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FEATURES

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DEPARTMENTS

The Engineer Doctrine Update is now available online at: <https://home.army.mil/wood/application/files/8916/3891/7300/EN_Doctrine_Update.pdf>.

Clear the Way

COLONEL JOSEPH C. "CLETE" GOETZ II
100th Commandant, U.S. Army Engineer School

"It is safe to say that no Army has ever had an excess of engineer troops. The demands upon them have invariably been greater than their capacity."
– P. S. Bond[1]

It is a tremendous opportunity and privilege to serve the Engineer Regiment as its 100th Commandant. The past 6 months have reaffirmed for me that we have tremendous Soldiers and dedicated Army civilian professionals. Combined with our allied and partner nation students, alongside whom we train, I'm convinced that the world's best military engineers are trained at Fort Leonard Wood, Missouri.

This position comes with a front row seat from which to witness the changes taking place in the Army and in our Regiment in preparation for the demands of conflict in 2030 and beyond. I have spent many hours considering our future force structure, the equipment we must field between now and 2040, and the way we must shape our leaders so that the second lieutenants and enlisted engineers of today will be successful battalion commanders and sergeants major in the Army of 2040.

Not coincidentally, we are blessed with a fantastic engineer museum at Fort Leonard Wood. A visit to our past gives us insights to our future, and I am convinced that the nature of what our Army has asked us to do, from 1775 to today, has never changed—and that it never will. It is the way that we provide our support, the character of our profession, that is always changing. Professionals dedicate themselves to advancing the collective body of knowledge and practice for the good of the Nation. That's what we do here and in our units across the force.

The unchanging nature of the Engineer Regiment is characterized by our three interdependent disciplines of combat, general, and geospatial engineering that, when focused through the power of the Engineer Regiment and the U.S. Army Corps of Engineers, enable us to provide support along our four enduring lines of effort, which are—

- Assure mobility.
- Enhance protection.
- Enable force projection and logistics.
- Build partner capacity and develop infrastructure.

These lines of effort and what they provide to the joint force are enduring. There's no future in which the Army and joint force will not require these capabilities of us.

As the character of war changes, what will change is *how* we deliver those lines of effort. Large-scale ground combat operations (LSCGO) in the five domains and three dimensions of a multidomain environment demand that the Army remain agile; converge effects; and endure, for extended periods over tremendous depth, from the homeland to the objective. Our Regiment must adapt in order to protect and enable Army and joint operations in new ways.

As in nature, these adaptations will not happen overnight. What we start now will likely be up to the 110th Commandant to finish, but we have started. In training and leader development, we're modernizing our programs of instruction to account for the demands of LSCGO. Students will spend more time learning to apply our tools in a LSCGO environment. For example, prior to arriving for the Engineers Captain's Career Course, officers will virtually complete many of the U.S. Army and Training and Doctrine Command core requirements, allowing us to spend more time focusing on the craft of military engineering during the course. Our doctrine will evolve. The publication of Field Manual (FM) 3-0, *Operations*,[2] provides the impetus for us to reconsider and recast the character of the Regiment requirements set forth in FM 3-34, *Engineer Operations*.[3]

The most obvious changes in the Regiment will occur in the areas of organization and materiel. Engineer 2030 Force, a package of six force development updates representing the most fundamental reorganization of engineers since modularity and the establishment of brigade engineer battalions, is currently in the final stages of Headquarters, Department of the Army, approval. Engineers in divisions will be division assets. The need for engineer brigade level command and control in the two reinforced armored divisions in order to execute wet gap-crossing operations will be recognized. Some of the overmodularity within our combat engineer formations will be rolled back. At the company level, every single redesigned formation will be more capable. These changes will come at a cost. They could result in Active Component reductions of positions due to reallocation in other Army branches, which may be most apparent at the battalion headquarters level. That which was true for P. S. Bond in 1916 remains true today; our Army will have no surplus of engineers, which makes our modernization vital.[4]

To prepare for the Army of 2030, we have maintained continuity of priorities within our portfolio. We must first resolve our terrain-shaping shortfalls. We have awarded the contract for our first of three tranches of new terrain-shaping capabilities. By 2030, we will have completed the activation of seven new-growth multirole bridge companies to partially mitigate a capability gap for our Army. The replacement for the mine-clearing line charge is in the early stages of development. We will have made continued strides in both getting sappers out of the breach in teleoperated equipment and in improving their safety with more-capable, better-protected combat vehicles.

This leads to the final consideration about the future of the character of our Regiment. It is time to reconsider the roles of engineers across our three components. The time-phased and at-depth skills required are different. Duplication of capabilities across components in a rotational force-generating Army gave us the depth we needed to endure 20 years of sustained conflict. The Regiment of 2030 and beyond will require some degree of specialization to provide the niche capabilities that the joint force will need over the depth of the extended battlefield. The requirements for LSGCO are, at once, too numerous and too substantial for the Regiment to fail to have all capabilities on hand.

I opened with a quote from P. S. Bond's book, *The Engineer in War*, published in 1916.[5] More than 100 years ago, Bond offered his thoughts on military engineering—and those thoughts resonate with many of his present-day contemporaries. His book covers subjects like road construction, military fortifications, and demolitions. Our nature has not changed and will not change. Engineers enhance and overcome the effects of terrain. As it was yesterday, it is today and will be tomorrow. Yet, our character must change. I'm excited to continue our discussion on the character of our Regiment when we meet for Engineer Week in April. Until then . . . *Essayons!*

Endnotes:

[1]P. S. Bond, *The Engineer in War*, McGraw-Hill Book Company, Inc., New York, 1916.

[2]FM 3-0, *Operations*, 12 October 2022.

[3]FM 3-34, *Engineer Operations*, 18 December 2020.

[4]Bond.

[5]Ibid.

Lead the Way

Command Sergeant Major Zachary R. Plummer
Regimental Command Sergeant Major

Greetings from the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri. Time passes quickly, and change is inevitable—but one thing remains consistent: Our great Regiment always provides the best support to our maneuver formations and solutions to our Nation's greatest challenges.

As is the norm, USAES experienced personnel turnover this past year, welcoming Colonel Joseph C. Goetz as the 100th Commandant and me as the 29th Command Sergeant Major. I am truly honored to serve you in this capacity and excited about the future of our Regiment. I look forward to supporting you and to meeting you as I circulate through the units.

Regimental Week is rapidly approaching. It kicks off with the 16th Annual Lieutenant General Robert B. Flowers Best Sapper Competition. Teams will report on 20 April 2023, and the competition takes place 22–24 April—with the awards ceremony scheduled for 25 April. Please encourage your sapper-qualified personnel to sign up and compete. We are seeking representation from all components and a total of 50 teams. Please come; visit Fort Leonard Wood; support our competitors; and participate in Regimental Week activities, which will culminate with the Regimental Ball on 28 April 2023. We look forward to seeing you.

In October 2022, the U.S. Army Training and Doctrine Command (TRADOC) implemented changes to the delivery of the Advanced and Senior Leader Courses at our three training sites—the Maneuver Support Center of Excellence (MSCoE) Noncommissioned Officer Academy (NCOA), Fort Leonard Wood; the 102d Training Division (U.S. Army Reserve), Fort Leonard Wood; and the 164th Regimental Regional Training Institute (U.S. Army National Guard), Bismarck, North Dakota. The significant changes apply to the MSCoE NCOA experience, which is now a two-phase experience. Phase 1 takes place in a virtual learning environment, where instructors teach students via Microsoft Teams© and testing occurs in the Blackboard© system. Then, students are required to quickly report to their respective training sites for the Phase 2 resident experience, as the time between phases is very short. The consecutive completion of the phases is crucial to the career progression of noncommissioned officers—particularly for those granted a temporary promotion. If a Soldier's professional military education requirement is not completed within the appropriate timeframe, then he/she reverts to his/her previous pay grade. It is prudent for Soldiers to attend schooling when scheduled; submission of a deferment or cancellation jeopardizes the career progression of noncommissioned officers.

Smartbook–Department of the Army (DA)–Pamphlet (Pam)–600-25, *U.S. Army Noncommissioned Officer Professional Development Guide*[1], has been updated, and it reflects a few significant changes. First, key developmental (KD) minimum time requirements changed from 18–24 months to 24–36 months. Second, security forces assistance brigade team advisor positions are not KD credit-producing positions. Last, with an additional six Military Occupational Specialty (MOS) 12Y50—Geospatial Engineer (senior sergeant) first sergeant positions in the Regiment as of 1 October 2022, first sergeant is now a KD requirement for 12Y50 Soldiers.

In conclusion, I encourage you to seek opportunities and venues to provide feedback to USAES and to let us know what we can do to better support you. An incredible team of uniformed and civilian professionals at Fort Leonard Wood is dedicated to supporting you and this great Regiment. I am absolutely amazed by all that you do and all that the team here does to continuously build on our great legacy as engineers, and I am very proud to be a part of it. From everyone here at USAES, thank you. *Essayons* . . . We will succeed!

Endnotes:

[1]Smartbook–DA–Pam–600-25, *U.S. Army Noncommissioned Officer Professional Development Guide*, 8 September 2017, <https://www.milsuite.mil/book/groups/smartbook-da-pam-600-25>, accessed on 8 February 2023.

Show the Way

Chief Warrant Officer Five Dean A. Registe
Regimental Chief Warrant Officer

Greetings from the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri.

As we continue to capitalize on warrant officer recruiting progress, which directly translates to improving the health of the engineer warrant officer population in all components, we now focus our efforts on U. S. Army warrant officer modernization initiatives. As the war for talent continues to engage the Army, we must continue to recruit for the warrant officer cohort. The ongoing warrant officer initiatives to modernize the Army cohort include several elements that build on one another to achieve a single solution of a stable, healthy warrant officer cohort postured for Army 2030.

To meet the personnel demands of Army 2030, the Engineer Regiment has adopted a warrant officer accession philosophy that is based on talent, skills, and potential, which is a deviation from previous determinations of eligibility based solely on rank and time in Service. In line with the new philosophy, the Engineer Regiment has revised the accession prerequisites standards for applying to become an engineer warrant officer in order to satisfy the Army goal of accessing enlisted personnel during the 5- to 9-year period of service. This will allow the Engineer Regiment to open the aperture for actual talent management and find highly qualified Soldiers who desire to become warrant officers earlier. This line of effort will *support Army readiness* and is in line with how we currently grant waivers at the Regiment and continue to seek out Soldiers who have acquired engineering skills through higher education or on-the-job training. Modification of the standards allows us to increase accession opportunities and tap into hidden talent earlier in order to develop the warrant officer skills and knowledge necessary to succeed in the Army of 2030 and beyond.

Altering the accession prerequisite standards will drive our warrant officer professional military education framework, as prescribed by the warrant officer modernization efforts. For us to *build world-class engineer* warrant officers, we can't continue to train and educate them the same way we do now. Since we are hoping to select candidates earlier in their military service, the Engineer Regiment will be required to evaluate what we train in our Warrant Officer Basic Course—and that will dictate that the training be focused on the deeper technical processes of both the construction and geospatial disciplines. Adding another touchpoint for our cohort at the chief warrant officer two level will normalize the frequency with which our warrant officers receive valuable technical training and doctrinal updates.

The last significant portion of the warrant officer modernization initiatives that will create pathways of success for our engineer warrant officers will be key developmental position updates to Department of the Army (DA) Pamphlet (Pam) 600-3, *Officer Professional Development and Career Management*,[1] and DA Pam 611-21, *Military Occupational Classification and Structure*.[2] New authorizations and other changes require that the Engineer Regiment maintain the grade balance in order to ensure a sustainable pyramid and the proper level of responsibility for warrant officer grades in each position based on the knowledge and skills required for the position. This will modernize how the Engineer Regiment develops warrant officers and eliminate the Industrial Age way of building warrant officers.

Finally, as I transition out of this position this summer, I want to thank everyone for their unwavering support for all of the new initiatives. Chief Warrant Officer Five Willie J. Gadsden has been selected to succeed me, and he will take the mantle as the 6th Engineer Regimental Chief Warrant Officer. It has been an absolute pleasure serving all of the fine professionals of the Engineer Regiment. As I move on to another assignment, I will always cherish my time at USAES, serving engineer warrant officers and the Engineer Regiment. *Essayons* . . . We will succeed!

Endnotes:

[1]DA Pam 600-3, *Officer Professional Development and Career Management*, 3 April 2019.

[2]DA Pam 611-21, *Military Occupational Classification and Structure*, 20 December 2022.

Using Open-Source Intelligence to Improve Readiness

By Lieutenant Colonel Michael P. Carvelli

The U.S. *National Security Strategy* states, "Russia now poses an immediate and persistent threat to international peace and stability,"[1] and this claim is further reinforced in the *2022 National Defense Strategy of the United States of America*, which states, ". . . Russia's government seeks to use force to impose border changes . . ..'[2] The second Russian invasion of Ukraine, on 24 February 2022, serves as a case study on the use of obstacles in countermobility operations as Russia attempts to consolidate gains in Ukraine. This case study provides an opportunity to improve military readiness through the use of open-source intelligence (OSINT) in the integration of adversary techniques.

Intelligence staff officers and noncommissioned officers can assist commanders and training officers in focusing training objectives through the use of OSINT, which refers to "relevant information derived from the systematic collection, processing, and analysis of publicly available information in response to known or anticipated intelligence requirements."[3] Potential sources of publicly available information include national media articles and social media platforms such as Twitter© and Facebook©. Without accessing classified systems, intelligence staffs at home station can systematically collect and analyze these sources to provide relevant adversary tactics, techniques, and procedures (TTP) for focused training objectives.

The use of OSINT and its dissemination to commanders and training officers provide opportunities to add to or update existing standard operating procedures (SOPs) since existing SOPs may not necessarily account for adversary TTP currently in use and may be outdated or fail to accurately reflect required time and resources. Integrating OSINT into home station training allows commanders to include relevant training objectives, update SOPs, and improve readiness.

Intelligence staffs at home station are often not as busy as they would be if they were deployed in support of operations or participating in combat training center rotations. The integration of OSINT into staff routines, including command and staff or training/operations meetings, improves the competence of the intelligence staff outside of deployments, combat, or high-operational training environments. For example, starting training meetings with an unclassified update derived from OSINT enables commanders to increase the relevance of the training. At the battalion level, the battalion intelligence officer and noncommissioned officer should lead the updates. To enhance the effectiveness of company level training meetings and ensure focus for home station training, enlisted intelligence analysts should provide updates for two reasons. First, more detailed analyses can help shape company mission-essential task training to maintain company level readiness. For example, brigade engineer battalion intelligence staffs can help shape training objectives for engineer; signal; military intelligence; chemical, biological, radiological, and nuclear; and sustainment formations in their battalions. Second, this approach creates a payback loop in which enlisted intelligence analysts improve their competence and capability in collecting, analyzing, and disseminating information on a routine basis instead of just during the normalized surges of combat training center rotations and deployments. Practicing the operations process, including the integration of OSINT, increases the readiness of staffs and hones skills that can atrophy.

Russia's second invasion of Ukraine serves as a case study for improving OSINT integration at home stations. With specific reference to engineer mobility training, Russia has been installing dragon's teeth—pyramidal concrete blocks designed to slow advancing vehicles—in Ukraine.[4] According to a Twitter post from the United Kingdom Ministry of Defence, Russia was in the process of preparing a defense in depth behind its front line in November 2022, likely attempting to forestall rapid Ukrainian advances.[5] This tweet was corroborated by another post, which included geolocation information showing the obstacle belt of trenches and dragon's teeth.[6] Using OSINT to describe Russian countermobility operations provides relevant, realistic opportunities to focus U.S. Army mobility training and update unit SOPs.

The use of dragon's teeth obstacles for training would provide several opportunities to hone valuable skills at home station. First, protective obstacles—specifically, concrete barriers—are mentioned a few times in Field Manual (FM) 3-34, *Engineer Operations*, but the manual does not provide much insight into their employment;[7] therefore, engineer companies could replicate these obstacles, enabling their own training on countermobility-related mission-essential tasks. Practicing the employment of dragon's teeth would help leaders become familiar with the time and resources required to create, move, and use them. Second, once constructed and emplaced, engineer companies could devise ways to breach these obstacles. Mechanical and explosive breaching methods could be used to reduce the obstacles, and engineer heavy equipment, including bulldozers, dump trucks, and bucket loaders, could be used to move or fill in the obstacles to create breach lanes; SOPS could then be created or updated. Last, leaders could capture information about the time and resources required and provide commanders with updated staff estimates for these operations.

Dragon's tooth concrete barriers

It is dangerous for us to assume that our adversaries will use obstacles described in U.S. military doctrine (for example, triple-strand concertina wire to train mobility tasks); instead, leaders need to correlate enemy doctrinal templates with relevant obstacles used by our adversaries. Maintaining focus on adversary methods will ensure that units are training on relevant objectives. OSINT can help provide adversary TTP.

Commanders must use time and resources available to meet required training objectives and maintain readiness. Army doctrine cannot possibly include every scenario and type of obstacle that engineer units could encounter in a combat environment. Integrating OSINT into routine training events ranging from weekly training meetings to combat training center rotations enables intelligence professionals to improve tactical and technical capabilities—and vice versa. The use of open sources to shape training events increases readiness and provides relevant, adversary-focused objectives.

Endnotes:

[1]*National Security Strategy*, The White House, Washington, D. C., 2022, p. 25, <https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf>, accessed on 5 January 2023.

[2]*2022 National Defense Strategy of the United States of America*, U.S. Department of Defense, Washington, D. C., 27 October 2022, p. 5, <https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF>, accessed on 3 January 2023.

