ENGINEER

The Professional Bulletin of Army Engineers

2021 Annual Issue

Headquarters, Department of the Army
PB 5-21-1 Approved for public release; distribution is unlimited.

U.S. Army Engineer School

(573) 563-6192/DSN 676-6192

COMMANDANT
BG Mark C. Quander
563-6192, <mark.c.quander.mil@mail.mil>

ASSISTANT COMMANDANT (AC)
COL Brian P. Hallberg
563-6192, <brian.p.hallberg.mil@mail.mil>

DEPUTY COMMANDANT (DC)
Dr. Shawn P. Howley
563-8080, <shawn.p.howley.civ@mail.mil>

REGIMENTAL COMMAND SERGEANT MAJOR (RCSM)
CSM John T. Brennan
563-8060, <john.t.brennan.mil@mail.mil>

REGIMENTAL CHIEF WARRANT OFFICER (RCWO)
CW5 Dean A. Registe
563-4088, <dean.a.registe.mil@mail.mil>

DEPUTY ASSISTANT COMMANDANT (DAC) – USAR
COL Charles W. Lewis
563-8045, <charles.w.lewis36.mil@mail.mil>

DEPUTY ASSISTANT COMMANDANT (DAC) – ARNG
MAJ Richuard C. Ghinelli
563-8046, <richuard.c.ghinelli.mil@mail.mil>

CHIEF OF STAFF (CoS)
LTC Aaron M. Williams
563-7116, <aaron.m.williams.mil@mail.mil>

COMMANDER, 1ST ENGINEER BRIGADE
COL Gerald S. Law
596-0224, <gerald.s.law.mil@mail.mil>

DIRECTOR OF TRAINING AND LEADER DEVELOPMENT (DOTLD)
LTC James T. Palmer
563-4093, <james.t.palmer.mil@mail.mil>

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

COUNTER EXPLOSIVE HAZARDS CENTER (CEHC)
Mr. William E. Secules
563-2767, <william.e.secules.civ@mail.mil>

MSCoE CDID, RDD
COL Robert A. Davel
563-7158, <robert.a.davel.mil@mail.mil>

ENGINEER DOCTRINE BRANCH, MSCoE FFID DOCTRINE
Mr. Douglas K. D. Merrill
563-0003, <douglas.k.merrill.civ@mail.mil>

ORGANIZATIONAL BRANCH, MSCoE FFID
LTC Michael T. Loftus
563-6282, <michael.t.loftus4.mil@mail.mil>

TRADOC PROPONENT OFFICE - GEOSPATIAL (TPO-GEO)
COL Kenneth J. Frey
563-8263, <kenneth.j.frey.mil@mail.mil>

ENGINEER PERSONNEL DEVELOPMENT OFFICE (EPDO)
MAJ Serafina S. Moore
563-3019, <serafina.s.moore.mil@mail.mil>

PRIME POWER SCHOOL, COMMANDER & DEPUTY COMMANDANT
CW4 Willie Gadsden Jr.
596-0612, <willie.gadsden.mil@mail.mil>

By Order of the Secretary of the Army:

JAMES C. MCCONVILLE
General, United States Army
Chief of Staff

Official:

KATHLEEN S. MILLER
Administrative Assistant
to the Secretary of the Army
2021602

Engineer (ISSN 0046-1989) is published once a year by the U.S. Army Engineer School and the Doctrine Division, Fielded Force Integration Directorate, Maneuver Support Center of Excellence, Fort Leonard Wood, Missouri.

Send submissions by e-mail to <usarmy.leonardwood.mscoe.mbx.engpb@mail.mil>. Due to regulatory requirements, we normally do not publish articles that have been published elsewhere.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, and official unit requests to receive a digital subscription should be sent to *Engineer* at the preceding address. Telephone: (573) 563-4137; DSN: 676-4137; e-mail: <usarmy.leonardwood.mscoe.mbx.engpb@mail.mil>; Web site:<https://home.army.mil/wood/index.php/contact/publications/engr_mag>.

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

CONTENT is not copyrighted. Material may be reproduced if credit is given to *Engineer* and the author.

DISTRIBUTION: Distribution is electronic media only (EMO). If you have a paid subsctiption and need a refund, please contact the U.S. Government Publishing Office, P.O. Box 979050, St. Louis, MO 63197-9000.

SUBSCRIPTIONS FOR DIGITAL ISSUES can be requested by contacting <usarmy.leonardwood.mscoe.mbx.engineer@mail.mil>. Digital versions of the issues are posted online at the Defense Visual Information Distribution Service Web site: <https://www.dvidshub.net/publication/516/engineer> and on the Engineer Professional Bulletin home page: <https://home.army.mil/wood/index.php/contact/publications/engr_mag> and are available with the Magzter© mobile application.

ENGINEER

The Professional Bulletin of Army Engineers

Volume 51 PB 5-21-1 | Headquarters, Department of the Army | *2021 Annual Issue*

U.S. ARMY ENGINEER SCHOOL

COMMANDANT

Brigadier General Mark C. Quander

MANAGING EDITOR

Diana K. Dean

EDITOR

Cheryl A. Nygaard

GRAPHIC DESIGNER

Jennifer C. Morgan

Front cover: U.S. Army photographs

Back cover: Top: Operation Inherent Resolve, Company B, 326th Brigade Engineer Battalion, 1st Brigade Combat Team, 101 Airborne Division.

Bottom: Soldiers conduct explosive breaching using Bangalores alongside a team of engineers from Company A, 52d Brigade Engineer Battalion, Fort Carson, Colorado. (Photo by Captain Chelsea Hall)

DEPARTMENTS

FEATURES

ENGINEER
The Professional Bulletin of Army Engineers

Volume 51 PB 5-21-1 | Headquarters, Department of the Army | *2021 Annual Issue*

FEATURES, continued

Clear the Way

Brigadier General Mark C. Quander
98th Commandant, U.S. Army Engineer School

Fellow engineers, I hope this finds you and your Families doing well.

Throughout the last few months, the world has been grappling with the complex problem of the Novel Coronavirus (COVID-19). As a result of COVID-19, the U.S. Army and the Engineer Regiment have redefined normal operating procedures and continue to make significant strides in supporting the demands of the Nation while incorporating mitigation strategies to slow the spread of the virus. I would like to thank each of you for your innovative efforts and utmost adaptability to help sustain the readiness of our force. Perpetual optimism and creative ideas from junior Soldiers and senior leaders alike are vital in ensuring that our Regiment continues to evolve.

Regardless of the circumstance or challenge, the Engineer Regiment continues to embody the "*Essayons* . . . We WILL succeed" spirit. The U.S. Army Corps of Engineers (USACE) constructed numerous alternate care facilities to reduce the burden on hospitals and support the medical requirements of the Nation. The 1st Engineer Brigade and the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri, train hard every day to produce quality Soldiers to fill the ranks of units in the field. Throughout the world, engineer units are competing with our adversaries and showcasing our resiliency and perseverance. In Europe, the 15th Engineer Battalion, Grafenwöhr, Germany, reinforced regional partnerships and enhanced existing infrastructure during Exercise Resolute Castle 2020. In the Pacific region, the 7th Dive Detachment, Hickam Air Force Base, Hawaii, partnered with various agencies to conduct port clearance operations through hydrographic surveys and scuba diving. Soldiers from the 579th Engineer Battalion, Santa Rosa, California, and the 14th Brigade Engineer Battalion, Joint Base Lewis-McChord, Washington, helped fight wildfires throughout various regions in California. The 9th Engineer Battalion, Fort Stewart, Georgia, conducted an excellent wet-gap crossing during Defender 2020, highlighting the need for more engineers in order to ensure brigade and division success during future wet-gap crossings. In every facet, engineers are supporting the fight against COVID-19 and are training to ensure optimal readiness.

Throughout garrison, units continue to harness virtual platforms to stay connected. With an increase in virtual communications, I ask that subordinates, peers, and supervisors remain engaged. It is vital that Soldiers continue to communicate any additional burdens caused by the COVID-19 pandemic and that leaders continue to share creative ways to tackle problems. I look forward to seeing how various units revolutionize collective training, routine preventive maintenance checks and services, and communication efforts under the COVID-19 restrictions.

I ask that you continue to build your team and a culture that values inclusion, moral fortitude, and the Army values. Building our teams and genuinely caring for the health and welfare of Soldiers help tackle the challenges of suicide, sexual misconduct, and racism/extremism. All Soldiers and leaders are part of the solution!

Thank you again for your steadfast commitment to the Regiment and USAES. My team and I appreciate the support and commitment to mission success. "*Essayons* . . . We WILL succeed!"

"Perpetual optimism and creative ideas from junior Soldiers and senior leaders alike are vital in ensuring that our Regiment continues to evolve."

Lead the Way

Command Sergeant Major John T. Brennan
Regimental Command Sergeant Major

I hope that this message finds each of you and yours well. It is an honor for me to have the opportunity to communicate with such an incredible and diverse group of professionals. I am humbled to be the 28th Regimental Command Sergeant Major of the U.S. Army Engineer School (USAES) and to give back to our great Regiment in this capacity. My transition into USAES was seamless, largely due to the efforts of the phenomenal team here. I want to publicly thank Sergeant Major Eric T. Arredondo, the engineer proponent sergeant major of the Engineer Personnel Development Office. He did an exceptional job of maintaining the continuity of this position during a period of transition. He is an absolute professional. Thank you, Sergeant Major Arredondo. And I would be remiss if I didn't take a moment to acknowledge all the great work and efforts of Command Sergeant Major Douglas W. Galick during his tenure as the 27th Command Sergeant Major of USAES. Thank you, Command Sergeant Major Galick, for all that you did to advance multiple efforts for the Engineer Regiment. We wish you and your Family the absolute best during your assignment with the Pacific Ocean Division, U.S. Army Corps of Engineers (USACE), Fort Shafter, Hawaii.

The Novel Coronavirus (COVID-19) pandemic forced all of us to adjust our lifestyles, personally and professionally. From the personal aspect, many discovered new activities or learned new ways to enjoy old activities and many connected with their Families in a deeper way—potentially gaining a greater appreciation for loved ones. Professionally, Soldiers transitioned to teleworking, conducting their daily duties from a computer at their residence; many businesses and organizations implemented personnel rotations, limiting the number of personnel in the work place at any one time and offering balance while rotating personnel through the office. Remaining connected and engaged without the typical day-to-day, face-to-face interactions with Soldiers was a challenge for Army leaders. But leaders found creative ways to leverage technologies and continue the mission. Through technology, leaders maintained accountability, conducted decentralized physical training, and replicated leaders' time training on a virtual platform. The most concerning aspect of this pandemic for the Army is the impact on individual and unit readiness. For a short period of time, institutional training ceased. The Army worked to establish a new method of operating schools and conducting classes while mitigating the potential spread of COVID-19. The analysis took time; but once again, our Army and our Soldiers demonstrated tremendous flexibility and adaptability.

