well, eliminating the need for bulk water delivery. A water purifier was shipped in to provide clean, safe water for showers without the danger of bacterial infections. Next to arrive at the temporary camp was a water distiller of the sort used by U.S. embassies in Africa to provide clean drinking water. The total cost for clean drinking water, including the well, water purifier, and water distiller, was less than $60,000. Water delivery and bottled water had been costing $30,000 per month, so the camp began saving money in 60 days. The savings will amount to $360,000 over the next year. Combine that with $500,000 in fuel savings, and the savings add up quickly for a small, temporary camp that serves fewer than 50 personnel. Besides the financial savings, the camp now has secure water resources, providing the option to continue the mission even if the logistics tail is compromised. Another benefit is the ability to provide clean drinking water to partner nation forces at almost no added cost. In a country where clean drinking water is scarce and water-borne illness is a leading cause of death among children, this capability helps build credibility and buy-in with the local population.

Wastewater. Engineers turned to private industry to solve the problem of wastewater. Over the past 2 years, they worked with private companies to develop a portable treatment facility. In October 2014, a facility that allows the camp to fully treat gray and black water and discharge effluent that meets U.S. Environmental Protection Agency standards for sewage discharge was purchased. American forces are now able to discharge their wastewater outside the camp without the cost or security concerns of having a truck arrive daily to remove the wastewater. The effluent is a higher quality than the river that borders the city of N'Djamena. Potential future uses of this discharge range from supporting agriculture to watering livestock to quickly reprocessing into clean drinking water.

More Energy Savings

Wind. By 2017, Kenya will receive 15 percent of its total power from wind energy systems. In the United States, wind energy is approaching almost 4 percent of all energy produced. This technology is the fastest-growing renewable energy system in the world. It is time to find a way to harness wind energy with portable systems that can be easily employed in field conditions. A system, which could produce 50 kilowatts of power, is currently being tested. That much power is enough to turn off the last generator at the camp in N'Djamena, allowing it to be completely fuel-independent.

Energy efficiency. Another way to reduce energy requirements would be to make use of facilities that were more energy efficient. Building in Africa is not only expensive; it is almost impossible due to new construction funding limitations. The camp needed a facility with solid walls that would increase energy efficiency and allow that last generator to be turned off. What we discovered was remarkable. The U.S. Army Corps of Engineers has been testing compressed-earth technology and recently released designs that are safe and provide substantial ballistic protection. The cost of a compressed-earth brick machine is less than $50,000, and the materials used by the machine are the earth that surrounds a camp site, plus reinforcing steel. Replacing tents with new, compressed-earth block structures would increase energy efficiency by 100 percent, reduce the energy requirement by another 60 kilowatts, and allow the last generator to be turned off. Earlier, this article discussed the benefit of providing clean drinking water to the local populace. Similar benefits to training the local populace to use the machine to make bricks for U.S. forces would be realized; the local populace could be paid to use the bricks to build facilities at a fraction of the cost of traditional structures. The machine could then be given to the people. This approach could win over the population, reduce the logistics tail, and create quality encampments for U.S. Service members.

Trash disposal. Seventy-five percent of the trash at the N'Djamena base camp consisted of plastic water bottles or packaging from meals, ready to eat. With the introduction of a clean drinking system, the plastic-bottle problem was eliminated. The next question was whether the rest of the trash could be burned and turned into energy. Private industry and the Department of Defense Operational Energy Program are working on systems to reduce energy across the force. The "Joint Waste-to-Energy Group" reports to the office of the Assistant Secretary of Defense for Operational Energy Plans and Programs and is looking for ways to convert waste to energy. While small-scale, waste-to-energy incinerators are not coming onto the market soon, heat from the incinerators could save energy by providing hot water and heat on cold desert nights. By simply running a water line next to the incinerator, water could be heated without turning on a generator or gas-fired heater.

Conclusion

It is clear that U.S. forces are ready for the net zero base camp model. While the products and techniques may vary, the ideology of net zero works everywhere. It is time to eliminate or reduce the logistics tail. In a budget-constrained environment where we face an ever-growing global threat network that can exist anywhere, we must find a way to become financially responsible and reduce our vulnerabilities. The costs savings are significant. In our model with only 50 personnel, we produced a savings of almost $1 million per year in fuel and the elimination of bottled water, wastewater, water delivery, and waste removal. This model would not have been feasible immediately after the United States invaded Iraq in 2003; but by 2004, it could have been used in almost every location. Using a savings of $1 million per 50 Soldiers as a baseline, it is possible to conservatively estimate a savings of more than $2 billion (and the lives of hundreds of Soldiers) per year through the implementation of a net zero base camp model. Add in the years 2005–2009, and savings approach the $10 billion mark, based on applying the net zero logistics model to only 100,000 of the Service members who were on the ground at any time between the years 2005 to 2009.

We need to secure energy and water resources in a volatile environment. More importantly, we must never repeat the logistical demands created during Operation Iraqi Freedom and Operation Enduring Freedom, which resulted in hundreds of casualties. The number of convoys bringing fuel and water was too high and too expensive and represented an unwise decision in regard to safeguarding our most precious resource—the Service members of the U.S. military. Are you ready for the net zero base camp model?

Endnote:

[1]David H. Petraeus, Memorandum to U.S. Forces–Afghanistan, 7 June 2011.

Lieutenant Colonel Lockridge serves as Chief of Construction for U.S. Army Europe. He previously served as command engineer for U.S. Special Operations Command, Africa. He holds a bachelor's degree in civil engineering from The Citadel and a master's degree in business from Webster University. He is also a graduate of the U.S. Marine Corps Expeditionary Warfare School.

("Training With Industry," continued from page 9)

by changing the way I managed the use of equipment and techniques during projects. The knowledge gained from the TWI Program will help NCO participants apply a new level of performance in the field of engineering.

Furthermore, by networking with civilian professionals, NCOs will establish a direct connection to the commercial industry. From the start of the assignment, the Caterpillar staff ensured that I was part of the team by including me in all events and meetings. Between training sessions, there were countless opportunities to talk with clients, which gave insights into ways to start and maintain a small business after a career with the Army. This program will help guide NCOs to further their studies and experience in the realm of technology.

Lessons Learned

The expansion of the TWI Program to enlisted members is a significant step toward the broadening opportunities that will enhance the career of an NCO. As the first NCO to pilot the program, I helped make some adjustments to the program. First, I outlined possible objectives to help future NCO participants understand what to expect from the TWI experience. Next, I identified baseline courses, such as the Six Sigma certifications and Caterpillar's Instructor Accreditation Program, that will benefit participants in their next assignment and help them achieve their personal goals. The TWI Program should be sustained within the Engineer Regiment. It provides a solid baseline of fundamentals for an NCO's follow-on assignment at the Maneuver Support Center of Excellence Directorate of Training and Leader Development.

Staff Sergeant Ethridge is a training developer in the Directorate of Training and Leader Development at the Maneuver Support Center of Excellence. He is a graduate of the Engineer Senior Leader Course and is working toward an associate's degree in construction management.

Training Task Force Engineers

For the Operation Inherent Resolve Advise-and-Assist Mission Set

By Major Randy M. Schultz

As the 39th Brigade Engineer Battalion (BEB), 2d Brigade Combat Team (BCT), 101st Airborne Division (Air Assault), prepared for its deployment to Operation Inherent Resolve (OIR), it quickly became apparent that every member of Task Force Strike would need to be a proven force multiplier due to the constraints of a theater-wide force manning cap. The cap limited the BEB and BCT from deploying their full complement of engineer enablers to operate along the lines of engineer support. The BEB staff realized that one of the most effective ways to provide these lines of engineer support was by placing a task force engineer inside each battalion level advise-and-assist (A&A) headquarters. This article discusses the methodology that the 39th BEB used to select and train these critical staff enablers before the OIR deployment.

Selection of Task Force Engineers

To better understand the role of the task force engineer during the 39th BEB deployment, it's best to begin with the Task Force Strike adviser framework. Based on current policies, the Combined Joint Forces Land Component Command–Operation Inherent Resolve (CJFLCC–OIR) operates under a force manning cap that limits its only BCT from fully deploying its formation to the combined joint operating area. As the BCT planned the task organization for the deployment, each battalion level headquarters expected to partner and conduct A&A operations with an Iraqi army division level headquarters preparing to retake key cities along the Euphrates and Tigris River Valleys. Based on the operational environment observed during the site survey before deployment, BCT leaders expected the task force A&A teams to advise their Iraqi counterparts on mechanical and explosive breaching operations, wet-gap crossings, survivability operations, and counter improvised explosive device (C-IED) operations. Task force commanders also expected to receive key BEB engineer enablers as resources were shifted to support the decisive operation. These conditions required the inclusion of a task force engineer in each of the staff organizations.

With slight variations by individual battalions, adviser staff organizations were composed of only 24–30 Soldiers. This limit meant that task force commanders critically weighed the value of staff members to ensure that each vital position was filled with an officer who was able to operate at a high level. The BEB was just as deliberate in its methodology for choosing its task force engineers. Acting in his role as the brigade engineer, the BEB commander carefully selected engineer lieutenants who were finishing or still serving successful stints as platoon leaders or executive officers. The temperaments of the supported task force and the supporting engineer staff officer were also taken into account to ease any friction from integrating into a new staff. With the prospective task force engineers identified, the BEB armed these officers with the tools they needed to provide expertise across the lines of engineer support

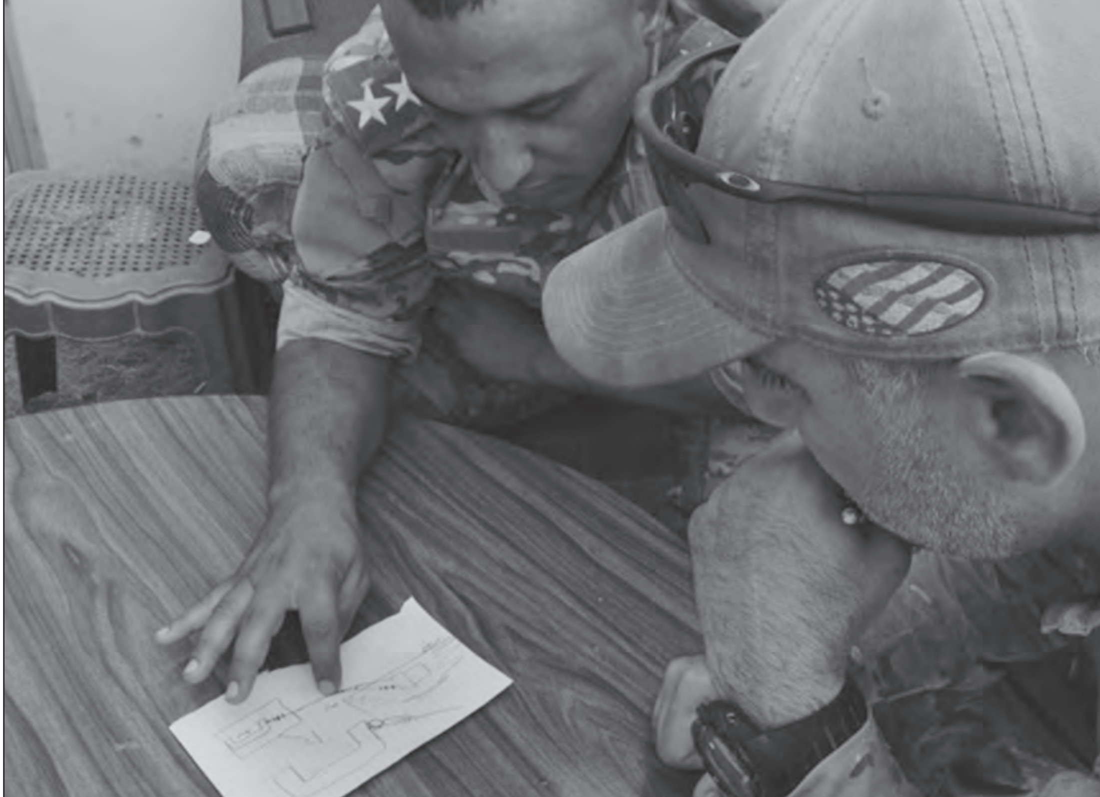
A bridging adviser assigned to Company A, 39th Brigade Engineer Battalion, Task Force Strike, points to the far side of a river to indicate Iraqi positions during an A&A mission in northern Iraq.

Battalion Training Program

As BEB leaders prioritized how the unit would spend its limited time before deploying, the commander realized that the battalion junior engineer officers were not proficient in many of the requisite planning tasks they needed in order to succeed on a task force staff. The battalion had just completed an intensive training program to prepare for a decisive-action rotation and needed to reorient its training priorities toward the deployment. As the brigade engineer, the BEB commander developed a course that would provide the BCT with trained and proficient task force engineers who were capable of providing engineer expertise at the battalion level. This course would provide the battalion junior engineer officers with the skills needed to participate in battalion level planning on offensive and defensive operations and on OIR-focused tasks. Using a mixture of classroom instruction (led by engineer company commanders and staff officers) and hands-on practical exercises, the engineer lieutenants were taught new doctrinal concepts and given an opportunity to apply them. The offense and defense periods of instruction culminated in a tactical exercise without troops that gave students the opportunity to walk a notional engagement area plan and discuss how they would attack and defend key terrain. The students divided into groups, developed plans, and back-briefed their plans to a larger audience. The task force engineer academy provided exceptional "bang for the buck" to the BEB and larger BCT formations.

The final BEB-led training event for the lieutenants focused on the conduct of a wet-gap crossing. The BEB expected to A&A the Iraqi army on the conduct of this critical operation during its attack across the Tigris River. The BEB spent 1 day refreshing the lieutenants on the doctrinal basics of a wet-gap crossing, focusing on the staff planning and preparation aspect, and then brought in bridging subject matter experts to discuss tactics, techniques, and procedures that advisers could relay to their future Iraqi army counterparts. The lieutenants were also tasked to complete either antiterrorism officer or contracting officer representative certification so that they could provide a critical enabling function to their supported task force. The investment in the professional development of the junior engineer officers soon had an impact on the maneuver task forces during the BCT culminating training event.

This A&A-centric command post exercise provided the first opportunity for the freshly trained BEB task force engineers to integrate themselves into another battalion staff. Though the training scenario wasn't optimally designed to allow task force level engineer planning to be executed, the engineer officers were charged with finding a way to prove to the task force commander that they were key staff



An Iraqi army captain with an Iraqi security forces bridge regiment displays a diagram of bridging operations during an A&A mission in northern Iraq.

enablers. Each of the engineers exemplified the "can do" nature of the Engineer Regiment and filled in as battle captains and key leader engagement managers while providing engineer expertise when needed during planning. One critical result from integrating the task force engineers was that the officers earned the confidence of their supported units and were allocated a critical staff manning position for the deployment. This early integration of the engineer staff officers meant that the maneuver commanders fought to retain these positions as the BCT brought its deployed task organization within the manning limits. It also ensured that the task force engineers would hit the ground running once deployed.

Task Force Engineer Experiences in OIR

Upon arrival in the CJFLCC-OIR combined joint operations area, task force engineers integrated with the Task Force Strike artillery battalion and two battalion A&A teams and filled the assistant brigade engineer role on the BCT staff. They planned and executed survivability, general engineering, mobility, and C-IED operations as advisers and in support of BCT priorities. An engineer lieutenant who supported the fires battalion serves as an example of this integration. The lieutenant, who had previously supported the battalion as a light-equipment platoon leader during an earlier training exercise, was charged with all of the force protection efforts on an austere firebase. After completing a relief in place, he began planning the employment of a task-organized light-equipment squad and rapidly began employing the squad to complete force protection and quality-of-life improvements. The task force engineer led efforts to execute expeditionary dust abatement and trail construction, helicopter landing zone construction, and bunker construction and served as the contracting officer's representative for the eventual closure of the base. Use of his engineering expertise wasn't limited to within the camp; he also developed a survivability plan to protect artillery pieces and crews during multiple gun raids to support Iraqi Army river-crossing operations. The lieutenant was also able to effectively leverage contracted construction assets to support his attached light-equipment section. His contracting officer representative training and knowledge as an engineer allowed him to effectively oversee the Kurdish construction company and ensure that it was fulfilling the requirements of the contract.

In contrast to this experience, the engineer lieutenant supporting the task force operating in Baghdad focused most of his initial engineering effort on the military decision-making process and conducting terrain analysis, ultimately resulting in a military combined obstacle overlay. As this A&A task force mission changed, the task force engineer shifted his focus to facilitating Iraqi security force C-IED operations, assessing Iraqi security checkpoints, and assessing construction of the Baghdad wall that was designed to protect the civilian population from Islamic State of Iraq and the Levant threats. The lieutenant was also selected as the task force protection officer.

The final task force engineer experience to be discussed highlights the importance of selecting the right personnel to fill these critical positions. Within the first month of the deployment, the BCT was without its assistant brigade engineer and the position could not be backfilled internally. Thanks to the availability of its task force engineers, the BEB was able to fill the position with an engineer lieutenant from a task force that was not expected to have a large engineering requirement. Upon assignment to the BCT staff, this officer quickly integrated herself and led a number of critical staff efforts to support the Iraqi army attack across the Tigris River. She also headed the BCT protection line of effort and was critical to the success of the BCT protection working group. A significant basing requirement was also integrated into the BCT protection line of effort. The assistant brigade engineer became the project lead for a number of critical BCT-directed construction projects and was able to apply the tenets of construction management. Finally, she was a critical planner in the BCT operation to reconnoiter, reoccupy, and reconstruct the former Iraqi airbase at Qayyarah.

Lessons Learned

Talent management. The experiences of the 39th BEB during its preparation for, and conduct of, operations during OIR offer a number of important lessons learned that other leaders can apply to their formations. First, as with many army operations, talent management is critical to success. Not every officer is prepared to step into an infantry battalion staff and succeed; the ability of the BEB leaders to select the right lieutenants for each task force ensured that each task force engineer was up to the challenge as mission requirements shifted. Technical and tactical competency on engineer tasks at the platoon and company levels, the ability to integrate into a maneuver battalion staff, personal resiliency, strong interpersonal skills, and maturity were common attributes selected across all of the task force engineers.