[3]FM 1-02.1, *Operational Terms*, 3 March 2021, p. 1-73.

[4]Peter Beaumont, "Russia Installs 'Dragon's Teeth' Barriers to Slow Advance of Ukrainian Forces," *The Guardian*, Guardian News and Media, 8 November 2022, <https://www.theguardian.com/world/2022/nov/08/russia-installs-dragons-teeth-blocks-in-shift-to-more-defensive-warfare>, accessed on 4 January 2023.

[5]"Latest Defence Intelligence Update on the Situation in Ukraine," Twitter, United Kingdom Ministry of Defence (@DefenceHQ), 15 November 2022, <https://twitter.com/DefenceHQ/status/1592402834578083840>, accessed on 3 January 2023.

[6]"Russians Also Seem To Have Built a New Set Of Dragon's Teeth/Vehicle Trenches Around Novoivanivka," Twitter, Rollo (@rollowastaken), <https://twitter.com/rollowastaken/status/1592183458918699010>, accessed on 5 January 2023.

[7]FM 3-34, *Engineer Operations*, 18 December 2020, p. 2-15.

Lieutenant Colonel Carvelli is the deputy commander of the New England District, U.S. Army Corps of Engineers. He holds a bachelor's degree in civil engineering technology from the Rochester Institute of Technology, New York, and master's degrees in operations management from the University of Arkansas, Fayetteville; civil engineering from the University of Florida, Gainesville; defense and strategic studies from the U.S. Naval War College, Newport, Rhode Island; and military operations from the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas.

Hamid Karzai International Airport Prime Power Mission

By Chief Warrant Officer Two Darius J. Cooper

On 17 August 2021, the U.S. Central Command requested that U.S. Army Central provide prime power support for the evacuation of joint international military forces, Special Immigrant Visa applicants, and civilian personnel from the United States and other nations at the Hamid Karzai International Airport (HKIA) in Kabul, Afghanistan, via the U.S. Army Corps of Engineers 249th Engineer Battalion (Prime Power), Fort Bragg, North Carolina, forward element prior to the conclusion of the operation on 31 August 2021. The primary mission of the 249th was to replace contractors from Ecolog International (who were stationed at HKIA electrical power plants) with prime power Soldiers. While it was necessary to quickly evacuate the contractors from Afghanistan, the requirement for reliable, uninterrupted electrical power continued for the duration of the military retrograde and removal of evacuees.

On 19 August 2021, Chief Warrant Officer Two Darius J. Cooper led a team of five prime power noncommissioned officers (Military Occupational Specialty 12P—Prime Power Production Specialists) from Camp Arifjan, Kuwait, to HKIA to begin the relief-in-place mission and take control of power plants. HKIA electrical power generation systems consisted of three diesel-fueled prime power plants that provided electrical power to critical facilities, with tactical spot generation units distributed throughout the airport for remote facilities with minimal power requirements (such as guard towers and maintenance workshops). By 21 August 2021, all contractors from Ecolog International had properly transitioned from their assignment and their duties as prime power operators, repairers, and maintainers were reassigned. Cooper and his team felt confident in performing the assigned mission, as they were familiar with the model of Caterpillar® generators since they were made by the same company that had manufactured their organic equipment generator engines. The team immediately assumed responsibility of the three power plants and the corresponding obligations.

A Soldier assists an environmental engineer from the U.S. Army Corps of Engineers while he works to get the pumps back online at the water treatment plant.

Since the team was not augmented with additional qualified operators from the Prime Base Engineer Emergency Force, 1st Expeditionary Civil Engineer Group, U.S. Air Forces Central, Chief Warrant Officer Two Cooper and Staff Sergeant (now Sergeant First Class) Roy Adkins, the noncommissioned officer in charge, decided to make use of roving teams to simultaneously run all three plants. This decision was critical, as a minimum of eight prime power Soldiers working 12-hour shifts is normally required to safely operate one power plant with 24/7 coverage. Each team consists of a control room operator, log book recorder, equipment operator, and plant supervisor. The three plant operator noncommissioned officers (Staff Sergeant Jeffrey Bevington, Sergeant [now Staff Sergeant] Alfonso Marquez, and Sergeant Myles Keyser) and Cooper developed a roving two-man team shift schedule in which personnel rotated and conducted checks on each plant throughout the day. This was done based on the shortage of personnel. Cooper and Adkins focused on overseeing, reporting, and attending daily meetings to ensure that all stakeholders from U.S. Forces–Afghanistan and the 82d Airborne Division were informed of any power plant operational updates. When not interacting with stakeholders, Cooper and Adkins also roved and checked on the teams and power plants. They set up the shift schedule to attend the one dining facility meal each day, allowing them an opportunity to physically check on the team members' well-being and update them with mission timelines and other pertinent information.

Power Plant 1 (PP1), a 6-megawatt plant, controlled more than 8,000 coalition and U.S. forces housing units, the North Atlantic Treaty Organization Support and Procurement Agency, the North Atlantic Treaty Organization helicopter hanger, and Dining Facility 1 (the only dining facility operational during retrograde operations). Power Plant 2 (PP2), a 7.6-megawatt plant, controlled the water and wastewater treatment plants, hospital, flight line lighting, and airfield operations facilities. Power Plant 3 (PP3), a 6-megawatt plant, controlled the new mosque, joint operations center, and joint force living quarters. In total, the three power plants produced 19.6 megawatts of power.

On 12 August 2021, Chief Warrant Officer Two Cooper instructed his team to visit the water and wastewater treatment plants and develop a simple standard operating procedure so that a responsible unit could assume control of both locations after the contractors were evacuated. The standard operating procedure was delivered to the logistics officer (J-4), to be transferred to the unit responsible for operation of the plants on 24 August 2021. It was critical to keep the water and wastewater treatment plants properly functioning throughout the evacuation and retrograde because of the need for clean water for the hospital as well as for the life, health, and safety of all U.S. and coalition forces. Unfortunately, due to a lack of consistent monitoring of the pumps, the water treatment plant shut down and was flooded. Sergeant First Class Adkins, a certified state electrician, worked tirelessly to get the power restored after the floodwater was drained from the water treatment plant. Additionally, he assisted U.S. Army Special Operations Command operators and an environmental engineer from the U.S. Army Corps of Engineers in getting the water plant back online.

Containment material was placed on the ground to soak up the excess fuel after the generator day tank overflowed.

While in control of the three power plants, the prime power teams manually and independently calibrated the PP1 and PP2 generator controls so that all of the prime generators equally shared electrical loads. Load sharing was an enduring challenge in these two power plants when all five generators were synchronized and put online at the same time. A problem associated with the fuel tanks at PP3 was also corrected, and all four fuel tanks were left in good working condition, improving the fuel storage capacity of the power plant.

After a terrorist attack at Abbey Gate on 26 August 2021, Chief Warrant Officer Two Cooper decided to redeploy the three plant-operating noncommissioned officers who had developed the roving teams back to Camp Arifjan. Cooper and Sergeant First Class Adkins remained at HKIA as the

A Soldier discusses the fuel level readings at PP2 with two plant operator noncommissioned officers and an employee from Ecolog International.

trail element in order to maintain continuous power and then retrograded with the 82d Headquarters and Headquarters Battalion trail company on 30 August 2021.

The main body departed on 27 August 2021, and the joint operations center authorized the sanitation and demilitarization of equipment and the clearing of facilities at HKIA. During the facility clearing, the PP3 fuel monitoring and transfer system was damaged, causing an overflow of diesel fuel on the morning of 28 August 2021. After minimal spillage, Sergeant First Class Adkins shut off the switching system and the fuel system was brought back online. With help from nearby fuelers, Chief Warrant Officer Two Cooper used a spill containment kit to soak up the remaining fuel. Cooper and Adkins continued to conduct daily checks of each plant to ensure that operation, routine maintenance, and fuel deliveries continued.

On 29 August 2021, all 15 prime power generators from the three HKIA power plants were started, synchronized, and connected to the distribution system in order to support the last phases of the Central Command operation after the departure of the main body. The 10 fuel storage tanks from the combined power plants were filled to maximum capacity to ensure that the power plants would run for the maximum possible time following the joint tactical exfiltration. Based on the number of tanks topped off the morning of their scheduled trail element departure, Chief Warrant Officer Two Cooper and Sergeant First Class Adkins estimated that each power plant could generate more than 2 to 3 weeks of continuous power. Also on that day, the bulk water treatment plant flooded and shut down for a second time, causing a complete loss of the HKIA potable water supply for 12 hours. Cooper and Adkins unsuccessfully tried to correct the issue. The plant was deemed a low priority and remained non-mission-capable for the duration of the retrograde.

During the check of PP3, Sergeant First Class Adkins discovered that the fuel system had suffered damage due to

(Continued on page 13)

Bridging the Gap Together:
Send in the Joint Engineer Support Brigade

By Captain Thomas J. Van Kirk

China seeks "Western Pacific dominance by 2035" and has its sights set on "becoming a leading world power by 2049" by increasing the ability of the People's Liberation Army (PLA) to operate within all domains of the operating environment.[1] In order to maintain superiority within the Pacific Theater, the United States must now rely on joint capabilities harmoniously working together. As a result, the U.S. military developed a "joint combined arms" strategy to maintain its advantages within contested environments.[2]

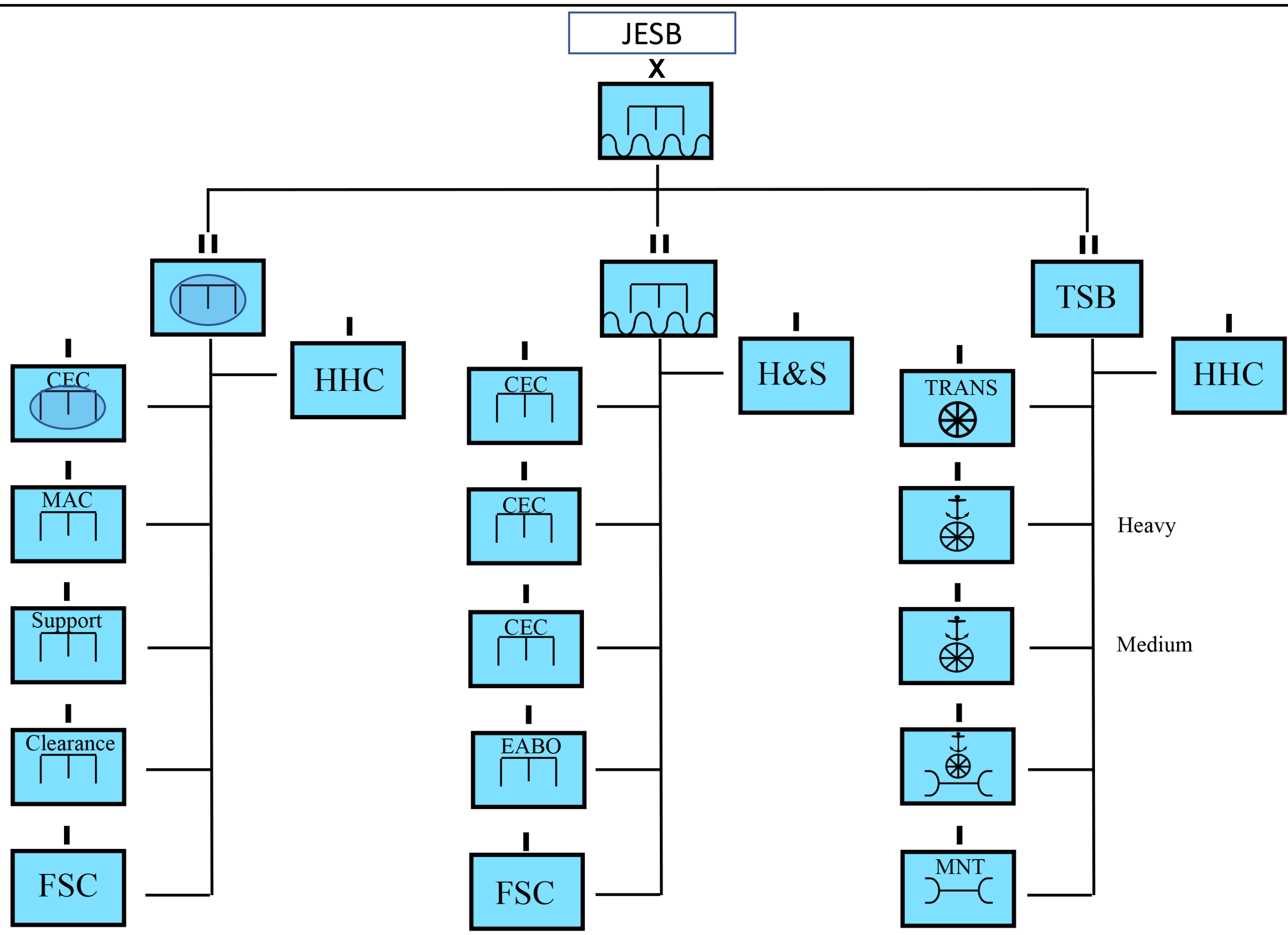
Although the notion of joint combined arms is a relatively new concept, interoperability between military Services across multiple domains is not. In past wars, Army engineers conducted amphibious shore-to-shore operations to project combat power from friendly seaports to enemy-controlled shores.[3] The Army did away with these amphibious engineer units in the mid-20th century and began to focus on other forcible-entry operations. Similarly, U.S. Marine Corps engineers divested themselves of capabilities that support assured mobility in land environments to focus on expeditionary operations within littoral environments.[4] The elimination of these capabilities from both Services has created capability gaps that adversaries can exploit to their advantage; therefore, the Army and Marine Corps must develop a joint engineer support brigade (JESB) to bridge existing gaps, enhance inter-Service capabilities, and provide full spectrum engineering for the joint force commander. The JESB would redevelop an amphibious capability for the Army while enhancing Marine Corps skills for conducting expeditionary operations and sustaining knowledge about conducting inland mobility operations.

During the early years of World War II, the Army identified the importance of conducting amphibious operations for power projection into the European theater.[5] Development of the Engineer Amphibian Command provided this capability. The command was composed of subordinate engineer amphibian brigades capable of providing operational maneuverability and logistical support.[6] These brigades, later renamed engineer special brigades, conducted amphibious assaults, defended beachheads, constructed facilities, and transported logistical supplies from shore to shore within both the European and Pacific Theaters.[7] As a result of previous political disputes with the Navy and in order to focus on other forcible-entry operations, the Army eliminated the remaining engineer amphibian brigades after the Korean War.[8] Therefore, the Army currently lacks the ability to operate within a littoral environment and conduct amphibious operations. The lack of an amphibious capability forces the Army to rely on airborne operations for power projection within the Pacific Theater. With the growing and robust PLA arsenal of air defense capabilities, it is unlikely that U.S. airborne operations will be as successful as they have been in previous conflicts. Commanders risk losing combat forces and aircraft by relying solely on airborne operations for power projection in the Pacific Theater.

Beyond the littoral environment, Marine Corps engineers cannot sufficiently support assured mobility due to changes in *Force Design 2030*.[9] The Marine Corps recently divested itself of many assets and reorganized its forces in hopes of naval integration via a return to its historic roots of operating within the marine littoral environment.[10] Gap-crossing and armored capabilities, which serve as critical enablers for extending a commander's operational reach on land, were among the divested assets. There are more than 15 major rivers throughout China which the PLA could leverage as obstacles that the Marine Corps will be unable to breach—and the Marine Corps divestment of tanks provides additional advantages for the PLA. The loss of tanks severely reduces the ability of Marine Corps engineers to create mobility lanes to support armored maneuver or potentially combat armored PLA assets. PLA armored battalions, on the other hand, have assets capable of operating on land and in amphibious environments.[11] The PLA will likely seek opportunities to leverage its advantages against the Marine Corps within the littoral environment. The recent divestments of Marine Corps gap-crossing and armored capabilities will prompt Marine commanders to accept unnecessary risk in conducting expeditionary operations within littoral environments due to effects on their ability to seize contested beachheads ashore and to support assured mobility for continued operations.

Marine Corps engineers also lack some of the expertise necessary to support assured mobility and expeditionary advanced base operations (EABO) within littoral environments. Marine Corps engineers are not trained in operating geospatial technologies, which support assured mobility (by enabling commanders to visualize the operational environment)[12] and EABO (by enabling a commander to analyze lines of communication, infrastructure, hydrological data, and other intelligence relating to the physical environment).[13] Additionally, most Marine engineers lack professional engineering credentials, organic contracting specialties, and tactical leadership training (Army Sapper Leader Course, Ranger Leader Course, Urban Mobility Breacher Course).[14] These knowledge deficiencies further reduce the ability for Marine Corps engineers to support assured mobility and conduct EABO.

The mission of the proposed JESB would be to provide tactical maneuverability of troops and equipment for the joint force operating within littoral environments.[15] The proposed JESB would fill the inter-Service gaps with a centralized command, a diverse task organization, and joint training exercises. It would serve as a centralized engineer command under an Army colonel, improving Marine access to Army technical schools and geospatial and contracting officer courses. The JESB would consist of three subordinate battalions (see Figure 1)—two engineering battalions (one Army and one Marine) and one transportation support battalion. The transportation support battalion would provide mission command of terminal operations, two watercraft companies, and logistical support at embarkation sites to enable brigade overseas transportation.[16] The joint nature of the JESB would make it differ from previously proposed amphibious engineer units. The joint staff of the JESB would consist of leaders certified in planning joint engineer operations through a joint engineer operations course. This would enable the subordinate battalions to execute joint training exercises. Furthermore, the organization of each battalion would provide a full spectrum of engineer support for the joint force commander.