Early on, Army leaders identified the need to get our professional military education (PME) system back online, with personnel requiring PME for promotion. Given the environment and challenges, this took place rather quickly. Engineer PME is back on, and leaders are training again. The biggest difference now is that most will encounter a 14-day quarantine upon arrival. Different courses incorporate virtual training into those 14 days in order to maximize efficiency. Another significant difference is that most courses are filling at 50 percent capacity and—depending on the military occupational specialty—the opportunity may only be available twice a year. This is all the more reason for our noncommissioned officers to be prepared when the opportunity arises; "no-shows" are detrimental to the Regiment. Most of the engineer functional courses are also back in session with similar limitations. I encourage leaders and units to get Soldiers scheduled for courses or use "walk-on" opportunities, where applicable.

I encourage all engineer Soldiers and leaders to seek opportunities and venues to provide feedback to USAES. Let us know what we can do to better support you. There is an incredible team of uniformed and civilian professionals here, dedicated to you and our regiment. I'm amazed by all that is done here and by all of you out there; I'm very proud to be a part of the best Regiment in the Army.

Although the COVID-19 environment presented unusual circumstances and numerous challenges, our incredible engineers continue to reinforce and personify the Regimental motto, "*Essayons*. . . We WILL Succeed."

Show the Way

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

Greetings from the U.S. Army Engineer School (USAES).

The last several months have been very challenging due to the Novel Coronavirus (COVID-19) pandemic. COVID-19 has forced us into uncharted waters and has enabled us to grow in several areas. I would like to commend everyone in the Engineer Regiment for taking an active role in the effort to be part of the solution.

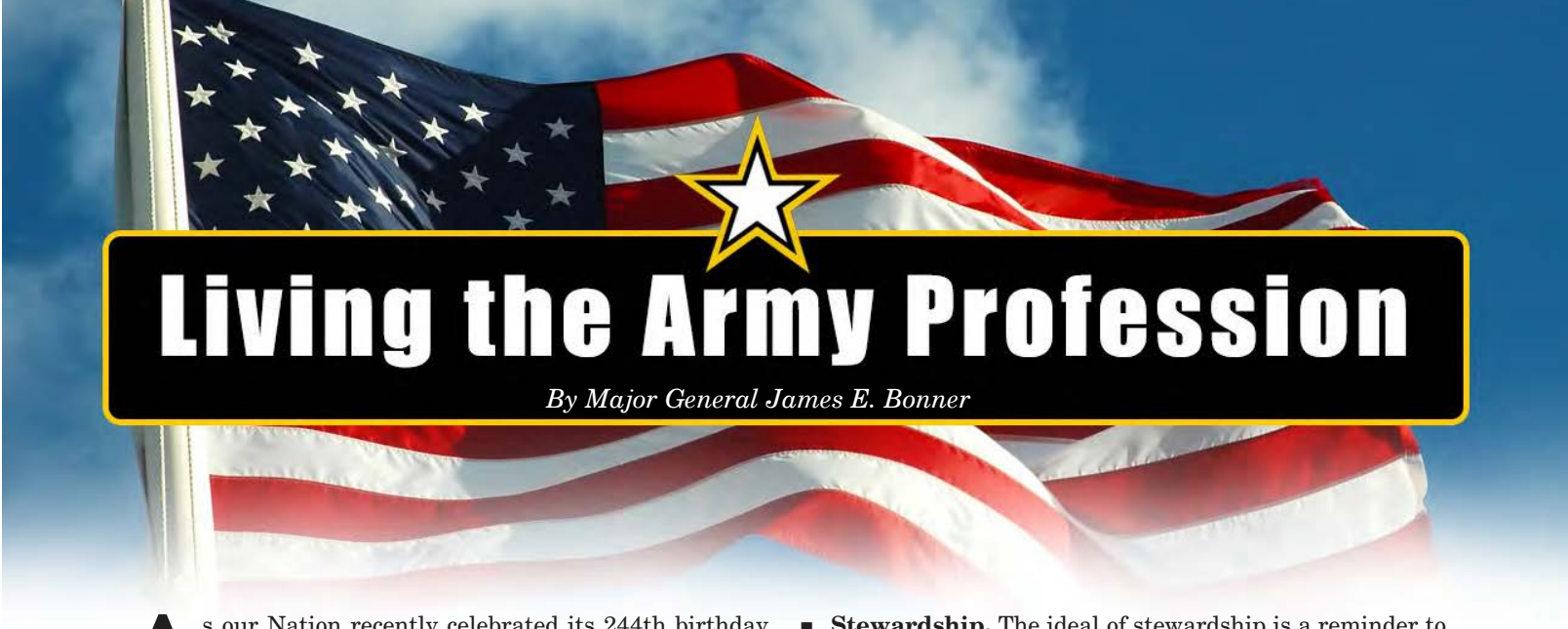
During the initial phase of the COVID-19 pandemic, USAES sent warrant officers to support several U.S. Army Corps of Engineers (USACE) districts in combating the pandemic. This effort was highly successful and highlighted the skill sets that our Military Occupational Specialty (MOS) 120A–Construction Engineering Technicians bring to the fight. Thank you to all Soldiers for their support during these trying times, and a specific thank you to Chief Warrant Officers Five Corey K. Hill and Frank O. Davis and Chief Warrant Officers Three Michael L. Keck, Daniel W. Schwab, and William S. Test for supporting these efforts and showcasing the critical role that MOS 120As serve in USACE.

There was a tremendous surge of work in the geospatial arena of the Regiment. At the Army Geospatial Center (AGC), Humphries Center, Fort Belvoir, Virginia, Chief Warrant Officers Five Stephen E. Joseph and Angel Martinez Jr. led efforts to stand up a geospatial task force to develop a visualization tool that would enable senior Army leaders to understand how COVID-19 was spreading throughout the world. The geospatial dashboards created by multiple units demonstrated the power of geospatial information and services and illustrated how it can be leveraged in a noncombat environment. Similar efforts were led by Chief Warrant Officer Three Ivan Deleon, 543d Engineer Detachment, U.S. Army North, San Antonio, Texas. He created an unclassified common operating picture with direct geospatial foundation data feeds from various organizations including the Department of Homeland Security; the U.S. Census Bureau; the Environmental Systems Research Institute; the Centers for Disease Control and Prevention; the U.S. Department of Health and Human Services; and Johns Hopkins University, Baltimore, Maryland, and other sources such as Public Health Informatics, Defense Installations Spatial Data Infrastructure, and USACE Reach-back Engineer Data integration (REDi).

Despite the pandemic, the warrant officer cohort has made great strides with the Warrant Officer Talent Management Task Force, with initiatives to change the promotion management system. Significant changes to warrant officer promotions are currently in draft form as a proposal for inclusion in fiscal year 2022 legislation. If approved, warrant officers would receive promotion flexibilities similar to those rendered to other officers. Warrant officers would be eligible for merit-based promotions and would have the ability to opt out of promotion boards. The Army would promote the top warrant officer performers based on the promotion board order-of-merit list and remaining warrant officers based on their seniority.

I would like to congratulate the warrant officer selectees for the July 2020 accessions board. Yet again, we charted unknown territory by selecting two MOS 12B–Combat Engineers to join our engineer warrant officer ranks as MOS 120As. The Regiment has been working on this initiative for more than a year. We continue to look deep into our engineer formations to find hidden talent and Soldiers with civilian-acquired skills that align with our warrant officer specialties. I am confident that our two new MOS 12B selectees and all of our current warrant officers will continue to make the Regiment proud. Thank you again for your optimism and perseverance despite our unknown circumstances. *Essayons* . . . We WILL succeed!

"We continue to look deep into our engineer formations to find hidden talent and Soldiers with civilian-acquired skills that align with our warrant officer specialties."



Living the Army Profession

By Major General James E. Bonner

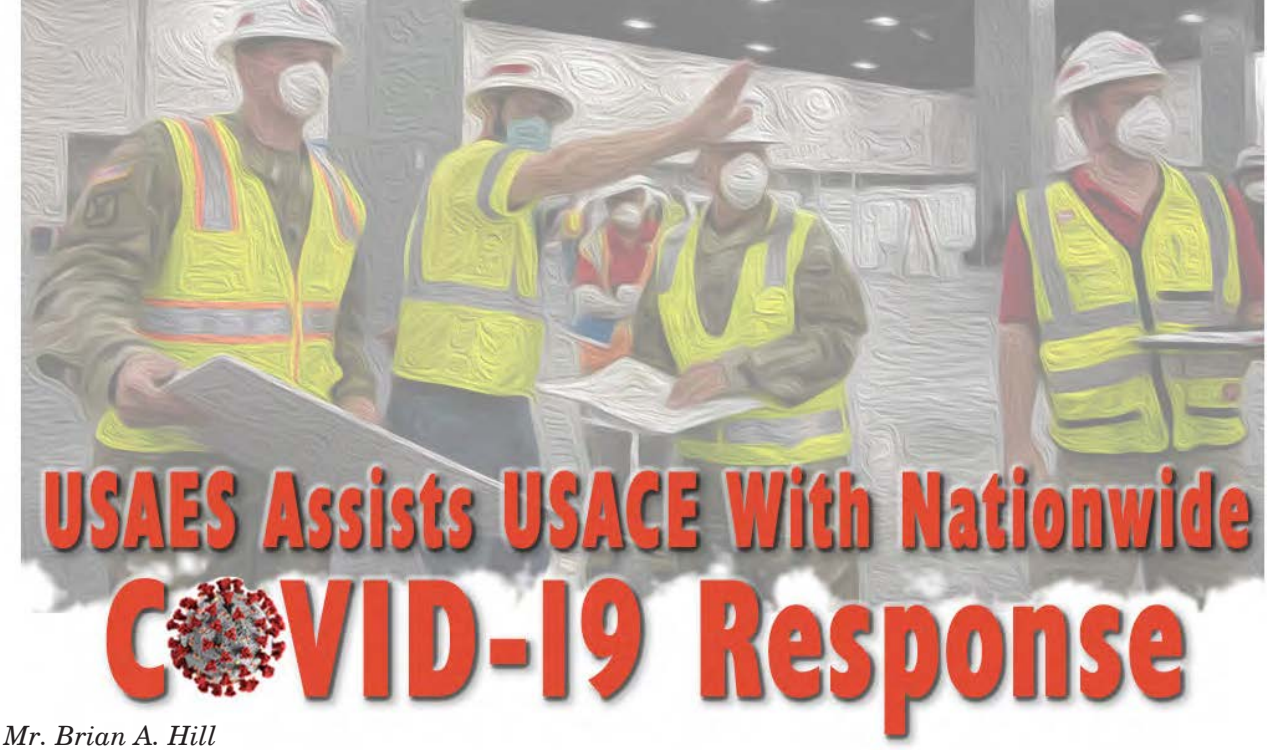
As our Nation recently celebrated its 244th birthday and our Army—which is older than our Nation—turned 245 years of age, we reflect on our history. We are proud to be a part of the best-trained, most lethal, and most respected institution in the world.