Focused training. Selecting the right officers was only the first step in the process. Though strong officers find a way to accomplish the mission, investing a modicum of time in training these officers on prioritized, mission-focused skills guarantees their success once they integrate into the task force staff. As training time is a finite and ever-decreasing resource in the months before a deployment, the BEB staff must also discipline itself to select only the most relevant tasks for training. Each hour spent in the task force engineer academy is an hour that these officers are not with their platoons or company operations sections. The 39th BEB achieved its goals by limiting the course to the length of a single training week and scheduling it for a period of time when no platoon-level-or-above collective training was planned.

Force protection emphasis. One common factor in the experiences of all of the task force engineers was their involvement in the BCT force protection line of effort. This spanned the spectrum from planning and supervising force protection upgrades to tracking critical force protection equipment to construction contract oversight to basic construction management. Involvement in this area led to the task force engineer's involvement in the theater construction approval and management process. Based on after action review comments, this area is worth more emphasis through additional leader development or training to better prepare the task force engineers.

To enhance the integration of its officers into the task force staff and justify their inclusion in a manning-capped formation, it was important for the BEB officers to arrive with skills and certifications that would fill anticipated capabilities gaps. Providing these capabilities to the task force ensured that the engineer officers were recognized as a valuable addition to the supported staff. Similarly, integrating the engineer officers into their supported staffs as early as possible enhances their value.

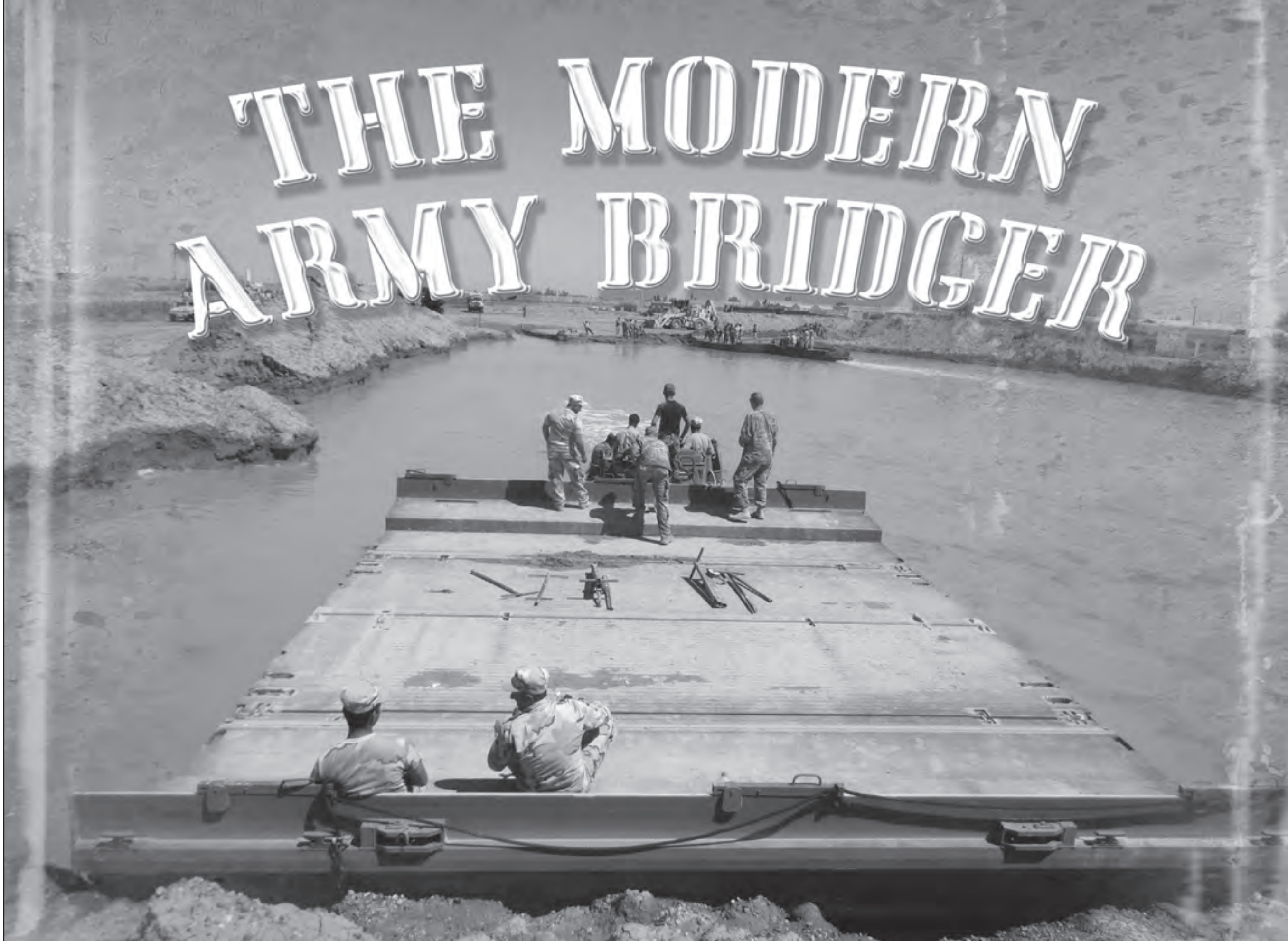
In terms of the operational employment of the task force engineers, including these personnel in each task force staff ensured that the BCT had the appropriate subject matter experts to plan critical force protection, general engineering, mobility, and C-IED operations. Having an officer with each task force also provided the BEB—and ultimately the BCT—the flexibility to weight decisive operations with the appropriate engineer officers.

Conclusion

When properly selected and trained, these task force engineers provide the capacity to lead planning and to synchronize efforts along the engineer lines of support. As seen through the experiences of the 39th BEB, the employment of task force engineers across the BCT formation is an effective way to embed engineer expertise into formations even during deployments with force manning constraints. Their inclusion in the BCT A&A staffs guaranteed that engineer subject matter experts contributed to critical force protection, assured mobility, and guided general engineering operations that ensured success during an A&A-centric deployment.

Major Schultz is the executive officer for the 39th BEB, 2d BCT, 101st Airborne Division (Air Assault). He is a graduate of the U.S. Army Command and General Staff College, the Engineer Captains Career Course, and the Engineer Basic Officer Leader Course. He holds a bachelor's degree in civil engineering from the U.S. Military Academy–West Point, New York, and a master's degree in education from Kansas State University. He is a project management professional.

THE MODERN ARMY BRIDGER



By Captain Garrett A. Dean

In April 2016, 15 members of the 502d Multirole Bridge Company, 19th Engineer Battalion, deployed to Iraq to support Operation Inherent Resolve. Assigned as a division level asset to Combined Joint Forces Land Component Command–Iraq, they became the bridge training team (BTT). Their mission was to train the sole Iraqi army (IA) bridge regiment on the employment of the floating improved ribbon bridge (IRB) and the fixed Acrow® modular bridge system. The BTT included two commissioned officers, nine noncommissioned officer (NCO) bridge crewmembers (Military Occupational Specialty 12C), and four NCO maintainers. Upon arriving in Iraq, they learned that the Iraqi bridge regiment would play a key role in Operation Valley Wolf, a shaping operation with the objective of seizing Qayyarah Airfield West in northern Iraq.

Having identified the need for a rapidly emplaced bridge across the Tigris River, the unit focused on training with the IRB and maintaining its equipment, including—

- Common bridge transporters.
- Bridge erection boats.
- IRB interior and ramp sections.

Based alongside the Iraqi bridge unit at Camp Taji, the BTT quickly established relationships with its Iraqi counterparts and, with their input, laid out a plan that would eventually lead to mission success.

Challenges Overcome

The first major challenge confronting the BTT was the disrepair of the Iraqi equipment, especially the bridge erection boats. Without these boats, no bridge could be emplaced. Faced with a lack of tools, parts, and knowledge, most of the boats had become non-mission-capable since they were received in 2012. By sourcing a single aluminum welder and exercising some strategic, controlled substitution within the fleet, the BTT maintenance team returned nearly half of the boats to mission-capable status without any available repair parts. The team members' experience and knowledge proved invaluable in helping the IA to bridge a gap that was wider than expected.

After conducting more than 150 hours of operator and maintenance training, it was time for the IA personnel to test their ability on the water. However, although the Tigris River flows just 50 meters from Camp Taji, conventional U.S. forces did not have the authority to partner with their IA counterparts outside of fortified military installations. This prohibition prevented BTT participation in training on the Tigris River, and BTT participation was an important requirement for the on-water training to be worthwhile. Therefore, the BTT identified a large retention pond on Camp Taji that normally held storm water runoff for the camp. A colocated U.S. Army Reserve horizontal-construction unit

A large retention pond that held storm water runoff for Camp Taji became a training area for Iraqi army bridgers.

improved the pond to accommodate the launch and recovery of IRB equipment. The addition of a boat slip and launching ramp quickly transformed the uninteresting water hole into a valuable training resource. With these improvements, and a fortuitous rainfall at the tail end of Iraq's rainy season, the pond soon played host to more than four bridge erection boats and eight IRB bays at a time. Here, the BTT crew trained its IA counterparts on the basics of boat operation and bay and ramp hookup. The pond later accommodated a scale model of the full-size bridge the IA later emplaced on the Tigris, with some additional shore improvements. This makeshift training resource provided the perfect opportunity to hone boat-operating skills and improve overall efficiency on the water.

Bridge Protective Device

The possibility that waterborne improvised explosive devices would be launched by the enemy to destroy the floating bridge became a real concern. This threat prompted the need to construct an obstacle upstream to prevent such attacks. However, the last time such a device was mentioned in an Army publication was in a 1988 training circular.[1] Without any dimensions or reference to its construction, the manual shows a line drawing of a sample mine

Iraqi troops and the BTT work together to complete full enclosure on the makeshift training pond.

A common bridge transporter retrieves an IRB bay at the end of a day of training.

boom constructed from simple materials. Similar materials were purchased, and the BTT became responsible for designing and constructing a protective device and training the members of the IA bridge unit on its emplacement.

The protective device was designed not only to protect against waterborne improvised explosive devices, but also to observe two other important factors: simple construction and ease of emplacement. Once assembled and emplaced, the bridge protective device served its purpose. Together with IA security personnel, it defeated several threats aimed at inflicting damage to the bridge within the first 30 days of emplacement. The design, construction, and success of this device served as a testament to U.S. Army engineer ingenuity and problem-solving skills.

A member of the BTT discusses maintenance procedures for the scoops on a bridge erection boat with members of the IA bridge unit.

Advise-and-Assist Relationship

Learning to navigate Iraqi military culture took time and patience. Despite initial difficulties, the BTT achieved a favorable position within the advise-and-assist relationship. Then the BTT brought about genuine change in mission planning and influenced systemic change within the larger organization. BTT linguists contributed

BTT members coached their Iraqi counterparts through a well-executed rehearsal-of-concept drill.

to this endeavor by serving as cultural guides and assisting with nearly everything from negotiations to navigation through the cultural nuances that sometimes impeded success.

It immediately became apparent that rank discrepancies between BTT members and their Iraqi counterparts would present challenges. The commander of the Iraqi bridge regiment held the rank equivalent to a brigadier general, and the rest of the IA bridge unit was overstaffed with officers. Recommendations for change were often ignored at first. Nevertheless, after socializing over many cups of *chai*, the credibility of the BTT grew and the Iraqis slowly began to embrace change. After the mission, the Iraqi commander requested a formal after action review with BTT leaders to discuss Iraqi performance on the river. This was a true display of humility and trust.

As in the U.S. Army, the majority of experience in the IA resides in the enlisted ranks. However, IA culture does not encourage input from its NCOs. This can result in unrealistic planning. Overcoming this obstacle and promoting NCO involvement took real effort, but the effort paid off in a comprehensive mission plan. Gathering officers and NCOs together in a conference room, the BTT ensured that all leaders had an opportunity to voice their opinions before detailing the plan on a whiteboard. This tactic also improved morale among the enlisted soldiers, who had often felt underappreciated.

In the days leading up to the mission, BTT operational planning efforts culminated. In what became an entirely Iraqi-led event, leaders and soldiers at all levels in the IA bridge regiment conducted a rehearsal-of-concept drill using a large-scale terrain map. Because the IA bridge unit had not conducted rehearsals of this scale in the past, the BTT spent a considerable amount of time working with the Iraqi leaders on the presentation of the rehearsal and on operational details. The rehearsal was a well-executed event and was exactly what the Iraqi bridge regiment leaders needed to clearly communicate their plan to the lowest ranks.

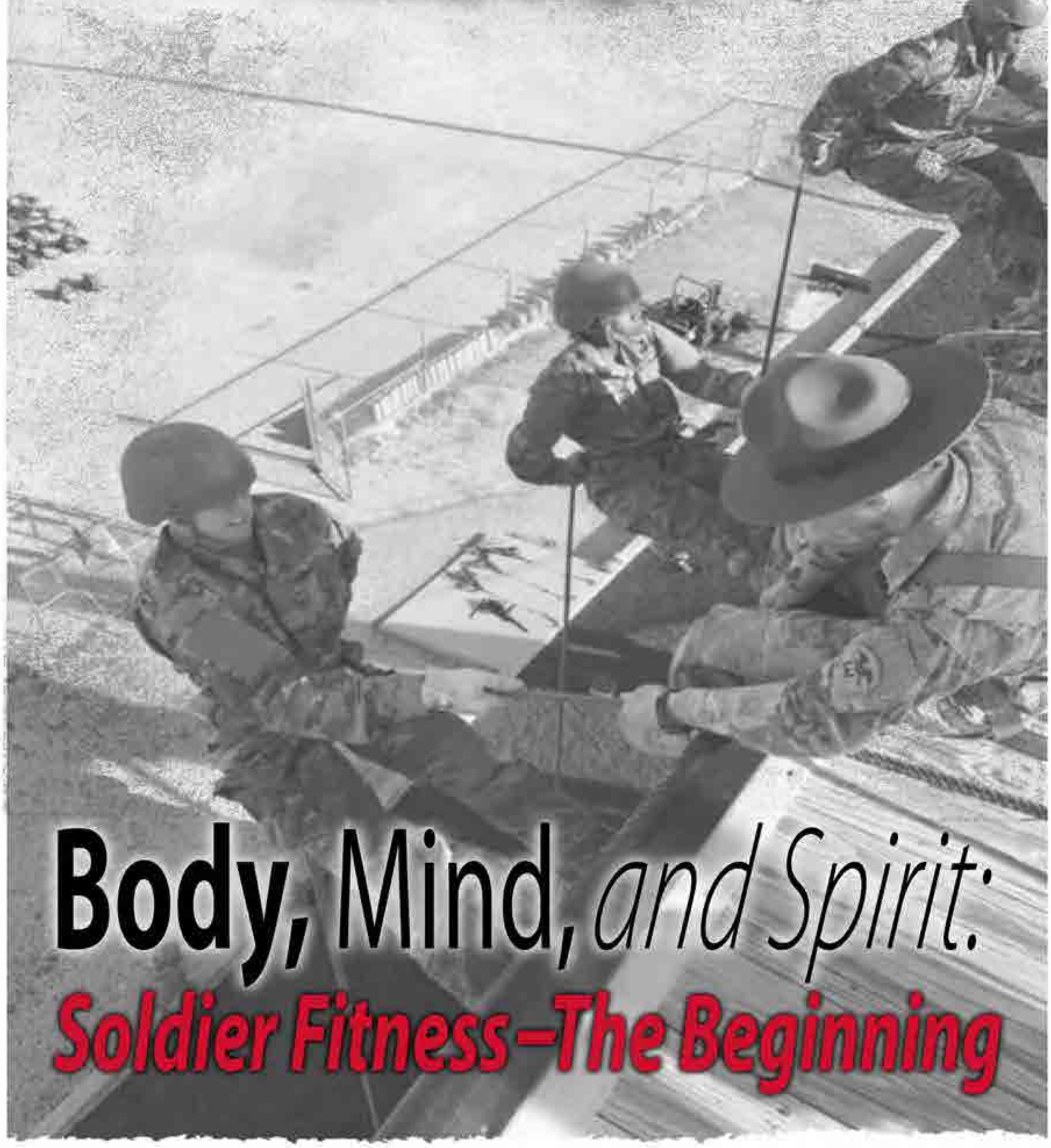
End Result

The BTT effort resulted in the emplacement of a 230-meter IRB across the Tigris River on 15 July 2016. Iraqi soldiers were primarily responsible for the construction, while a small section of the BTT contributed in an advise-and-assist role from the nearshore of the river. It was the first frontline, battalion level advise-and-assist mission during Operation Inherent Resolve. The Iraqi bridge regiment exceeded expectations by completing the assembly of the IRB to U.S. Army standards in an impressively short period of time and without substantial injury, despite taking enemy fire. The emplaced bridge facilitated the resupply and equipping of IA troops on the west bank and later supported U.S. Army efforts in reconnoitering and occupying Qayyarah Airfield West.

Endnote:

[1]Training Circular 5-210, *Military Float Bridging Equipment,* 27 December 1988.

Captain Dean was the commander of the BTT from the 502d Multirole Bridge Company. He holds a bachelor's degree in civil engineering from the U.S. Military Academy–West Point, New York, and a master's degree in engineering management from Missouri University of Science and Technology at Rolla. He is licensed as a professional engineer in Missouri.



Body, Mind, and Spirit: Soldier Fitness–The Beginning

By Colonel Martin Dale Snider, Lieutenant Colonel Charles B. Gray, and Lieutenant Colonel Michael D. Helton

Soldiers begin their transformation into the Army as willing civilians, the best of America's national treasures—her people. Citizens join for many reasons, not the least of which is to become more than they are and to serve the call to freedom's defense. Their mental transformation begins with an immediate introduction to stress and maximum control by drill sergeants. This condition gradually shifts to a more positive coaching environment as Soldiers in training begin to adopt the Army values and to display personal responsibility and teamwork. The mental transformation strategy maximizes stress up front and then slowly reduces it.

However, taking a similar approach to physical development can potentially add too much stress too quickly, injuring Soldiers—many of whom have not previously maintained active lifestyles or healthy diets. This stress significantly increases risk for injury and adds to the Army's long-term health care costs. This article examines the following:

- Physical aspects of initial-entry training (IET).
- Current research on how physical demands affect the body's transformation.
- Immediate changes that can be made within current fiscal and training time constraints.
- A possible optimal training environment.