Legend:

CEC—combat engineer company

EABO—expeditionary advanced base operations

FSC—forward support company

HHC—headquarters and headquarters company

H&S—headquarters and service company

JESB—joint engineer support brigade

MAC—mobility augmentation company

MNT—maintenance

TRANS—transportation

TSB—transportation support battalion

Figure 1. Proposed JESB

The proposed Army engineer battalion would provide combat engineering support to a landing force while also supporting construction operations for expeditionary advanced bases. This battalion would consist of one headquarters and headquarters company, one armored combat engineer company (CEC), one mobility augmentation company, one engineer support company, one mobility augmentation company, one clearance company, and one forward support company (FSC). The headquarters and headquarters company would provide command and control for engineer operations ashore. The CEC would be responsible for conducting mobility and countermobility operations in support of armored maneuver units. It would also support the initial assault of a beachhead, enabling access to enemy territory for follow-on forces. The mobility augmentation company and clearance company would support mobility operations through gap-crossing and route clearance operations, respectively; additionally, these companies would facilitate the movement of troops ashore. The engineer support company would construct the infrastructure and survivability positions required to support expeditionary or other defensive operations. Finally, the FSC would provide sustainment and maintenance services to support the tactical effectiveness of the battalion. The JESB joint training exercises would provide Army leaders with the opportunity to work with their Marine counterparts to become educated on planning and executing amphibious operations. These joint training exercises would facilitate the development of the doctrine and tactical procedures necessary to rebuild Army engineer amphibious competencies. Such a reestablished capability could enable Army engineers to augment Marine forces in future amphibious operations and provide the joint force commander with more options for deploying ground forces in the Pacific Theater.

The proposed Marine combat engineer battalion (CEB) would consist of one headquarters and service company, three CECs, one EABO company, and one FSC. The headquarters and service company would maintain command and control of engineer forces operating within littoral zones. The CECs organic to the Marine CEB would support amphibious assaults and augment maneuver companies inside contested littoral environments. The EABO company would be responsible for reconnoitering tentative advanced base locations, conducting beach surveys, and serving as the subject matter expert for establishing future expeditionary bases;[17] the company would consist of small teams whose members were trained as bulk fuelers, construction engineers, heavy-equipment operators, geospatial intelligence engineers, and surveillants while also possessing the skills common to all combat engineers.[18] The FSC would provide the equivalent services for the U.S. Army and Marines, as well as maintain the capability to build expeditious forward-arming and refueling stations to support aircraft. JESB gap-crossing exercises would allow CEB Marines to maintain proficiencies that enabled assured mobility within littoral and inland environments. Additionally, these joint training exercises would help develop shared standard operating procedures and understanding of the institutional differences between Services.[19] Lastly, leaders within the Marine CEB would have access to Army technical and tactical leadership courses in support of the EABO concept. This task organization, lessons learned from joint exercises, and increased access to technical schools would assist in developing the skills required to support the initiatives of *Force Design 2030*.[20]

In opposition to support for a joint Army/Marine engineer brigade, the Marine Corps does not require large land-based capabilities to support expeditionary operations.[21] However, Army gap-crossing and armored capabilities would enable the mobility of Marine forces to support expeditionary operations within contested environments. Additionally, information gathered from previous joint operations in support of Operation Iraqi Freedom suggests that Army and Marine engineers are fairly aligned to one another, due to their similar focus on combat operations, mission sets, and capabilities.[22] Army and Marine Corps engineers provide general engineering support leading to the construction of several types of logistics facilities that support combat operations.[23] The diverse knowledge and capabilities nested within the JESB would fill the inter-Service gaps and provide operational flexibility for supporting assured mobility in support of expeditionary operations.

The United States must currently rely on symbiotic relationships between military Services to maintain its advantage against the rising threat within the Pacific Theater. The Army and the Marine Corps can support each other by resurrecting the amphibious capability of the Army and improving the technical proficiency of the Marine Corps in supporting assured mobility ashore. A JESB would enable the joint force to project combat power within a contested environment by combining knowledge, experience, and equipment capabilities under one command. With the technological advancements of the PLA in China, the joint engineer force will require more in-depth knowledge of inter-Service capabilities, which can be attained from joint training initiatives.[24] A JESB could bridge the gap between the two Services; consequently, leaders must consider its establishment.

Endnotes:

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[9]*Force Design 2030*.

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[17]Walt Carr, "The Marine Combat Engineer Regiment," *Marine Corps Gazette*, Vol. 104, Issue 5, May 2020, p. 37, <https://www.proquest.com/docview/2397845819?accountid=14746&parentSessionId=a37AbJNoV3%2Bf1J%2BiZVxSsfWxX%2FdA9OaCVrMfrKNBzCI%3Dpqorigsite=primo>, accessed on 29 November 2022.

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[20]*Force Design 2030*, pp. 2, 8, 9.

[21]Ibid.

[22]Payne and Anderson, p. 13.

[23]Ibid, pp. 11, 14.

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("Hamad Karzai International . . . ," continued from page 9)

the actions of the previous day. As a result, the pumps no longer transferred fuel from the four bulk fuel storage tanks to the generator day tanks. Coordination was immediately conducted with the fuel delivery unit to directly fill the day tanks for continued operations. For fueling to take place, disassembly of the inlet pipes was required. This course of action reduced the continuous operations timeline of PP3 to 16–24 hours because fuel was being drawn from the day tanks—not the underground storage tanks. The operation time that had previously been calculated for the generators at PP3 was roughly 21 days. On the evening of 29 August 2021, the Counter Rocket Artillery Mortar System lost electrical power. This required a controlled power reset. After this corrective action was taken, the power for the building was restored and was no longer dependent on its uninterrupted power supply system.

On the morning of 30 August 2021, the Counter Rocket Artillery Mortar System was back online and managed to thwart an attempted rocket attack aimed at HKIA. The end-of-mission plan consisted of one final check for all three plants. Since PP3 was slated to run out of fuel first, Chief Warrant Officer Two Cooper and Sergeant First Class Adkins ensured that the joint operations center powered by this plant was notified of the impending loss of power. Fortunately, all tactical operations had been switched over to the 82d Airborne Division. Cooper and Adkins completed their final checks of the power plants, prepared to retrograde with the trail element, and joined the 82d Headquarters and Headquarters Battalion Company later that afternoon. They departed HKIA in a C-17 aircraft and returned to Camp Arifjan that evening, completing the mission.

Chief Warrant Officer Two Cooper was the prime power officer in charge of a forward element from Company B, 249th Engineer Battalion (Prime Power), during the events described in this article. He now serves as a facilities engineer technician, 44th Medical Brigade, Fort Bragg, North Carolina. Chief Warrant Officer Two Cooper holds a bachelor's degree in construction management from Southern Polytechnic State University, Marietta, Georgia, and a master's of business administration degree in project management from Liberty University, Lynchburg, Virginia.

Implementing Lessons Learned to Build a Better Command Post

By Captain Shawn R. Bottoms

The current war in Ukraine serves as an ongoing case study on conventional warfare, and it demonstrates how Russian forces fight in a large-scale combat operational environment. One of the critical lessons learned from Russian failures is in regard to the vulnerability of stationary tactical operation centers (TOCs) at the brigade level and how the loss of these facilities can impact command and control. As the U.S. military prepares for future large-scale combat operations, Russian experiences in Ukraine indicate that American forces need to find new ways to "slim down" their physical command-and-control infrastructure. Future command posts must be capable of rapidly deploying across the area of operations while also maintaining control of the fight and remaining undetectable by the enemy. One concept regarding this more mobile TOC has been planned, executed, and validated by Headquarters and Headquarters Company, 92d Engineer Battalion, 20th Engineer Brigade, Fort Stewart, Georgia. This concept directly ties into the readiness guidance established by the XVIII Airborne Corps, Fort Bragg, North Carolina, commanding general and the 20th Engineer Brigade commander as they continue their initiative to eliminate tent-based TOC systems by the end of 3d quarter, Fiscal Year 2023.[1]

Russian Experience

An underlying problem with Russia's tactical battle-tracking infrastructure stems from the lack of trust that Russian officers have in the leadership abilities of their noncommissioned officers. In "The Russian Way of War," Lester Grau and Charles E. Bartles describe Russian noncommissioned officers as having minimal leadership development compared to their American counterparts.[2] This lack of development among these ranks leads to a lack of development in junior leaders and a lack of trust in company grade officers throughout the formations. The lack of trust, in turn, leads to micromanagement at higher echelons (such that senior leaders plan company level operations at battalion and brigade levels). This creates a need for large staff cells and results in the development of large, centralized TOC infrastructure. Because large infrastructure is an easy target for indirect fire, the need for small, decentralized TOC infrastructure is reaffirmed.

The Problem

A TOC is responsible for the following primary functions:

- Conducting knowledge management and information management.
- Building and maintaining situational understanding.
- Controlling operations.
- Assessing operations.
- Coordinating with internal and external organizations.
- Performing command post administration.[3]

In accordance with the traditional design for a brigade combat team maneuver battalion TOC, staff sections are spread between a current operations tent and a sustainment tent. The current operations tent holds staff members who are pushing information out to down-trace units and providing information to the commander in real time. Personnel in the sustainment tent receive data from down-trace and adjacent units and create products for shared understanding. If the TOC is functioning properly and the commander is promptly receiving information with which to make decisions, then the only problem is a lack of mobility. In the event of a precise indirect-fire attack or the employment of a nonpersistent chemical by the enemy, TOC personnel must pack up and move to another location while maintaining a clear picture of the battlefield. TOC infrastructure is static and cannot react accordingly. How can we fix this problem?

Mobility

The simplest way to impart mobility to a static object is to add wheels. In the case of TOC infrastructure, the "wheels" that could be used to increase mobility consist of two light medium tactical vehicles (LMTVs) and one LMTV trailer. One LMTV would be used primarily for current operations, housing the operations cell and most of the tactical communications infrastructure (Joint Battle Command–Platform, Single Channel Ground and Airborne Radio System, command post node) in the TOC and serving as a single point for the push/pull of information to/from subordinate and adjacent units. The second LMTV and the LMTV trailer would be used for the TOC sustainment cell, housing other primary and special staff leaders. These vehicles and trailers would be arranged in a triangular formation, with the rear of the vehicles facing each other. This would create a single point of information dissemination in the center of the TOC.

Generators for the TOC would be connected to the infrastructure, located 30 meters from the main systems. Life support supplies for the TOC, which would be managed by the headquarters company, would be dislocated by 50 meters to minimize the impact caused by an enemy indirect-fire attack. The headquarters company would establish security in a 360-degree, cigar-shaped formation 75 meters from the main element. If more workspace were required, an auxiliary TOC with three additional LMTVs under the headquarters and headquarters company modified table of organization and equipment would be set up 50 meters from the main element. The battalion tactical assembly area would be dispersed across a maximum of 10,000 square meters, with no element within 50 meters of another.

There would be one table with a quad-fold board (referred to as "the football") covered with camouflage netting or tarps in the center of the TOC. In the center of this football, there would be a map with multiple overlays attached. These overlays would include the enemy situational template and current and future (24-hour and 48-hour projections) locations of all relevant units. The four sides of the football would feature relevant current and projected data such as personnel and logistic statistics, friendly and enemy task organizations, important information requirements (serious incident reports, commander's critical information requirements, and priority intelligence requirements), and significant events occurring in the past 48 hours. This football would serve as a mobile analog tracking system that could be deployed and redeployed within seconds. The battle captain would be the party responsible for managing the football and presenting it to the commander upon his or her entry into the TOC.

The Result

Under the new TOC concept, the six primary TOC functions would be implemented, while overall tactical capability would be improved through the expediency of setup/teardown and dispersion of elements in the assembly area. After multiple iterations by a battalion headquarters, the average time for TOC setup was 20–30 minutes and the average time for full tactical assembly of area operational capability was 50 minutes after initial quartering party occupation. In comparison, construction of a TOC in which one air beam tent is used to house key TOC infrastructure takes more than 2 hours—and that does not include the time necessary for assembly area occupation.

When it becomes necessary to move the command post to another location, it takes 30–40 minutes to close the TOC and prepare it for deployment. This timeline includes 10 minutes to push out the quartering party, 10 minutes to tear down the TOC, and 20 minutes (at most) to consolidate all elements of the assembly area prior to deployment to another location. It would take 90 minutes to accomplish all these tasks with a tent-based TOC infrastructure.

A mobile TOC

Although mobile command posts are nothing new for units with platforms that have a built-in capability, it is necessary for leaders to transition large-scale battle-tracking systems to focus on maneuverability. This concept would make use of movement platforms that are available to most Army headquarters units and is transferrable across multiple warfighting functions. Echelon-above-brigade engineer battalions could easily integrate this concept into their formations as they await the arrival of Bradley fighting vehicles and their internal battle-tracking systems.

Conclusion

The evolution of technology depends on increased speed and ease of use. This new concept would increase the tactical capability of battalion and brigade headquarters elements through improvements in ease of deployment and speed of construction and deconstruction as well as forced adequate dispersion that could be easily adjusted based on the terrain of the assembly area location.

Endnotes:

[1]*Annual Readiness Guidance for Fiscal Year 2023*, 20th Engineer Brigade, Fort Bragg, North Carolina, 1 August 2022.

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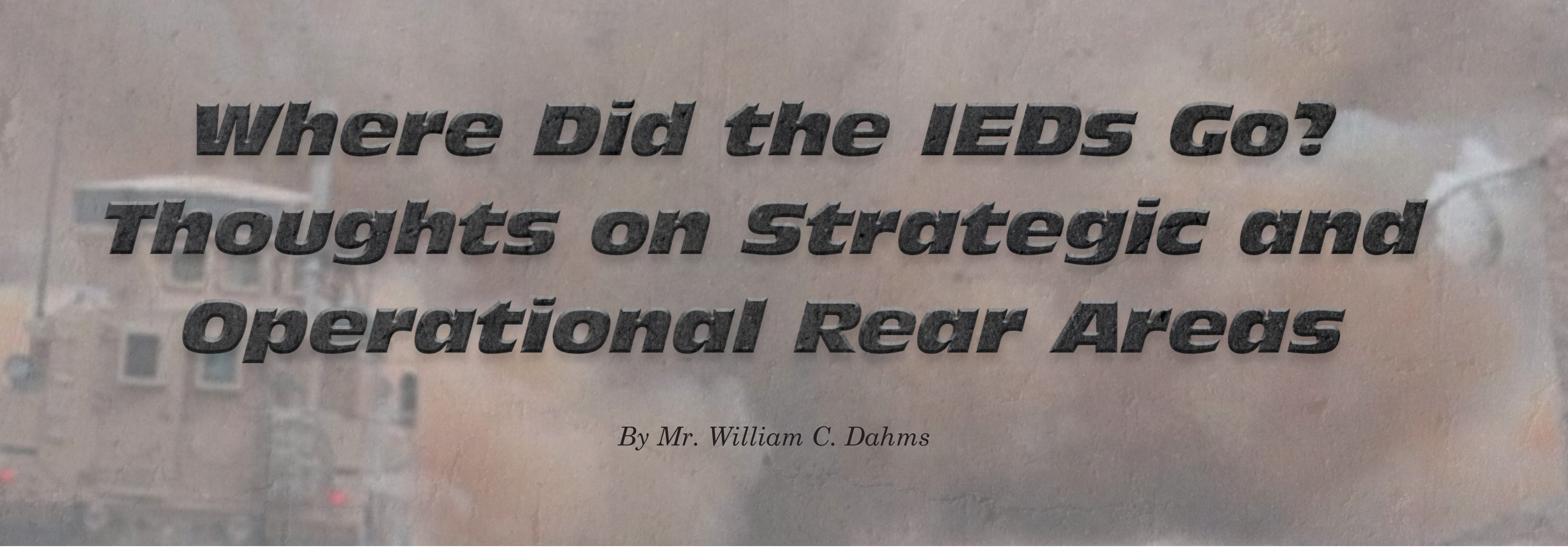

Where Did the IEDs Go? Thoughts on Strategic and Operational Rear Areas

By Mr. William C. Dahms

"It is a myth that military organizations tend to do badly in each new war because they have studied too closely the last one; nothing could be farther from the truth. The fact is that military organizations, for the most part, study what makes them feel comfortable about themselves, not the uncongenial lessons of past conflicts. The result is that often militaries must relearn in combat and usually at a heavy cost; lessons that were readily apparent at the end of the last conflict."

—Williamson Murray[1]

During Operation Desert Shield/Storm in the early 1990s, the U.S. Army was unquestionably at its highest level of readiness. During the ensuing years leading up to 11 September 2001, Army forces gradually lost their overmatch advantage. That was a time of tranquil chaos. Our adversaries continued to examine our capabilities, attempting to better understand the magnitude and reach of our combat power. As a result, these adversaries began to formulate alternative means to threaten America. It was then that the world changed and a new era of threats that were not restrained by the previous global wars of World War I and World War II emerged. Improvised explosive devices (IEDs)—which, according to the National Security Strategy,[2] are one of the oldest forms of weapons that can be employed against any superior force—became the weapon of choice for the enemy against the United States in Iraq, Afghanistan, and South America. Our experience with IEDs and other explosive hazards (EH) had been limited to the Vietnam War and World War II.[3, 4, 5, 6]

History tends to repeat itself. For example, the recent Russian incursion into Ukraine was preceded by the Russian invasion of Crimea in 2014. However, with a return to large-scale combat operations (LSCO) and the advent of multidomain operations, the next conflict obviously will not be like those of last 2 decades. Although our adversaries will likely continue to employ IED capabilities, they will improve their effectiveness through the use of unmanned aerial vehicles for gathering intelligence, performing surveillance, conducting reconnaissance, and delivering lethal payloads. When coupled with more advanced robotics, autonomous platforms, artificial intelligence, and cyber/electromagnetic warfare operations, the protection challenge will be significant.