Our Soldiers make us great. From enlistment to separation, the U.S. Army develops Soldiers and instills values, successfully transforming citizens into leaders of character and Soldiers for life. Leadership goes on 24/7 and requires engagement in order to know people, equipment, and operations. As leaders, we must visit our areas of responsibility to ensure good order and discipline—all while treating everyone with dignity and respect. To accomplish our mission, we must live by the five characteristics of the Army profession:

- **Trust.** Trust is the foundation of our profession. The American public believes that its Army will act ethically, effectively, and efficiently in order to protect the Nation and its interests. Soldiers and Army civilians trust their superiors, subordinates, and peers to be competent and reliable. To build trust and ensure mission success, we must embrace the diversity within our units and be inclusive of every person.
- **Honorable service.** Honorable service refers to the oaths of enlistment or office that all Soldiers and civilians take. Army professionals protect and defend the people of the United States—an exclusive responsibility. To gain perspective and to generate trust, we must tell our story and we must listen to those in our formations and learn why they serve. We must share their stories with the American public to inspire the next generation of Soldiers to join our ranks.
- **Military expertise.** Military expertise encompasses the expectation that all Soldiers and Army civilians become masters of their craft. Competence—in leader development, ethics, culture, and technical areas—is our watchword. Chemical, biological, radiological, and nuclear; engineer; and military police Soldiers are essential in granting our maneuver units freedom of movement on the battlefield. The Army cannot succeed without the critical maneuver support skills and capabilities developed at Fort Leonard Wood, Missouri.
- **Stewardship.** The ideal of stewardship is a reminder to respect the trust and develop the next generation of leaders. We meet this responsibility by holding each other accountable. If we notice a violation of our professional standards, we must take the opportunity to respectfully correct it. If we are on the receiving end of a correction, we must respond with "thank you" and we must fix the issue.
- **Esprit de corps.** Esprit de corps encapsulates the winning mentality of our Army. This spirit helps unify us into a cohesive group. Our units display esprit de corps by respecting traditions, maintaining discipline, and fostering a team-centric environment. Winning matters, and units that foster esprit de corps understand that. They never quit in the face of adversity, and they stand by each other during the toughest missions.

Achieving these five characteristics as individuals and teams will ensure that we are able to fight and win on any battlefield. To learn more about the Army profession, visit the website <https://capl.army.mil/>.

Major General Bonner is the Commanding General of the Maneuver Support Center of Excellence and Fort Leonard Wood. Major General Bonner was a distinguished military graduate from Southern Illinois University. He holds master's degrees in administration from Central Michigan University and national security and strategic studies from the U.S. Naval War College, Newport, Rhode Island.



USAES Assists USACE With Nationwide COVID-19 Response

By Mr. Brian A. Hill

***Editor's note**: All quotes in this article are from personal interviews conducted in April 2020. Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

As the Novel Coronavirus (COVID-19) response continues, the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri, has sent engineers to locations across the country to assist the U.S. Army Corps of Engineers (USACE) with the planning and building of alternate care facilities that will expand the number of hospital beds available for the treatment of patients.

According to Major Richuard C. Ghinelli, officer in charge of the USAES augmentation mission, the officers and warrant officers on this mission have advanced degrees and certifications and will primarily use their skills for site assessment, mission tracking, and data management. They will also act in quality assurance roles, overseeing contractors as alternate care facilities are constructed.

"The U.S. Army engineer officer has a variety of skills that are pertinent to this support mission," Major Ghinelli said, "The selected engineer officers all have training and experience in running a tactical operations center that conducts operations planning and tracking to accurately report the progress of the mission and recommend needed adjustments. Other officers will directly support USACE teams conducting site assessments of potential alternate care facility locations and provide quality control and assurance of contracted construction to ensure the plan comes together as rapidly and correctly as possible to provide the critical facilities to those in need."

Additionally, Major Ghinelli indicated that geospatial engineer officers are supporting the mission by visually tracking resource distribution and by mapping project status and pandemic statistics to provide leaders with a common operating picture. "These maps enable district leaders to visualize current and projected hospital bed occupancy rates, which helps the district commander and local leaders better understand COVID-19 saturation and severity," he said.

According to Lieutenant General Todd T. Semonite, USACE commander, USACE has built 17 facilities with a

A Soldier from USAES takes notes while conducting an assessment of hotel rooms in Kansas City, Missouri.

A USACE district commander orients an augmentee from USAES on the areas of responsibility for the district and identifies locations for potential alternate care facilities.

total of nearly 15,000 beds so far. Semonite estimated that, depending on the number of COVID-19 cases that occur, 40 to 50 total facilities might be built by USACE in the next several months. Major Ghinelli added, "The scale of the emergency response required for this mission is one of the biggest reasons for USAES engineers to be supporting USACE."

Soldiers inspect rooms as part of the process to identify potential alternate care facilities in support of the COVID-19 emergency response.

"The majority of USACE personnel is comprised of civilian employees who are not typically deployed or working from an operations center," Ghinelli said, "So, as the size and scope of their operations increased to the level . . . required for the COVID-19 pandemic, Soldiers from USAES and the Engineer Regiment are uniquely suited to augment USACE and expand their already significant disaster response capability."

Major Ghinelli added that, in recent years, USAES has supported other large-scale emergency response situations, such as Hurricane Katrina in 2005; Super Storm Sandy in 2012; and Hurricanes Harvey, Irma, and Maria in 2017. "In every case, these officers played a significant role in executing the National Response Plan," he said.

Brigadier General Mark C. Quander, USAES Commandant, spoke to Fort Leonard Wood engineers before they departed on 6 April 2020. He told them that he was proud of everything they were about to do. "We're asking you to use all the talents that you have learned in the military to date and contribute to our Nation's efforts to win the war against COVID-19," Quander said, "When we've recovered as a Nation, you will each look back and reflect on the contributions you made to help overcome the adversities that we all endured through this significant point in our Nation's history—and you will have made a difference."

Mr. Hill is the managing editor of the Guidon*, Fort Leonard Wood. He holds a bachelor's degree in history from Texas State University, San Marcos.*

Facilities-Based Solutions to Fighting COVID-19 in the Barracks

By Lieutenant Colonel Lisa (Reyn) Mann, Chief Warrant Officer Three Travis W. Henning, and Warrant Officer One Maksym Zymin

A breakout of an infectious disease in unaccompanied personnel housing (otherwise known as the barracks) can have crippling effects on unit readiness. Although good hygiene and routine disinfection remain the best practices for preventing a virus like the Novel Coronavirus (COVID-19), there are also some facilities-based recommendations that could potentially contain—or at least slow—an outbreak. We gathered recommendations from infectious-disease experts; industrial hygienists; and Army warrant officer facilities experts, Military Occupational Specialty (MOS) 120As–Construction Engineering Technicians, to compile a list of mitigating measures that unit representatives can take once a Soldier living in the barracks has tested positive for COVID-19.

First and foremost, commanders and first sergeants should establish and train unit "clean teams" to disinfect areas where COVID-19-positive Soldiers have been. These teams should be provided with proper medical-grade personal protective equipment and disinfectant cleaning products. As a best practice, our unit (the 84th Engineer Battalion, Schofield Barracks, Hawaii) relied heavily on MOS 74D–Chemical, Biological, Radiological, and Nuclear Specialists to lead and train these teams. The teams should also have the opportunity to rehearse disinfection procedures.

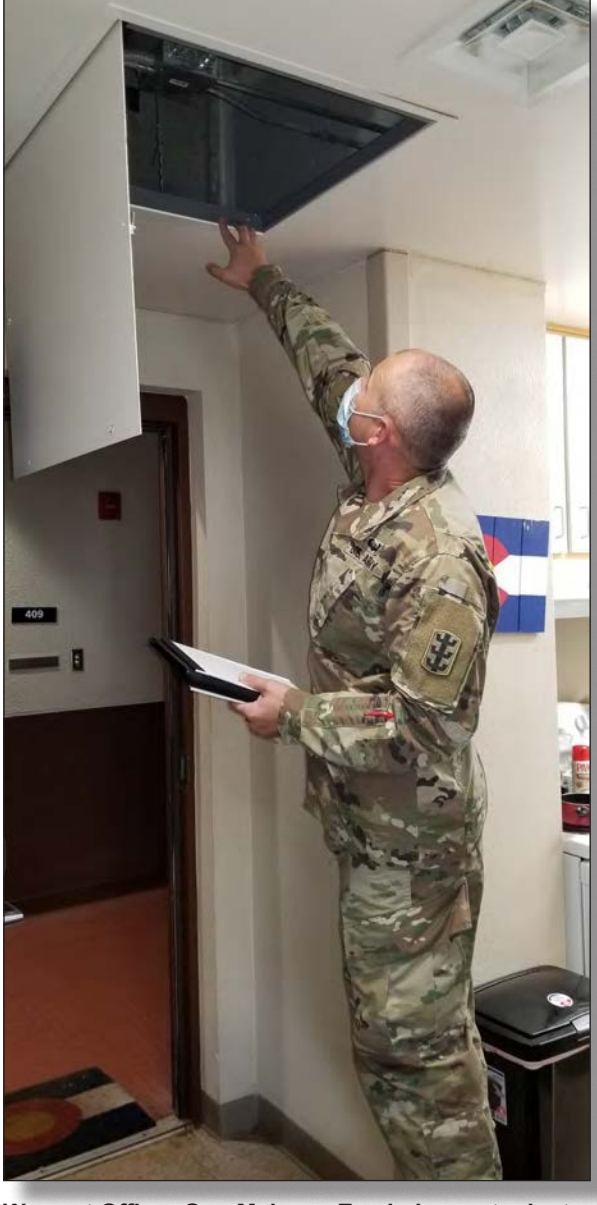
As an added preliminary step, unit leaders should request field-expedient assessments of the barracks through the Directorate of Public Works (DPW) or from local engineer units. Although the U.S. Army has aspired to reach a "1+1 standard" for barracks design and construction (in which Soldiers each have their own private bedrooms that open into shared common space with a bathroom and kitchen area), there are still numerous layouts and unique design features in barracks facilities across different installations. A hasty reconnaissance of the barracks can be conducted to determine some of the specifics required to emplace mitigating measures. Construction engineering technicians are assets in any formation; however, MOS 120A warrant officers can be lifesavers during a pandemic. Commanders, first sergeants, and savvy barracks managers can verify some factors over the phone, alleviating the need for in-person assessments. DPW should have a repository of blueprints for each building, which would also prove useful. Heating, ventilation, and air conditioning (HVAC) drawings would be particularly important and would greatly assist with the assessment. The location of the air intake and the way in which the bathroom fans are connected will make a difference.

Facilities Considerations for COVID-19 Assessments

Unit barracks managers should consider several factors when performing barracks assessments:

- **Carpeting.** Do the barracks contain carpet? For ease of cleaning, it is recommended that COVID-19-positive Service members be housed in rooms without carpet. During elevated health protection condition levels, it is recommended that all Soldiers roll up and store away any personal rugs and window curtains in order to ease the burden on unit clean teams.
- **Door Seals.** Do the entrance doors have good seals? Can daylight be seen under or around the closed door from either side? If the doors are not properly sealed, installing door seals or hanging plastic on the doors of COVID-19-positive Soldiers is recommended. If the door opens outward, the seals or plastic barrier should be placed on the inside. If the door opens inward, the seals or plastic barrier should be placed on the outside. Barracks managers should keep self-adhesive silicone weather stripping on hand.
- **Temperature.** Studies show that COVID-19 thrives at temperatures of 69–73°F, within the range of the temperature settings of most buildings. According to the National Academies of Sciences, Engineering, and Medicine, laboratory studies have shown a relationship between higher temperatures/humidities and reduced survival of COVID-19 but there is currently no recommendation for real-world mitigation.[1] Consideration of temperatures in the barracks is worthwhile to determine whether conditions are generally more ideal or less-than-conducive for a viral outbreak.