Recently, the U.S. Army Training and Doctrine Command (TRADOC) provided a fitness model to compare current Army physical fitness training and testing standards to physical requirements that Soldiers must be able to meet in combat. In this model, TRADOC identifies endurance as the current center of gravity for common Army fitness training. The model also demonstrates a need for more emphasis on strength training, explosive power, speed, and agility. The model links a different training emphasis, one based on the mission-focused, common physical requirements of Soldiers. As doctrine and practice come online with institutionalizing a new Army fitness center of gravity, leaders in the IET community can lean forward with implementation.

Soldiers prepare to pull casualties from a vehicle.

The Army professional must be a warrior athlete. Carl von Clausewitz wrote, "War is the realm of physical exertion and suffering. . . . Birth or training must provide us with certain strength of body and soul."[1] If professional athletes need to use strength and conditioning coaches and fuel their bodies with proper nutrition to maximize performance, how much more, then, do aspiring warrior athletes need to be properly conditioned and fueled? Most Soldiers in IET are enduring rigorous physical training for the first time in their lives. We must wisely transform physically unfit Soldiers into warrior athletes. Appropriate athletic and master fitness training and proper nutrition are key. We are committed to ensuring that the aspiring professional Soldiers produced by the 1st Engineer Brigade enter the force as warrior athletes. They should have a basic understanding of strength and conditioning training and proper fueling because they will have been properly trained and fueled during basic combat training and advanced individual training. Most importantly, when commanders of U.S. Army Forces Command units receive our graduates, they will receive Soldiers who have started their progression to becoming warrior athletes.

TRADOC Regulation 350-6, *Enlisted Initial Entry Training Policies and Administration,* describes current efforts to improve Soldier performance. Efforts include incorporating healthier foods in dining facilities and using athletic trainers and strength and conditioning specialists to identify and

Many Soldiers quickly discard initial-entry boots upon graduation from IET.

Soldiers carry 40-pound cratering charges.

treat overuse injuries early, stressing the importance of sleep discipline.[2]

One of the challenges that IET units must address is that many recruits are unfit for the rigors of basic combat training.[3] The Army has long known that warfare is work. Field Manual 7-22, *Army Physical Readiness Training,* clearly identifies that mission accomplishment is heavily dependent on Soldier fitness.[4] Unified land operations place a premium on the Soldier's strength, stamina, and agility. The question is how to develop a large group of individuals, who are initially at various levels of fitness and health, to the required standard as quickly as possible without breaking their bodies in the process. The prescribed TRADOC method to quickly transform young Americans, in large groups, from citizens to Soldiers is through the Physical Readiness Training (PRT) Program.

Field Manual 7-22 describes PRT as a system of drills and activities designed to enhance the performance of warrior tasks and battle drills. The Army PRT Program seeks to develop the physical attributes of Soldiers to their full potential. It states that "the toughening phase of BCT training schedules . . . when executed to standard, provide the proper training intensity and exercise volume and gradual progression appropriate to improving physical fitness and controlling injuries."[5] In the 1st Engineer Brigade, this has proven to be a very good method for getting the masses from a low point of physical fitness to a good, solid initial standard with very little equipment in a reasonable amount of time. If followed as prescribed, this program undoubtedly improves the progression of strength, endurance, and mobility while minimizing injury. However, the program of instruction requirements of basic combat training, advanced individual training, and one-station unit training add additional impacts that, when combined with PRT, can lead to injuries for those who have not previously maintained an active lifestyle.

The manual states that "overtraining often results from a lack of adequate recovery, rest or, in some cases, a lack of nutrient intake. Thus, too much training, too little recovery, and/or poor nutrient intake may elicit both the physical and psychological symptoms associated with overtraining syndrome."[6] While PRT alone balances the principles of precision, progression, and integration, the additional activities of initial military training can inhibit proper recovery between PRT sets and increase the risk of overuse injuries.

The physical fitness environment in the training brigade can be referred to as *PRT–Plus.* It involves quickly putting Soldiers into Army combat boots and loading their bodies with additional weight. From the first training day, Soldiers start moving quickly, often running with new boots and adding the weight of a weapon and other heavy items. For the first 3 weeks of training, they move to most training sites by foot. The course program of instruction also includes very physical activities such as the confidence course, confidence tower, physical endurance course, and land navigation course. Soldiers are fitted for combat boots within 48 hours of arrival at reception units. From then on, they are usually in their boots. Other than during PRT, Soldiers (except for those with profile restrictions) are in boots for most of the training day. Throughout their day, they are either running, marching, or in an expedited state of movement. For some new Soldiers, this rapid increase in physical activity is too much. Overuse injuries account for 70 to 80 percent of IET-related musculoskeletal injuries and more than half of all disability discharges among first-year recruits.[7, 8, 9, 10] The PRT Program was developed to get at these musculoskeletal injuries and allow the undertrained initial recruit's body to adapt at an acceptable (but high) rate without injury. A key element of the PRT Program is a decrease in running frequency and duration with a corresponding increase in running intensity. Many serious musculoskeletal overuse injuries can be prevented through leader education, leader enforcement of proven methods, and injury tracking and reporting. One area of injury prevention is the wearing of properly fitted boots and orthotics, if required. Currently, no verification or fitting of orthotics is occurring. Interestingly, many Soldiers quickly discard initial-entry boots upon graduation. Initial-entry boots are harder and lack the flexibility offered in other available boots. In an anecdotal survey through observation, the authors observed that very few professional Soldiers wear initial-entry boots, even though they are cheaper and readily available through the Army and Air Force Exchange System.

Soldiers participate in a ruck run.

Current fitness injury and prevention research provides empirical evidence that recruits with a history of low fitness levels are not prepared for the physical stress that they undergo during their first weeks of training.[11] As many as 25 percent of male and 50 percent of female recruits sustain at least one musculoskeletal injury during IET.[12] A 2006–2010 study of more than 210,000 Soldiers in training identified the increased challenge for military trainers of transforming increasingly overweight and less-fit recruits into the warrior athletes required by the Army. The study shows that this problem is compounded by inadequate bone and connective tissue health among these populations, resulting in high early-injury rates. The study also found that injuries are expensive, some resulting in long-term care that could mostly be avoided through leader education, leader enforcement of established injury prevention guidance, and injury surveillance with reporting.[13]

". . .warrior athletes must be trained to sustain themselves and their units at maximum physical levels on their own."

An IET brigade at Fort Jackson, South Carolina, has considered the above studies; initiatives there include phasing in running and foot marches over a short time period, requiring a minimum of 7 hours sleep (with a goal of 8 hours) per night, and changing the recruit nutritional plan. Nutrition is a main focus. Soldiers receive no less than 15 minutes to eat every meal. All Soldiers are provided a fourth meal whenever possible. Drinking chocolate milk is encouraged at every meal. The brigade has also added days for physical recovery and healing. For example, mandatory active resting and greater use of the Army physical fitness uniform are encouraged on Sundays.[14]

There are several initiatives to consider in moving to improve IET fitness and injury prevention. One question that needs to be addressed quickly is: What can be done now? First, many of the agencies that support Soldier physical care can be moved to the forefront of intervention, assessment, and recovery through a Total Soldier Fitness review. Currently, most of these agencies provide great support, but in a fragmented way. By moving these agencies into a review board that routinely meets at the brigade and battalion levels, we can get ahead of awareness, prevention, and intervention more rapidly. Another initiative would introduce the approach used by the 194th Infantry Brigade, Fort Jackson, and the 14th Military Police Brigade, Fort Leonard Wood, Missouri, which phases in the wearing of new boots and makes incremental increases in running requirements and weight-loading. Another initiative would address shortfalls in quality calories and nutrients. The possibility of incorporating additional high-quality meals and snacks through existing dining facility contracted services will be determined.

In the near term, a focus group can determine how to quickly assess the physical fitness of new recruits and how to conduct PRT by ability group. Fitness sessions could be more rapidly tailored if it could quickly be determined which personnel are fit enough to press forward with intermediate and advanced levels of strength, stamina, and agility training through the existing PRT Program while those who are underperforming could also be identified. Those who were underperforming IET standards could move to master fitness and athletic trainer oversight to physically press new recruits without injuring them.

The IET community should not stop with the implemention of the above, but should pursue an optimal environment. A physical fitness reach goal is established to create an environment of incentivized physical fitness, where motivated Soldiers want to achieve their own fitness potential and their unit physical fitness goals. Soldiers must be warrior athletes. War is work, and maximizing warfighting systems so that Soldiers can manage their own fitness in austere, dangerous, difficult environments is key. A Soldier's true place of work is in these difficult environments. Every other environment must allow for the preparation necessary to win at those places of work. The human ability to successfully prepare for one's self and one's organization requires a highly fit body that can sustain the mind to make the best decisions possible. Therefore, warrior athletes must be trained to sustain themselves and their units at maximum physical levels on their own. Units need to move to ability group PRT. After Soldiers reach a higher level of fitness, installations and units need to support expanded ability group training. Expanded ability group fitness must include a full range of mobility, strength, flexibility, and cardiovascular opportunities. All of these must be tracked for quality and accountability with the ease of opening a "smart phone" application.

For example, an ability group of Soldiers conducting strength and cardiopulmonary circuit training would scan their common access cards or walk across a Bluetooth-enabled mat before and after fitness events. Their smart workout device would track their entire workout and upload their location, duration, heart rate, and other vital signs to a cloud-based application, where leaders could review them throughout the reporting period. Individual, semiannual testing to ensure that Army standards are being met must be tied to promotions, awards, school selections, and pay. Unit fitness success would also be assessed for progress. Quantifiable unit successes would be connected to group leader promotions, awards, selection, and pay.

In conclusion, the current fitness model and practices provide America's military with foundationally trained and prepared Soldiers. Civilians are being transformed into great young Soldiers who are certified in their IET and military occupational skills. However, plenty of space for improvement remains. The quality of each new Soldier's physical preparedness can be improved. There is plenty of empirical and anecdotal evidence to guide us to better-qualified and more-fit Soldiers as they graduate from IET. In the near term, there are areas we control that can be improved, while long-term, positive, institutional changes can be pursued.

Endnotes:

[1]Carl von Clausewitz, "On War," <http://www.gutenberg.org/files/1946/1946-h/1946-h.htm#link2HCH0003>, accessed on 9 December 2016.

[2]TRADOC Regulation 350-6, *Enlisted Initial Entry Training Policies and Administration,* 7 November 2013.

[3]Joseph M. Molloy et al., "Physical Training Injuries and Interventions for Military Recruits," *Military Medicine*, Vol. 177, Issue 9, May 2012, pp. 553–558.

[4]Field Manual 7-22, *Army Physical Readiness Training*, 26 October 2012.

[5]Ibid., p. 4-1.

[6]Ibid., p. 5-2.

[7]D. W. Niebuhr et al., "Chapter 4: Morbidity and Attrition Related to Medical Conditions in Recruits," *Textbooks of Military Medicine: Recruit Medicine*, pp. 59–79, <http://www.bordeninstitute.army.mil/published_volumes;recruit_medicine/RMch04.pdf, accessed on 9 December 2016.

[8]"Accession Medical Standards Analysis and Research Activity," 2010 Annual Report, <http://www.amsara.amedd.army.mil/reports/2010/AMSARA_Annual_Report_2010.pdf, accessed on 9 December 2016.

[9]S. A. Almeida et al., "Epidemiological Patterns of Musculoskeletal Injuries and Physical Training," *Medicine and Science in Sports and Exercise*, August 1999.

[10]B. H. Jones et al., "Chapter 6. Injuries Treated in Outpatient Clinics," *Surveys and Research Data Military Medicine,* 1999.

[11]Malloy, et al. p. 556.

[12]Ibid., p. 554.

[13]Shawn J. Scott et al., "A Multiple Intervention Strategy for Reducing Femoral Neck Stress Injuries and Other Serious Overuse Injuries in U.S. Army Basic Combat Training," *Military Medicine*, Vol. 177, Issue 9, May 2012, pp. 1081–1089.

[14]Colonel John Conor briefing at the U.S. Army Center for Initial Military Training, *194th AR Injury Prevention,* [September 2016].

Colonel Snider is the commander of the 1st Engineer Brigade, Fort Leonard Wood. He holds a bachelor's degree in geography from Texas Tech University, a master's degree in construction management from Texas A&M University, and a master's degree in strategic studies from the U.S. Army War College. He is a graduate of the Engineer Officer Basic Course, the Field Artillery Officer Advanced Course, the U.S. Army Airborne School, the U.S. Army Air Assault School, the U.S. Army Combined Arms and Services Staff School, and the U.S. Army Command and General Staff College.

Lieutenant Colonel Gray is the commander of the 31st Engineer Battalion, Fort Leonard Wood. He previously served as the deputy commander of the U.S. Army Corps of Engineers, New England District. He holds a bachelor's degree in civil engineering from the U.S. Military Academy–West Point, New York, and a master's degree in civil engineering from Missouri University of Science and Technology in Rolla. He is a graduate of the Engineer Officer Basic Course, the Engineer Captains Career Course, the U.S. Army Command and General Staff College, the U.S. Army Ranger School, the U.S. Army Airborne School, the U.S. Army Air Assault School, the U.S. Army Jumpmaster School, and the Sapper Leader Course. He is a professional engineer in the state of Kansas.

Lieutenant Colonel Helton is the commander of the 35th Engineer Battalion, Fort Leonard Wood. He holds a master's degree in engineering management from Missouri University of Science and Technology in Rolla. He is a graduate of the U.S. Military Academy–West Point, New York, the Engineer Officer Basic Course, the Engineer Captains Career Course, the U.S. Army Combined Arms Services Staff School, the U.S. Army Bradley Leaders Course, the U.S. Army Command and General Staff College, and the U.S. Army Air Assault School.

ENGINEER WRITER'S GUIDE

Engineer is a Department of the Army-authenticated publication that contains instructions, guidance, and other materials to continuously improve the professional development of Army engineers. It also provides a forum for exchanging information and ideas within the Army engineer community. *Engineer* includes articles by and about commissioned officers, warrant officers, enlisted Soldiers, Department of the Army civilians, and others. Writers may discuss training, current operations and exercises, doctrine, equipment, history, personal viewpoints, or other areas of general interest to engineers. Articles may share good ideas and lessons learned or explore better ways of doing things. Shorter, after action type articles and reviews of books on engineer topics are also welcome.

Articles should be concise, straightforward, and in the active voice. Avoid using acronyms when possible. When used, acronyms must be spelled out and identified at the first use. Avoid the use of bureaucratic jargon and military buzzwords. Text length should not exceed 2,000 words (about eight double-spaced pages).

Articles submitted to *Engineer* must be accompanied by a written release from the author's unit or activity security manager before editing can begin. All information contained in an article must be unclassified, nonsensitive, and releasable to the public. It is the author's responsibility to ensure that security is not compromised; information appearing in open sources does not constitute declassification. *Engineer* is distributed to military units worldwide and is also available for sale by the Government Printing Office. As such, it is readily accessible to nongovernmental or foreign individuals and organizations. For convenience, a user-fillable security release memorandum is provided at <http://www.wood.army.mil/engrmag/Security%20Release%20Form%20cx.docx>.

Authors are responsible for article accuracy and source documentation. Use endnotes (not footnotes) and references to document sources of quotations, information, and ideas. Limit the number of endnotes to the minimum required for honest acknowledgment. Endnotes and references must contain a complete citation of publication data; for Internet citations, include the date accessed.

Include photographs and/or graphics that illustrate information in the article. Graphics must be accompanied by captions or descriptions; photographs should also be identified with the date, location, unit/personnel, and activity, as applicable. Do not embed photographs in Microsoft® PowerPoint or Word or include photographs or illustrations in the text; instead, send each of them as a separate file. If illustrations are created in PowerPoint, avoid the excessive use of color and shading. Save digital images at a resolution no lower than 200 dpi. Please see the photo guide at <http://www.wood.army.mil/engrmag/Photograph%20Illustration%20Guide.htm> for more information.

Copyright concerns and the proliferation of methods used to disseminate art, illustrations, and photographs require that the origin of any graphics be identified. If a graphic is copyrighted, the author must obtain copyright approval and submit it to *Engineer* with the proposed manuscript. As a general policy, *Engineer* will not use artwork that cannot be attributed.

Provide a short paragraph that summarizes the content of the article. Also include a short biography, including full name, rank, current unit, job title, and education; U.S. Postal Service mailing address; and a commercial daytime telephone number.

When an article has multiple authors, the primary point of contact should be clearly designated with the initial submission. The designated author will receive all correspondence from *Engineer* editors and will be responsible for conferring with coauthors concerning revisions before responding to the editors.

Engineer will notify each author to acknowledge receipt of a manuscript. However, we make no final commitment to publish an article until it has been thoroughly reviewed and, if required, revised to satisfy concerns and conform to publication conventions. We make no guarantee to publish all submitted articles, photographs, or illustrations. If we plan to publish an article, we will notify the author. Therefore, it is important to keep us informed of changes in e-mail addresses and telephone numbers.

Manuscripts submitted to *Engineer* become government property upon receipt. All articles accepted for publication are subject to grammatical and structural changes as well as editing for length, clarity, and conformity to *Engineer* style. We will send substantive changes to the author for approval. Authors will receive a courtesy copy of the edited version for review before publication; however, if the author does not respond to *Engineer* with questions or concerns by a specified suspense date (typically five to seven working days), it will be assumed that the author concurs with all edits and the article will run as is.

Engineer is published three times a year: April (article deadline is 1 December), August (article deadline is 1 April), and December (article deadline is 1 August). Send submissions by e-mail to <usarmy.leonardwood.mscoe.mbx.engineer@mail.mil> or on a CD in Microsoft Word, along with a double-spaced copy of the manuscript, to Managing Editor, Engineer Professional Bulletin, 14010 MSCoE Loop, Building 3201, Suite 2661, Fort Leonard Wood, Missouri 65473-8702.

As an official U.S. Army publication, *Engineer* is not copyrighted. Material published in *Engineer* can be freely reproduced, distributed, displayed, or reprinted; however, appropriate credit should be given to *Engineer* and its authors.

Note: Please indicate if a manuscript is being considered for publication elsewhere. Due to regulatory requirements and the limited space per issue, we usually do not print articles that have been accepted for publication at other Army venues.