Our peer adversaries have already revealed how they intend to challenge us. They have created multiple layers of defensive standoff through their antiaccess and area denial systems. U.S. forces have superior weapons—maybe not in quantity, but in quality and reliability. The training proficiency and skill of U.S. forces are also superior. But what about our most vulnerable support areas, where there are fewer tactical units?

The solution to this issue most likely lies in the shaping of the environment, through the calibration of our forces, and the degree to which unified action partners are integrated. Protection, like any other response to a threat including IEDs EH is not a linear activity. It is dependent upon our ability to plan, prepare, execute, and assess our protective posture in a continuous and enduring manner. The key to success is sustaining a balanced protected support area, layered by depth, and an echelon enabled with speed and sufficient combat power while maintaining a high operational tempo.

Responsive and mobile sustainment must also keep pace with maneuver forces over extended distances. Let's set aside the discussion of tactical forces in our support areas and Threat Level I, II, and III concerns for a moment and focus on the obstacles to our freedom of movement that we are most likely to face in our support areas. Let's focus on IEDs and EH like unexploded ordnance, conventional mines, explosive booby traps, and explosive remnants of war in the battlespace. IEDs were unquestionably a challenge over the last 2 decades, and there is no clear indication that their use will be discontinued in future conflicts. IED attacks still occur daily, both abroad and in the homeland—yet, the terms IED and EH are mentioned only one time each in Army Doctrine Publication (ADP) 3-37, *Protection*[7]; the likelihood that EH will be encountered along routes is implied—but not specified—within the terms of area security and routes. So, what are we missing? We're missing the capacity for EH mitigation in our support areas and its integration into our area security activities.

Our strategic and operational support areas are vulnerable in a way that is similar to the vulnerabilities of our supply convoys of World War II. According to the March 2006 *Defense Science Board Report*, "When there are no front lines, all forces are at risk and logistics convoys, like merchant ship convoys of World War II, become 'movements to contact' or are targets for loosely organized enemy actions."[8]

"Many EH attacks may not be traditionally adversarial in nature (as when we are not at war) but tend to be more criminally or politically motivated and are reported with frequency."

Many IED/EH employments may not be traditionally adversarial in nature (as when we are not at war) but tend to be more criminally or politically motivated and are reported with frequency. It is clear that our strategic and operational rear areas or support areas will continue to be vulnerable.

Lucrative locations, such as those containing transportation hubs, power or electrical substations, water supplies, sewage systems, administrative facilities, infrastructure, communications equipment, and religious convergencies will remain soft targets. This vulnerability affects our ability to project power and to sustain force tactical operations. In the past, we focused upon the effects to tactical operations. We now need to consider expanding the threat environment to include our support areas. Events in Ukraine serve as a recent example of how a combination of IEDs and technology can be employed against a superior force in order to delay, disrupt, deter, and deny operations and command and control. Other examples include the fighting in Crimea in 2014 and the little-known Karabakh War of 2020 between Azerbaijan and Armenia. A key theme of recent and historical events is clear: It is essential to have consistent sustainment flow to forward support areas in order to maintain offensive momentum.

During the February 2022 Maneuver Conference at Fort Benning, Georgia, 1st Cavalry Division leaders provided an insightful review of how they intend to initially fight in a LSCO environment. The vulnerabilities of our support areas were specifically called out during this conference. Operations in Crimea in 2014, Azerbaijan in 2020, and Ukraine in 2022 have made it clear that mines, IEDs, and other EH will remain a part of the future battlefield; where and how these explosives are used are what we need to prepare for now. It is clear that, for successful operations, the penetration division requires a protection brigade and substantial reinforcements. This includes an engineer brigade just to mitigate risks associated with gap crossings (LSCO Gap 8) to set conditions for operational success. The general nature of a heavy-division fight is as a high-risk/high-reward operation. U.S. Marine Corps leaders are also advocating for the reestablishment of counter-improvised explosive device (C-IED) programs and training before deployments.[9] Naturally, commanders are in favor of risk reduction and advocate for what their experiences have shown to be effective ends-ways-means risk. Risk mitigation and force structure/budgetary restrictions are two parts of the Army and Marine Corps challenge. The ability to balance threats against force structure with the reality of our budget and manpower limitations will remain a significant challenge to both Services.

When considering how EH may be viewed on the future battlefield in the context of protection, some specific questions come to mind. We have an opportunity to address identified shortfalls, while preparing the best we can for future conflicts. With some modifications, the protection brigade for EH operations is needed to augment LSCO operations. To that end, the following thought-provoking questions should be asked and addressed:

- Has the Army adequately designed the protection brigade to conduct C-IED operations for corps and divisions?
- Does the Army have enough capacity to mitigate the effects of EH in our support areas in terms of route clearance companies, explosive-ordnance disposal, engineer brigades/battalions, or EH coordination cells or organizations?
- How would adversaries most likely employ IEDs during LSCO?
- Is the United States adequately training Soldiers and combined arms formations to mitigate the effects of EH in support areas?
- Where can commanders receive attack-the-network/network engagement, military search, and site-exploitation training?
- Will military search (intermediate and advanced) and site exploitation operations be needed?

Fortunately, the purpose of the Counter Explosive Hazards Center (CEHC), Fort Leonard Wood, Missouri, is to preserve the fighting force by providing EH awareness to deploying forces, assisting in identifying and fielding viable countermeasure solutions and technologies, and developing the intellectual and situational superiority of combat units. CEHC also collects, analyzes, and stores C-IED/EH information in such a manner as to allow easy access by warfighters. The repository is aligned with the current U.S. Army "C-IED Strategy Lines of Effort."[10] Each line of effort is organized with knowledge from past conflicts and a mix of historical, current, and technical resources. Community resources for C-IED/EH Army professionals are available at: <https://www.milsuite.mil/book/community/spaces/apf/counter-ied> (common access card-enabled/protected).

Endnotes:

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(Continued on page 39)

Multidomain Operations:

The Latest Evolution of Operational Doctrine

By Lieutenant Colonel Laura E. Shiplet and Captain Carlos J. Valencia

Doctrine is the guide by which Army forces conduct operations. As our environment and the world in which we operate have grown ever more complex and transparent over the past 40 years, Army doctrine has evolved and the focus of the Army has changed to support U.S. national objectives.[1] To keep pace with the growth, the Army has continuously sought to improve its operational concept and has codified those improvements in doctrine. The new 2022 edition of Field Manual (FM) 3-0, *Operations*,[2] introduces a new Army operational concept that retains the focus on large-scale combat operations, builds on the importance of integrating joint and multinational capabilities, and expands on the combined arms approach—with an emphasis on creating complementary and reinforcing effects with capabilities from multiple domains.

Multidomain operations refer to the combined arms employment of capabilities from all domains that create and exploit relative advantages to defeat enemy forces, achieve objectives, and consolidate gains during competition, crisis, and armed conflict. Multidomain operations constitute the Army contribution to the joint fight. All operations are multidomain operations, regardless of joint force capabilities contributed at each Army echelon. This is because Army forces employ organic capabilities in multiple domains and continuously benefit from capabilities that they do not control; examples include benefits gained from the Global Positioning System and from combat aviation support from the U.S. Navy or the U.S. Air Force. Multidomain operations demand a mindset that focuses on how Army forces view their operational environment (OE), threats, and roles within any operation.

Why is all of that important to you? As Army engineers, we are masters of the terrain (land). In *Prisoners of Geography*, Tim Marshall states, "The land on which we live has always shaped us. It has shaped the wars, the power, politics, and social development."[3] But while we maneuver and operate in the land domain, we also enable forces that operate in the other domains. This is because all things that are man-made are controlled by a force that resides on the earth. According to FM 3-34, *Engineer Operations*, "Engineer operations are unique because, regardless of the intended purpose, they are directly aimed at affecting or improving the understanding of the terrain. In this context, the terrain includes natural and man-made terrain features. As a result, the terrain is central to the three engineer disciplines."[4]

So, what does the modern OE look like—and how do the domains fit in? An OE is a composite of the conditions, circumstances, and influences that affect the employment of capabilities that bear on the commander's decisions. Within the context of an OE, a domain is a physically defined portion of the OE that requires a unique set of warfighting capabilities and skills. The OE includes portions of the land, maritime, air, space, and cyberspace domains as impacted through three dimensions (physical, human, and information). The land, maritime, air, and space domains are defined by their physical characteristics, and cyberspace—a man-made network of networks—connects them, as represented by the dots shown in Figure 1.

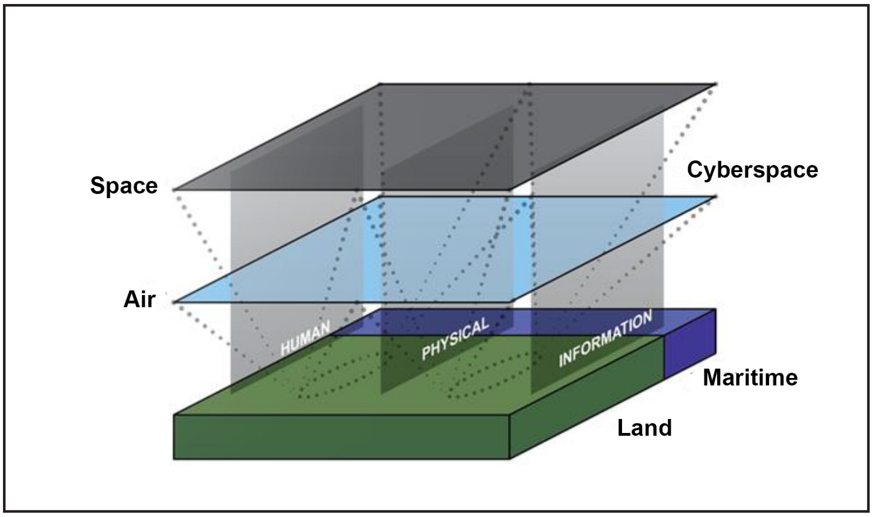


Figure 1. The OE

To be successful on the modern battlefield, leaders at all echelons must understand how these three dimensions impact the OE. From a small reconnoitering team action to a major offensive campaign, all operations affect the physical world, the humans residing in it, and the information it conceptualizes. Additionally, multidomain operations aim for Army leaders to think beyond previous planning considerations and emphasize the integration of the Army capabilities across the five domains to compound effects with sister

Services and create multiple dilemmas to deter and defeat peer threats at the lowest cost.

An additional change to the updated version of FM 3-0 is the introduction of the strategic situation, which stems from the competition continuum introduced in Joint Publication (JP) 3-0, *Joint Campaigns and Operations*.[5] The strategic situation describes how the Army conducts itself across the range of military operations in three strategic contexts—competition below armed conflict, crisis, and armed conflict. Together, these three strategic contexts form a progressive continuum along which the Army must be prepared to proceed to match an adversary's escalating violence and increases in U.S. national interest. Proceeding along this continuum is an acknowledgment that Army forces do not simply operate and create effects during conflict but can deter or defeat threat intentions or actions in competition below armed conflict. Below armed conflict, nation or nonnation states with unaligned interests use various peaceful and malicious methods to compete with one another and gain the upper hand. After all, according to Marshall, "All great nations spend peacetime preparing for the day war breaks out."[6]

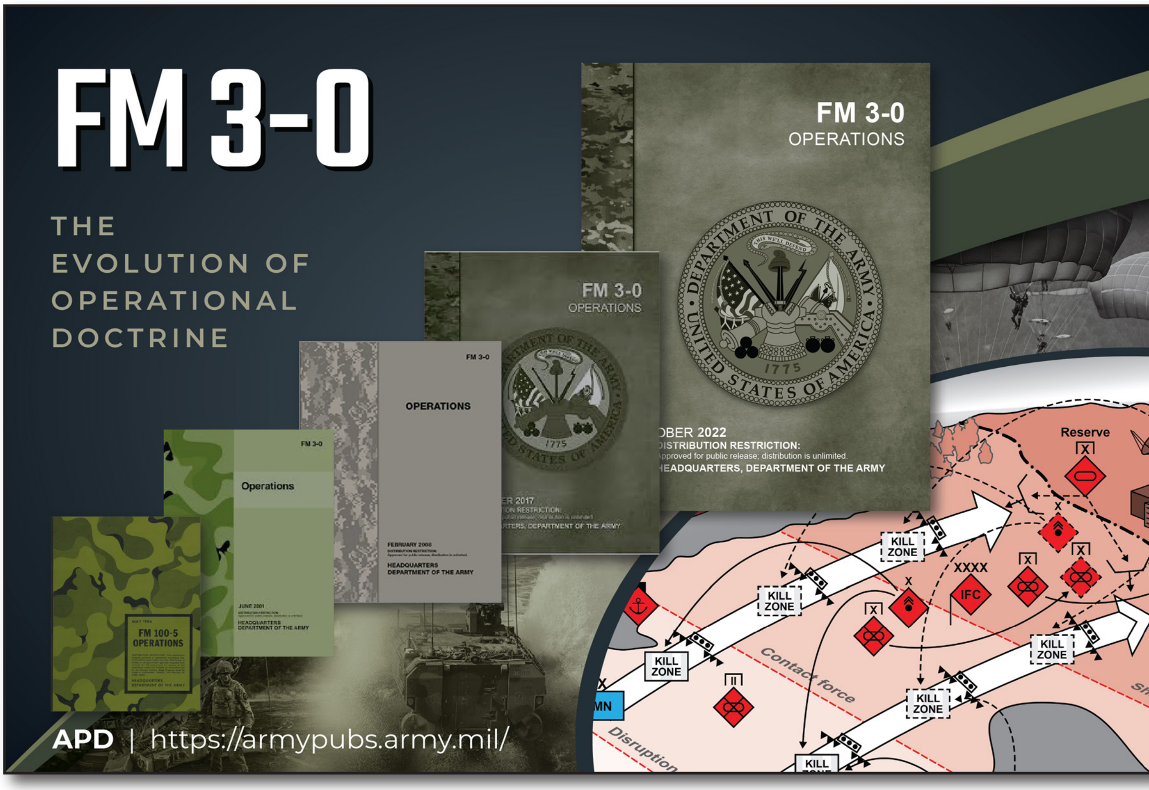
The traditional Army contribution to unified action during this strategic context of competition below armed conflict consists of military engagement and security cooperation while preparing for armed conflict. As events or incidents that threaten U.S. national interests occur, the strategic context gradually moves toward crisis; this may require Army intervention, and Soldiers may be deployed to forward locations to deter conflict and prepare for war. If all else fails, nation or nonnation states may use lethal force to achieve their goals. In response, the Army conducts combat operations, exploiting its preparations from the competition and strategic crisis contexts to defeat the adversary. Competition below armed conflict, crisis, and armed conflict are not foreign concepts. Still, the strategic situation helps leaders better conceptualize operations as the Army operates in different strategic contexts worldwide.

Along with the previously mentioned updates to the current edition of FM 3-0, additional significant updates and changes include—

- Establishing the dynamics of combat power—leadership, information, mobility, and survivability—which are generated by the warfighting functions.
- Identifying the four tenets of operations—**agility**, **convergence**, **endurance**, and **depth**. These tenets are attributes that should be built into all plans and operations, and they are directly related to how the Army operational concept should be employed. The new FM 3-0 introduces convergence as the concerted employment of capabilities from multiple domains against combinations of objectives to create effects against a system, formation, capability, or decision maker.
- Describing the nine imperatives as actions that Army forces must take to defeat peer enemy forces and succeed in operational environments extended through all domains.
- Providing an update to the operational framework. The update—
  - Expands assigned areas, introducing and defining zone and sector areas.
  - Removes consolidation area, as the consolidation of gains now occurs throughout the entire operation, regardless of location.
  - Reintroduces main effort, supporting effort, and reserve, which replaces decisive, shaping, and supporting efforts.
- Adding informational considerations to the mission variables, which are aspects of the three dimensions (physical, human, and information) that affect how humans and automated systems derive meaning from, use, act upon, and are impacted by information.
- Introducing influence as a ninth form of contact.
- Adding the strategic theater level as the fourth level of war.
- Adding chapters on Army operations in maritime-dominated environments and leadership during operations.

As in the past, the 2022 version of FM 3-0 will prompt the force to update other Army doctrine to nest with the new concept and framework. As the Army doubles down on its focus on large-scale combat operations, FM 3-0 serves as a reminder that the three engineer disciplines of combat engineering, general engineering, and geospatial engineering exist to provide the necessary support to commanders to assure mobility, enhance protection, enable force projection and logistics, build partner capacity, and develop infrastructure among populations and nations. Additional publications that are in the process of being updated to align with the newly published FM 3-0 include Army Doctrine Publication (ADP) 3-37, *Protection*,[7] FM 3-34,[8] Army techniques publications (ATP) 3-37.34, *Survivability Operations*,[9] and various engineer ATPs. Engineers also uniquely cross among combat, combat support, and combat service support assignments. Engineer leaders play a critical role in analysis and planning at echelon. They must lean forward, understand the new FM 3-0 (to change their mindset), and use the information contained within when communicating with senior leaders and Soldiers.