Private First Class Rachel A. Rivera-Corley wipes down a countertop in the barracks.



Warrant Officer One Maksym Zymin inspects ductwork in the barracks.

- **Ventilation.** It is recommended that bathroom fan vents and all other return vents in the room of a COVID-19-positive Service member be closed until a filter can be installed over the vents. The average diameter of the COVID-19 virus is 0.125 micrometers,[2] so high-efficiency particulate air (HEPA) filters are highly preferred. Depending on the existing construction design, the size of the filter needed can vary. Drywall screws and aluminum duct tape are needed in order to affix the filters over the vents. The installation of filters assists in creating negative pressure without contaminating the rest of the system. If HEPA filters are not readily available, standard filters can be used to provide some protection by keeping out larger droplets to which the virus can attach.

- **Exhaust.** Where does the exhaust from the vents exit the building? If the exhaust exits from the roof, the preferred location for housing COVID-19-positive Soldiers is on the highest possible floor. If the exhaust exits on the ground level, the preferred location for housing COVID-19-positive Soldiers is on a lower floor. This should reduce contamination of the entire ductwork system if the HEPA filters lose their seals or otherwise fail.
- **HVAC.** Does the barracks building have a centralized HVAC system, or does each room have its own dedicated unit? The housing of COVID-19-positive Soldiers in rooms with their own environmental control units that recirculate and cool or warm the interior air is preferable. If the building has a centralized HVAC system, it is recommended that exterior windows remain closed where Soldiers who test positive for COVID-19 are housed. Again, the dampers for the bathroom fans and other return vents should be closed until a HEPA filter can be installed over the vents. It is recommended that Soldiers create positive pressure in adjacent rooms by opening the windows to let in clean air. This provides uninfected personnel with an additional measure of protection—although it may be unnecessary, given that most large droplets fall out of suspension within 6 feet from the source and the separating walls already provide an excellent physical barrier.

Central HVAC systems assist with pulling in fresh air from outside and mixing it with recirculated air within a building, allowing the dilution of any potential contaminants that are floating around. Overall, increasing the air exchange enhances the dilution of the air in the building. Therefore, 20–30 minutes before sending a unit clean team in to disinfect a room, the windows should be opened to allow fresh air to dilute the contaminated air space. If negative pressure is required, additional facilities modifications will be necessary and DPW approval must be obtained.

Deliberate Containment Options for Facilities

Once it has been determined how an HVAC system is designed and built, one option for deliberately creating negative pressure might be to work with DPW to reprogram the digital diagnostic controls to modify fan speeds and create negative pressure in all barracks rooms.

As part of the tiered national response to COVID-19, the Army Facilities Components System Team developed a low-acuity care tent hospital solution. The design is now available through the Joint Construction Management System (JCMS) desktop software and the U.S. Army Corps of Engineers Army Facilities Components System REDi Portal at <https:uroc-redi.usace.army.mil/sites/afcs/default.aspx>. Each 125-bed module is entirely designated either for COVID-19-positive Soldiers or COVID-19-negative Soldiers, limiting HVAC and separation/isolation requirements.

Clean team members Sergeant Chad L. Martinez, Specialist Zachary R. Yauger, and Specialist Thoren Z. Miller work in a common area of the barracks.

Baseline Recommendations

These recommended measures are meant to rapidly address COVID-19-positive Soldiers in the barracks; however, it is clear that there is no way to completely mitigate risk with facilities-based solutions. The following are some baseline recommendations from an infection control specialist:

- Commanders should restrict COVID-19-positive Soldiers to their rooms. If there are shared facilities such as a kitchen or bathroom, doors should be kept closed to limit exposure. The unit should provide all basic Soldier needs including food, laundry, and mail. Personnel providing the needed supplies should have no physical contact with the COVID-19-positive Soldier and should maintain good hand hygiene (washiing hands with warm, soapy water for at least 20 seconds or using an alcohol-based hand sanitizer) after interaction.
- Service members who have tested positive for COVID-19 and have a roommate should be separated from that roommate. Preferably, the infected Soldier stays in the room and the other Soldier is treated as a close contact of a known positive case and is moved elsewhere, restricted from further movement, and directed to self-monitor.

Specialist Chance M. True and Specialist Miller mop and spray a common area of the barracks.

Sergeant Martinez seals a bag after a clean team rehearsal.

- If COVID-19-positive Soldiers must share facilities with others, doors should be kept shut and Soldiers should wear masks and maintain good hand hygiene before entering the kitchen, bathroom, or other common areas. Personnel around infected Soldiers should be limited by establishing "common area time" and asking others to avoid these areas during the times allocated. Once an infected Soldier recovers, he or she can disinfect his or her own room. Alternatively, if an infected Soldier vacates a living space, unit clean teams must disinfect all living areas.

Conclusion

In summary, commanders and first sergeants can implement the recommended COVID-19 measures as part of a comprehensive strategy to rapidly address a COVID-19-positive Soldier residing in the barracks. In addition to medical-grade personal protective equipment and disinfectant cleaning supplies for unit clean teams, we recommend an emergency supply of materials to cover a bathroom fan or other return vent and self-adhesive weather stripping to properly seal a door. In spite of facilities-based measures that can be taken, routine disinfection of barracks rooms remains the best method for the mitigation and containment of COVID-19. Although the threat and impacts of COVID-19 have fundamentally changed the way that we do business in the Department of Defense, one thing remains constant: Engineers have risen to meet the challenge with solutions. Together with recommendations from the medical community and chemical, biological, radiological, and nuclear experts, we can and will defeat the virus.

Endnotes:

[1]*Rapid Expert Consultation on SARS-CoV-2 Survival in Relation to Temperature and Humidity and Potential for Seasonality for the COVID-19 Pandemic*, National Academies of Sciences, Engineering, and Medicine, The National Academies Press, Washington, D.C., 7 April 2020, <https://doi.org/10.17226/25771>, accessed on 30 April 2020.

[2]"Coronavirus," *Encyclopedia Britannica*, 30 April 2020, <https://www.britannica.com/science/coronavirus-virus-group>, accessed on 29 April 2020.

Lieutenant Colonel Mann is the commander of the 84th Engineer Battalion. She holds a bachelor of science degree in environmental engineering from the U.S. Military Academy–West Point, New York, and a master of science degree in environmental engineering from Missouri University of Science and Technology at Rolla. She is a licensed professional engineer and a project management professional.

Chief Warrant Officer Three Henning is a construction engineering technician with the 84th Engineer Battalion. He is pursuing a degree in construction management.

Warrant Officer One Zymin is a construction engineering technician with the 84th Engineer Battalion. He holds bachelor and master of science degrees in electrical engineering from the Kyiv Polytechic Institute, Ukraine.

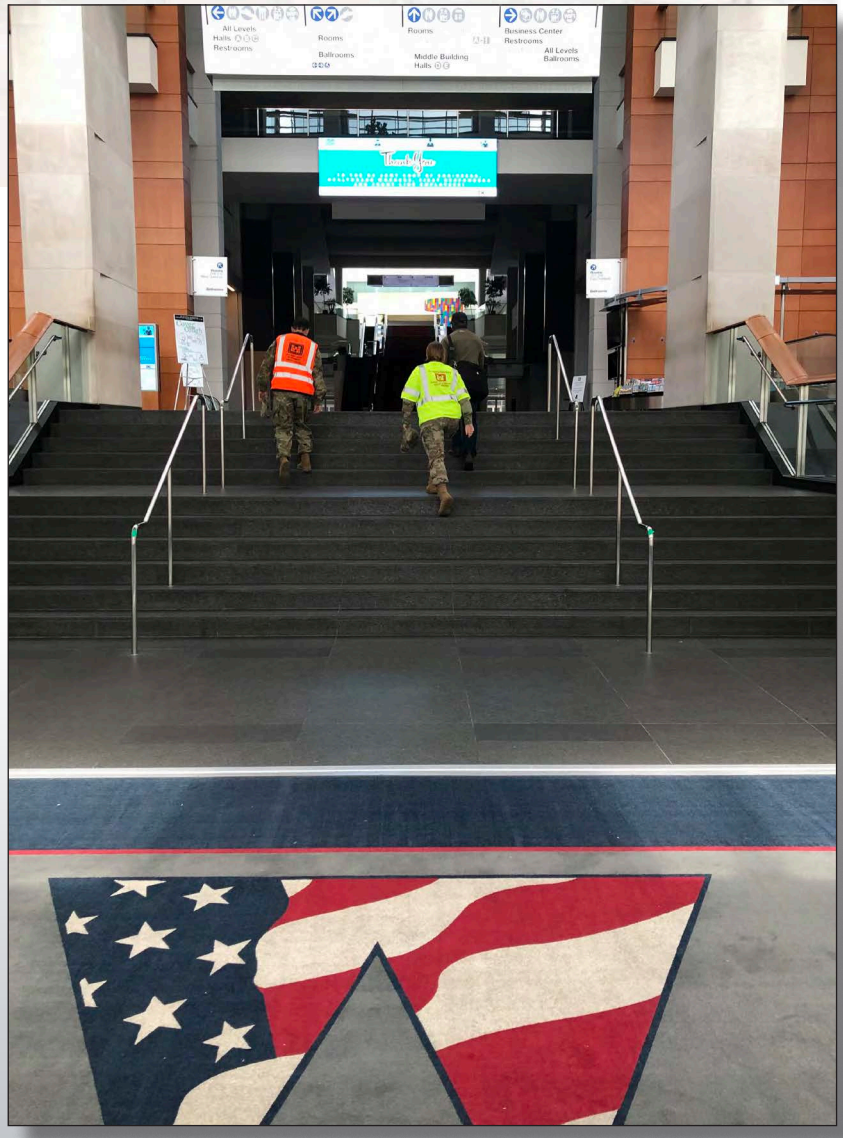
USACE COVID-19 Response: A Federal and Family Enterprise

By Captain Matthew T. Golden

In the early months of 2020, the world as we knew it came to a screeching halt and the Novel Coronavirus (COVID-19) began to sweep the Nation. An unparalleled problem had presented itself, and the Nation needed an immediate solution; in stepped the U.S. Army Corps of Engineers (USACE). According to Lieutenant General Todd T. Semonite, Chief of Engineers and commanding general of USACE, USACE prides itself on its ability to provide "innovative solutions for our Nation's toughest challenges,"[1] including the challenge of a COVID-19 response.

Ready and willing to provide support on a moment's notice, Soldiers and civilians from across the Nation—myself included—were called to action to augment the emergency response.