ISR-I: Your Chance to Be Heard

By First Lieutenant Shaun J. Levandoski

The *ISR* in the title of this article does not address a new form of intelligence, surveillance, and reconnaissance. ISR-I refers to an Installation Status Report–Infrastructure Program that provides data for assessing key elements of an installation, such as the office spaces, parking lots, and maintenance bays that Soldiers use every day. The program provides a checklist for inspecting and rating assets associated with a facility, installation, or base. The information from the checklist is uploaded to the program Web site at <https://isr.hqda.pentagon.mil/>, where it is rolled into a mission, quality, and readiness rating that allows Army leaders to evaluate the mission support function capability, quality, and readiness of the elements and infrastructure for the reporting facility. This article focuses on the U.S. Army Reserve process, but also applies to the Regular Army and Army National Guard processes.

For U.S. Army Reserve facilities, the report provides regional support commands (RSCs) with detailed information on the status of the facility and the possibility for increased restoration and modernization dollars. The report answers questions about the facility, such as whether it—

- Is capable of meeting the mission of current tenants.
- Has sufficient parking for 60 percent of tenant military equipment.
- Offers sufficient storage for newly fielded equipment.

Most RSCs assign an area facility operations specialist (AFOS) to complete the report worksheets and enter them into the ISR database, but tenants may be assigned the additional duty of gathering information and filling out the worksheets. Leaders at each facility should be involved in assessing their facilities, assisting the AFOS, and producing accurate reports. This is an opportunity for facility tenants to be heard.

The Report

The ISR–I checklists are referred to as workbooks and can be found at the ISR Web site. There are 73 workbooks that cover more than 1,000 facility category codes, each representing a specific type of asset. For example, Workbook 6 covers maintenance facilities, capturing 31 category codes. Workbook 68 covers training centers and captures two category codes. These two workbooks cover most off-installation Army Reserve assets that leaders and Soldiers use. Each AFOS must receive annual ISR training, but the workbooks are designed for ease of use. The first few pages of each workbook list a brief description of the codes covered inside. Inspection instructions, to include a description of the inspected component, follow.

It is worth noting that Army Regulation 140-483, *Army Reserve Land and Facilities Management,*[1] Appendix B, is listed frequently in Workbook 68. It explains how much space units are authorized within a facility. Tenants planning to send a red flag up the chain regarding a lack of office space or military equipment parking should first look through Appendix B. The regulation is under revision and

New equipment that requires more motor pool space should result in the authorization of more space for receiving units.

should contain space authorization updates. Each element of a facility is given a green, amber, or red rating based on the spreadsheet criteria. Elements are rated based on their designed use, not necessarily on their current use.

Quality and Mission Functional Ratings

The quality, or *Q rating*, assesses the overall condition of an asset against Army standards. The mission, or *F rating*, represents an element's functionality and mission support for its intended purpose. More plainly, the Q rating describes the physical condition of the asset and the F rating shows whether the rated asset meets the mission requirements of the current tenant. For example, all Army Reserve facilities are authorized classroom space based on the number of Soldiers present during the largest battle assembly weekend. Each F-rated component is weighted from 1 to 4, based on the nature of the component. Each facility element listed in the workbook receives a color rating from the inspector: green for *good* or *like new*, amber for *adequate*, or red for *poor.* Once these color ratings are entered into the ISR Web site, the database calculates Q and F ratings from 1 to 4. For example, an F1/Q1 rating indicates that little attention is required, while F4/Q4 ratings suggest that there are significant problem areas. These Q and F ratings are the final product of the ISR-I inspection process and are the first item reviewed by leaders, but inspectors are highly encouraged to include additional comments.

Asset Readiness Ratings

The *C rating* (also referred to as the Commander's Readiness Rating) is similar to the Q and F ratings in that it has a value of 1 to 4. However, this rating is made by the RSC commander or delegated representative by taking the Q and F ratings and other appropriate factors into consideration, including projected mission changes and restationing actions. The rating applies to an entire area of responsibility rather than to each individual asset.

Inspection Frequency

The frequency of asset ratings varies based on previous ratings, on whether it is a new asset, and on whether it is a multiuse asset with shared components. Assets that receive a rating of Q4 or F4 must be inspected every year. Assets rated Q2–3 or F2–3 are inspected every 2 years, while those with Q1 and F1 ratings are inspected every 3 years. Facilities with an overall rating of *green* do not need to be inspected for 3 more years.

The Red Stigma

It is important to shed the notion that a rating of red is a "bad" rating that carries a stigma to be avoided. Facilities should receive a thorough inspection and a rating that represents their actual condition. A red rating on a facility doesn't mean that the commander, facility manager, or AFOS is failing; it means that the facility is failing. Unless a facility is in like-new condition, it should not be rated green. It would be a mistake to manipulate the inspection ratings to get the desired overall ratings. At the RSCs, a green rating on an older facility that has not been restored will raise a flag quicker than an amber or red rating. Directorate of public works staffs know that the majority of their assets were constructed long ago and are not in perfect condition. Giving a facility an unrealistic green rating ties the hands of those who could help improve the facility. Accurately reporting the condition of facilities and assets allows the directorate of public works to generate work orders and identify features that need to be refurbished or replaced.

The Status Quo

The Army sometimes makes changes without considering second- and third-order effects. Accurate ISR-I data is important to inform leaders and justify funding decisions at each RSC, at the U.S. Army Reserve Command headquarters, and at the Department of the Army headquarters. A few years ago, the Army replaced its M920 series medium-equipment transporters with the M983A4 light-equipment transporter. These new vehicles require a much larger turning radius and take up more space in motor pools. Units are authorized 25 additional square yards of parking per light-equipment transporter issued. The mission rating for military equipment parking should have been changed once a unit fielded this equipment, indicating a need for more parking. It is unlikely that all units got the extra authorized space when this equipment was fielded. This is just one example of how forced changes generate second- and third-order effects.

In the U.S. Army Reserve, RSCs struggle to receive accurate reports. It is impossible for a 40-year-old building that has had no major restoration or revitalization to deserve a rating of green across the board, but some buildings get that rating. This is why some units may be struggling to train their Soldiers as effectively as the Army demands. Army Reserve assets are intended for training and readiness. If facilities are not properly evaluated, leaders should contact their RSC or directorate of public works so that they can contact the appropriate AFOS to properly rate the facilities. Inspectors should be working with representatives from each unit, preferably a leader or a member of the full-time staff. That is the best way to inform them of changes within an organization and their effects on readiness. Engineers are always going to make do and get the job done. But the voice of Army Reserve engineers, joined with the voice of their RSC, speaks louder than a single voice from the RSC.

Endnote:

[1]Army Regulation 140-483, *Army Reserve Land and Facilities Management*, 24 July 2007.

First Lieutenant Levandoski serves as a directorate of public works plans officer for the 63d RSC in Mountain View, California. He is a graduate of the Engineer Basic Officer Leader Course and holds a bachelor's degree in architecture from the University of Kentucky.

Homeland Operations: Army Warfighter Challenge No. 6

By Mr. Tony W. Sexton

Defending U.S. territory and the people of the United States is the highest priority of the Department of Defense (DOD), and providing appropriate defense support of civil authorities (DSCA) is one of the Department's primary missions.

Strategy for Homeland Defense and Defense Support of Civil Authorities[1]

The Army develops capabilities for homeland operations based on national strategies, joint and DOD directives, and current doctrine. These capabilities enable the Army to protect the homeland by deterring and defeating attacks and mitigating the effects of attacks and natural disasters as described in the 2014 Army Operating Concept (AOC), as stated in U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-3-1, *The U.S. Army Operating Concept—Win in a Complex World*: "The AOC describes how future Army forces will prevent conflict, shape security environments, and win wars while operating as part of a joint force and working with multiple partners. It provides the intellectual foundation and framework for learning and for applying what we learn to future force development under Force 2025 and Beyond."[2] Concepts do not constitute doctrine, but they serve as the beginning of the process for delivering capabilities to future Army forces. The AOC presents 20 Army warfighting challenges (AWFCs) as first-order problems, the solutions to which improve the effectiveness of the future force. AWFCs provide an analytical framework to integrate efforts across warfighting functions while collaborating with key stakeholders in learning activities, modernization, and future force design.[3] The U.S. Army Maneuver Support Center of Excellence (MSCoE) has been assigned the responsibility to lead AWFC No. 5, Countering Weapons of Mass Destruction (WMD), and AWFC No. 6, Homeland Operations. The AOC requirements reflect the two primary missions identified in the *Strategy for Homeland Defense and Defense Support of Civil Authorities*:

- Defend U.S. territory from direct attack by state and nonstate actors.
- Provide assistance to domestic civil authorities in the event of natural or man-made disasters.[4]

The role of MSCoE as the AWFC No. 6 lead is to guide, facilitate, and integrate learning across Army missions that support deterring and defeating attacks; mitigate consequences of attacks and disasters; support integration into capability development for future force required capabilities; and develop capabilities for MSCoE equities.

Where We Started

When the AOC was issued in 2014, it stated, "To protect the homeland, the Army deters and defeats attacks and mitigates the effects of attacks and natural disasters."[5] These two missions, 1) deter and defeat attacks and 2) mitigate effects, although equally important, had not received equal consideration. Over the preceding decade, TRADOC and the operational force conducted extensive work on the DSCA requirement to mitigate the effects of attacks and natural disasters, primarily for domestic chemical, biological, radiological, and nuclear response. It was evident that the Army had a role in deterring and defeating attacks, but initial analysis identified very limited learning to support capabilities development. This mission is complex and crosscutting and includes many civilian organizations.

Where We Need to Be

The Army must not focus on the homeland itself but must equally balance efforts across the homeland, in the approaches, and in the far regions. This is a whole-of-government approach that will be pursued in the building of the community of practice. The Army's responsibility to protect the homeland is a primary strategic priority. The homeland is increasingly at risk as threats become greater and the world effectively becomes smaller. To meet these more dangerous threats, the Army must prioritize the development of capabilities to deter and defeat attacks against the homeland and to mitigate the consequences of attacks and disasters in the homeland. The homeland mission must be a consideration for the development of Army capabilities to address the full range of military operations. These considerations must be developed in a concept for homeland operations that describes an Army total force approach to synchronize efforts across components and between the operating and generating forces. A concerted effort is necessary to gain a shared understanding of the homeland defense and DSCA principles and the Army role in DOD missions in support of civil authorities. This entails an analysis of policies that impact the Army ability to conduct homeland operations; define or refine its homeland defense and DSCA principles; and enable capability development across doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF).

"The Army must integrate homeland considerations into new and existing scenarios to provide an accurate foundation for Army capabilities development."

DOTMLPF addresses critical challenges affecting the operating force ability to perform missions and fosters readiness through coordinated contingency planning and exercises between the Army total force and joint and civil authorities.

The Army must integrate homeland considerations into new and existing scenarios to provide an accurate foundation for Army capabilities development. These scenarios must include a comprehensive model of the domestic operational environment that accounts for the unique homeland conditions, including statutory constraints and relationships with federal, state, and local governments. Experimentation must deliberately evaluate Phase 0 through Phase 2. Given the growing interconnectedness of the homeland with the world, the Army must also account for the mutual effects of domestic events and expeditionary operations to accurately portray the challenges to be faced by the future force.

Within the operational environment affecting homeland operations beyond 2025, the future challenges are too numerous and complex to be addressed solely by U.S. military and civilian agencies. A significant portion of national unified action efforts must be oriented around building foreign partnerships and helping partners attend to their internal challenges. The Army, for example, must enhance partner activities. This approach establishes long-term relationships fostering mutual trust and confidence, promoting a more stable international security environment, and setting conditions to prevail during armed conflict. To prevail, future Army forces must collaborate with unified action partners to develop security capacity and support capacity building of partners' efforts through security cooperation activities at the individual, institutional, and ministerial levels.

Conclusion

The Army must develop capabilities to support assigned missions as an integral part of its effort to develop the Army of 2025 and Beyond in support of *The National Military Strategy of the United States of America*.[6] Army analysis over the last 2 years provided some much-needed background, particularly the chemical, biological, radiological, and nuclear response enterprise force modernization effort, to establish a thorough integrated learning plan and solutions strategy for the task of mitigating effects. Moving forward, the primary lines of effort required to support this AWFC are to—

- Define the operational environment for homeland operations in terms of unified action partners, the global operational environment, and homeland-specific conditions.
- Clarify Army roles and responsibilities associated with homeland operations and prioritize their integration into concept and doctrine development as a basis for all Army capabilities development.
- Develop and educate Army leaders at all levels of homeland operations.

MSCoE will continue to lead the collaboration among the stakeholders through monthly meetings of the AWFC No. 6 workgroup, the proposed governance forum, and other venues to ensure the integration of homeland operations throughout Army capabilities development. The homeland operations community will approach this AWFC with a near-term emphasis on readiness and implementation of mature, high-payoff solutions.

Endnotes:

[1]DOD, *Strategy for Homeland Defense and Defense Support of Civil Authorities*, February 2013.

[2]TRADOC Pamphlet 525-3-1, *The U.S. Army Operating Concept—Win in a Complex World*, 31 October 2014, p. i, <http://www.tradoc.army.mil/tpubs/pams/tp525-3-1.pdf>, accessed on 15 December 2016.

[3]Ibid.

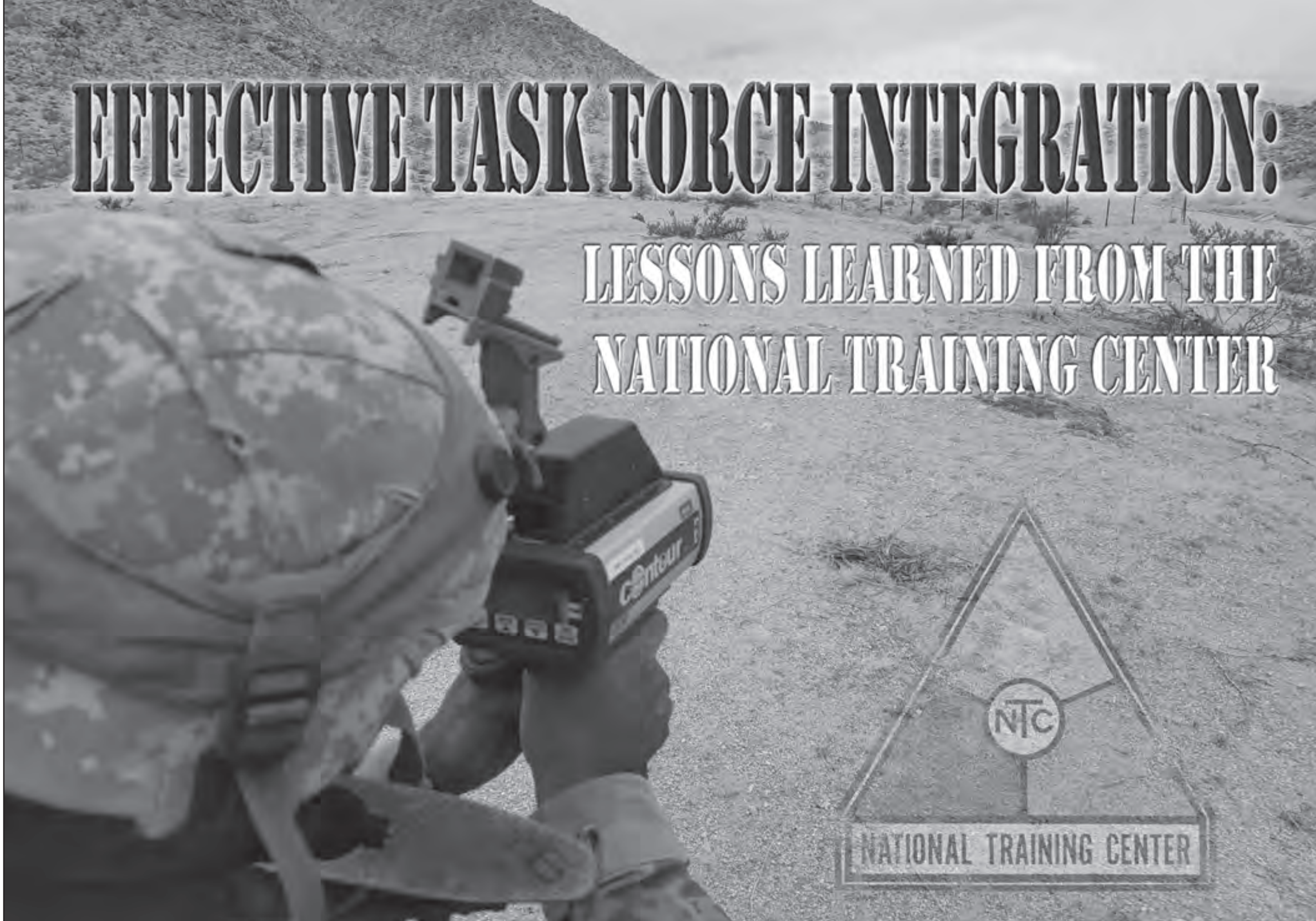
[4]*Strategy for Homeland Defense and Defense Support of Civil Authorities*.

[5]TRADOC Pamphlet 525-3-1.

[6]Joint Chiefs of Staff, *The National Military Strategy of the United States of America*, June 2015, <http://www.jcs.mil/Portals/36/Documents/Publications/2015_National_Military_Strategy.pdf>, accessed on 15 December 2016.

Mr. Sexton is the lead for AWFC No. 6 and a military analyst for the MSCoE Concepts, Organization, and Doctrine Development Directorate, Fort Leonard Wood, Missouri.

EFFECTIVE TASK FORCE INTEGRATION: LESSONS LEARNED FROM THE NATIONAL TRAINING CENTER



By Lieutenant Colonel Brian P. Hallberg

The 16th Engineer Battalion Catamounts had a very successful deployment supporting the 1st Brigade, 1st Armored Division, during National Training Center (NTC) Rotation 17-02 in the fictional country of Atropia. Some of the highlights included a large number of Shadow® flight hours, battalion retransmission, the integration of enablers, obstacle effects, and antivehicular ditch (AVD) breaching with bulldozers. The Shadow platoon broke the NTC, Fort Irwin, California, record by accumulating 260 flying hours. The battalion successfully created a retransmission team out of hide, providing frequency modulation coverage across the brigade area of operation. Brigade level assets were integrated to enable combined arms maneuver. Many linear meters of obstacle effort were executed in the defense, which provided good effects on the opposing Donovian forces. Breaching AVDs is a challenge for a Stryker engineer battalion, so the battalion trained hard to breach the AVDs with bulldozers and achieved a full lane in less than 10 minutes.