As engineers, we are no strangers to the three dimensions, as we work throughout the competition continuum to constantly play a part in setting conditions; seeing the threat (and terrain); and enabling through construction, the building of partner capacity, geospatial analysis, and more. The five domains are trickier. Initial thoughts are that, as a ground force, we can only affect the land domain; but with some additional critical thinking, it is evident that we complement the others. For example, through mobility, countermobility, and survivability tasks, engineers provide critical endurance and agility to other forces, enabling them to gain depth on the battlefield. Engineers can enable all of the other domains by repairing infrastructure or enabling survivability at seaports of debarkation/embarkation (maritime),



airfields and air defense batteries (air), antiballistic missile launch facilities (space), and satellite communication uplink sites (cyberspace). Although each of these critical sites is within the land domain, power is projected through the others. These are just a few examples; I challenge everyone to think critically when reading the updated version of FM 3-0 and to come up with other examples.

As a result of the new version of the FM 3-0 publication, engineer doctrine will be updated and sent to leaders within the Regiment for review. As drafts of the various publications appear in leaders' e-mail inboxes, I implore you to read them and provide feedback; this is the only way to improve our doctrine.

FM 3-0 is a critical piece of doctrine that leaders must read in order to understand Army operations and how each branch of the Army contributes to the fight. The U.S. Army Combined Arms Doctrine Directorate has developed multiple means of complementing and reinforcing the information presented in FM 3-0, including an audiobook, available at <https://rdl.train.army.mil/catalog-ws/view/FM3-0Audiobook/index.html>; an introductory YouTube© video, available at <https://www.youtube.com/watch?v=QFYjO3XHd3Q>; the FM 3-0 mobile training team video playlist, available at <https://www.youtube.com/playlist?list=PLPbbRw97BH2tcvslBqUGpuol9JzVxsgjM>; a series of Doctrine Digest videos, available at <https://usacac.army.mil/organizations/mccoe/cadd>; and the "Breaking Doctrine" podcast, available in both Apple© and Google© formats. You can also get involved by following the Combined Army Doctrine Directorate on Facebook©, at <https://www.facebook.com/combinedarmsdoctrinedirectorate/>.

Endnotes:

[1]ADP 1-01, *Doctrine Primer*, July 2019.

[2]FM 3-0, *Operations*, 1 October 2022.

[3]Tim Marshall, *Prisoners of Geography*, Simon and Schuster, Inc., 9 July 2015.

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[5]JP 3-0, *Joint Campaigns and Operations*, 18 June 2022.

[6]Marshall.

[7]ADP 3-37, *Protection*, 31 July 2019.

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[9]ATP 3-37.34, *Survivability Operations*, 16 April 2018.

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Strong Point Huff: Building the LSCO Fight

By Captain Matthew T. Stanley and First Lieutenant Edward P. Lara

As the U.S. Army shifted from counterinsurgency operations to large-scale combat operations (LSCO), the U.S. Army Forces Command (FORSCOM) asked the command of the Joint Readiness Training Center (JRTC) and the 687th Engineer Construction Company, 46th Engineer Battalion, 20th Engineer Brigade, Fort Polk, Louisiana, to provide training opportunities as the Army moves forward with the new era of combat. JRTC and Fort Polk vetted several options for building a bunker and trench system using troop construction and/or civilian contracted workers. Ultimately, FORSCOM decided to construct a fortified defensive position with the use of troop construction assets, thus conceptualizing Strong Point Huff.

The 46th Engineer Battalion volunteered to take on the project, and the 687th Engineer Construction Company—enabled with support from battalion staff, the Forward Support Company, the Headquarters and Headquarters Company, survey and design staff, and the 573d Clearance Company—took the lead. Strong Point Huff, the largest Army troop construction project in decades, has demonstrated that engineer construction companies are capable of completing large-scale construction projects (which, in recent history, have been awarded to civilian contractors). The use of troop construction for the Strong Point Huff project saved the Army roughly $1.2 million dollars in operational and labor costs.[1] More importantly, the resulting bunker and trench system will provide Soldiers with a heavily fortified position during simulated combat experiences against well-established near-peer enemies. If the training opportunities afforded by Strong Point Huff save even one life during future combat actions, then the 46th Engineer Battalion, JRTC, FORSCOM, and the Army have succeeded.

JRTC and the Fort Polk Operations command group named Strong Point Huff in honor of Command Sergeant Major Paul B. Huff. During World War II, Huff (then a corporal) was serving in the 509th Parachute Infantry Regiment, Fort Benning, Georgia, when the unit earned the nickname "Geronimo." The 509th participated in the Italian Campaign, in which Corporal Huff earned the Medal of Honor when he led a six-man team on a patrol to locate the source of indirect fire sustained by its platoon. Huff and his team received mortar, machine gun, and small-arms fire during the patrol. After determining that it was too dangerous for his team to continue, Huff went on to patrol alone; with little to no cover available, he continued to receive direct and indirect fire. However, Huff went on to destroy an enemy machine gun position and the crew. He then quickly recorded the remaining enemy positions, weapons, and unit disposition before returning to his platoon. The information that Corporal Huff had gathered during the patrol was vital, and it led to an allied patrol (including a group under his leadership) to rout the enemy position. Ultimately, the patrol ousted a 125-man enemy company, killing 27 Germans and capturing 21.[2]

Defilade layer heights being checked with vehicles

Strong Point Huff is composed of a system of five crew-served machine gun concrete bunkers, one concrete command bunker, three vehicle fighting positions, seven 25-meter-long trenches, 183 linear meters of concrete wall, and 23 dragon's teeth (square-pyramidal fortifications of reinforced concrete, which surround the perimeter). The machine gun bunkers along the perimeter are connected by trenches, with a central trench leading to the command

Aerial photograph of the project site after drainage emplacement

bunker. The design called for the trench walls to be constructed in sections and tied in with steel I-beams to ensure structural soundness and ease of maintenance. Together, the machine gun bunkers provide a 360-degree view along the perimeter, with interlocking sectors of fire.

Construction began by clearing and grubbing the site, located at the intersection of Six-Mile Creek and Fullerton Road in the JRTC "box." Using two D7 bulldozers, Soldiers spent 3 days removing trees, debris, and brush from the site. Once the clearing and grubbing were complete, the 687th Engineer Construction Company excavated the site to a depth of 1.7 meters. Upon excavation, Soldiers placed corrugated perforated pipe throughout the footprint of the planned bunker and trench system to allow for proper drainage. The drainage system followed the pattern of the center of the trench system, with two additional pipes running diagonally from the system. To prevent standing water during heavy rain, the pipe was extended from the site to the drainage ditch already present at the intersection. The bunker and trench system design incorporated a 1 percent slope throughout the site to prevent flooding.

Concrete being poured for the I-beams and bunker footers

Vertical-construction engineers place concrete for the trench walls.

The vertical-construction platoon of the 687th concurrently used 2 x 4 and 2 x 6 lumber to construct wooden forms. The forms consisted of wooden boxes that would later be laid on a flat surface for placement of the concrete walls and bunkers. Nine different wall sizes (with a total of 126 wall sections ranging from 4 feet to 10 feet in length) were included in the design. The two horizontal-construction platoons sequentially completed the bunker and trench system in four quadrants. This allowed the vertical-construction platoon to create the wooden forms for one section and then later reuse those forms for the other sections, thereby saving time and materials. Based on its size, each wall required 0.20–0.75 cubic meters of concrete. Concrete-mixing trucks from local vendors placed 23–31 cubic meters of concrete on a weekly basis. The walls were allowed to set for 5 days before the platoons removed the forms; they underwent an additional 10 days of set time before being transported to the project site.

While the vertical-construction platoon constructed forms and placed concrete, the horizontal-construction platoons used skid steer auger attachments to augur holes for I-beam emplacement. The I-beams were placed into 0.6-meter-diameter, 2.1-meter-deep holes. After the I-beams were placed in the holes, Military Operational Specialty (MOS) 12T–Technical Engineers, verified the I-beam grid coordinates, angles, and depths. The I-beams were blocked and braced with 2 x 4 lumber, creating a "box" around them to ensure that they would not sink or shift. The company placed, blocked, and braced 209 I-beams to meet project requirements. Additionally, the hydraulic jackhammer attachment for the high-mobility engineer excavator was used to dig 0.6-meter-deep footers for each bunker.

I-beam placement was a crucial part of the project, and precision was key during this phase. After blocking and bracing most I-beams, 62 cubic meters of concrete were placed in the holes between the hours of 0300 and 0630 (due to the limitations of the contractor that was supplying the concrete). This required all available personnel, along with an externally procured concrete pump truck. The concrete was allowed to cure for 7 days before wall emplacement officially began.

A Soldier serves as a ground guide for the crane operator while other Soldiers assist in emplacing bunker walls.

The 20-ton 687th Engineer Construction Company crane lifted and emplaced the walls between the I-beams. In the interest of safety, only essential personnel remained onsite during crane operations and safety measures were utilized while sliding the walls into place. Bunker emplacement occurred concurrently with emplacement of the trench walls. While some Soldiers completed Quadrants 1 through 4 of the bunker and trench system, others applied a 15-centimeter layer of gravel to the trench floor to prevent a heavy impact on the system due to rainy weather.

As the bunker and trench system neared completion, the platoons excavated vehicle fighting positions, including hide, hull, and turret defilade leveling. Although the defilade design is optimal for the BMP-1 Infantry Fighting Vehicle (commonly used by the Geronimo Regiment at JRTC), it does account for the future use of the M3 Bradley Cavalry Fighting Vehicle. For the defilade walls, 2.1-meter-wide, 2.1-meter-deep holes were augured for 8 x 8 lumber to be placed and held by concrete footers. The 8 x 8s were blocked and braced in the same manner as the I-beams. Seventeen 8 x 8s were required for each side of each defilade, for a total of 102 8 x 8s among the three vehicle fighting positions. The holes were filled with concrete to anchor the 8 x 8s, and the platoons used railroad ties to build the defilade walls. The railroad ties were stacked in a 1/3, 2/3 brick-lay pattern for maximum structural strength. In total, the company stacked 1,200 railroad ties weighing roughly 250 pounds each. Once the walls were complete, concrete deadman anchors were placed, with steel cables tied onto the 8 x 8s, and the holes were backfilled with dirt placed at a 45-degree angle from the wall.

A crane emplaces the final walls.

Strong Point Huff will serve as a landmark at the premier Army combat training center for decades to come, and it will forge the next generation of warfighters. The magnitude of the construction at Strong Point Huff demonstrates the scale of work that troop construction assets can complete. Strong Point Huff serves as a key milestone in the Army transition to LSCO and the need to train how we fight.

Endnotes:

[1]Heath Coles and Andrew Flynn, "Strong Point Huff: 46th Engineer Battalion Support to Increased Lethality at the Joint Readiness Training Center," *Army Engineer Association*, 2022, <https://armyengineer.com/army-engineer-association-summer-2022/>, accessed on 6 December 2022.

[2]Katie Lange, "Medal of Honor Monday: Army Command Sgt. Maj. Paul B. Huff," U.S. Department of Defense, 8 February 2021, <https://www.defense.gov/News/Feature-Stories/Story/Article/2492065/medal-of-honor-monday-army-command-sgt-maj-paul-b-huff/>, accessed on 6 December 2022.

Captain Stanley is the company commander for the 687th Engineer Construction Company. He holds a bachelor's degree in biosystems engineering from the University of Tennessee, Knoxville, and a master's degree in environmental engineering from the University of Missouri Science and Technology at Rolla. He is a project management professional.

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Managing Manhattan: A Case Study in Complex Project Management

By Lieutenant Colonel Bryan J. Baldwin (Retired)

The Manhattan Project, the U.S.-led secret program to develop the atomic bomb, established the blueprint for the collaboration between the military, academia, and industry. In a span of just more than 3 years, the Manhattan Project transformed a complex scientific theory into the most destructive weapon system the world had ever known. On 16 July 1945, the force of the first atomic explosion shocked even the team of scientists working on the Manhattan Project and forever changed the global security environment. This crowning achievement in American ingenuity highlights how U.S. Army Corps of Engineers leaders leveraged complex problem-solving and risk management skills to attain extraordinary results.

Quantum Revolution

The early 20th-Century revolution in quantum mechanics provided the scientific framework for developing atomic fission. Danish physicist Niels H. D. Bohr, synthesizing existing research by Ernest Rutherford and Max K. E. L. Planck, developed the first modern model of the atom, launching a period of rapid expansion in the field of atomic physics.[1] In 1938, two German physicists stunned the scientific community by unexpectedly discovering atomic fission. Albert Einstein recognized the importance of this discovery and wrote a cautionary letter to President Franklin D. Roosevelt, highlighting the implications were Nazi Germany able to weaponize the science; Einstein cautioned that "This new phenomenon would also lead to the construction of bombs, and it is conceivable—though much less certain—that extremely powerful bombs of a new type may thus be constructed."[2] He advised Roosevelt to establish a scientific research program regarding the technology and to secure a supply chain of uranium ore.[3] Einstein's revelations jolted the President into action; and in 1939, he commissioned a committee to study uranium.

The Unlikely Pair, Brigadier General Leslie Groves and Dr. J. Robert Oppenheimer (Photograph courtesy of the U.S. Department of Energy)

The Advisory Committee on Uranium served as the focal point for U.S. government research into atomic fission, sponsoring the research of scientists Enrico Fermi and Leo Szilard at the University of Chicago, Illinois. In 1941, President Roosevelt also created the Office of Scientific Research and Development to mobilize American science for the purposes of war and appointed Vannevar Bush to lead the effort.[4] That same year, a parallel British effort resulted in the publication of the MAUD report.[5] This pivotal study, based upon research conducted by scientists Niels H. D. Bohr, Otto R. Frisch, and Rudolf E. Peierls, not only contained conceptual plans for developing an atomic bomb, but also concluded that ". . . it is quite conceivable that Germany is, in fact, developing this weapon."[6] The prospect of a Nazi atomic weapon was a clarion call for the national security community, and plans were developed to not only defeat the Nazi program, but also fast-track an American bomb.

Manhattan Engineer District

The Army, specifically the Corps of Engineers, assumed control of American atomic bomb development. Vannervar Bush had recognized that the scientific community lacked the necessary expertise in process development, procurement, engineering capability, construction, intelligence, and operational security and that the Army would be best equipped to lead the effort. The Office of Scientific Research and Development retained control of university research and provided advice to the Corps of Engineers, but command of the project was transferred to an Army officer. To manage the project, the Corps of Engineers established the Manhattan Engineer District, selecting the name so as to disguise the nature of the program. Colonel Leslie R. Groves Jr. was chosen to command the district. Groves had previously served as the Army Deputy Chief of Construction, and his portfolio included managing the construction of the Pentagon. Groves was a plainspoken and decisive leader; he "had intelligence, he had good judgement of people, he had extraordinary perceptiveness and an intuitive instinct for the right answer."[7] More importantly, under Groves's leadership, people achieved extraordinary results.[8]

One of the first critical decisions that Groves (who, by that time, had been promoted to brigadier general) made was the selection of a process for producing fissionable materials. Office of Scientific Research and Development scientists identified five methods of producing fissionable materials: "three isotope separation processes (electromagnetic, gaseous diffusion, and centrifuge) for producing uranium-235 and two pile processes (uranium-graphite and uranium-heavy water) for manufacturing plutonium."[9] Given constrained time and resources, Groves decided to pursue two parallel efforts in order to develop fissionable material from both uranium-235 and plutonium. The centrifuge method of uranium enrichment was eliminated from consideration, and Groves designated that the laboratory at Oak Ridge, Tennessee, develop electromagnetic and gaseous diffusion plants.[10] He further selected the chemical manufacturer DuPont™, in concert with the Metallurgical Laboratory at the University of Chicago, to lead plutonium production at the Hanford Engineer Works in Washington. The Hanaford plutonium production plant was based on the Chicago Pile-1 uranium-graphic reactor; a heavy water process was not seriously considered.[11] With material production plants in place, Manhattan's next milestone was weapons system design.

Project Y

Brigadier General Groves next turned his attention to designing and testing the bomb, code-named "Project Y." He selected Los Alamos, New Mexico, as the location for the laboratory and then wrestled with the more important decision of naming a scientific director for this work, ultimately selecting University of California physicist Dr. J. Robert Oppenheimer to lead the team. Oppenheimer was an unconventional choice, given that ". . . he had had almost no administrative experience of any kind, and he was not a Nobel Prize winner."[12] Additionally, he posed a security concern due to ties to the Communist Party. Despite these risks, Groves considered that Oppenheimer was "a man of tremendous intellectual capacity, that he had a brilliant background in theoretical physics, and that he was well respected in the academic world."[13] Many of the scientists who Oppenheimer selected as members of the team were recent Jewish immigrants who came to the United States to escape the Nazis. With the location and director for Project Y in place, the premier scientists and engineers converged upon an isolated boy's school in Alamogordo, New Mexico, which served as the laboratory site.