After having completed the Engineer Captains Career Course and, subsequently, the professional development program at the Missouri University of Science and Technology, Rolla, Missouri, I found myself in the middle of an international permanent-change-of-station move when the Department of Defense implemented its first stop movement action as a result of the COVID-19 outbreak. I was on permanent-change-of-station leave in New York, which had quickly become the Nation's epicenter for COVID-19. It was during this time that I received a call from the U.S. Army Engineer School, Fort Leonard Wood, Missouri, indicating that I would be joining USACE in the fight against an invisible enemy—a term that quickly became synonymous with COVID-19. Within 48 hours, I arrived at the Baltimore District, USACE, in Baltimore, Maryland, to support the emergency management office.



Captain Matthew Golden enters the Walter E. Washington Convention Center in Washington, D.C.

Emergency Management

The job of the Baltimore District Emergency Management Office is to plan and manage response and recovery efforts for natural and manmade disasters in accordance with Public Law 84-99, *Flood Control and Coastal Emergencies,* and Public Law 93-288, *Robert T. Stafford Disaster Relief and Assistance Act*.[2] USACE supplements organizational efforts at all levels to save human lives and mitigate property damage.

Captain Golden and Captain Charles P. Robitaille review initial plans for the Walter E. Washington Convention Center.

Nothing about disaster response is simple; but, in short, Public Law 93-288 enables the Federal Emergency Management Agency (FEMA) to orchestrate a federal national disaster response.[3] Through mission assignments and funding, FEMA leans on USACE and a plethora of other agencies to execute various emergency support functions to synchronize the integration of tribal, local, state, and federal partners and others during a time of crisis.

USACE is the primary organization for FEMA Emergency Support Function No. 3, Public Works and Engineering.[4] FEMA Emergency Support Function No. 3 deals with assisting FEMA and the Department of Homeland Security in the delivery of services, including providing public works engineering and construction management expertise and other critical support to prepare for, prevent, respond to, and recover from domestic incidents like the COVID-19 pandemic.

Federal Fight Against COVID-19

In the battle against COVID-19, the USACE Baltimore District was tasked by FEMA to help augment anticipated medical surge response needs in Washington, D.C.; Maryland; and Pennsylvania. This included inspecting 45 facilities such as hospitals, schools, correctional facilities, convention centers, and hotels across the region to determine their viability to serve as alternate care sites and converting those sites that were selected by the states.

The Baltimore District assessment teams determined facility viability based on the following factors:

- Structural soundness.
- Bed capacity.
- Isolation space.
- Electrical capabilities.
- Communication capabilities.
- Plumbing capacity.
- Heating, ventilation, and air-conditioning systems.

The feasibility of creating a negative-pressure environment to contain the introduction of new pathogens, safety codes, and the Americans with Disabilities Act[5] compliance were three important considerations. The district equipped its state partners with inspection reports sothat they could determine which facilities (if any) should be converted to alternate care sites and how to proceed. Based on models that predicted when peak infection rates would most likely stress the existing healthcare facilities beyond their capabilities, state governments requested the conversion and construction of selected alternate care sites.

Nationwide, USACE leveraged expertise from local industry and the USACE Medical Center of Expertise, Huntsville, Alabama, to provide life-saving and life-sustaining services through the design and construction of the alternate care facilities. The Medical Center of Expertise developed standard work performance statements to cover the conversion of specific facilities (such as an arena) to healthcare facilities; these statements could easily be modified to address project-specific requirements across the Nation.

On 16 April 2020, at the request of the Washington, D.C., government, the Baltimore District issued a contract to convert a portion of the Walter E. Washington Convention Center in Washington, D.C., into an alternate care facility. There were several advantages to converting the convention center, including its central location and the vast utility infrastructure. The Baltimore District oversaw the contract that covered the conversion of Hall A of the convention center into a 151,000-square-foot medical treatment facility with space for approximately 450 beds—nearly half of them capable of supplying oxygen to patients. The project also included support facilities like patient registration offices, storage and staff areas, and pharmacy and laboratory rooms.

In a matter of weeks, the Baltimore District team delivered a world-class care facility. A contract of this complexity and magnitude could take years to deliver; but through standard design and a Herculean team effort, the Walter E. Washington Convention Center conversion was completed

on 8 May 2020. The facility was then turned over to the Washington, D.C., government for operation.

Volunteer Force

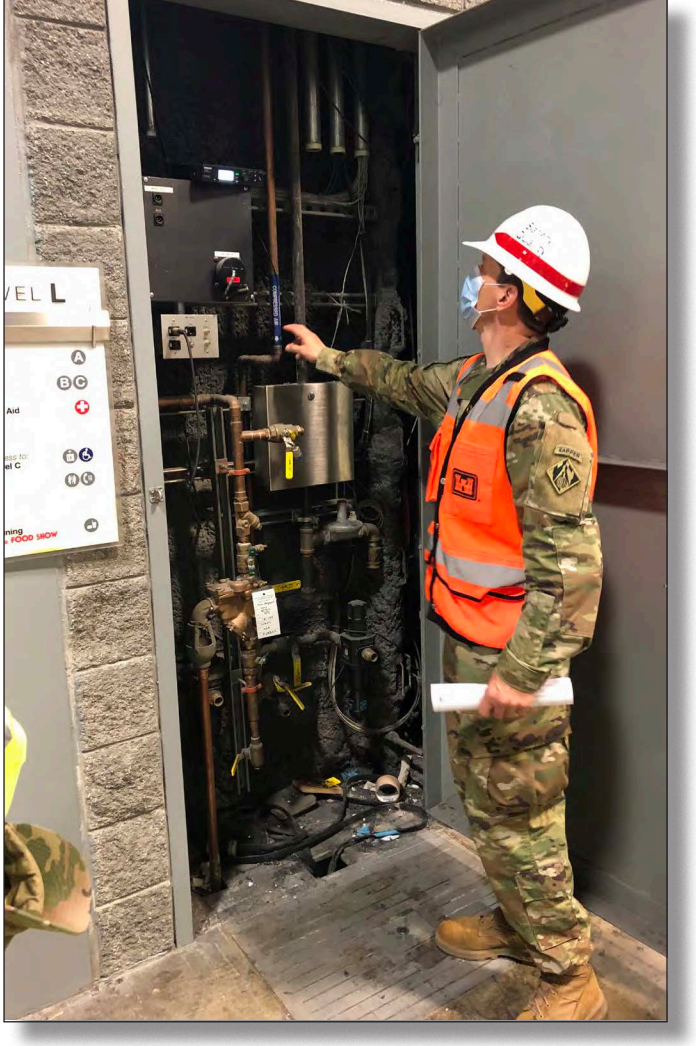
What surprised me most upon my arrival at the Baltimore District Emergency Operations Center was not the massive onslaught of emergency tasks and responsibilities that existed, but the team-like approach. Successful mission execution was not the only "wow factor." The way in which the mission was achieved was also impressive; a group of strangers had come together to tackle the COVID-19 response head-on—united by a desire to help a Nation in need.

Other than a small, permanent emergency management staff at the Baltimore District, in times of disaster, emergency operations are conducted almost entirely by a volunteer force of USACE civilians, with a few military augmentees added to the mix. These volunteers leave their day-to-day jobs within USACE and deploy for 30 days or more to fill various emergency management roles—most of which are completely unrelated to their normal duties. This includes professionals such as archeologists, engineers, logisticians, regulators, and human resource specialists. The district chief of emergency management, Ms. Dorotha (Dorie) M. Murphy, was responsible for more than 100 emergency management volunteers/responders during the pandemic response. It was remarkable to observe people excelling at their newly assigned positions—completely committing themselves to mission success; displaying a unified sense of purpose; and working vigorous shifts, often exceeding 12 hours.

Caring and camaraderie were at the forefront of the emergency management team, breeding a culture of positivity and support—much like an extended Family. Emergency staff members frequently checked in on one another. Activities and events like "Funny Hat Day," virtual team lunches, "Hero of the Day" recognition, and holiday and birthday celebrations introduced levity during tough times. During a period of uncertainty and isolation, this was a refreshing experience.

To best protect the entire workforce, approximately 90 percent of the district staff teleworked as staff members adhered to newly implemented social distancing measures. Despite this additional level of complexity, the district continued to deliver its other essential programs, such as flood risk management and the provision of drinking water to our Nation's capital, while mitigating the spread of COVID-19.

USACE is an enterprise that demonstrates its commitment to its most valuable resource—its people. USACE and organizations like it epitomize what it means to be a team of teams. The COVID-19 response is just one example.



Captain Robitaille inspects the infrastructure in the Walter E. Washington Convention Center.

Endnotes:

[1]"Huntsville Center Professionals Working Around the Clock So Assessment Teams Can Hit the Ground Running," USACE, 3 April 2020, <https://www.hnc.usace.army.mil/Media/News-Stories/Article/2135710/huntsville-center-professionals-working-around-the-clock-so-assessment-teams-ca/>, accessed on 14 July 2020.

[2]*Baltimore District Handbook*, USACE, February 2019, p. 36.

[3]Public Law 93-288, *Robert T. Stafford Disaster Relief and Assistance Act*, 22 May 1974, <https://www.fema.gov/media-library-data/1582133514823-be4368438b-d042e3b60f5cec6b377d17/Stafford_June_2019_508.pdf>, accessed on 24 August 2020.

[4]*National Response Framework*, FEMA, <https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response#esf>, accessed on 6 October 2020.

[5]"Army Corps Inspects Facilities Across D.C., Maryland, and Pennsylvania for Potential Care Site Conversion," USACE, 26 March 2020, <https://www.nab.usace.army.mil/Media/News-Releases/Article/2126351/army-corps-inspects-facilities-across-dc-maryland-and-pennsylvania-for-potentia/>, accessed on 14 July 2020.

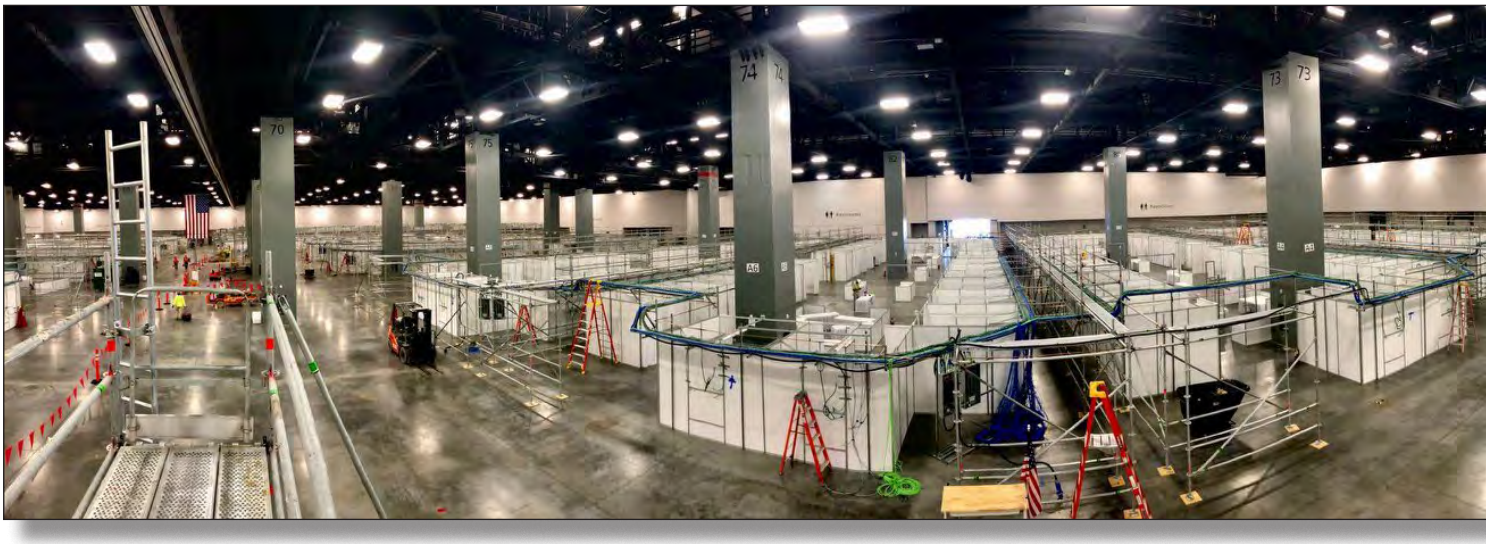
Captain Golden is an operations officer for the 15th Engineer Battalion, Grafenwoehr, Germany. He holds a bachelor's degree in mechanical engineering from Lehigh University, Bethlehem, Pennsylvania, and a master's degree in engineering management from Missouri University of Science and Technology at Rolla.