One of the important lessons learned regards ways to improve the effectiveness of brigade engineer battalion (BEB) assets attached to supported battalions. The quality of training at home station must be improved before arrival in Atropia. The focus of the training should be on the company and troop commanders. The final assessment after completing the NTC rotation indicated that the 16th Engineer Battalion is great at integrating assets with sister battalions with the intent of enabling combined arms operations. The problem is that maneuver task forces do not always realize the full potential of the attached asset. Why aren't engineers and intelligence collection assets as effective during combined arms maneuver operations? How can we improve the use of BEB assets at the supported task force operation? There is a recommended way to support maneuver commanders more effectively.

The 16th Engineer Battalion executed collective training to validate all its assets and capabilities the month before integration with maneuver task forces. Engineer squads were integrated at infantry platoon situational training exercises (STXs) and live-fire exercises. Engineer platoons, human collection teams (HCTs), signal intelligence teams, unmanned aerial reconnaissance and surveillance assets, and antitank guided missile platoons were integrated during infantry company STXs and live-fire exercises. All assets also supported battalion and brigade STX lanes before deploying to NTC. An engineer reconnaissance team (ERT) was resourced out of hide with hopes of improving obstacle intelligence and marking bypasses to facilitate the tempo during the attack. A Prophet signal intelligence collection team was pieced together to add signal collection into the fight. An assault breacher vehicle and engineer Bradley fighting vehicle were borrowed from the 40th Engineer Battalion to build mobility capability in a depleted second combat engineer platoon in Company A. But all of this effort resulted in disappointment at the loss of tempo and missed opportunities during operations.

Some of the shortcomings include force protection shortfalls, blown cover, and faulty economies of force. Because of manning shortfalls, the supported battalions required additional combat power to secure critical mission command nodes. In many instances, BEB enablers provided security at command posts and the battalion aid station. This happened across all types of attached units and did not meet the intended use. There is a perception that the Prophet team blows the reconnaissance screen's cover since the Prophet system is slow, cumbersome, and takes a long time to set up. Therefore, the team is perceived as a risk to reconnaissance and surveillance operations. Other assets were misused in mistaken economy-of-force measures. Infantry Soldiers were required to finish seizing the objective, so HCTs spent their time pulling guard duty on detainees rather than collecting actionable intelligence that would support current operations. Engineer platoons had to provide their own security while constructing obstacles, which decreased productivity and effective obstacle integration. BEB assets were required to do more with less because rifle battalions were undermanned and in the middle of reconstituting combat power.

The friction of war is part of the problem at NTC; the enemy has a vote. Maneuver battalion commanders do not set out to intentionally misuse BEB assets. However, supported battalion commanders need to assign attached assets at the platoon level and below to a company headquarters—and that company headquarter's understanding of how to employ those assets is the underlying problem. Properly using the assets versus simply task-organizing them is a problem that needs to be solved across the Engineer Regiment. How should we improve asset use?

First, I propose that we train company and troop commanders during company and battalion STXs. We must clearly establish that these commanders own the training objective. The emphasis was placed on the enabler actions on the objective versus the commander's interaction and use of assets on the objective during the gated training strategy. The tasks need to be externally evaluated by observer-controller trainers and should be formally assessed during the after action review. The gated training strategy focused almost solely on Stryker infantry maneuver and clearing tactical objectives during the attack. Less focus was placed on effectively integrating enablers to improve intelligence collection on the objective even though most of the objectives included securing or clearing a civilian population center.

Secondly, we must ensure that the brigade operations order clearly states the task and purpose of the asset attached to the maneuver battalion. The brigade staff did an adequate job of conceptually planning and verbally describing the information collection plan during the operations order briefing. What they failed to do was provide clarity and specificity to the task. The brigade staff needs to be more directive in how brigade assets—especially ERT, human intelligence, and signal intelligence assets—should be used. Specific information collection requirements, locations, and times to collect should be provided. Likewise, the task and purpose must be clear in operations orders from battalions and squadrons to company and troop commanders. The brigade staff may have buried that information in an annex, but that was not effective in getting results at the company and troop levels.

Next, we must educate company and troop commanders on the capabilities, functionalities, and limitations of

Route clearance Soldiers in observation point

16th Engineer Battalion command post

common BEB attachments. There has not been time during the last year to familiarize commanders on the abilities of the BEB. Two combat training center rotations in a year have been a time management nightmare, but I highly recommend that the capabilities and functions of the system in a field environment be demonstrated to all commanders. We need to clearly articulate system limitations and explain ways that company and troop commanders can mitigate some of the limitations so they can realize their full potential in support of the brigade operation.

Another idea is for the military intelligence company to take the initiative in helping company and troop commanders visualize how to employ human and signal intelligence assets. The key is to use a multifunctional team platoon leader, who should develop the contingency operations plan that provides the concept of intelligence collection, recommended locations for the intelligence collection, and the resources required from the supported task force in order for the intelligence collection to be effective. For example, the security force required, the processing area layout, and the method of processing the flow for task force detainee information collection could be listed. The multifunctional team platoon leader should also develop line-of-sight products to help company and troop commanders place the Prophet to collect signal intelligence. The military intelligence company commander can validate the platoon leader's plan during troop leading procedures.

Lastly, I acknowledge that I could have done a better job of influencing the use of assets with my fellow battalion and squadron commanders. I failed to establish metrics for the use of the ERT, the Prophet, and the HCTs in the commander's critical information requirement (CCIR) list. The Prophet and the HCTs made the combat power CCIR, but that is not enough information to influence the effectiveness of the asset. Refining the CCIR to assess how and when collection assets were being used would have helped me influence asset use with fellow commanders and make recommendations to the brigade commander about refining task organization.

My final thoughts are that BEB commanders need to influence brigade staffs in weighting the main effort, which will decrease asset idleness. The ERT was with the cavalry squadron during most of the rotation. When the team members were idle, they pulled guard duty. The task force that was attacking to seize population centers could have used the ERT to collect intelligence about protective obstacles and to help task force commanders decide on a point of breach with battalion scout platoons. That would have increased the tempo of battalion hasty breaches. Likewise, the battalion task force that was seizing population centers could have used additional HCTs, which would have eliminated HCT members pulling guard at the command post simply because they did not have a task or purpose with the supported battalion during that phase of the operation.

Overall, during NTC Rotation 17-02, the 16th Engineer Battalion Catamounts were successful in enabling combined arms maneuver operations in Atropia. But the battalion will continue to push to achieve its full potential through improved, realistic, and tough combined arms training focused on educating company and troop commanders.

Lieutenant Colonel Hallberg is the commander of the 16th Brigade Engineer Battalion, 1st Brigade, 1st Armored Division, Fort Bliss, Texas. He is a graduate of the Command and General Staff College, the Engineer Officer Basic Course (now the Engineer Officer Basic Leaders Course), and the Engineer Captains Career Course. He has a bachelor's degree in civil engineering from the U.S. Military Academy–West Point, New York, a master's degree in industrial and systems engineering from Texas A&M University, and a master's degree in engineering management from the Missouri University of Science and Technology at Rolla.

CTC Corner

The National Training Center: New and Improved

By Lieutenant Colonel Robert A. Hilliard

Just a couple of years ago, the National Training Center (NTC), Fort Irwin, California, transitioned from counterinsurgency-based training to the *decisive-action training environment*, combining what many of us remember from before 2004 as *high-intensity combat* with multiple urban areas and civilians to create a truly hybrid fight. Rotations begin with the traditional 5-day reception, staging, onward movement, and integration followed by 10 days of force-on-force training and 4 days of live-fire operations. Live-fire operations have changed significantly over the past year and are now brigade level training events, rather than sequential task force level iterations. There is now a rapid transition from force-on-force training to live-fire with no intervening "dry-fire" day. Units conduct requisite rehearsals at echelon and move directly into force-on-force training under live-fire conditions. Most significantly for engineers, only live rockets and live mine-clearing line charge tubs are used in live-fire operations.

There are keys to home station training success for units preparing for rotations at NTC. Future Combat Training Center (CTC) Corner articles will dive deeper into each of the following subjects:

- ***Engineer qualification tables***. It is recommended that units prepare by conducting engineer qualification tables through Table XII (platoon level live-fire) and combined arms live-fire exercises at company team level or higher. While a combined arms live-fire exercise is not a requirement, units that are integrated with combined arms teams early on are much more proficient.
- ***Live-fire waivers.*** The brigade decides whether engineer units will fire the 25-millimeter main gun or small arms during live-fire training. For engineer units that plan to take part in live-fire training, a waiver must be submitted through the brigade commander for approval by the commander, Operations Group, if the unit hasn't completed gunnery/engineer qualification tables through Table XII or if it has turbulent crews.
- ***Battalion staff military decision-making process training and tactical operations center proficiency.*** It's imperative that battalion staffs conduct thorough mission analysis and course-of-action development to identify and solve problems for the brigade. Reverse breach planning, defensive planning, defended asset list planning, engagements, route reconnaissance, and area security must be addressed. Specific training objectives must be prepared for the NTC Leader Training Program; battalion commanders and command sergeants major should participate in a 2-day NTC ride-along.
- ***Integrated training for military intelligence and signal companies.*** These companies should be fully included in task force and brigade level exercises. The tyranny of distance and the communications challenges at NTC are difficult to replicate at home station, but the integration of all systems at home station can result in the early identification of deficiencies and weaknesses.
- ***Sustainment as an operation.*** Logistic and operational planning must occur simultaneously. Unit leaders should develop reporting requirements, build a logistics common operating picture, and rehearse the logistics plan.

NTC remains the premier venue for armored and Stryker brigade combat team training. The professional feedback, instrumentation, and world-class opposing force help get the best out of the team. For official NTC trends, visit the Sidewinder binder at the Joint Lessons Learned Information System (JLLIS) Web site at <https://www.jllis.mil>.

Lieutenant Colonel Hilliard serves as the current Sidewinder 07, the senior brigade engineer battalion trainer at NTC. He holds a bachelor's degree in civil engineering from Auburn University and master's degrees in civil engineering from Montana State University and Missouri University of Science and Technology at Rolla.

The Engineer Company Commander's Role During the Defense

By Captain Gregory D. Bascomb II, Captain Anthony C. Funkhouser Jr., and Captain Scott E. King

Within the last year, the brigade engineer battalion (BEB) training team at the Joint Multinational Training Center, Hohenfels, Germany has seen a steady improvement in the way engineers help shape the battlefield for a brigade combat team. However, a recently observed trend is the ineffective integration of sapper companies into the maneuver task force during defensive operations. A lack of engineer experience, expertise, and credibility has degraded the ability of the task force engineer to provide countermobility support to task force engagement area development. This edition of the Combat Training Center (CTC) Corner examines the problem set and recommends steps to ensure that company level engineer officers regain the knowledge necessary to effectively contribute to the defense.

Over the last decade, engineers have focused primarily on counterinsurgency and stability operations, sometimes to the detriment of defensive operations. This has resulted in an experience gap in the roles and responsibilities of the task force engineer. Units primarily conduct brigade-directed, offensive-based training progressions, which results in missed opportunities for the task force engineer to gain experience at assisting the maneuver staff with defensive planning. Many junior officers experience task force engineer operations for the first time when they attend one of the CTCs. With the high CTC operational tempo, task force engineers may struggle with procedures for integrating into the maneuver task force. Senior leaders at the battalion level and above are the only individuals who have knowledge of this role. It is the responsibility of BEB commanders to mentor their subordinate commanders on the proper role of the engineer commander within a task force.

The U.S. Army Engineer School, Fort Leonard Wood, Missouri, is currently the primary source for developing expertise on the role of the task force engineer. During the Engineer Captains Career Course, students spend 2 weeks on defensive operations as a task force engineer. Although the course lays down a good introduction, it is not the responsibility of the schoolhouse to be the sole source of education. To obtain a better task force engineer foundation, this education needs to be reinforced through training and experience. The best way to do this is to integrate with maneuver units during training events. This leads to task force engineers becoming more experienced and ultimately increases their credibility with the maneuver commanders.

Task force engineers establish credibility through competence and confidence. Engineer company commanders may fail to effectively communicate their unit capabilities to the maneuver commander. Without a clear understanding of engineer capabilities, the maneuver commander cannot visualize a sound operational approach. Engineer company commanders are frequently observed to be uncomfortable and inexperienced with the process of integration into a maneuver task force. Their lack of competence and confidence often causes them to lose credibility with their supported maneuver commanders.

Although Army Techniques Publication 3-90.5, *Combined Arms Battalion*,[1] discusses the roles and responsibilities of the task force engineer, there is no current engineer doctrine that further elaborates or discusses this at the company level. Past task force engineer doctrine existed in Field Manual 5-71-2, *Armored Task Force Engineer Combat Operations*,[2] but was rescinded during the transition to the new 3-34 series of Army publications. The Engineer School is currently updating Army Techniques Publication 3-34.22, *Engineer Operations–Brigade Combat Team and Below*,[3] to include discussion on the roles and responsibilities of the task force engineer. Additionally, BEB commanders need to institute leadership development programs or *enabler academies* to ensure that subordinate leaders fully understand their responsibilities to increase expertise. Leaders at the company level will gain more experience through combined training events with habitually supported maneuver units. These combined training events will assist the company commander and ultimately establish credibility within a maneuver task force.

Endnotes:

[1]Army Techniques Publication 3-90.5, *Combined Arms Battalion,* 1 October 2009.

[2]Field Manual 5-71-2, *Armored Task Force Engineer Combat Operations*, 28 June 1996 (rescinded).

[3]Army Techniques Publication 3-34.22, *Engineer Operations–Brigade Combat Team and Below,* 5 December 2014.

Captain Bascomb serves as an observer-controller trainer at the Joint Multinational Readiness Center at Hohenfels. He is a graduate of the Engineer Captains Career Course, the U.S. Army Ranger School, the U.S. Army Airborne School, the U.S. Army Air Assault School, the Sapper Leader Course, and the Marine Engineer Diving Officer Course. Captain Bascomb holds a master's degree in engineering management from Missouri University of Science and Technology at Rolla.

Captain Funkhouser is an observer-controller trainer at the Joint Multinational Readiness Center at Hohenfels. He is a graduate of the Engineer Captains Career Course, the U.S. Army Air Assault School, the Route Reconnaissance and Clearance Leadership Course, and the Engineer Explosive Ordnance Clearance Agent Course. He holds a master's degree in engineering management from Missouri University of Science and Technology at Rolla.

Captain King serves as a task-force engineer observer-controller trainer at the Joint Multinational Readiness Center at Hohenfels. He is a graduate of the Engineer Captains Career Course. He holds a master's degree in geological engineering from Missouri University Science and Technology at Rolla.

The Brigade Engineer Battalion Role at the Joint Readiness Training Center

By Lieutenant Colonel Michael R. Biankowski Jr.

Task Force 5 is often asked how brigade engineer battalions (BEBs) are employed at the Joint Training Readiness Center (JRTC), Fort Polk, Louisiana. The Regular Army has completed the Active Component transition from the special troops battalion to the BEB; nonetheless, many BEBs are still treated as legacy special troops battalions and assigned missions according to the battalion leader's strengths and the brigade combat team (BCT) commander's confidence level in the organization.

According to doctrine, the BEB may perform nonfunctional roles, such as area security and terrain management, in extreme circumstances. However, in reality, the BEB consistently conducts additional tasks beyond its functional role of providing engineer coordination for combined arms maneuver; countermobility and survivability; and the requisite military intelligence, signal, and chemical reconnaissance support to the BCT. These additional tasks vary according to each BCT and rotation. Recurring tasks include—

- Rear area security.
- BCT command post and base cluster defense.
- Key leader engagement with U.S. government and host nation partners.
- Noncombatant evacuation operations.
- Establishment of detainee collection points.

In a sense, the term *brigade enabler battalion* seems to apply, especially when the BCT commander relies on the BEB to serve as the mission command problem solver as external attachments arrive to enhance the capabilities of the BCT.

Given the probability that this trend will continue, BEB leaders must develop and train their staffs to manage these multiple roles and rapidly transition between them. This begins with clear guidance and expectations from the battalion commander and is reinforced by—

- Integrating recurring staff processes in garrison by establishing daily battle rhythms, incorporating the military decision-making process in all planning horizons, preparing command post standard operating procedures, and conducting rehearsals.
- Developing an effective common operational picture (COP) through numerous repetitions, comparing it to the BCT COP, and understanding that the battalion is the divide between digital and analog COPs.
- Developing and validating a reception, staging, onward movement, and integration standard operating procedure to help integrate external enablers.
- Understanding the applicable on-the-ground command or support relationships with enablers and identifying the subject matter experts on the staff.
- Practicing and developing countermobility/survivability synchronization matrices along with effective reporting and tracking systems to feed into the COP.

Units should not wait until they are tagged for a combat training center rotation to begin training their staff. Instead, leaders should leverage every working day as an opportunity to hone their systems and processes. However, this requires guidance, organization, and prioritization.

Finally, there are two ways to provide firsthand learning opportunities to help understand BEB employment during combat training center rotations:

- Send personnel to the JRTC as guest observer-coach trainers.
- Request a short ride-along with the Task Force 5 Team to gain experience during an actual rotation.

For more information about Task Force 5, call (337) 353-8287 or (337) 208-3441.

Lieutenant Colonel Biankowski is the Task Force 5 (BEB) senior observer-coach trainer at the JRTC. He recently commanded the 9th BEB, 2d Infantry Brigade Combat Team, 3d Infantry Division, Fort Stewart, Georgia.