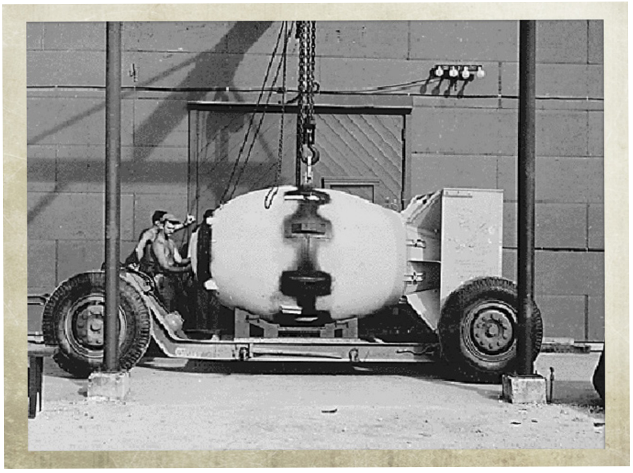
Dr. Oppenheimer began to tackle the initial challenge of designing a bomb that could accommodate both uranium-235 and plutonium as the fissionable material. This task was compounded by the fact that any knowledge of fission explosions was still completely theoretical. Project Y scientists struggled with determining the amount of fissionable material necessary for the weapons system, and Groves stated that this uncertainly "plagued us continually until shortly before the explosion of the Alamogordo test bomb."[14] The central problem involved creating a device in which two subcritical masses of fissionable material would come together in a precise manner at a high speed to form a supercritical mass, causing a super explosion.[15] To achieve this effect, the physicists experimented with a "gun type" design as well as an implosion method. In parallel with the bomb design, a metallurgical team worked on purifying the uranium and plutonium into a stable state and a mechanical design team worked on the physical structure of the bomb, including the arming and wiring devices. Despite initial concerns, Dr. Oppenheimer proved to be adept at complex project management and problem solving.

As work progressed, it became clear that the significant issue would be the design of the atomic "trigger." Scientists were able to perfect the much simpler "gun type" device, but making the implosion method work proved to be more problematic. By late 1944, work at the Los Alamos Laboratory shifted from research and development to production and testing. The team proceeded with building the uranium bomb with the "gun type" device while continuing to work on perfecting the implosion method for the plutonium bomb. The final components for the uranium "gun type" device, code-named "Little Boy," were shipped to Japan via the United States Ship (USS) Indianapolis in July 1945. Due to their confidence in the design, the design team shipped Little Boy without testing the weapon.

Dr. Oppenheimer appointed Dr. George B. Kistiaskowsky to lead a "Cowpuncher Committee" to fast-track the development of the implosion method. The design for a plutonium implosion bomb, code-named "The Gadget," was approved in March 1945, and "The Gadget" was prepared for 16 July 1945 testing at the Trinity Test Site. Brigadier General Thomas F. Farrell, deputy to Brigadier General Groves, described the situation as hectic and tense; at 0 hour, ". . . there came a tremendous burst of light followed shortly thereafter by the deep growling roar of the explosion."[16] Although the initial reaction consisted of both jubilation and relief, the Los Alamos team came to the sobering conclusion that it had given birth to "a great new force to be used for good or for evil."[17]

Little Boy and Fat Man

Having proved the concept of the plutonium implosion bomb at the Trinity Test Site, the Los Alamos scientists scrambled to assemble another weapon, code-named "Fat Man." A team of Army Air Corps engineers at Wendover Field, Utah, simultaneously worked to modify the B-29 Superfortress to deliver Little Boy and the larger Fat Man. Politically, Nazi Germany had surrendered and the Allies were meeting at Potsdam, Germany, to plan for the final defeat of Japan and the future of postwar Europe. Upon the death of U.S. President Franklin D. Roosevelt, President Harry S. Truman had ascended to the Presidency and the decision about whether to employ the weapon would be one of the first of his Presidency. During the Allied conference at Potsdam, Truman reluctantly briefed Premier Joseph V. Stalin on the atomic weapon. At the conclusion of the conference, the Allies issued Japan an ultimatum calling for its unconditional surrender, though the threat of the atomic bomb was not explicitly mentioned.[18] Truman then authorized the 509th Composite Group, 20th Air Force, to employ Little Boy on one of several military targets in Japan—one of the most consequential and controversial decisions ever made by a U.S. President.



Fat Man being unloaded on Tinian Island, Northern Mariana Islands (Photograph courtesy of the U.S. Army Corps of Engineers)

On 6 August 1945, 43 seconds after it left the B-29 Enola Gay aircraft, Little Boy exploded on Hiroshima, Japan. Much of the city was destroyed in an instant, and the blast resulted in more than 160,000 casualties. In spite of the devastation, Japanese military leaders refused to surrender. On 9 August 1945, Fat Man was deployed, exploding with a force of 22 kilotons and killing up to 140,000 more Japanese. On 10 August 1945, Japanese Emperor Hirohito offered unconditional surrender; and on 14 August 1945, he accepted the Allied terms, even as Brigadier General Groves was preparing a second Fat Man for shipment to the Pacific Theater.

The development of the atomic bomb was an American-initiative triumph that stretched the known limits of science. An unlikely pair of leaders transformed the theoretical into the workable through the management of multiple complex projects across scientific disciplines. The Corps of Engineers developed a sophisticated supply chain to acquire and refine highly experimental materials. Unlike the acquisition procedures of today, Brigadier General Groves and Dr. Oppenheimer developed a novel weapon system with little input from the warfighter or from industry. The unconventional approach of the Manhattan Project team illustrates how problem solving, risk management, and integrated process teams serve as the hallmarks of complex project management.

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Value of the POP Method in Training

By First Lieutenant Alexis G. Eliopulos and First Lieutenant Patrick J. Nessler

Training is essential in order for Army units to accomplish their missions—especially in times of erratic or infrequent deployments. A lack of deployments does not mean that the world is safe. Threats from around the globe are as hot and dangerous as ever.[1] Training serves to test systems, maintain unit proficiency, and simulate scenarios in order to prepare units to deploy and win our Nation's wars.

Most units are on a combat training center rotation or on standby as a quick-reaction force or they are training for general readiness. Units have limited time to prepare for these missions; and often, certain aspects of readiness—such as movements, communications systems, and deployment systems—are overlooked. Using the patrol, objective, patrol (POP) method can alleviate many of these issues.

Introduced and utilized by the 326th Brigade Engineer Battalion, 1st Brigade, 101st Airborne Division, Fort Campbell, Kentucky, the POP method embodies a mission-based mindset used to maximize the objectives and completed tasks for a singular training event. With the POP method, the typical administrative pieces of the operation are replaced with realistic training scenarios. A unit patrols to the objective (possibly a range, training area, or repel tower), conducts the training event at the objective, and then patrols back to the starting point or company area. All components of the planning/preparation process, movements, and recovery are considered training opportunities. The POP method creates a more realistic training environment, provides additional checks on systems, and increases training value.

Application of the POP method allows units to realistically train the tactical skills needed in conflict without administrative movement or pauses in the tactical scenario. Leaders should strive to make each training exercise mimic a real combat mission in which the enemy is present and danger is posed. They should use warning, operations, and fragmentary orders to supply information. Movements to and from the training event should be tactical, and movement control reports and communications windows should be enforced. The Army method for planning and executing training is captured in the eight-step training model (see Figure 1, page 28)[2]; the POP method is implemented in each of the eight steps of the model, from planning to retraining. Leaders should continually enforce realism and minimize unrealistic pauses.

An emergency deployment readiness exercise (EDRE) is an excellent example of a situation where the POP method is applied in training. An EDRE is an exercise in which units, without warning, are notified of a notional military deployment. They are completely scenario-based—all the way from unit notification to the end of the exercise and after-action review. One of the 326th Brigade Engineer Battalion sapper companies recently conducted an EDRE. The company was tasked with an air assault into a breach. The platoons competed the tasks necessary for a deployment (an aircraft load, hot and cold loads on helicopters); leaders planned and briefed orders; and Soldiers conducted rehearsals. The company was then flown into the theatre via a UH-60 Black Hawk helicopter and a C5 Galaxy. From there, each platoon conducted its missions. The platoons could have easily reserved a demolition range and trained on breaches on their own; however, the incorporation of required skills into a realistic scenario added significant value. It allowed the Soldiers to practice these skills in a contested environment, stressing the endurance necessary to perform breaching tasks after completing the realistic tasks involved in arriving at the objective. Engineer leaders could see that the Soldiers were more motivated than usual and had a mission-based mindset from the beginning to the end of training.

POP-based training also tests standard operating procedures (SOPs) and systems. During training, some of the smaller, yet extremely important SOPs sometimes get overlooked or skipped. Oftentimes, it is not difficult to acquire the necessary skills but regular practice is needed in order to maintain proficiency. For example, SOPs involving preparing a platoon for a patrol include precombat checks and precombat inspections. Other SOPs cover communications during patrols. The POP method creates more opportunities to practice these SOPs during a training event by including the patrolling aspect. It also adds checks on equipment and maintenance. As an example, a route clearance platoon had been conducting route reconnaissance (patrol) on the way to a demolition range (objective) when one of its vehicles suffered a Class II coolant leak and the engine started to overheat. The vehicle had been recently checked by the motor pool operators; however, using equipment for actual missions always provides a better assessment of its functionality. The problem was identified, and mechanics were able to fix the vehicle before the gunnery, which was slated for a few weeks later. Adding the additional equipment

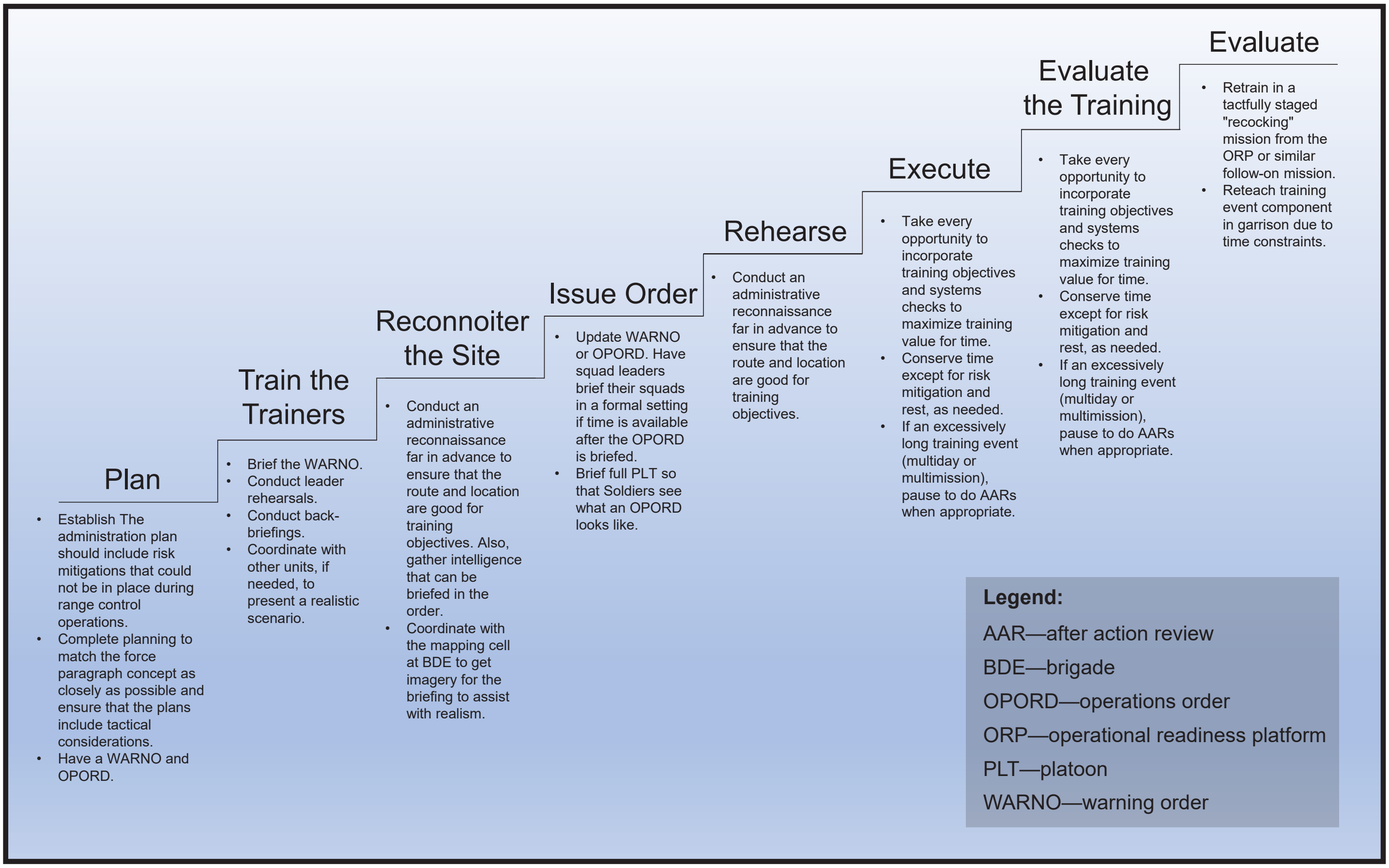

Figure 1. The eight-step training model

checks preserved that vehicle for the gunnery and increased the mission capability of the fleet. The POP method allows equipment a chance to function as it would during a mission, and this gives Soldiers an opportunity to identify and fix faults. The POP method is easily applied, usually requiring very little additional time or resources, as it is simply added to an existing event.

The most advantageous aspect of the POP method of training is the increase in opportunities to train within a single training event. This improvement in effectiveness can be assessed by using training & evaluation outlines (T&EOs), which contain the performance measures needed to complete a task to determine proficiency. Unit and Soldier T&EO performance is graded using the trained, practiced, or untrained "TPU" system. More training and evaluations will ultimately elevate units to the trained status, demonstrating better preparation for future missions.[3]

Units can become proficient in tasks included in the training at the objective as well as tasks trained during the patrols conducted before and after reaching the objective. The POP method does not need to be applied to an event as elaborate as an EDRE. An M4 rifle qualification range can serve as an example. An M4 range is traditionally used only to accomplish the task of individual weapon qualification; however, when using the POP method, the training of collective tasks is limited only by creativity and planning efforts. Figure 2 shows an example in which all of the following collective tasks are trained:

- Conducting a tactical convoy.
- Reacting (while mounted) to indirect fire.
- Establishing a dismounted objective rally point.
- Clearing and occupying an objective

This example and many others illustrate that the POP method increases the number of tasks that can be trained in a training event without any additional demand on resources, time, or equipment.

While the POP method is effective for maximizing training, there are situations where it is definitely not optimal or even realistic. In order to use the POP method to the fullest extent, a considerable amount of thorough planning and coordination is required. With a condensed training schedule or competing unit requirements, this may not be possible. In addition, unavoidable administrative actions (reception, staging, onward movement, and integration) must take place for certain training events. The POP method is also advanced; and when training new Soldiers or units on new battle drills, it is often advantageous to simply focus on the task at hand rather than implement a patrol aspect. Lastly, if the POP method is continuously executed to the

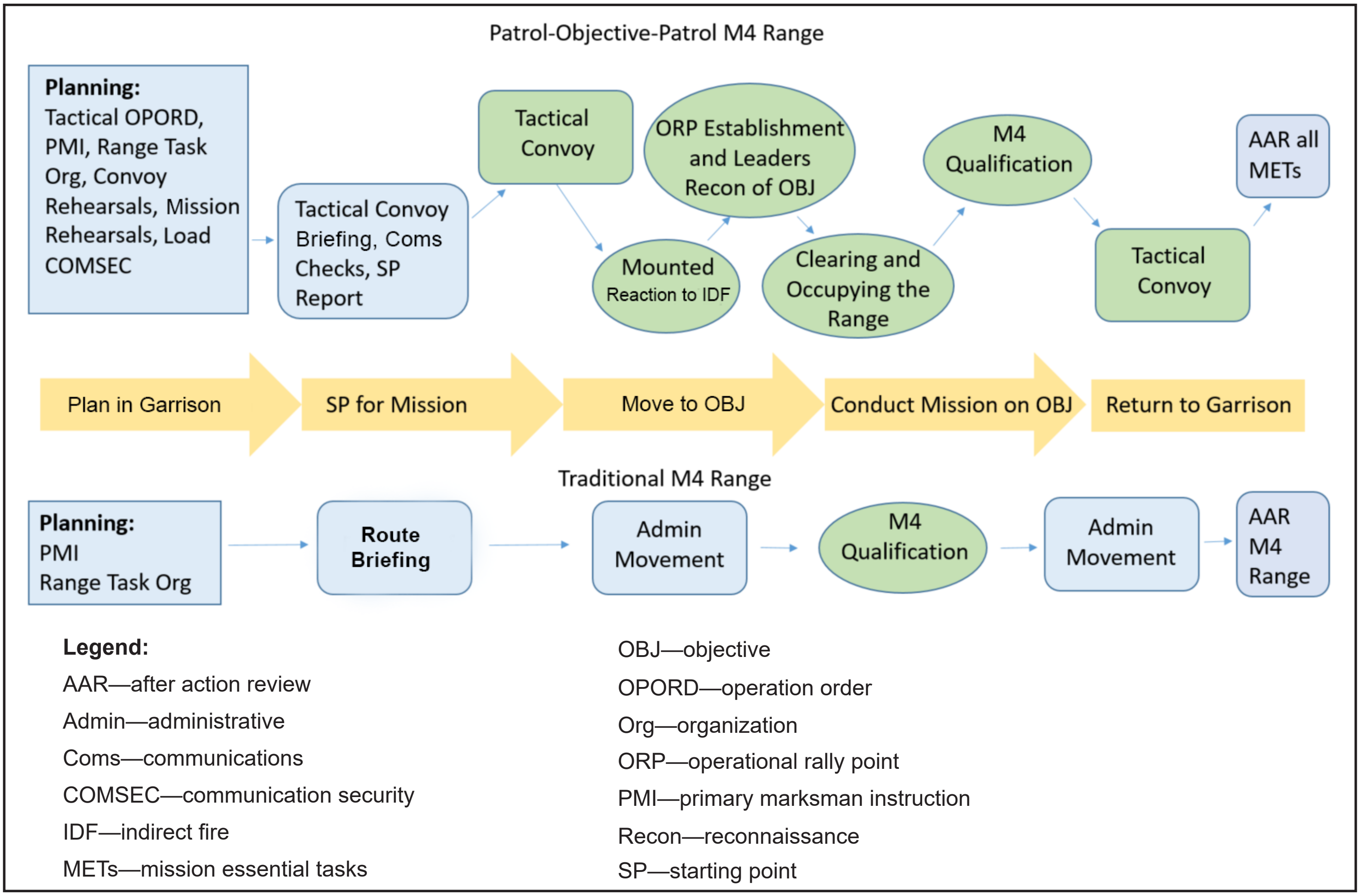

Figure 2. Example of a training event with collective tasks

fullest extent, Soldiers and leaders can become burned out. For optimal results, adequate rest and recovery opportunities must be available. Available planning time and training and recovery requirements can all halt full implementation of the POP method.