USACE Jacksonville District Constructs ACFs at the Miami Beach Convention Center

By Captain Shannon K. Peebles

Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

During late April 2020, the U.S. Army Corps of Engineers (USACE) tasked a group of engineer captains to join the fight against the Novel Coronavirus (COVID-19) across USACE districts throughout the country. When Captain Shannon K. Peebles was informed that she would be traveling to the Jacksonville District, Florida, to aid in emergency operations, she was elated to return to serve the community where she had lived as a child. Captain Peebles arrived at the Jacksonville District headquarters on 7 April 2020 and got to work with the



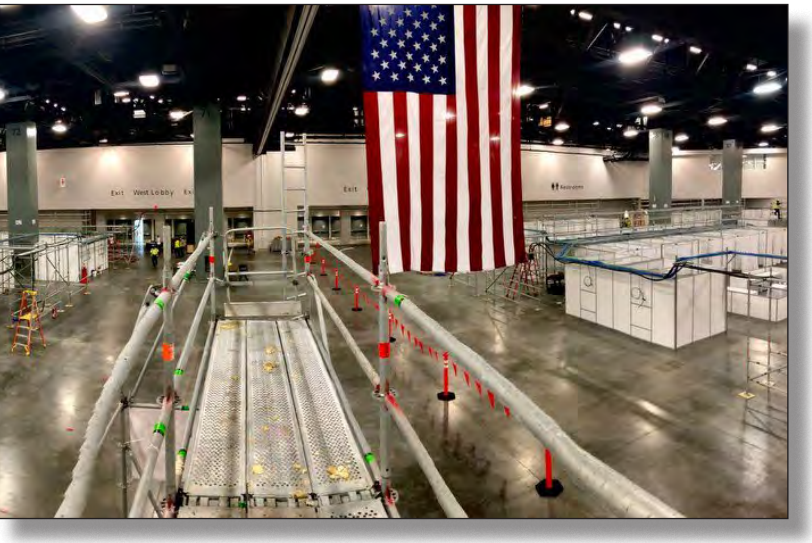
Panoramic view of construction progress at the MBCC ACF

district emergency operations center, tracking assessment teams that were traveling throughout Florida to evaluate potential alternate care facilities (ACFs), which were be used to treat the anticipated influx of COVID-19 patients.

Engineers from the Jacksonville District completed assessments of 26 potential ACFs in Florida, specifically in anticipated hotspots in the Miami region. Two of these sites were selected to be transformed into ACFs—the Miami Beach Convention Center (MBCC) and the Miami Medical Center. The State of Florida and the Federal Emergency Management Agency planned to use MBCC (with 400 acute- and 50 intensive-care beds) as the primary ACF and the Miami Medical Center (with a 180-bed capacity) as a secondary ACF. The MBCC construction contract was awarded to USACE, and that construction became the primary mission assignment.

Installation of oxygen, power, and network lines at MBCC

As mission priorities shifted to coordination and planning with the State emergency operations center and contractors, Captain Peebles traveled to Tallahassee, Florida, to work with USACE representatives who were operating at the state level. The intent of dispatching personnel to various locations involved in the COVID-19 response was to build a shared understanding of the government/private entity dynamics involved in working together during emergency operations. This understanding was crucial for connecting the operations in Jacksonville and Tallahassee with the major construction efforts in Miami. Captain Peebles then traveled to the MBCC ACF site to work as a liaison and project engineer. Her primary role involved working with USACE project managers to maintain synchronization across the different organizations operating within the ACF, including the Florida Division of Emergency Management; the Federal Emergency Management Agency response team; the Jacksonville District incident command node; the Florida National Guard, Miami; the joint task force medical team; and supporting contractors.



While USACE work on MBCC construction was proceeding ahead of schedule, it was crucial that the primary project contractor ensure that all components of handover preparation were completed prior to 21 April 2020. Handover preparation included facility construction, equipment staging, sanitization, and preparation of the staff (by logistical and medical organizations) for receiving patients. As the peak of COVID-19 cases changed, becoming less severe during the 2 weeks of construction, the requirements for the ACF changed as well. The intent of the operating capability for MBCC shifted from treatment of a large number of nonambulatory patients to the treatment of less than 70 ambulatory "step-down" patients. This created construction design issues that needed to be addressed—specifically, the number of patient showers and restrooms required. Based on the large capacity for patient treatment at Florida hospitals, many project individuals speculated that the facility could potentially never receive a single patient. As of the writing of this article, MBCC has served as a major COVID-19 testing site for Miami residents—and Florida, along with many other parts of the country, has experienced record-breaking numbers of new cases of COVID-19.

Captain Peebles is a recent graduate of the Engineer Captains Career Course, Fort Leonard Wood, Missouri. She holds a bachelor's degree in integrated science and technology from James Madison University, Harrisonburg, Virginia, and a master's degree in information technology from Virginia Polytechnic Institute and State University, Blacksburg.

Combating COVID-19 and Flooding in the Motor City

By Captain Jacob D. Hughes

In April 2020, the situation in Michigan was grim. In the emergency operations center of the Detroit District, U.S. Army Corps of Engineers (USACE), I received an orientation to the crisis that was unfolding across the state of Michigan. A heat map displayed on a projector depicted a surge in Novel Coronavirus (COVID-19) infections across the state, concentrated in the Detroit metropolitan area. Stars across the map marked potential locations for temporary hospitals, termed alternate care facilities (ACFs), that might be constructed to meet the increasing demand for patients. In the weeks leading up to the orientation, USACE had partnered with officials from the State of Michigan to survey these sites and determine the feasibility of converting existing facilities into ACFs.

Two sites had been approved for construction. Transformation of the TCF Center, Detroit, into an ACF had already begun, with construction nearing completion. Meanwhile, in the suburb of Novi, Michigan, construction had just begun on the Suburban Collection Showplace convention center, which had been selected as an additional 1,100-bed ACF.

Unfortunately, COVID-19 was not the only challenge in Michigan. Mr. Patrick Kuhne, emergency operations manager for the Detroit District presented slides that showed a graph of the rising water level in the Great Lakes. Projections indicated that the rising water threatened to cause significant flooding across the state.

ACF under construction at the Suburban Collection Showplace

Captain Jacob Hughes leads a tour of an ACF.

It was clear that an effective government response was urgently needed in order to meet the challenges in Michigan. Fortunately, the Detroit District was ready to do its part to effectively respond to the rising COVID-19 caseload as well as the rising water levels.

I was assigned to assist the project manager for the Suburban Collection Showplace ACF in Novi. The day before my assignment began, the scope of the project was revised from a 1,100-bed ACF to a 250-bed ACF, based on assessed needs from the State of Michigan. As the project team worked around the clock to update requirements and continue construction, I assisted the project manager by coordinating site visits for the project stakeholders, which included USACE personnel, the prime contractor responsible for constructing the facility, the Michigan National Guard elements supporting construction of the facility, other State of Michigan officials, and the health care team responsible for operating the ACF.

Maintaining shared understanding and a common operating picture amongst these stakeholders was key. Together with the project manager, I developed a walking tour of the site to demonstrate not only the experience of a patient receiving care in the facility, from arrival to discharge, but also the experiences of health care workers staffing the facility. Walking through the project site proved effective in synchronizing the expectations and requirements of each stakeholder as the project developed. Key insights were drawn from these visits, as each stakeholder brought his or her unique perspective and requirements to the site, confirming or refuting assumptions and providing valuable feedback to the project team. Early input from all stakeholders was critical for rapidly designing, constructing, and delivering an effective, safe ACF.

Additionally, I supported the project manager in preparing for and executing a site tour for distinguished visitors, including Michigan Governor Gretchen E. Whitmer; Senator Gary C. Peters; Congresswoman Haley M. Stevens; Oakland County executive, Mr. David W. Coutler; Federal Emergency Management Agency Region V administrator, Mr. James K. Joseph; Health and Human Services Region V director, Mr. Doug O'Brien; and Michigan's adjutant general, Major General Paul D. Rogers. Finally, I joined the quality assurance team, which consisted of Detroit District personnel and augmentees from the Navy Facilities Command, to conduct quality assurance checks on construction ranging from plumbed oxygen systems designed to deliver oxygen to every patient to backup generators to provide the facility with an uninterruptible power source.

Toward the conclusion of the ACF project, I was assigned to assist the emergency operations center with flood prevention and recovery efforts. The shoreline of Michigan is home to public infrastructure and residential properties. The Detroit District partnered with local municipalities to protect assets by providing flood-fighting education and expertise to local governments and residents. The Detroit District flood-fighting team coordinated with local community emergency managers regarding the logistics necessary to distribute supplies across the state and advised local contractors and citizens about the proper use of sandbags, HESCO® barriers, and inflatable flood-fighting barriers.

My experience in Detroit was humbling. It was truly impressive to realize what can be accomplished when federal, state, and local governments partner with private industry to rise to the challenges of unpredictable threats. The effectiveness and speed of the USACE response to the COVID-19 pandemic and flooding in Michigan reinforced the value of, and the need for resources for, USACE. I am proud to be an Army engineer and to serve alongside the courageous men and women bringing their talents to bear on our Nation's most daunting challenges. *Essayons!*

Captain Hughes was a platoon trainer for the Engineer Basic Officer Leadership Course, 1st Engineer Brigade, Fort Leonard Wood, Missouri. He holds a bachelor's degree in electrical engineering from the U.S. Military Academy–West Point, New York.

Engineer Support to the Kansas City District

By Chief Warrant Officer Three Michael L. Keck

Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

In early April 2020, seven Army engineer officers from Fort Leonard Wood, Missouri, were mobilized in support of the Kansas City District, U.S. Army Corps of Engineers (USACE), response to the Novel Coronavirus (COVID-19) pandemic. They augmented the district and made an immediate impact by assisting with surveys of alternate care facilities (ACFs) throughout Kansas and Missouri. These ACFs were to be used to help alleviate the burden on existing hospitals due to an influx of COVID-19 patients.