Ready to Respond:

The 911th Technical Rescue Engineer Company Offers Unique Assignments

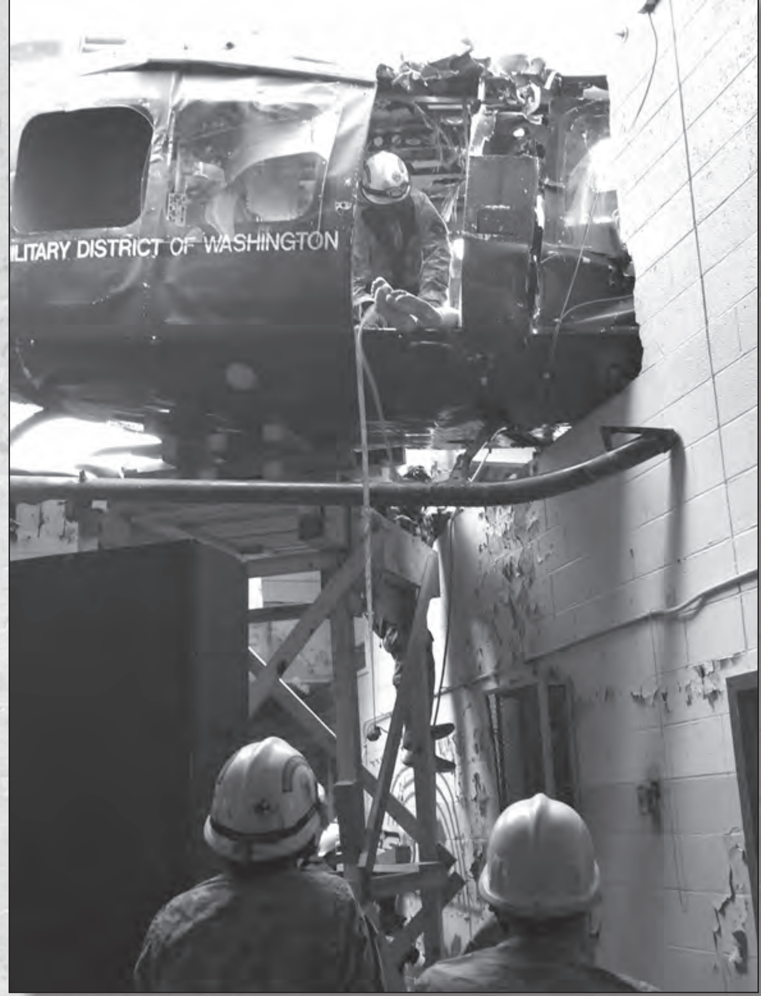
By First Lieutenant Michael A. Connors

There is an unusual engineer unit embedded within the 12th Aviation Battalion, U.S. Army Aviation Brigade (formerly known as the U.S. Army Air Operations Group). Soldiers in the Engineer Regiment may have heard rumors of the existence of the 911th Technical Rescue Engineer Company (TREC) in some form, either in a passing comment or from a friend of a friend who was once assigned there. The 911th TREC is an elite unit that continuously seeks motivated applicants who wish to challenge themselves and become part of a unique team with a unique mission. The company is located in the National Capital Region, tucked away on Fort Belvoir, Virginia. In addition to its classified primary mission set, the unit stands ready to provide technical rescue support during disasters—man-made or natural—within the District of Columbia metropolitan area and to execute defense support of civil authorities operations within the surrounding area.

The company earned its name after responding to the 11 September 2001 attacks on the Pentagon, where members of the unit conducted 24/7 search-and-rescue operations for 10 days. Though named after the date of the attacks, the unit has been called everything from a "unicorn" to the "redheaded stepchild" of the Engineer Regiment. In keeping with its various nicknames, the company faces unique challenges associated with its one-of-a-kind mission set.

As the current commander pointed out, "We don't deploy. In a normal [Army force generation] cycle, a unit would train, deploy, reset, and begin training again. The 911th doesn't have a ramp-up period. Rather, we constantly train in order to be ready for America's worst day. Our 'deployment' can come any day, any time; and we always have to remain ready."

The 911th TREC recruits only Soldiers capable of supporting this highly coveted mission with national consequences. The candidates they want on the team are Soldiers who are highly motivated and disciplined. Prospective applicants should enjoy learning new skills because new arrivals usually possess little knowledge of the technical rescue profession. The ideal Soldier has been described as "one who loves being part of a team, is a meticulous problem-solver, and an attention-to-detail-oriented Soldier," said the commander. Rescuers need to be well-grounded, mature decision makers who are confident in their abilities. The personal readiness of 911th TREC Soldiers can make the difference between life or death—for themselves, for fellow rescuers, and for trapped victims.



Soldiers practice helicopter stabilization and victim rescue.

Since the majority of Soldiers who come to the company have little experience in the field, the learning curve is steep and requires individual commitment. But the training that new members get at the 911th TREC is incomparable. First-year Soldiers in the unit spend about 3 months on temporary duty at different locations in the United States, learning the skills they'll need to be successful in the company. Every Soldier earns professional certifications that are recognized across the military and civilian urban search-and-rescue communities. Regardless of their military occupational specialty (MOS), each Soldier gets specialized training on ropes; confined-space operations; structural collapse; and trench, mine, and tunnel rescue techniques. The company trains with national search-and-rescue teams, local first responders, the Federal Emergency Management Agency, and other federal and state agencies in the National Capital Region. By the time new Soldiers have been with the unit for a year, the Army has invested a lot of time and money in training, outfitting, and certifying them.

Another unique aspect of the company is the diversity of MOSs in the ranks. Line platoons are composed of engineer officers (MOS 12A), combat engineers (MOS 12B), firefighters (MOS 12M), horizontal-construction engineers (MOS 12N), and carpentry and masonry specialists (MOS 12W). The headquarters and support platoons are composed of construction engineering supervisors (MOS 12H); signal support systems specialists (MOS 25U); health care specialists (MOS 68W); chemical, biological, radiological, and nuclear specialists (MOS 74D); wheeled vehicle mechanics (MOS 91B); allied trade specialists (MOS 91E); construction equipment repairers (MOS 91L); automated logistical specialists (MOS 92A); petroleum supply specialists (MOS 92F); and unit supply specialists (MOS 92Y).

Soldiers from the 911th TREC, Fort Belvoir, Virginia, compete for the title of Rescuer of the Quarter.

Each junior enlisted Soldier, noncommissioned officer, and commissioned officer brings a different perspective to the team and plays an important role in contributing to the success of the unit. The current company first sergeant summed it up by saying, "This is an incredibly unique assignment and unlike anything else you're going to encounter in the Army. Applicants need to have an open

A Soldier from the 911th TREC competes for the title of Rescuer of the Quarter. The biannual competition tests the physical fitness level, technical knowledge, and basic fundamental skill set of unit members.

mind and be humble. Regardless of MOS, rank, or time in Service, everyone who comes here is a new rescuer. And everyone who comes here needs to be motivated to learn a new skill set while striving to remain proficient in their primary MOS. The company affords the unique opportunity for individuals to attend a lot of professional military and civilian schools to do just that."

The 911th TREC is a table-of-distribution-and-allowances unit with plans to expand the organization to adapt to the ever-changing skill set of technical rescue. The company strives to remain current with the equipment, training, and technology required of such a specialized unit. Every Soldier plays a role in adapting to the fluidity of the profession by staying current with his or her certifications and training. Soldiers cross-talk and cross-train with each other and with civilian entities to remain ready to respond. The company tries to improve every day and constantly seeks eager, committed Soldiers who aren't afraid to test their limits as part of a highly technical, fast-paced team. Further, the unique and highly valuable skills of the Soldiers are reinvested into the Engineer Regiment as seasoned 911th TREC members move on to new assignments after their time in the 12th Aviation Battalion.

Soldiers interested in applying for the 911th TREC should contact the 12th Aviation Battalion adjutant at <usarmy.belvoir.usamdw.mbx.12avnbn-pac@mail.mil>.

A Soldier from the 911th TREC competes for the title of Rescuer of the Quarter.

First Lieutenant Connors is the assistant operations officer for the 12th Aviation Battalion. He served as a platoon leader and executive officer in the 911th TREC from November 2013 until December 2015. He holds a bachelor's degree in English from Virginia Wesleyan College. He is a graduate of the U.S. Army Ranger School, the U.S. Army Air Assault School, and the Sapper Leader Course.

PHOTOS FROM THE FIELD

The 2016 Sapper Stakes at Joint Base Lewis–McChord, Washington, 25–26 October, consisted of nine lanes that evaluated how well squads performed basic combat engineer tasks. This year's competition marked the first time that women combat engineers had taken part since the Army opened the combat engineer field to women. (Photographs by First Lieutenant Tanangachi Mfuni)

Above: A sapper from the 555th Engineer Brigade prepares a road-cratering charge.

Right: Soldiers create an 11-row wire obstacle.

We Need Your Photographs!

***Engineer* is always looking for good-quality, action photographs (no "grip and grins," please) to use on the outside covers. If you have photographs of Soldiers who are in the proper, current uniform and are participating in training events or operations or photographs of current, branch-related equipment that is being used during training or operations, please send them to us at <usarmy.leonardwood.mscoe.mbx.engineer@mail.mil>.**

Ensure that photographs depict proper safety and security procedures, and do not send copyrighted photographs. All photographs must be high-resolution; most photographs obtained from the Internet, made smaller for e-mailing, or saved from an electronic file such as a Microsoft® PowerPoint or Word document cannot be used for print. In addition, please include a caption that describes the photograph and identifies the subject(s) and photographer (if known). Please see our photograph guide at <http://www.wood.army.mil/engrmag/Photograph%20Illustration%20Guide.htm> for more detailed information.

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**	**Description/Status**
Publication Revisions		
ATP 3-34.80	*Geospatial Engineering*	Revisions include loss of the topographic companies, adoption of Joint Publication 3-34, *Joint Engineer Operations*, migration of the Digital Topographic Support System into the Distributed Common Ground System–Army family of systems, establishment of other peripheral systems and software to the geospatial realm, and further establishment of the Standard and Shareable Geospatial Foundation. **Status:** To be published in 2d quarter fiscal year (FY) 2017.
ATP 3-37.34	*Survivability Operations*	Revisions include updated survivability data in various tables. **Status**: To be published in 3d quarter, FY 17.
ATP 3-34.45	*Power Generation and Distribution*	This manual supersedes Technical Manual 3-34.45, *Engineer Prime Power Operation*, and will cover low and high voltage. **Status:** To be published in 4th quarter, FY 17.
ATP 3-34.22	*Engineer Operations Brigade Combat Team (BCT) and Below*	This revision will include discussion of the roles and responsibilities of the task force engineer; clarify the roles and responsibilities of the brigade engineer battalion (BEB) commander, BEB operations officer, and assistant brigade engineer; and include discussion of additional BEB missions and responsibilities within the BCT. **Status:** To be published in 4th quarter, FY 17.

"Doctrine is indispensable to an army. Doctrine provides a military organization with a common philosophy, a common language, a common purpose, and a unity of effort."

—General George H. Decker,
U.S. Army Chief of Staff, 1960–1962

Engineer Doctrine Update

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

New Army Publication Highlights

Updates to Army Doctrine Publication/Army Doctrine Reference Publication 3-0, *Operations*, 11 November 2016, include the following:

- Updates the definition of unified land operations: simultaneous offensive, defensive, and stability or defense support of civil authorities tasks to seize, retain, and exploit the initiative and consolidate gains to prevent conflict, shape the operational environment, and win the Nation's wars as part of unified action.
- Modifies the tenets of unified land operations to simultaneity, depth, synchronization, flexibility.
- Adds principles of unified land operations: mission command, develop the situation through action, combined arms, adhere to law of war, establish and maintain security, and create multiple dilemmas for the enemy.
- Adds discussion of multiple dilemmas. Army forces present the enemy with multiple dilemmas because they possess the *simultaneity* to overwhelm the enemy physically and psychologically, the *depth* to prevent enemy forces from recovering, and the *endurance* to sustain operations.
- Expands the traditional concept of combined arms to include joint and multinational assets as integral to combined arms and discusses how the Army conducts these operations across multiple domains.
- Adds "Conduct security cooperation" as a sixth stability task.
- Adds "Plan and conduct space activities" as an additional task within the mission command warfighting function.
- Adds discussion of position of relative advantage, which is defined as a location or the establishment of a favorable condition within the area of operations that provides the commander with temporary freedom of action to enhance combat power over an enemy or influence the enemy to accept risk and move to a position of disadvantage.
- Adds discussion of consolidating gains, which is defined as the activities to make permanent any temporary operational success and set the conditions for a sustainable stable environment allowing for a transition of control to legitimate civil authorities.

Please contact us if you have any questions or recommendations concerning doctrine.

Lieutenant Colonel Matt McCulley, Telephone: (573) 563-2717; e-mail: matthew.y.mcculley.mil@mail.mil

Mr. Douglas K. Merrill, Telephone: (573) 563-0003; e-mail: douglas.k.merrill.civ@mail.mil

Engineer Doctrine Team, e-mail: usarmy.leonardwood.mscoe.mbx.cdidcodddengdoc@mail.mil

Desert Construction

By Captain Jeffrey R. Walton

Between February 2014 and December 2015, the U.S. Army Special Operations Aviation Command (USASOAC) from Fort Bragg, North Carolina, built five facilities in Arizona for the U.S. Army Special Operations Command Flight Company (UFC). There had previously been no facilities at Yuma Proving Grounds (YPG), Arizona, for the Army's newest aircraft, the C-27J Spartan airplane. The USASOAC deputy command engineer (DCE) served as the primary USASOAC representative to the agencies working on the projects; he worked to ensure that the projects were executed on budget and in a timely manner.

The DCE contributed to every stage of the construction process and coordinated the work of the agencies involved. He faced many challenges along the way, including handling normal construction issues, working across time zones, and balancing Army needs with reality. It is important to pass along the numerous lessons learned over the 2 years to future leaders. The lessons may seem simple, but their implementation can make the difference between project success and failure.

The Yuma projects consisted of two prefabricated metal buildings (PMBs), a fabric hangar, two fabric sunshades, and corresponding airport taxiway extensions. These simple structures were necessary for the UFC to support the U.S. Army John F. Kennedy Special Warfare Center and Military Free Fall School. The PMBs were needed to store aircraft parts and to house the Spartan pilots, crews, and maintainers. An enclosed hangar was needed for conducting aircraft repairs, especially during the harsh desert summer. Overhead sunshades were needed to reduce the heat buildup inside the plane during the day. USASOAC purchased a fabric hangar and fabric sunshades as a temporary solution until permanent facilities could be constructed.

The DCE received the project in its conceptual stage. Funds to purchase materials and start work had not been approved, the U.S. Army Corps of Engineers (USACE) designs were only 65 percent complete, and a military unit to build the projects had not been designated. The USASOAC commander directed that the facilities be up and running within a year to begin supporting the Military Free Fall School, which allowed the DCE to begin working on the project.

USACE was the primary agency outside of USASOAC that worked on the projects, with involvement from five districts:

- Los Angeles.
- Sacramento.
- Mobile.
- Omaha.
- Louisville.

The Los Angeles District was the primary district involved, providing a project engineer to coordinate operations. The Sacramento District provided designers, the Mobile and Omaha Districts provided design and aircraft facility expertise and support, and the Louisville District started the projects but later turned them over to the Los Angeles District since it was geographically closer to YPG.

Many military units were involved throughout the life of the projects. The U.S. Naval Construction Force—the Seabees—originally planned to construct the facilities. They reviewed the designs and developed cost and timeline estimates for USASOAC. However, the Seabees could not build the facilities due to other mission requirements. USASOAC then called upon the U.S. Air Force Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE) to perform the work. The 820th RED HORSE Squadron picked up where the Seabees left off. It determined the bill of materials, coordinated with USACE to order the equipment required, and completed the hangar and sunshades from the ground up.

All construction plans were submitted to the YPG garrison commander for approval, while the YPG Department of Public Works worked with USASOAC to approve work orders. The Department of Public Works also coordinated with other personnel including base master planners, the installation fire chief, airfield managers, the installation environmental office, other Army units, and other organizations in the area to ensure project success. During construction, the Department of Public Works worked closely with the 820th and helped the Air Force engineers with any problems they encountered.

The 820th could not provide enough resources and workers to construct the PMBs in time for the UFC to begin operations as planned. USASOAC then looked to USACE, which hired a general contractor. This removed the burden of daily construction management from the DCE and entailed minimal coordination.

The last group involved with the projects was the vendor who provided the fabric hangar and sunshade structures. These structures were much like interlocking toy building sets. The prefabricated frame pieces were sent directly to the site, where they were erected by the 820th RED HORSE. The vendor that won the bid provided the plans for assembly and sent a representative to YPG to assist the 820th. The vendor also worked directly with USASOAC to ensure that the structure customizations, including specialized electrical components, a fire suppression system, and a gantry crane, met the needs of the aircraft.

As with any construction project, there were difficulties. Site conditions differed from the time of the initial survey to the start of construction. Environmental concerns arose. Communication problems led to misunderstandings. And unique problems came from obtaining funding authorizations; working as the middleman between the end user, the civilian contractors, and USASOAC; and working across three time zones.

Hangar under construction

> ***"The primary question resulting from the project is, 'What can be learned?' Regular communication, proper planning, proper documentation, physical inspection, follow-through, and knowing the end user were vital to the success of the projects."***

Differing Site Conditions

The problem of differing site conditions is very common in the construction industry. It is impossible to analyze every square inch of a site. The substantial foundations required for the YPF projects became an issue. Foundations usually support the weight of a structure, but the Yuma project consisted of fabric structures stretched over poles. The foundation designs were meant to keep them from blowing away in the site's high winds. Poor soil conditions required the purchase of extra fill material to boost soil compaction levels.

Environmental Concerns

The desert environment also posed unique challenges. Because of the existence of an endangered species of cactus on the site, the YPG Environmental Office had to relocate the cacti before work could start. Dust pollution was another problem. Dust kicked up by wind and moving construction equipment covered the site, which had to be watered regularly to reduce the problem. Finally, erosion was another major factor that had not been initially considered. It rains hard in Yuma, and soil erosion can cause considerable damage. Careful site drainage planning was required to reduce erosion effects.

Communication Problems

There were some problems with communication. Concerned parties were not always notified of design changes. For example, USAOAC inspectors were surprised to see dropped ceilings that were not called for in the original design. In addition, problems occurred when a USAOAC team arrived from Fort Bragg for a PMB inspection and discovered that the structures weren't ready to be inspected.

Funding Authorizations

The USASOAC commander approved the project budget, but funding limits were tight. There were several funding account types for each project. For example, the communication equipment was purchased from one funding account and construction materials had to be purchased with another. This made the DCE role of keeping track of the expenses complex and important.

The Role of the Middleman

Throughout the life of the projects, the UFC and USASOAC commanders requested many modifications that were not feasible due to budget, time, or resource constraints. The DCE's job was to inform the commanders of what was possible and what was not. Keeping the civilian contractors updated with change orders through USACE and specifying changes required by Army regulations posed another set of challenges. For example, regulations required separation between the computer server rooms and the main portion of the building, so USACE modified the design to meet the requirement.