In a world that is growing ever more complex, the U.S. Army faces the challenge of determining the best way to prepare its troops. Units face condensed training schedules and multiple competing requirements. The POP method establishes a realistic training environment, adds checks on SOPs and systems, and creates opportunities for more valuable training. The POP method can rapidly increase proficiency in tasks and prepare individual Soldiers and battalions for the real fight.

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Lessons Learned From Defender Europe 2022: The MRBC Perspective

By Captain Carley A. Lafranchi

The North Atlantic Treaty Organization (NATO) is actively shifting its focus to large-scale combat operations, which has prompted Defender Europe, an annual exercise between several NATO members, to grow in strength and scope. Defender Europe is an exercise designed to help train international partners in preparation for a peer or near-pear threat, testing theater level command and control, logistics, and credible combat capability. Each year, different countries host the exercise and work with participating nations to create training objectives. Last year, the exercise unexpectedly aligned with rising tensions and conflicts within Europe, ultimately solidifying and strengthening the relationships between current and future NATO members.

As part of Defender Europe 2022, several units planned and executed the extremely complex mission set of wet-gap crossings. The 74th Multirole Bridge Company (MRBC), 62d Engineer Battalion, 36th Engineer Brigade, Fort Hood, Texas, participated in the portion of the exercise held in Poland, demonstrating interoperability and multiple capabilities throughout the exercise. Only six Regular Army MRBCs exist, providing a unique capability—that of bridging wet- and dry-gap obstacles.

A 1st Battalion, 66th Armor Regiment, Abrams crosses an IRB in Nowogród, Poland

Defender Europe 2022 consisted of five critical phases. The 74th MRBC participated in Phase III, "Long-Distance Movement." During this phase, a maneuver battalion (1st Battalion, 66th Armor Regiment [1-66], 3d Armored Brigade, 4th Infantry Division, Fort Carson, Colorado) joined the 74th MRBC at two locations to execute wet-gap crossings. The 74th MRBC maneuvered Abrams main battle tanks and Bradley fighting vehicles to the far shore to allow 1-66 to seize objectives. At each location, the phases of the wet-gap crossing were executed while integrating gap-crossing fundamentals, flexible planning, extensive preparation, the element of surprise, traffic management, and organizational speed through unit integration and coordination.[1]

There were several lessons learned during the course of the 74th MRBC participation in Defender Europe 2022, beginning with lessons learned regarding predeployment and preparation.

Predeployment and Preparation Lessons Learned

Throughout planning conferences, the 74th MRBC received several mission briefings on the roles and expectations within Defender Europe 2022. The unit assumed risk and focused training on specific mission-essential tasks. Concentrating on select supporting collective tasks allowed the training cycle to be tailored toward specific exercise requirements, enabling increased mission set complexity and contingency planning during training.

Each country participating in Defender Europe 2022 retained unique self-governing laws and regulations. The 74th MRBC coordinated with U.S. Army Europe and Africa to understand the requirements, limitations, and constraints of operating in Poland. Standard operating procedures/execution checklists, planning conferences, in-country points of contact, and resident knowledge of experienced Soldiers were put in place to create condition checks and enable mission success.

Army prepositioned stock (APS) was available for this mission. The on-hand list was assessed early in order to identify shortfalls and create a unit deployment list; critical equipment unavailable through APS was then shipped from the home station to ensure that the company could execute mission objectives.

The mission began with an APS equipment draw. The equipment was shipped from the Belgium/Netherlands/Luxembourg region. APS civilians and the hired contract team had a fluid and highly efficient process for drawing equipment. Signing for the modified table of organization and equipment was completed within 3 hours. However, inventorying components of end items and basic issue items (BII) while conducting preventive maintenance checks and services and technical inspections took 36 hours and was spread over 4 days. After reconfiguring secondary loads to align with the unit standard operating procedure, the 74th MRBC departed for its mission at Wet-Gap Crossing 1 and joined forces with the Swedish *Göta* Engineer Regiment. Several lessons were learned regarding prepositioned stock.

Prepositioned Stock Lessons Learned

Regardless of unit type, units utilizing APS must inquire about the stock early, asking what associated items are included in the draw; in this case, shop stock quadruple containers, bulldozer BII, a triple container, and the BII box of skid steer attachments arrived in addition to the rolling stock. Factoring in redundancy, the 74th MRBC drew additional platforms with lift capabilities. This enabled the 74th MRBC to secure and transport all organic and attached equipment between locations instead of needing to request support for each site.

The 74th MRBC brought select repair parts and petroleum, oils, and lubricants (POLs), unaware that APS had already allocated parts and a similar container filled with POL to the shop stock. The home station containers arrived at the time of the APS technical inspections, allowing access to the needed POLs. This contributed to the equipment rapidly becoming fully mission-capable. The repair parts brought from the home station were specific to unique engineer equipment that required extended aquisition lead times. These items were not present in the APS shop stock, so it was helpful to have them on hand to keep the unit mission-capable. If possible, an inventory of the shop stock items should be obtained early in order to mitigate maintenance issues and the addition of specific items should be requested if needed.

Assembling the improved ribbon bridge (IRB) and conducting rafting operations require critical pieces of BII. Redundant BII was brought from the home station, and that proved incredibly vital since the BII from APS was incomplete for this bridge system. Inquiring about all BII for all equipment (including whether gases are included with the welding trailer) is suggested.

U.S. and Swedish forces both use the same IRB system. The system comes with two types of bridge pieces—interiors and ramps. A seven-float bridge consisting of five interiors and a ramp at both ends is typically built for rafting operations. This float is small enough to easily maneuver and large enough to support the weight of an Abrams main battle tank (up to Military Load Class 115)[2] during rafting operations. For full closures, the ramps are in contact with both shores and the number of interiors required depends on the width of the river. Full closures act as floating bridges for vehicles to cross quickly. Since the Swedish *Göta* Engineer Regiment uses the same type of bridge as the United States, both countries can interconnect pieces, solidifying interoperability and allowing NATO forces to cross wider rivers than an MRBC can support organically.

At the first crossing in Deblin, Poland, the 74th MRBC connected with the Swedish *Göta* Engineer Regiment for the first time, creating a full closure spanning 190 meters over the Vistula River. The unit immersed with the Swedish, integrating equipment and techniques from both countries. Although the same type of bridge is used by both countries, there are variations in the types of boats used for inspection, proofing techniques, load classification systems, and additional equipment. More than 60 international vehicles (from the United States, Poland, and France) crossed the full closure at this location.

Upon completion of the first wet-gap crossing, the 74th MRBC integrated with Polish, Swedish, and French forces to coordinate and execute Wet-Gap Crossing 2 at Nowogród, Poland. This crossing was more complex due to the integration of air support, assault vehicles, and dismounted operations. Once again, the 74th MRBC connected with the Swedish, creating another multinational full closure. The exercise culminated in a display of U.S., Polish, Swedish, and French forces working together to accomplish a wet-gap crossing for the Polish president. It also culminated in doctrinal lessons learned.

Doctrinal Lessons Learned

Wet-gap crossings are executed with the brigade crossing force at the division level. Regardless of the echelon of the training audience, integration of wet-gap crossings into unit training plans ensures holistic preparation and understanding of the fundamentals required to prepare collective forces for future fights in large-scale ground combat operations.

The 3d Armored Corps and Fort Hood recently completed their first Gap-Crossing Training Center exercise. Once the Gap Crossing Training Center becomes fully developed, it will serve as the premier training center for gap-crossing operations and allow Regular Army, U.S. Army Reserve, and Army National Guard MRBCs to be evaluated at full scale alongside maneuver elements. Brigade and division staffs can conduct MDMP, integrate warfighting functions, and execute a mission throughout the exercise. By practicing and validating a wet-gap crossing, maneuver elements can refine this complex mission set before conducting large-scale ground combat operations.

Defender Europe is an annual NATO training event that increases alliance capabilities and interoperability. The experience varies each year, but the training received is always invaluable. Linear wet-gap obstacles are present in every theater, pushing U.S. forces to increase MRBC efficiency and conduct collective training throughout maneuver elements. Training alongside NATO partners enables increased proficiency and interoperability. Defender Europe 2022 proved that we are capable and ready. *Stronger Together!*

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At the time this article was written, Captain Lafranchi was the commander of the 74th MRBC. She currently serves as an assistant operations officer for U.S. Army Europe and Africa. She holds a master's degree in environmental engineering from the Missouri University of Science and Technology at Rolla.

"Let Us Try" to Implement FM 3-0:

Challenges of LSCO at the Engineer Company Level

By Captain Neal T. Eichenberg, Captain Steven D. Fusco, Captain Mateo M. Ledesma, and Captain Andrew Lightsey IV

With the current Russian aggression toward neighboring Ukraine and China's territorial disputes in the South China Sea, many are beginning to question the status of the United States as the leading military superpower. Field Manual (FM) 3-0, *Operations*, starkly reminds us that "The Army no longer enjoys superiority across all the warfighting functions. Peer threats, particularly Russia, China, North Korea, and Iran, can contest the U.S. Army and the joint force across all domains."[1] Given this reality, company commanders will need to step up and lead during upcoming engagements but they will do this with a myriad of challenges.

Analysis of the new FM 3-0 and the shift to large-scale combat operations (LSCO) reveal obstacles that will affect company level leadership in all branches of the Army. This article showcases those challenges by highlighting key friction points in the U.S. Army Engineer Branch. Company level engineer leaders face fierce challenges, including attaining a level of understanding of peer level adversary capabilities sufficient for incorporation into training; maintaining the resiliency necessary to push through significant losses; and ensuring the ability of their units to provide mobility, countermobility, and survivability capabilities to joint maneuver forces.

Over the past 2 decades, U.S. near-peer competitors have met or surpassed the capabilities of the United States. These competitors ". . . fielded more professional forces with advanced capabilities, improved training, and combined arms formations designed to contest us and our multinational partners across all domains."[2] Engineer companies must understand current enemy capabilities so that they can plan and train accordingly.

For example, consider Russian unmanned aerial vehicles and their "overwhelming disparity in information collection."[3] Companies must respect the Russian unmanned aerial vehicle range of 200–500 kilometers, which exceeds the U.S. capability of 150 kilometers, and incorporate that information into their plans. The longer range in Russian forward reconnaissance will make obstacle and battle position emplacement challenging and may result in reduced obstacle effectiveness due to rushed execution. Training must reflect these expedited execution requirements.

The advantage of Russian unmanned aerial vehicles, coupled with their longer-range artillery assets, allows for early detection of engineer assets and "destruction with massed fires."[4] This makes the execution of breaching, bridging, and route reconnaissance a far greater challenge for engineers. Over the next decade, engineer companies will be required to resource and train with consideration for near-peer capabilities in accordance with FM 3-0.[5]

The last time the Army conducted a joint multidivisional campaign was in Iraq in 2003. Since then, the Army has not participated in major combat against near-peer or veteran opponents. With adversaries who can outperform the Army—most notably, in the area of indirect fire—commanders and their companies must demonstrate the resiliency that was necessary during the Vietnam War and before. This resiliency will be manifested by the drive to continue the mission, even in the face of mass casualties and equipment losses.

In his article, entitled, "Bringing Order to Chaos," Lieutenant Colonel Peter J. Schifferle details how LSCO will change our perception of war, indicating that we must ". . . come to grips with the impact of significant U.S. casualties and become more comfortable with the sheer violence of modern combined arms battle" and that "we must be prepared to deal with the attendant horrors of mass casualties and the likely destruction of entire units . . .."[6] In the past, engineer commanders assumed a 50 percent loss of personnel and vehicles when conducting a breach. In the future, commanders must be resilient enough to push through "an enormous kill zone while defeating and bypassing maneuver forces seeking to [hold the enemy in a specific location], all while subject to artillery overmatch in both range and number of systems."[7] All commanders can expect greater casualties, but engineer commanders must be committed to pushing through up to 100 percent personnel and vehicle casualties, knowing that the entire maneuver force is dependent on what they can accomplish.

In a maneuver support role, engineers must provide freedom of maneuver throughout the battlefield while concurrently conducting countermobility and survivability operations. For the past 2 decades, the Army has leaned on its domination of warfighting functions. Current peer threats have the ability to jam communication platforms, making it increasingly more difficult to conduct offensive and defensive operations.

Decisive action serves as the foundation of the Army's operational concept in LSCO environments.[8] The requirement to conduct simultaneous offense, defense, and stability tasks most certainly causes engineers to be displaced throughout the battlefield. At the company level, leaders must not only train their units to operate remotely, but also train themselves to command and control squads and platoons that support multiple maneuver battalions throughout the area of operations.

Engineers must enable mobility of friendly maneuver forces while simultaneously disrupting and disabling the enemy to win the fight. It is a daunting mission for engineer companies to conduct simultaneous offensive, defensive, and survivability operations while under fire from a peer or near-peer threat. The same conditions also cause challenges for Soldiers, equipment, and company leaders who command the troops.

LSCO present complex problem sets across all aspects of company leadership. Preparing for a hostile environment under a peer or near-peer threat is a tall order. Success depends on engineer company leaders being prepared to provide mobility, countermobility, and survivability capabilities across hundreds of square kilometers of the battlefield.

Engineer company level leaders face several considerable challenges as the Army adopts the new FM 3-0 and redirects to LSCO. By beginning to understand the capabilities of peer-level foes for integration into training, sustaining the strength and resiliency needed to continue in battle despite incurring considerable losses, and ensuring that units can effectively execute their key combat engineering tasks for the ground force, these leaders can begin to navigate the new problem sets.

Endnotes:

[1]FM 3-0, *Operations*, 1 October 2022.

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[8]Ibid.

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Activating an MRBC: Challenges and Opportunities in Mobilizing a Force Multiplication Unit

By First Lieutenant Chan D. Kim

Creating and sustaining lines of communication in order to equip and supply land forces are keys to success in large-scale combat operations. Assured mobility becomes more difficult when echelons of battalion and above must cross water obstacles. Land force commanders rely on engineers—specifically, multirole bridge company (MRBC) engineers—to rise to these challenges. In a world with capable, modern, and agile forces that enable the rapid massing of fires and penetration of lines, the need for MRBC units is growing; thus, the activation and mobilization of such units are more critical than ever.

The collaboration of multiechelon headquarters, the absence of a preexisting MRBC within 150 miles of Fort Stewart, Georgia, and pandemic-infused complications shaped the operational environment; and, recognizing the importance of the MRBC, the U.S. Army modernization effort led to the 16 October 2021 activation and mobilization of the 497th MRBC, 92d Engineer Battalion, Fort Stewart. The 497th MRBC supports the 20th Engineer Brigade, XVIII Airborne Corps, and is aligned with the armored brigade combat teams within the 3d Infantry Division. This activation/mobilization offered many challenges and opportunities.

The MRBC is a unique engineer company that enables the mobility of land forces across austere and aquatic obstacles. MRBCs have organic assets to improve, repair, construct, and demolish bridge sites. They can also raft, bridge, and assault across wet gaps; control traffic; and support survivability operations. The unique capabilities of the MRBC increase land force combat power following the breach of inland water obstacles. Coordinated at echelons of division or higher, MRBCs efficiently and effectively enable maneuver forces to build and multiply combat power on the far side of the obstacle.

Company Footprint Establishment and Training Area Development

The absence of an active MRBC on or near Fort Stewart led to an extensive organizational effort to learn and network across the Engineer Regiment. The lack of the needed technical expertise prompted the MRBC and the 92d Engineer Battalion to consult with observer coach/trainers and sister MRBC units at Fort Knox, Kentucky, and Fort Leonard Wood, Missouri. Despite the numerous consultations and engagements, on-the-ground knowledge of MRBC equipment and its maintenance requirements remained insufficient for planning and establishing a proper footprint. These limitations, compounded by limited facilities and funds for force structure change on the installation, led to faulty MRBC assignment of the footprint. Although acquired motorpool space temporarily resolved the issue of equipment receipt and storage, critical issues soon became apparent. Specifically, the overhead lift capacity and dimensions of the maintenance bays were inadequate for the routine maintenance of lengthy MRBC equipment. In addition, tight corners in the vicinity of supporting structures led to limited maneuverability, added risk, and the need for extra caution in operating common MRBC equipment such as bridge transporters.

Furthermore, the unique training assets required for a Regular Army MRBC, which include a wet gap that is adequate for validating a 200-meter-wide company with survivability and traffic control operations, did not meet environmental constraints. Specifically, key limiting factors included a lack of road infrastructure, limited maneuver space, and mobility corridors that allowed for only one-way traffic (which increases the risk involved in MRBC operations). Given only limited, predictable requests from U.S. Army Reserve and Army National Guard MRBCs within Georgia, Fort Stewart had been able to sufficiently accommodate two to three annual training events at a single training area that is often used by civilians for recreational purposes. However, the area offered limited resolution with regard to the 497th MRBC need for more versatile, dynamic training environments that can accommodate night operations, live fires, and CBRN scenarios. These limitations, in conjunction with MRBC training being constrained to one operational area and the acquisition of appropriate approval for varying risks undergoing an evolution, add to the complexity of MRBC mission-essential task training events.