The team was initially tasked with assessing a variety of locations, ranging from new facilities at the University of Kansas, Lawrence, to older, unused hospitals and clinics across the two states. The engineer officers were rapidly integrated into USACE and used USACE systems to collect data and disseminate it throughout the organization. Following the initial wave of assessments, it was determined that the most rapid transformations could be accomplished by converting hotels to hospitals. With this information, the Soldiers completed a second wave of assessments to identify the most viable infrastructure for conversion to ACFs.

The assessments included the identification of pre-existing hazardous conditions such as structural damage and mold formation. They also included the identification of functional problem areas that were expected to be encountered if the facilities were converted, such as limited

The National Geospatial Intelligence Agency-West project in Saint Louis

electrical power, inadequate laundry facilities, and undersized elevators and patient rooms. Once the assessments were completed, the team produced reports recommending the most viable locations for conversion to ACFs.

USACE was not the only beneficiary of the engineer officer mobilization. The officers gained a wealth of knowledge and experience regarding the roles that the federal government plays in responding to a crisis. The augmentation provided a valuable example of how the country operates during a national disaster. The team observed the shared responsibility and decision making that take place between the federal and state governments as well as the many factors that leaders must take into consideration when making decisions.

Staff from the Kansas City District assess an ACF near Caney, Kansas.

In addition, the engineer officers also observed some Kansas City District daily operations and other ongoing USACE missions. For example, the team learned about the levee system in the Northwest Division and the USACE role in flood management and its ability to maintain navigable waterways. The National Geospatial Intelligence Agency–West headquarters facility project in St. Louis, Missouri, is another example. The team observed the on-site construction of the facility and received a briefing on the phases of the project, which demonstrated the large scale of the projects for which USACE is regularly responsible.

The mobilization of the Army engineer officers to the Kansas City District during a time of national crisis was truly beneficial. The flexibility and hard work of the officers were of tremendous value to USACE and the local population. In addition, the augmentation was helpful in developing the engineer officers.

A flood control project in Kansas City, Missouri

Chief Warrant Officer Three Keck is an instructor for the Warrant Officer Advanced Course, U.S Army Engineer School, Fort Leonard Wood, Missouri. He holds a bachelor's degree in computer and information science and a master's degree in management from the University of Maryland University College (now the University of Maryland Global Campus).

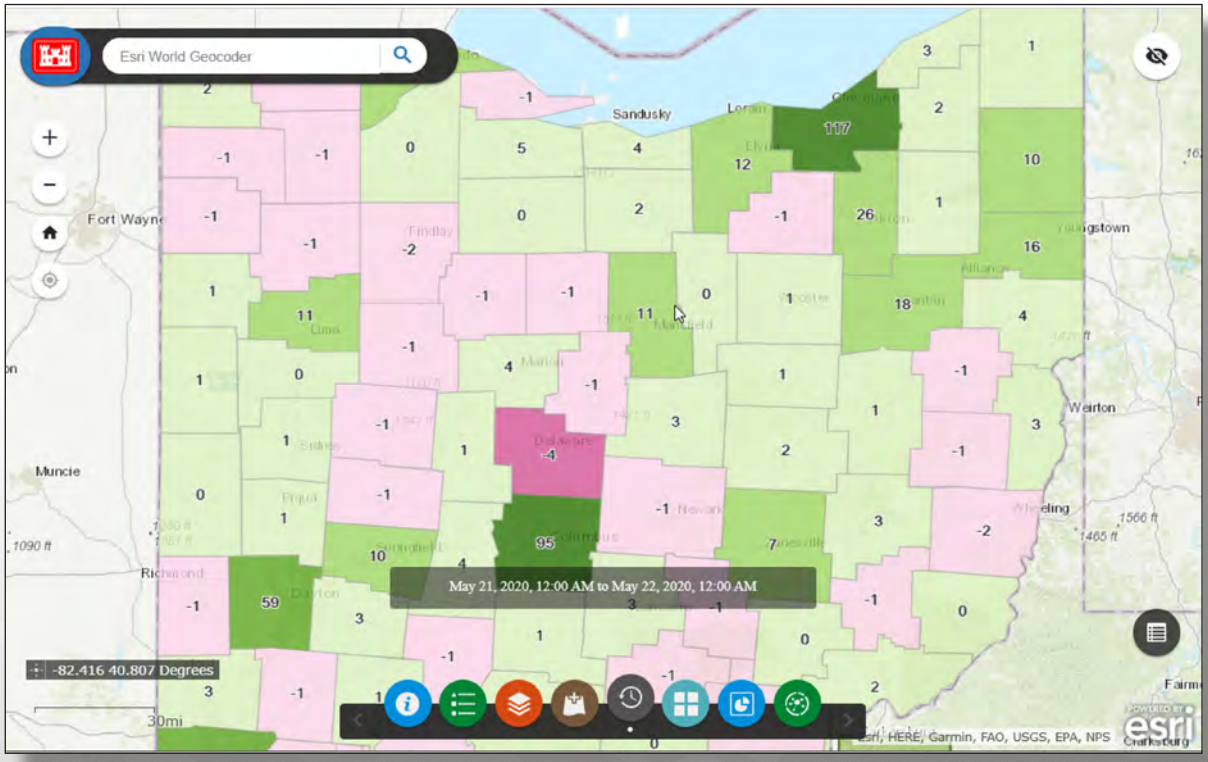
COVID-19:
Mapping the Fight Against the Virus

By Captain Dave J. Truong and First Lieutenant Matthew T. Hain

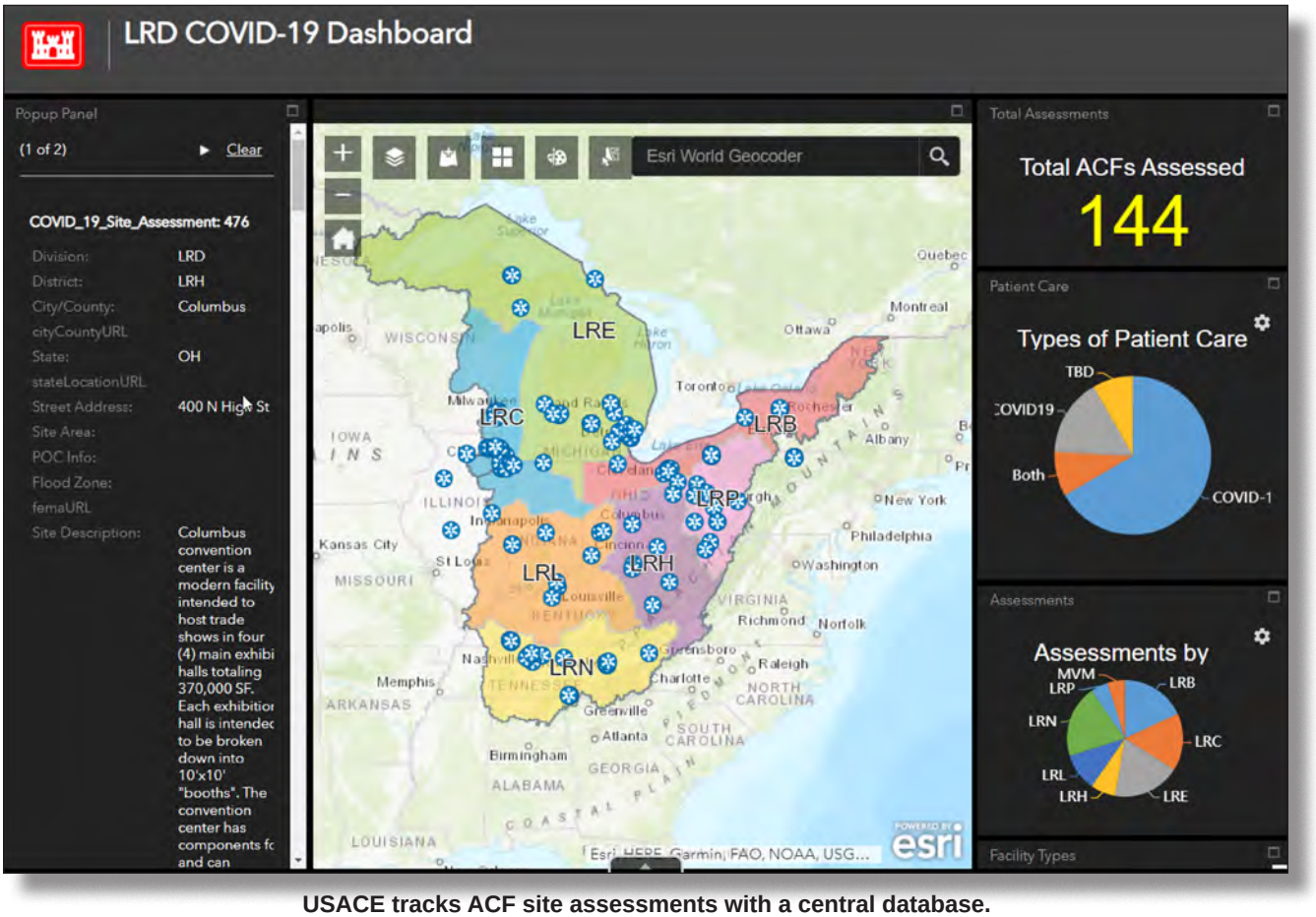
In the late days of March 2020, Army Capability Manager–Geospatial (ACM-Geo), U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri, received a tasking to provide two engineer officers with geospatial training to support the Huntington District, U.S. Army Corps of Engineers (USACE), in the fight against the Novel Coronavirus (COVID-19) by providing geospatial visualization and analysis for the alternate care facility (ACF) mission. ACM-Geo answered the call with volunteers Captain Dave Truong and First Lieutenant Matthew Hain, both currently assigned to ACM-Geo as part of the Engineer Regiment Geospatial Development Program. The first week in April, they deployed to Huntington, West Virginia, to provide geospatial information and services support for a mission that was projected to last more than a month.

Upon arrival at the Huntington District Headquarters, Captain Truong and First Lieutenant Hain received a briefing on district operations related to the COVID-19 crisis, including operations related to disaster response and ACF assessments and construction. They met with district geospatial staff, verified access to the USACE network, and then got to work.

The initial task consisted of using an online portal to create a map to depict hospital bed shortages within the U.S. Army Corp of Engineers common operating picture (UCOP) in Ohio, enabling the commander of the Huntington District to advise the governor of Ohio and the Federal Emergency Management Agency about which areas were most impacted by COVID-19 and, therefore, would most need ACF construction. Captain Truong and First Lieutenant Hain were provided with data that included the number, location, and availability of intensive-care units and nonintensive hospital beds throughout Ohio. They analyzed this data and reconfigured it so that it could be input into ArcGIS Pro (the latest professional desktop geospatial information and services application from ESRI©) within UCOP.



The Huntington District COVID-19 tracker served as a template for the national UCOP.



USACE tracks ACF site assessments with a central database.