Multiple Time Zones

The last challenge involved working across time zones. Although problems associated with multiple time zones are not unique to military projects, the need for project leaders to wait for 3 hours for their counterparts on the West Coast to get to work can be frustrating. It was important for the DCE on the East Coast to check official e-mails after normal working hours.

Lessons Learned

The primary question resulting from the project is, "What can be learned?" Regular communication, proper planning, proper documentation, physical inspection, follow-through, and knowing the end user were vital to the success of the projects. Most of the difficulties encountered were preventable through the application of these principles.

Communication

Regular, reliable e-mail communication is important. Senders should ensure receipt of e-mails by requesting a reply or calling on the telephone after sending a message. Also, since much of the information in an e-mail can get "lost in translation," verbal communication is vital to success. Telephone calls, face-to-face meetings, and teleconferences help explain e-mails and ensure the dissemination of accurate information. The best way to communicate is in person. The DCE traveled to YPG at least once per quarter to speak face-to-face with all parties involved. Meeting people this way helps establish good relationships; it is hard to ignore someone who is in the same room.

The projects in Yuma would have never been completed on time or to the satisfaction of USASOAC without regular team meetings. Meetings, via conference call or in person, provided a great means of ensuring that everyone was on the same page, that project details were discussed, and that tasks were not forgotten. Taking notes during meetings and disseminating the notes to all participants provided

(continued on page 51)

Revolutionizing Surveying Capabilities:

Unlocking New Potential With the Global Positioning System

By Mr. George H. Ohanian and Dr. Christina M. Bates

Traditional Survey Methods

Since the earliest times in our Nation's history, the ability to accurately and quickly survey and assess land has proven instrumental in enabling the acquisition and sale of land, the rise of local economies, and the free flow of commerce across what eventually became state boundaries. Migrations from the eastern to western United States relied in part on the fact that land could be accurately plotted and segregated for ownership using survey methods. However, as would be expected, these early survey methods were largely manual in nature, time-consuming, and prone to error. For example, early survey methods for both horizontal (latitude and longitude) and vertical (elevation) positioning required a clear line of sight from one observation to the next. Therefore, surveyors and their assistants invested years to develop a network of positioning survey marks that ultimately spread across the United States. The network continued to grow over time, reaching more than 850,000 positioning survey marks, and is now part of the National Spatial Reference System.

GPS-S controller

New Potential for Survey Methods

Despite the vast network of positioning survey marks, surveyors were still bound by the requirement of a clear line of sight from one survey observation to the next. These limitations endured until the advent of the global positioning system (GPS) in the late 1970s. Developed and launched by the U.S. military in 1978, GPS represents a literal constellation of 24 navigation satellites, positioned 11,000 miles above Earth, that continuously transmits radio signals. These signals enable accurate geographic positioning on Earth.

Before long, GPS use expanded well beyond military applications, but concerns about accuracy endured. In response, scientists developed a more accurate form of GPS, known as differential carrier phase positioning. This form of GPS enabled the determination of the positions of two stationary GPS receivers relative to one another. While limited by stationary requirements, this new form of GPS eliminated the need for line of sight and enabled the surveying of distances as great as hundreds of kilometers in just hours, as compared to weeks or even months using earlier methods (depending on the size and composition of the land being surveyed).

While this new form of GPS freed surveyors from line-of-sight limitations, its accurate application was limited in that the GPS receivers needed to remain stationary and only two GPS receivers could be engaged at a given time. To address these limitations, scientists began developing kinematic methods to process GPS data. Kinematics refers to the branch of mechanics concerned with the motion of objects (without reference to the forces that cause the motion). These methods ultimately enabled accurate positioning, within centimeters in some cases, even when one of the GPS receivers was in motion.

GPS-S-9367

A Cutting-Edge Capability to Support Army Engineers

Building upon decades of advancements in GPS technologies, the Global Positioning System–Survey (GPS-S) enables Army units to perform several types of survey missions, including—

- Reconnaissance.
- Construction stake-out and as-built surveys.
- Airfield surveys.
- Precise survey control relative to World Geodetic System 84.
- Establishment of control points for engineering, construction, field artillery, air defense, and intelligence.

GPS-S is managed by the Product Director Combat Terrain Information Systems (PD CTIS), a subordinate command of Project Manager Terrestrial Sensors. The mission of PD CTIS is to manage the total life cycle of capabilities that collect, disseminate, store, analyze, enhance, and improve data that is used in mission planning, design, construction, and topographic/hydrographic survey operations. The GPS-S system allows engineer teams to perform precision construction and topographic and hydrographic surveys using signals from several global navigation satellite systems to enable efficient and timely construction and construction management decisions. These systems include the current GPS, *Globalnaya Navigatsionnaya Sputnikovaya Sistema*, and the European Galileo global navigation satellite systems that support GPS-enabled survey equipment to ensure centimeter level accuracy in all surveys.

GPS-S uses encrypted U.S. military GPS signals in accordance with Department of Defense policy, which does not make these signals available to commercial survey equipment. Each GPS-S includes one reference station and two rover stations. The reference station will have the capability to receive and collect GPS data and compute and transmit real-time kinematic (RTK) differential survey and local area differential GPS corrections. The rover stations have the capability to receive and collect GPS data and receive and apply RTK corrections. The reference station is also capable of operating as a rover station to ensure redundancy within the system. The system includes a perpetual software license and associated support equipment that allows the end user to upgrade and maintain the following components:

- Tripods.
- Survey poles.
- Transit cases.
- Carrying bags.
- Cables.
- Battery chargers.
- Software installation/upgrade kit.
- Spare batteries for extended field operations.
- Transport cases to protect the equipment.
- Tools to calibrate and maintain the equipment in the field.

System Accuracy and Security

The accuracy and security of the GPS-S are critical, so it is equipped with selective availability antispoofing modules that allow operations in degraded and contested environments that are being spoofed or jammed. The GPS-S can operate in keyed and unkeyed modes to address operational needs. Once in keyed mode, the GPS-S antispoofing capability allows surveyors to continue surveying activities to complete their mission. Additionally, the GPS-S was specifically designed with a modular architecture that allows it to leverage and adopt current and future spoofing and jamming capabilities. This architecture improves security, reduces vulnerability, and allows continuous survey operations in degraded conditions.

The GPS-S is fully interoperable with the currently fielded Instrument Set, Reconnaissance and Surveying capabilities and the line-of-sight Army Integrated Survey Instrument (together known as *Total Station*). This interoperability allows for the seamless collection and processing of survey data within the family of systems that support combat engineers and surveyors and construction units without requiring additional hardware or software.

Further, the GPS-S has an embedded, switchable radio that allows it to communicate between the bases and rovers and with the currently fielded machine controls used on heavy equipment. The radios were designed and approved to be used in the continental United States and abroad. Unlike other commercial survey systems, the embedded radios, antispoofing receiver, and other components of the controller reduce cabling, standardize batteries, decrease setup time, and reduce overall maintenance.

Fielding of GPS-S

Fielding of the GPS-S was scheduled to start in late 2017, with the initial fielding to the Maneuver Support Center of Excellence, Fort Leonard Wood, Missouri. During this fielding, PD CTIS would provide new equipment training to the center community, which represents a combined audience of multiple Services. (The Army is the lead proponent for providing joint survey training to all Services). After the fielding to the Maneuver Support Center of Excellence, PD CTIS will begin fielding GPS-S to survey units and provide associated new-equipment training

Mr. Ohanian is the PD CTIS and serves as the chief of the Systems Acquisition Branch, U.S. Army Geospatial Center, U.S. Army Corps of Engineers. He holds a bachelor's degree from the University of Maryland and a graduate degree from George Washington University and is Defense Acquisition Workforce Improvement Act Level IV-certified in project management.

Dr. Bates is the managing director of C. M. Bates Consulting. She supports various organizations within the Army acquisition and research, development, and engineering communities as a strategic analyst, planner, and communications expert. She holds a bachelor's degree from Boston College, master of science and doctor of law degrees from Boston University, and a doctorate in communication from Arizona State University.

("Desert Construction," continued from page 48)

everyone with a record of the discussions and made it easy to update the commander about the project status. Physical records and notes ensured that everyone left the meetings with the same picture of the way forward. The ability of the DCE to reference notes and e-mails ensured that other agencies took responsibility for their assigned tasks. This helped prevent contractors and USACE from billing USASOAC for their mistakes on more than one occasion.

Follow-Through

The most important aspect of the construction projects was follow-through. It should be possible to trust that everyone working on a project is doing the right thing, but tasks can still be forgotten or ignored. Early during the construction of the hangar and first sunshade, the drawings for the second sunshade remained incomplete. Several months earlier, USASOAC had requested that USACE begin working on the designs; but USASOAC did not follow through, and USACE did not work on the drawings for several months. Both organizations subsequently forgot about the drawings, and there was a scramble to complete them in time for funding approval. Better follow-through from both parties would have prevented this problem.

Another key factor to success was knowing the end user. The UFC commander asked for many changes to the projects, but a knowledge of the actual requirements versus requests helped keep the change orders to a minimum. In addition, problems always crop up during projects. But awareness of the USASOAC commander's notification criteria kept the project running smoothly without any unnecessary explanation of project details. Informing the commander about every detail and problem that arose would have unnecessarily overwhelmed him.

The DCE was the lynchpin that held the entire venture together. The original plans changed considerably throughout the 2 years of the project, but persistence and hard work ensured success. Through all the problems, the requests for changes, and the coordination with the different elements, the DCE found a way to keep the project running.

Acknowledgement:

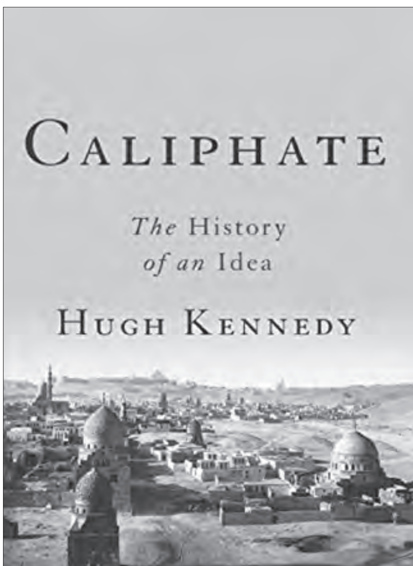
Special thanks to Dr. George Ford, Graduate Program Director for Construction Management, Western Carolina University.

Captain Walton serves as the deputy operations officer/chief of operations for the 18th Military Police Brigade at Grafenwoehr Training Area, Germany. He is a graduate of the Engineer Captains Career Course and the U.S. Army Basic Airborne Course. He holds a bachelor's degree in construction engineering and management from North Carolina State University and a master's degree in construction management. He is a certified project management professional and an engineer intern.

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 <https://www.milsuite.mil/book/groups/usaes-commandant-resource-menu>. 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 are a feature in each issue of *Engineer*. Authors of book reviews summarize the contents of books of interest and 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>. Books for review do not need to be selected from the reading list.



Caliphate: The History of an Idea, by Hugh Kennedy, Basic Books, 11 October 2016, ISBN-13: 978-0465094387

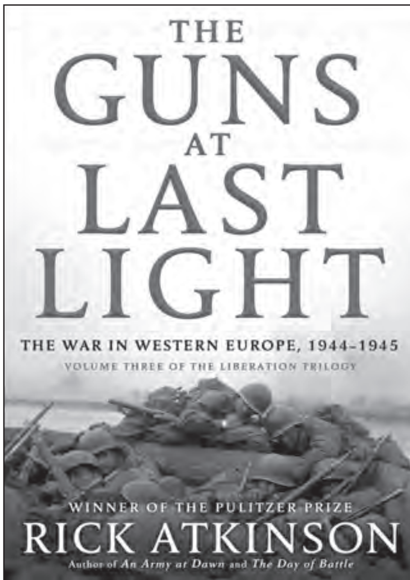
Reviewed by Captain Dale C. Braxton

This book contains an intriguing historical account that traces the lineage of the powerful concept of the caliphate from its inception to its modern manifestations. As Hugh Kennedy explains, "In order to understand the Islamic State's idea of caliphate and why it should prove relevant and important to many, we have to understand its roots deep in the Muslim tradition." Kennedy explores the historical connotations of the office and strives to draw a parallel between past Muslim concepts of the position to its present day existence in the Islamic State of Iraq and the Levant (ISIL). The text breaks down the idea of a caliphate by historical dynasties and explains how the legacy and contributions of each dynasty shaped the modern geopolitical climate. The text vividly describes the rise and fall of the dynasties, their struggles with the office, their achievements during their reign, and the way their contributions are being used in modern times to portray a romanticized view of Islamic warfare.

From its use of the traditional black color scheme on banners and attire, which was adopted during the Abbasid era, to its espousal of the tradition of *bay'ah,* which signifies allegiance to an individual as the caliph, ISIL appears to use the concept of a caliphate to justify some of its barbaric and violent actions. These actions are viewed by many as a repetition of past atrocities committed during the Islamic Golden Age, traditionally dated from the 8th century to the 13th century. The book begins with the explanation of the idea of a caliph, or God's deputy on Earth, and culminates by correlating the flexibility of the concept with the way ISIL uses the idea to legitimize its political and religious power over the Arab world today. From the selection of the first caliphs after Mohammed's death (which undoubtedly set the tone for the way later dynasties would struggle for power, determine the powers held by the position, and create the division of the Sunni and Shi'ite Muslims) to the current claim that Abu Bakr Baghdadi is to be the next caliph, ISIL is indeed attempting to revive an ancient conception, which some would argue is a perversion of Islam.

Kennedy does a marvelous job of breathing life into a historical text that encompasses centuries of historical incidents, while setting the tone to make historical connections between past occurrences and the ideological movement that is unfolding in the present day Middle East. This text is a must-read for those who wish to understand the effects that past caliphates have on the ever-growing movement we see today.

Captain Braxton is the commander of the 74th Multirole Bridge Company, Fort Hood, Texas. He is a graduate of the U.S. Army Air Assault Course, the U.S. Army Airborne School Basic and Advanced Airborne Courses, the Sapper Leader Course, the U.S. Army Ranger School, and the Defense Support of Civil Authorities Phase II Course. He holds a bachelor's degree in mechanical engineering from Auburn University.



The Guns at Last Light: The War in Western Europe, 1944–1945, by Rick Atkinson, Henry Holt and Company, 2013, ISBN 978-1-2500-3781-7

Reviewed by Colonel Martin Dale Snider

The hundreds of bombers overhead sounded like bees in the ears of those on the ground and darkened the midday sky as young Airmen flew on their way to pummel cities just a few miles ahead. By the dozens, American and British soldiers clung to the sides of Sherman and Challenger tanks streaming to the heartland of Germany to put an end to the war. Rick Atkinson paints remarkable detail of the scenario in broad, colorful swaths, through individual accounts and by capturing the movements of great armies across expansive terrain.

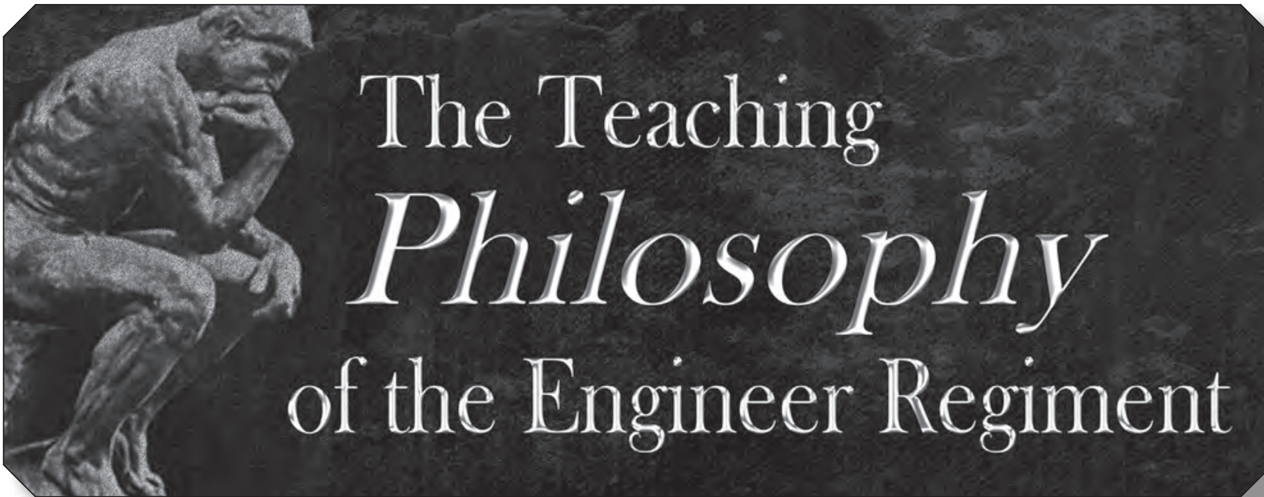
Mr. Atkinson, bestselling author of military history and senior editor of the *Washington Post* for more than 20 years, has accumulated many awards, including Pulitzer Prizes for history and journalism. *The Guns at Last Light* completes his World War II trilogy, which began with *An Army at Dawn* and continued with *The Day of Battle*.[1,2] It seems that little escapes his telling. For instance, he describes General Dwight D. Eisenhower's habit of smoking 90 cigarettes a day and details the Supreme Commander's deteriorating health from stress and lack of sleep. He provides details of privates and officers alike, carrying out their orders at the knife's bloody edge of battle. Mr. Atkinson reveals the human menagerie as it emerges from water's edge at Normandy and surges through Europe in fits and starts, through heroic, cowardly, faithful, and sometimes whimsical perpetual motion. He begins the story in England, as the Allies prepare for beach assaults on Normandy and southern France. He reveals the Allied leader's frustrations and compromises as the Allied armies formulate what will become Operation Overlord. As their plans unfold, equipment, supplies, men, and anxiety mount in England. Operation Overlord became the greatest air, land, and sea attack in history. In preparation for D-Day, hundreds of assault boats were built, hundreds of rehearsals were performed, and tons of supplies were gathered. Units organized, and the host country became uneasy as the youth of America descended on British soil. Mr. Atkinson describes vivid accounts of men on the march—all of whom had a single purpose: to race toward the German Fatherland and destroy the evil within.