Despite its difficulty in establishing a foothold on Fort Stewart, the 497th MRBC successfully received its personnel and equipment prior to its activation in June 2021. The ability of the 497th MRBC to effectively communicate with the 3d Infantry Division, the Directorate of Public Works, range control, and various other entities to address and alleviate these ongoing difficulties led to unique opportunities, such as opportunities to participate in construction and survey projects across Fort Stewart. The MRBC was also successful in obtaining approval for training with multiple headquarters. In addition, the lessons learned led to the detailed equipment area analysis necessary for 3d Infantry Division engineers to intake equipment with specialized/detailed maintenance needs. The process of conducting detailed equipment area analysis created the potential to activate two more units within the 92d Engineer Battalion, with minimal impacts to external units across Fort Stewart.

Receipt of Equipment via Lateral Transfers and Fielding

As implied by its name, an MRBC can accomplish varying mission sets—and it does so with assigned organic equipment. However, for the 497th MRBC, this ability was hindered by the difficulty in receiving proper equipment via lateral transfers from other units, by funding, and by fielding issues within several echelons. The difficulty, rooted in the reorganization of the MRBC table of organization and equipment and Army modernization efforts, increased with minimal coordination from the losing unit and external failures.

A Soldier constructs an IRB by joining the IRB bays and pumping the lever to secure the locks.

A lateral transfer, a tool used by two units to transfer government property from one to another, is often managed by commanders to shape and modernize their units in accordance with the Army vision. Because (despite its inactive status) the 497th MRBC received equipment prior to the effective date (E-Date),[1] there were substantial errors in administrative paperwork, which were driven by a lack of awareness about MRBC activation. These errors, compounded with the failure of external units to conduct proper inventories and maintenance, resulted in the frequent rescheduling and delay of lateral transfers involving up to 640 pieces of equipment. (An MRBC is fitted with 1,683 items.) Increases in the disposition actions of simultaneously receiving and conducting turn-ins added to the complexity of property book management.

Ongoing updates to the MRBC table of organization and equipment—such as the exclusion of dry support bridge and other unit kits—further added to the complexity. This degraded certainty on equipment receipt and planning timelines. The updates impacted the Army Tank-Automotive and Armaments Command, Army Material Command, fielding of M30 bridge erection boats and M15/16 improved ribbon bridges (IRBs)/ramps. The updates and consequential delays resulted in longer timelines for sufficiently training equipment operators and maintenance personnel. The delayed training timelines and external funding issues for shipments introduced unpredictability and created reactive (rather than proactive) actions from the 497th MRBC. IRBs are designated as pacing items—vital pieces of equipment that the MRBC needs in order to accomplish its assigned mission—and the delay resulted in readiness issues.

Despite the frustration of the equipment receipt process, the 497th MRBC successfully adapted to unpredictability through a multitude of internal systems such as the Lateral Transfer Program. Often aided by the 92d Engineer Battalion logistics officer/property book officer, the 497th MRBC attracted support from higher headquarters and the 3d Infantry Division in targeting nearby units, identifying organic elements within the battalion, and focusing on deactivating units. This method maximized installation transfers, minimizing travel and enhancing communication. Once the lateral transfer parties had been identified, the MRBC effectively communicated the activation status of the 497th and shared checklists that included key documentation such as disposition orders, delegation authorities, hand receipts, and multiple points of contact for the MRBC and the battalion. The lateral transfers included organic support for conducting on-site inspections and maintenance to minimize errors and enhance lateral transfer completions. The flexibility of the lateral transfer program allows adaptation to changes through weekly prioritization in conjunction with modernization efforts, alignment and scheduling of targeted dispositions, and fielding with experts who were already present in order to leverage their technical knowledge about inspections and maintenance.

The 497th MRBC and the 92d Engineer Battalion also successfully noted signs of delays in order to minimize readiness issues. By building a line of communication across the Fort Stewart installation (specifically, with the Force Management Plans and Operations Division, which delivers the fielded equipment from shipment contractors to the MRBC), the MRBC successfully gathered on-the-ground data and created accurate timelines. The positive rapport allowed the MRBC to readily adapt to the pending shipment delays and adjust planning and scheduling for training.

Integration Into Army Systems

The U.S. Army uses various online Army systems such as the Digital Training Management System (DTMS) and the Global Combat Support System–Army to collect, analyze, and update unit data such as that contained on a unit status report. The 497th MRBC overcame a multitude of challenges with these systems, primarily driven by its inactive status (prior to the E-Date). The greatest challenge for the MRBC was its integration into DTMS—not only due to E-Date issues, but also to changes in the operational Army, such as changes in the administration of the Army Combat Fitness Test and in record keeping. The 497th MRBC was unable to activate its own account on DTMS until the E-Date, meaning that analog record keeping was conducted to meet reporting requirements from higher headquarters. The problem of MRBC integration into the Global Combat Support System–Army was not as significant; however, integration necessitated increased reliance on the 92d Engineer Battalion staff and, at times, higher command actions for routine maintenance and supply activities that could normally be achieved at the company level. Compiling information from various systems into a unit status report was a challenge when painting an accurate battlefield picture for higher headquarters.

Soldiers take part in a boat school, a modification of driver's training for bridge crewmembers.

Other systems, such as the Transportation Coordinators' Automated Information for Movements Systems and the U.S. Army Total Ammunitions Management Information System, had minimal impact on the MRBC. These systems are not routinely used prior to activation and were heavily used only when the 497th MRBC was planning for larger-scale training exercises. However, the account creation process and training of personnel for these systems did impact the training timeline; in hindsight, these residual impacts could have been prevented by earlier activation, training, and use of these critical systems. More specifically, activation of the system unit identification codes prior to the E-Date would have eased the burden of integrating into these Army systems.

Despite the internal and external challenges of integrating into the aforementioned Army systems, the 497th MRBC benefited from the use of analog systems and the opportunities to build relationships in the midst of challenges. While inefficient and somewhat cumbersome, the use of analog systems empowered the 497th MRBC Operations Section to collect and track data using other (digital) platforms—leading to functionality and redundancy during blackouts in field environments. The ability to minimally rely on a digital footprint enabled the MRBC and postured it for modern warfare camouflage. Furthermore, the process of activating accounts and integrating the MRBC into Army systems enabled communications with various entities within and external to Fort Stewart. Most notably, the 497th MRBC was able to effectively communicate with the higher headquarters readiness office to leverage company needs, advancing equipment and personnel receipt as well as training for key positions, such as crane operators and sling load inspectors. These relationships also allowed the MRBC to troubleshoot system errors using appropriate points of contact and resources that would have otherwise been idle.

Conclusion

Activating and mobilizing a unit with multiple higher headquarters and interested parties and consisting of 183 personnel along with equipment valued at more than $66 million is a massive undertaking. Despite the extensive challenges, the 497th MRBC was successfully activated, executing its activation ceremony at the historic Fort Screven on Tybee Island, Georgia, on 15 October 2021—much like its original predecessor, the 1051st Engineer Port Construction and Repair Group, did on 25 November 1942. MRBCs are critical to accomplishing the Army mission in future warfare, and the appetite is only building. Although difficult and challenging, the fruits of labor and the impact of the MRBC are much greater than the pains of its activation. The Engineer Regiment can learn from the challenges and opportunities of the 497th MRBC to alleviate these pains and more efficiently and effectively impact the U.S. Army.

Endnote:

[1]Department of the Army (DA) Pamphlet 71-32. *Force Development and Documentation Consolidated Procedures,* 21 March 2019.

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Miniature Excavator

By First Lieutenant Eden E. Lawson
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The 101st Airborne Division (Air Assault), Fort Campbell, Kentucky, is "capable of executing air assault operations at various echelons to achieve speed, surprise, and lethality across terrain and the full spectrum of sustained combat operations."[1] Within each infantry brigade combat team, there is a brigade engineer battalion (BEB) that supports maneuver battalions.

Engineers from the 326th BEB, 1st Brigade Combat Team, 101st Airborne Division, have identified and attempted to rectify a critical shortfall with their modified table of organization and equipment (MTOE). Current 326th BEB MTOE engineer equipment is too heavy to be used in an air assault operation. Through conversations with multiple Chinook (CH-47) pilots, the engineers learned that the total weight of all sling-loaded equipment should be less than 15,000 pounds. While the aircraft is capable of lifting more weight than that, that is the maximum weight limit for a combat-equipped aircraft to fly a meaningful distance. The high-mobility engineer excavator (HMEE), which is the primary equipment used for individual fighting positions in the defense, weighs 18,000 pounds. The inability to conduct air assault means that units must rely on a ground lines of communication for movement; this increases risk to the mission. Field Manual (FM) 3-99, *Airborne and Air Assault Operations*, notes that "Ground tactical movement subjects the entire organization to the threat of improvised explosive devices or ground attack,"[2] which emphasizes the need for air assault operations for engineer units in support of their maneuver counterparts.

This need for air assault operations drove innovative thinking amongst 326th BEB engineers. The engineers assessed the situation and developed a problem statement in January 2022. They sought a useful piece of engineer equipment that was light enough to sling-load for use in a combat operation. Initial discussions focused on miniature excavators and skid steers. Miniature excavators, commonplace in civilian construction, weigh much less than HMEEs with similar capabilities. Skid steers, another lightweight option, are already part of the 326th BEB inventory but are rarely used. The engineers hoped that one of these two pieces of equipment could be sling-loaded to a secured area and immediately used to dig fighting positions, allowing engagement area development to begin while waiting for other engineer vehicles to arrive via ground assault convoy. Support platoons acquired and assessed miniature excavators and skid steers over a series of exercises, culminating with their integration into a battalion level air assault to defense. The experiment was ultimately considered a success, and the 326th BEB is currently in the process of writing an operational needs statement for the use of miniature excavators at the Joint Readiness Training Center, Fort Polk, Louisiana, and in future operations.

Methodology

In February 2022, the 326th BEB began its proof of concept with two 6,500-pound miniature excavators and one 7,500-pound tracked skid steer with auger bit. It was important to test the ability of the skid steer to dig fighting positions since the vehicle is already on the BEB MTOE and is light enough to sling-load. During this iteration of testing, Soldiers practiced digging with the equipment and rigging it on container roll-in/-out platforms for future sling-load validation.

The miniature excavators and skid steer were first put through a series of tests, including tests on on- and off-road driving speed, speed and ability to dig in an open field, speed and ability to dig in dense vegetation, and maneuverability in restricted terrain. These tests showed that the driving speeds of the miniature excavators were significantly slower than that of the skid steer, with travel at 2 miles per hour versus 10 miles per hour for the skid steer. However, the skid steer auger bit was easily entangled in root systems and driving the skid steer through dense vegetation was very awkward. The miniature excavator was easy to operate, and digging with it was very similar to digging with the HMEE, on which Soldiers are trained to dig fighting positions. In ideal conditions, operators could dig a machine gun fighting position in less than 20 minutes using the miniature excavator. The tests allowed engineers to rule out the use of skid steers for sling loading for use in combat operations due to their inability to complete the required digging mission.

Testing the ability of a miniature excavator to dig in an open field

The next test, rigging the miniature excavators, also served as an important learning experience. Instructors from the Sabalauski Air Assault School, Fort Campbell, Kentucky, recommended chaining the excavators to a container roll-in-out platform. Soldiers rigged and certified the load in accordance with procedures outlined in Technical Manual (TM) 4-48.11, *Multiservice Helicopter Sling Load: Dual-Point Load Rigging Procedures*.[3] Loading the excavators on either end of the container roll-in/-out platform left space in the middle of the platform for an initial set of Class IV barrier materials, which could be used to help maneuver units begin building their fighting positions. (Based on requirements outlined in Army Techniques Publication [ATP] 3-21.8, *Infantry Platoon and Squad*,[4] 116 sandbags, 11 U-shaped pickets or eight wooden 4 x 4s, and one sheet of plywood are required for one fighting position. Depending on the materials used, this equates to 170–284 pounds of material per position.)

Additionally, engineers configured a sled for the miniature excavator so that the Class IV barrier materials could be dragged from the helicopter landing zone to defensive positions. The sled, which weighed 150 pounds, consisted of two 4 x 4s, a sheet of plywood, 2 x 4 braces, and side hooks for the tie-downs. A tow strap or chain could be run through two slots in the front of the sled and around the body of the miniature excavator. All Class IV barrier materials were tied down on the sled so that, upon landing, the sled could immediately be downloaded and the materials dragged where needed.

The next equipment test involved load configuration; following that test, and with the help of the Illinois National Guard, the load was certified and able to be flown. Despite the imperfect configuration, the flight was a success and the 326th was able to offer the capability to support a maneuver battalion in an operational environment.

Integration

On 22 March 2022, support platoons from the 326th BEB, conducted a movement coordination exercise in parallel with the 506th Infantry Regiment "Red Currahee." The Red Curahee mission consisted of a battalion level air assault into an area defense for Companies A and D. For this mission, the 326th BEB rigged, sling-loaded, and dug with two 4,000-pound miniature excavators. Due to canalized mobility corridors, miniature excavators effectively tracked from the helicopter landing zone to the defensive line to support mechanical digging. Their small size and ability to maneuver in tight areas rendered them more efficient than HMEEs. The excavators proved to be excellent assets for digging several types of fighting positions. Over the course of 14 hours, the two miniature excavators were used to dig 15 fighting positions for the maneuver companies. These positions were 2 feet wide and 5 to 6 feet deep, depending on the needs of the Soldiers occupying the position. Due to austere conditions (severe rain, wind, and the need for use of night vision devices), coupled with inhibited travel time between positions due to muddy conditions, the speed of the operation was greatly degraded and the dig rate for the test was only one fighting position per hour. While it is possible to move faster and dig quicker with HMEEs, the miniature excavators proved superior in their ability to traverse through wooded terrain—and they were still capable of digging the necessary fighting positions.

Based on an assessment of overall mission and applicability, miniature excavators are a beneficial asset for supporting an infantry brigade combat team in the defense. One constraint that was identified was the limited power of the vehicles. Difficulties were encountered with the rubber-tracked miniature excavators in the woods under the adverse weather conditions. In one case, a miniature excavator threw track and it took an experienced operator 45 minutes to recover the vehicle from the muddy terrain. The open cab of the excavator also posed a threat to the operator, who had no protection from external hazards. Further iterations of integration testing revealed that it took more than 30 minutes to load and unload the miniature excavators on the trailers, which also significantly slowed progress.

Conclusion

Altogether, miniature excavators are useful dig assets that can be used to accomplish the mission of rapid engineer support via air assault. The ability to quickly transport miniature excavators via air increases the amount of dig time available to the maneuver unit before the "no-later-than" defend time. These assets should be allocated to the supported unit from the onset of the operation, offsetting the delay in further assets arriving via ground. The major constraint is that miniature excavators are not included in the BEB MTOE or Army inventory. Possible resourcing solutions include submitting a request for needed equipment to the division acquisition review board. Through this process, types of equipment not currently residing in the unit are reviewed and may be validated and approved for funding. The addition of miniature excavators could provide the BEB with the adaptability necessary for diverse missions and the capability of restructuring to compete in future large-scale combat operations.

Endnotes:

[1]*101st Airborne Division (Air Assault) Gold Book*, U.S. Army, February 2019.

[2]FM 3-99, *Airborne and Air Assault Operations*, 6 March 2015, p. 8-2.

[3]TM 4-48.11, *Multiservice Helicopter Sling Load: Dual-Point Load Rigging Procedures*, 5 July 2013.

[4]ATP 3-21.8, *Infantry Platoon and Squad*, 12 April 2016.

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[2]*Standing Well Back* website, <https:\\standingwellback.com>, accessed on 1 September 2022.

[3]Glenn K. Otis, "Threat to the Rear: Real or Myth?" Land Warfare Paper No. 2, Association of the U.S. Army, November 1989, <https://www.ausa.org/sites/default/files/LWP-2-Threat-to-the-Rear-Real-or-Myth.pdf>, accessed on 2 September 2022.

[4]Mark Gilchrist, "Reconsidering Rear Area Security—The 101st Airborne Experience During Operation Market Garden," *The Strategy Bridge*, 17 September 2017, <https://thestrategybridge.org/the-bridge/2017/9/17/reconsidering-rear-area-security>, accessed on 1 September 2022.

[5]Lester Grau and Charles Bartles, *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces*, Foreign Military Studies Office, Fort Leavenworth, Kansas, 2016.

[6]Marc Tranchemontagne, "The Enduring IED Problem: Why We Need Doctrine," *Joint Force Quarterly 80*, 1st quarter, 2016, <https://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-80/Article/643235/the-enduring-ied-problem-why-we-need-doctrine/>, accessed on 1 September 2022.

[7]ADP 3-37, *Protection*, 31 July 2019.

[8]*Defense Science Board Report*, March 2006, <https//dsb.cto.mil>, accessed on 9 September 2022.

[9]Marine Corps Order (MCO) 3502.10, *Counter-Improvised Explosive Device Training and Education Program*, 11 December 2018, <https://www.marines.mil/News/Publications/MCPEL/Electronic-Library-Display/Article/1714284/mco-350210/>, accessed on 9 September 2022.

[10]"C-IED Strategy Lines of Effort," U.S. Army, 2022, <https://www.milsuite.mil/book/community/spaces/apf/counter-ied>, accessed on 9 September 2022.

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