Mr. Atkinson candidly describes America's shortcomings. He tells how the country was woefully unready for war in 1943–44. Generalship at the highest levels was too often found wanting. Soldiers were poorly organized and inadequately equipped. But America's industrial might and adaptability steadily improved despite initial failures. Throughout the narrative, he tells how U.S. industry rapidly uncoiled to raise production levels and sustain them at heights unequaled by any other industrial nation during the war or for decades after. America began June 1944 with 3.5 million Soldiers, more than 2,000 tanks, 13,000 planes, and 5,333 ships. By the spring of 1945, it had more than 8 million men in uniform and was producing 50,000 planes per month. America's industrial machine allowed adaptations of equipment and then massed that equipment on the battlefield in quantities that the Axis powers could not keep up with. In June 1944, the U.S. Army Air Force launched 37 sorties for every one by the German *Luftwaffe*.

The author occasionally provides a wide-lens view of America's greater challenges, which is helpful in providing the reader with context. By early 1945, America was working to close down the war in Europe and was starting to turn its eyes toward Japan. By the time Germany surrendered in May 1945, America had already made significant advances toward mainland Japan. Mr. Atkinson provides an inside look at the power struggles between U.S. President Franklin D. Roosevelt, Russia's General Secretary Joseph Stalin, and British Prime Minister Winston Churchill. Their competition over occupation lands and jockeying for postwar alliances dominated their thinking, with each leader struggling to advance his own position. All three men knew that America was nearing completion of the atom bomb. What they did not know was that its use against Japan would tip the global scales of power toward the United States for more than 60 years.

Mr. Atkinson struggles to keep the reader on track from time to time. Clarity is occasionally lost as he leaps from individual stories and firsthand accounts to grand descriptions of the U.S. Army's movements across the battlefield. For example, he recounts "The windows are exploding, the

(Continued on page 56)



The Teaching *Philosophy* of the Engineer Regiment

By Staff Sergeant Eric T. Bailey

Serving as an instructor can be one of the most gratifying assignments in the Engineer Regiment. It provides the opportunity to shape and mold the next generation of Army engineers, who are highly motivated warfighters from all walks of life. Instructors have the potential to make a positive, lasting impact on the students who will fill the ranks of the Engineer Regiment. There are numerous techniques and methods of instruction that can be used to meet this challenge. This article focuses on three of them:

- Collaboration.
- Reflection.
- Student-centered instruction.

Understanding and successfully integrating these three methods enable instructors to produce the best engineers the military has to offer. Success is not measured by how well the instructors know their profession, but by how well they tap into the skills needed to cultivate a learning environment that extends beyond the classroom.

Collaboration

The engineer profession is risky business, even in the best of circumstances. By the time Service members are on assignment to be instructors, they have several years of military experience under their belts and should know that the success of a unit is not based on any single individual, but on the group. Students may not be familiar with group dynamics, with what it means to be part of a team, or with the importance of communicating with others. Engineering requires collaboration, which starts

An instructor monitors a student who is attempting his first surface weld.

A student begins to secure a flange at the aquatic training facility.

with the planning phase, continues through the execution phase, and ends with the recovery phase. Instructors should not expect students to automatically know how to collaborate. Rather, they should start by introducing the concept in the classroom instead of waiting until the students are performing an exercise in a field environment. Collaborative learning helps students understand the technical information that is presented.

Everyone brings something, such as prior knowledge or experience, to contribute in the classroom. The information that students learn in the classroom does not stem only from what instructors teach them. Instructors must make a conscious effort to learn who their students are and where they come from. Instructors should have the students share the experiences they had before they came to the school and urge them to connect those experiences to the lessons they are learning. This initial connection is associated with several benefits; it—

- Illustrates how students can tie their lessons to earlier experiences.
- Shows students that their experiences have value.
- Provides opportunities for students to share their thoughts with others, which leads them to think critically and avoid automatically accepting their lessons at face value.

The *Think-Pair-Share* technique promotes collaboration. Using this technique, the instructor poses a question to the students and asks them to think, then write down their answers. It is important that they write down their answers because this reinforces what they are thinking and forces them to commit to an answer. Then students pair up with a classmate to share their answers. The two-person conversation makes the exercise easier for those who are not comfortable talking in larger groups. It often reinforces what the students originally thought, thus making them more comfortable with sharing their thoughts with a larger group—or it might signal that their answers are off target, which provides their partners with a teaching moment. Finally, students are asked to share the conversation they had with their partners with the group. The exercise shows that competence is important, but that developing the ability to communicate, share, and teach is even more important.

Reflection

Reflection can be compared to the Army method of conducting after action reviews. Reflection can be conducted in large groups or performed individually. The *1-minute paper,* a form of reflection, is a quick, easy method of interactive instruction that can be employed anywhere. The instructor asks students to anonymously write down at least one thing they learned that day and pose one question they have about the material. The instructor reviews what the students wrote, then devises a game plan to tackle any misconceptions revealed by the questions. Using this approach requires that every student participate, allowing the instructor to gauge the students' level of understanding. This also allows students to remain anonymous and avoid any possible embarrassment for asking what they may fear are silly questions.

Another example of reflection takes place in a larger setting, where students share information with the entire class. The instructor takes notes throughout the day about subjects and activities on which the students could improve. When it comes time for reflection, the instructor is not responsible for leading the period of reflection, but facilitating it. The instructor holds the students responsible for comparing what was supposed to happen to what actually happened and then discussing how to make improvements. Students should commit their thoughts to paper before they share with the larger group. While the students are sharing, the instructor should listen for any misconceptions (to stop the spread of misinformation), while crossing topics off the list as they are mentioned. If there are items that have not been crossed off when the students are finished, the instructor should intervene with brief, pointed comments. By reversing roles, the instructor empowers the students, making them responsible for their own learning. At the end of a long day, students are likely to be more engaged when listening to their peers than their instructor, who has probably been talking to them all day. The final step for instructors is to ask for questions. This ties in well with collaboration and gives students the opportunity to find their own solutions.

Student-Centered Instruction

Lecturing is important, and it has its place; however, it should be used sparingly and along with other methods of instruction. Any time an instructor is the one who is talking, the learning is not student-centered. Many of the engineering fields are technical and full of procedural material, but that only means that instructors need to think of creative ways to educate students. One way to implement the student-centered method of instruction is to direct students to read the material that will be covered the following day. While the students are reading, they should come up with their own questions about any material that is unclear or about information that they would like to have explained in greater detail. As students pose their questions the next day, the instructor should invite others in the classroom to answer the questions. If there are no takers, the instructor can step in to shed some light. After all questions have been answered, students should be allowed to start on their homework. The instructor should remain available to answer questions. Students should be allowed to take responsibility for their own learning. When they show up in class with questions, the instructor knows exactly what topics to be addressed and can avoid wasting time on material the students already know. If anything in the lesson has been neglected, the instructor can create a small quiz that covers the material that wasn't discussed. This technique keeps students on their toes and makes them realize that they should not neglect information that was not covered in class. This may require that the instructor spend more time in preparation; but when it comes time to teach, the instructor should be able to operate more as a facilitator and less as a lecturer who repeats what is already written in the student guide.

Conclusion

Instructors never have enough time to hone all the facilitation skills that are required to teach. The small list of examples of instruction and facilitation techniques presented in this article should provide some insight that instructors can use inside and outside of the classroom. The intent of this article is to show instructors how to get students more involved in their learning. This teaching philosophy represents but a small portion of what I have learned as an instructor at the Naval Diving and Salvage Training Center, Panama City, Florida, and the Cadre Faculty and Development Course, Fort Knox, Kentucky.[1] By incorporating collaboration, reflection, and student-centered instruction into the learning environment, instructors in the Engineer Regiment are doing their part to produce the very best engineers the military has to offer.

Endnote:

[1]The Cadre Faculty and Development Course at Fort Knox is a pilot program for senior commissioned and noncommissioned officers to study organizational learning and leadership while earning college credits from the College of Education and Human Development, University of Louisville.

Staff Sergeant Bailey serves as an instructor-writer for Company A, 169th Engineer Battalion, at the Naval Diving and Salvage Training Center, Panama City, Florida. He is a graduate of the Cadre Faculty and Development Course and has been awarded the Senior Instructor Badge. He is working toward a bachelor of science degree in organizational leadership and learning from the University of Louisville.

("Book Review," continued from page 53)

floor is shaking, we are choking in the smell of gunpowder. She piled her children and mattresses onto a horse cart and fled inland… Allied planes swaddled the bombardment lanes with white smoke to blind German gunners."

Mr. Atkinson is skilled at guiding the reader through engaging accounts of the official correspondence of the greatest leaders of the Axis and the Allies, as well as more intimate personal accounts. For example, General Eisenhower's personal assistant, Captain Kay Sommersby, wrote in her journal: ". . . E. is very depressed. . . . E. worried because Monty has stopped going. . . . E. does not feel well, high blood pressure. . . . E's waspish mood is truly vile. . . . Beetle (General Walter Bedell "Beetle" Smith) was positive that he was on the verge of a nervous breakdown."

The Guns at Last Light is a five-star account of the best and worst of mankind at war. This book is engaging in its realistic descriptions; readers may have a strong desire to read it in a single sitting.

Endnotes:

[1]Rick Atkinson, *The Army at Dawn: The War in North Africa, 1942–1943*, Holt Paperbacks, New York, New York, 15 May 2007.

[2]Rick Atkinson, *The Day of Battle: The War in Sicily and Italy, 1943–1944*, Henry Holt and Company, New York, New York, 2 October 2007.

Colonel Snider is the commander of the 1st Engineer Brigade, Fort Leonard Wood, Missouri. He holds a bachelor's degree in geography from Texas Tech University and a master's degree in construction management from Texas A&M University. He is a graduate of the Engineer Officer Basic Course, the Field Artillery Officer Advanced Course, the U.S. Army Airborne School, the U.S. Army Air Assault School, the Combined Arms and Services Staff School, the U.S. Army War College, and the Command and General Staff College.

Engineer Brigades Continue To Execute the Army Total Force Policy

By First Lieutenant Timothy A. Cope and Chief Warrant Officer Three Stephen A. Ahrens

In September 2012, then Secretary of the Army John M. McHugh signed Army Directive 2012-08, *Army Total Force Policy*. In it, he challenged Regular Army and Reserve Component units to train together. He placed emphasis on ". . . collective training of tactical-level organizations, including for those organizations that will routinely deploy as multicomponent forces . . .."[1] Engineer companies and detachments assigned to engineer brigades fall into the category of organizations that routinely deploy as multicomponent forces.

The 16th Engineer Brigade, Ohio Army National Guard, and the 20th Engineer Brigade (Airborne), Fort Bragg, North Carolina, regularly seek opportunities to train tactical organizations. During the summer of 2016, firefighting detachments and engineer support companies (ESCs) from both brigades trained together in Ohio and Pennsylvania which served as a great opportunity to share skills across components.

Firefighter Detachment Training

The combined firefighting training event took place during the Ohio Army National Guard annual training cycle, 15–20 July 2016, at the Ohio Fire Academy, Reynoldsburg, Ohio, with the 295th, 296th, and 5694th Firefighting Detachments from the 16th Engineer Brigade and the 513th Firefighting Detachment from the 20th Engineer Brigade participating. The training consisted of classroom instruction by academy staff; search and rescue techniques training; live-burn training; and scenarios that included aircraft, structure, and vehicle fires and rescues. Firefighting detachments are small organizations consisting of just seven Soldiers. Members of Military Occupational Specialty 12M–Firefighter, make up a small, close-knit community. Some unit members know each other

A Soldier from the 945th ESC tends a concrete mixer as other Soldiers prepare a crater with a high-mobility engineer excavator.

from advanced individual training, oversees deployments, or prior training events.

During firefighting operations, the firefighters were trained on properly dispatching to an emergency. They also responded to vehicle fires and vehicle crashes. In these scenarios, firefighters were required to properly extract victims from the vehicles while stabilizing the casualties. Using hydraulic cutters, firefighters quickly evacuated casualties and rendered first aid. A noncommissioned officer from the 296th Firefighting Detachment described the overall training tempo and requirements of the exercise, stating that working with another team allowed firefighters to share their experiences and techniques, tactics, and procedures. He said that working together was beneficial for both organizations and that he hoped to train with another Regular Army element in the future.

During the three structure fire scenarios, firefighters rescued numerous victims from a three-story building. Search and rescue teams searched through pitch black, smoke-filled rooms that reached temperatures of over 1,000°F. Ladders were deployed to the second floor to retrieve casualties. A Soldier from the 513th Firefighting Detachment noted that carrying the combined weight of firefighting gear and a victim made for a demanding task. All of the teams worked in unison to battle the fire and save victims, with each Soldier playing an active part in the scenarios.

The 295th Engineer Detachment station chief supervises vehicle extrication training by an Army firefighter using hydraulic cutters.

Everyone agreed that the most difficult portion of the training was the downed C-130 aircraft scenario. Working through the night, the firefighters had little time to search for survivors while dealing with the fire from aircraft fuel. Managing the site was chaotic, with personnel performing numerous tasks. Firefighting team leaders used the Incident Command System to control the scenario and ensure safety. Truck placement, fire hose positioning, water tender operation, rescue techniques, and accountability were some of the individual tasks built into this collective training event. The Ohio Fire Academy staff maintained the integrity of the firefighting training throughout the scenario. One member of the 295th Firefighting Detachment said that the best part of the entire exercise was the opportunity to work alongside an active duty detachment. He said that the cooperation and mutual understanding of the firefighting elements led to better training because of the team effort by Regular Army and National Guard units.

Engineer Support Company Training

The 945th ESC, Ohio Army National Guard, and the 618th ESC (Airborne), Fort Bragg, trained on culvert and rapid runway repair from 11 to 26 June 2016. The 945th ESC was strong at culvert repair, but weak on rapid runway repair; conversely, the 618th ESC was strong on rapid runway repair, but weak on culvert repair. To gain proficiency in rapid

Soldiers of the 945th ESC conduct rapid runway repairs at Fort Indiantown Gap.

Soldiers from the 945th ENC and 618th ESC (Airborne) mix concrete to cap off the crater repair at the bottom left of the photograph.

runway repair, a platoon leader from the 945th ESC traveled to Fort Bragg months ahead of the scheduled collective training to observe training there. He observed the materials and equipment used during a full rehearsal of rapid runway repair by the 618th ESC. Upon return to Ohio, he prepared a list of necessary equipment and materials and the 945th ESC began planning the training for the upcoming annual training period. In turn, the 618th ESC sent one platoon to work with the 945th ESC to support Army Total Force Policy training in June.

The rapid runway repair training was conducted at Fort Indiantown Gap, Pennsylvania. A platoon from each company performed the following tasks in daylight and in limited visibility:

- Stone and grout repair.
- Concrete cap repair.

The units also shared equipment to minimize training equipment purchases and transportation costs. The 618th ESC provided repair-specific equipment such as anchor drills, drill bits, and anchors, while the 945th ESC provided the heavy engineer equipment, such as the Interim Engineer High-Mobility Excavator. Culvert repair training took place at Camp Ravenna Joint Military Training Center, Ravenna, Ohio. The companies repaired two washed-out culverts by excavating the unserviceable culvert, placing a new culvert, backfilling, compacting, and grading the roadway.

Unit Impressions of the Army Total Force Policy in Action

The combined efforts of the firefighting detachments allowed efficient and effective training to take place. Members of both units had only positive things to say about the overall training and expressed eagerness to participate in future combined training events. The detachment leaders credited the success of the training to the hard work and collaboration of Soldiers in each component.

The specific skill sets that each ESC possessed before conducting the combined training allowed the Army Total Force Policy to showcase the benefits that a partnership can bring. Each unit provided the other with technical training on key collective tasks that were important to their commanders. The units also developed a relationship that will result in future idea sharing and collaboration that did not exist before. Overall, the Army Total Force Policy training was a success and the units look forward to the next opportunity to train together.

Endnote:

[1]Army Directive 2012-08, *Army Total Force Policy*, 4 September 2012.

First Lieutenant Cope is the commander of the 945th ESC, 112th Engineer Battalion, 16th Engineer Brigade, Ohio Army National Guard. He is a graduate of the Engineer Basic Officer Leader Course and holds a bachelor's degree in organizational management from Ashford University.

Chief Warrant Officer Three Ahrens is the commander of the 5694th Engineer Firefighter Detachment, 112th Engineer Battalion, 16th Engineer Brigade, Ohio Army National Guard. He is a graduate of the Warrant Officer Advanced Course and holds a bachelor of science degree from The Ohio State University.

U.S. GOVERNMENT PRINTING OFFICE
KEEPING AMERICA INFORMED

PUBLICATION AND SUBSCRIPTION ORDER FORM

Order Processing Code: **3509**

Easy Secure Internet: **bookstore.gpo.gov**

Toll Free: 866 512–1800
DC Area: 202 512–1800
Fax: 202 512–2104

Mail: U.S. Government Printing Office
PO Box 979050
St. Louis, MO 63197–9000

Publications

Qty	Stock Number	Publication Title	Price	Total Price
			Total for Publications	

Subscription

Qty	List ID	Title	Price	Total Price
	708-023-00000-1	The Engineer Professional Bulletin	$24.00	
			Total for Publications	
			Total Cost of Order	

Prices include regular domestic postage and handling and are subject to change.
International customers please add 40%

Personal name (Please type or print)

Company name

Street address

City, State, Zip code

Daytime phone including area code

Fax or e-mail

Please return order form with payment

Check Method of Payment:

❑ Check payable to Superintendent of Documents

❑ SOD Deposit Account

❑ VISA ❑ MasterCard ❑ Discover/NOVUS ❑ American Express

(expiration date) ***Thank you for your order!***

AUTHORIZING SIGNATURE 10/07

Thank you for your interest in U.S. Government Information. ALL SALES ARE FINAL.

ENGINEERS' CREED

As a Professional Engineer, I dedicate my professional knowledge and skills to the advancement and betterment of human welfare.

I pledge—

- To give the utmost of performance.
- To participate in none but honest enterprise.
- To live and work according to the laws of man and the highest standards of professional conduct.
- To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with the need for divine guidance, I make this pledge.

Adopted by National Society of Professional Engineers, June 1954

PIN: 201145-000