Once configured, Captain Truong and First Lieutenant Hain loaded the data and used ArcGIS Pro to create a time lapse product that showcased which Ohio counties were most impacted by COVID-19 and which surrounding counties had hospital beds available for COVID-19 patients. They constructed three different maps based on data models that depicted the worst-case scenario, the best-case scenario, and the most likely scenario. This gave the Huntington District leadership a better understanding of impacts to the region. By the end of the process, they had mapped out the hospital beds for all 88 counties in Ohio, making critical contributions to the UCOP and helping leaders visualize and prioritize efforts in the region.

Along with mapping the response data, Captain Truong assisted with quality assurance and quality control of the incoming data on potential ACF sites from USACE teams conducting ACF site assessments within the district. He evaluated the initial data provided by the State and compared it to the final reports from the ACF assessment teams to ensure that the administrative and technical information matched before to adding it to the online UCOP.

One of the distinct advantages of using the UCOP is the ability of each USACE district to input COVID-19 ACF data directly into ArcGIS Pro, enabling USACE districts and USACE division headquarters to observe real-time data. Updates to COVID-19 patient counts, hospital bed availability, and suitability for ACF locations enabled USACE leaders to better inform and advise civilian leaders of whether to initiate the construction of ACFs within each district—and, if so, where and when the ACFs should be constructed.

After 3 weeks of supporting the USACE Huntington District (during which time, the COVID-19 situation stabilized and district operations returned to a state of normalcy), Captain Truong and First Lieutenant Hain fulfilled their mission of contributing critical data from the Huntington District to the UCOP and they received orders to return home. The Huntington District commander, Colonel Jason A. Evers, recognized these two professionals for their hard work and presented them with coins as tokens of his appreciation before they returned to Fort Leonard Wood.

Captain Truong is a geospatial development officer at USAES. He holds a bachelor's degree in sociology from the University of California, Irvine.

First Lieutenant Hain is a geospatial development officer at USAES. He holds a bachelor's degree in aerospace engineering from Virginia Polytechnic Institute, Blacksburg, Virginia.

USACE Chicago District Uses Innovation and Skill in Response to COVID-19

By Captain Anne Therese McEldowney with contributions from Captain Genesis Ramos

Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

In the latter part of 2019, people in Wuhan, Hubei Province, China, started becoming ill from an influenza-like virus. By early 2020, this virus had spawned a global pandemic that had infected huge portions of the world population—the likes of which had not been seen since the Spanish Influenza of 1918, more than a hundred years ago.

This pervasive and ferocious virus caused widespread fear and panic, forcing action from international leaders. By January 2020, the virus had spread to the United States and 18 other countries around the world. In February 2020, the World Health Organization declared a public health emergency of international concern—a designation reserved for catastrophic events—and assigned the name Novel Coronavirus (COVID-19). The United States began to see an increase in human-to-human cases of transmission, and the first known U.S. death from COVID-19 was recorded on 28 February 2020.[1]

The world watched in horror as Italy ran out of hospital beds and was forced to helplessly watch its death toll rise each day. The United States was determined to tell a different story. A lack of hospital space for those in need could be expected to directly correlate with the number of deaths, and preventive measures needed to be taken. On 13 March 2020, President Donald J. Trump declared the COVID-19 outbreak in the United States to be a national emergency,[2] authorizing the Federal Emergency Management Agency (FEMA) to deploy Emergency Support Function-3 (ESF-3) (Public Works and Engineering), as stipulated under the Stafford Act.[3] ESF-3 provides for the capabilities and resources to facilitate the delivery of services, technical assistance, engineering expertise, construction management, and other support to prepare for, respond to, and recover from a disaster in which the U.S. Army Corps of Engineers (USACE) is the lead coordinating federal agency.[4]

USACE Chicago District personnel greet National Guard Soldiers at Chicago Midway International airport.

From canal and bridge building to natural disaster relief projects and monuments in Washington, D.C., USACE has long been tasked with engineering solutions for the American people through the collaborative efforts of a joint U.S. Army/civilian workforce. USACE is a unique organization comprised of U.S. Army leadership mixed with civilian engineers and scientists, resulting in capabilities beyond any military or civilian unit.

Many states, including Illinois, Indiana, and Wisconsin, declared states of emergency as they anticipated an overwhelming number of people becoming infected with COVID-19. As the numbers of infected continued to climb each day, state governors, based on data from the Centers for Disease Control and healthcare experts, forecasted that their medical facilities would be overwhelmed due to lack of patient care space to treat the infected and they reached out

to FEMA. To combat the virus—and the potential for hospitals being over capacity—the federal government tasked USACE, through FEMA ESF-3, to work with the states to identify their COVID-19 requirements and submit requests to FEMA. Requirements varied from city to city and state to state, but the overarching goal for all was to create more bed space for potential COVID-19 patients.

It came as no surprise to USACE that calls requesting assistance in fighting this latest enemy began flooding in from leaders across the country. The surprise came in the form of the requested timeline; USACE had never before worked so rapidly on such large-scale projects. COVID-19 presented a situation in which hospitals were predicted to quickly reach full capacity, leaving sick patients with nowhere to go for care. Requests to immediately convert all types of existing facilities into alternate care facilities (ACFs) came in. At the start of the pandemic, USACE was unfamiliar with the term ACF, which is described by FEMA as a temporary facility that is less sophisticated than a typical hospital but has various capacity levels to care for patients. Conversion of existing facilities to ACFs was the most feasible option available to the federal government for immediately addressing the issue.

The USACE Chicago District, whose area of responsibility includes parts of Illinois, Indiana, and Wisconsin, was tasked with the survey, design, supervision, and execution of five ACFs throughout the Chicago area in a matter of a few short weeks. The new pandemic offered USACE an unparalleled set of emerging response challenges. For example, most emergency operations that involve ESF-3 are post-event (recovery) operations, while the COVID-19 mission occurred in the "during" phase and involved preparing for a worst-case scenario. However, the Chicago District team adjusted; and in keeping with the storied but dependable history of the U.S. Army, it answered the call for accelerated delivery.

The Chicago District organized a task force to support the USACE Great Lakes and Ohio River Division and executed six FEMA-issued mission assignment task orders (MATOs) to build $153 million worth of ACFs. More than 150 military and civilian personnel from around the United States arrived in support of the COVID-19 response in the Chicago District. Projects included converting arenas into hospitals and renovating old hospitals to serve as COVID-19-specific ACFs. To initiate the projects, the district completed 41 facility assessments throughout its AOR.

Of the 41 facility assessments completed by the district, five facilities were approved for conversion to ACFs:

- McCormick Place, Chicago, Illinois.
- The former MetroSouth Hospital, Blue Island, Illinois.
- Advocate Sherman Hospital, Elgin, Illinois.
- The former Westlake Hospital, Melrose Park, Illinois.
- Wisconsin State Fair Park Exposition Center, West Allis, Wisconsin.

Lieutenant General Semonite briefs the USACE Chicago District staff during his visit to ACFs.

On 28 March 2020, the Chicago District began construction to transform an arena to an ACF at McCormick Place. The contract was awarded for 3,000-patient-space capacity. The estimated cost of the project was $65.1 million. On 29 March 2020, construction was started to renovate the former MetroSouth Hospital to a 315-patient-space-capacity ACF, with a project cost of $14.9 million. Additionally, on 29 March 2020, construction started on Advocate Sherman Hospital. This 274-patient-space-capacity healthcare-to-ACF conversion cost $18.2 million. On 5 April 2020, construction started on the Westlake Hospital, a healthcare-to-ACF conversion with a project cost of $16.3 million for a 230-patient-space-capacity facility. Finally, on 7 April 2020, construction started on the Wisconsin State Fair Park Exposition Center, which was an arena-to-hospital-care space conversion with a project cost of $14.9 million for a 500-patient-space capacity.

The Chicago District works on numerous projects throughout the year and has the full-time task of managing Chicago's largest waterways. Most projects take weeks, months, or even years to go from the initial feasibility study to design to completion. However, the Chicago District completed these projects by 24 April—less than a month after they were approved. "Most of the governors are saying their peak [confirmed cases are] projected somewhere around the middle of April. This is not 'take all the time in the world' to do it," said USACE Commanding General and Chief of

USACE-Chicago personnel transferring the McCormick Place ACF to Chicago officials upon completion.

Engineers, Lieutenant General Todd T. Semonite, who added that USACE must provide a solution before the peak numbers are reached.[5] It was generally agreed that hospitals in the Chicago District AOR would reach full capacity by 24 April 2020, making that the Chicago District "D-Day."

Although USACE typically works on projects in a more linear and exacting fashion, the luxury of time was unavailable due to the pressing COVID-19 situation; therefore, the Chicago District "broke the mold" and got started on establishing ACFs as soon as possible. According to USACE Regulation 1180-1-9, "USACE commands will perform acquisition planning for all project acquisitions and provide project execution recommendations based upon the project's goals and objectives for budget, functional and technical quality, and urgency-of-need date and the most feasible delivery and contracting methods at the lowest sustainable cost."[6]

The USACE Chicago District commander and district engineer, Colonel Aaron W. Reisinger, was responsible for the unusual task of providing quality and urgency without definitized terms at the start of the project. At the beginning of a project, local USACE leaders typically work at length with partners to define the scope, come to terms with a design, and agree to the appropriate acquisition terms. It can take weeks to cut through all the red tape, even for a single part of that process; but in this most recent case, USACE had mere days available. The task facing the Chicago District was a daunting one; nevertheless, the district tackled it head-on. When the district impressively stood up the ACF at McCormick Place, meeting the highest level of quality and safety standards within 4 weeks, Mr. David F. Bucaro, the Chicago District task force lead for the project, stated, "In order to stand up the McCormick Place ACF to address the region's bed shortage projected at the start of the project, we utilized a contracting mechanism reserved for contingency operations that allowed for work to commence before the contract terms, specifications, or price were agreed upon. We typically utilize contracting methods where a project's scope and specifications are defined up front. That process would have taken too long to develop and not met the needs of FEMA and the State of Illinois to increase capacity to treat acute COVID-19 patients. I'm proud of the entire team for stepping up and successfully utilizing every tool available to successfully construct the largest ACF in the Nation in less than 4 weeks!"[7]

There are multiple project delivery methods, but the most commonly used method, by far, is the design-bid-build (DBB) method. The DBB method involves the owner, architect, and contractor working together in a chronological fashion. This method is the one most often selected because bidding is low, the owner is able to maintain control of the design, and the laws are well-defined. However, this linear process is also associated with the longest project delivery time. The design portion of the method involves an architect and engineer working together to create a complete or nearly complete design. Once the design portion is complete and approved, the parties move forward with the bidding process. The ability for firms to bid creates competition, enabling the owner to select the lowest bid or the lowest bid that maintains the quality and timeline. A drawback to the DBB method is that it is not the most efficient method in terms of rapid construction; it can be a painstakingly slow and deliberate process.[8]

When COVID-19 entered onto the scene, it became clear that the response could be neither slow nor excessively deliberate. Lieutenant General Semonite summarized the COVID-19 bed space issue as a complex problem requiring a simple solution. He reiterated time and again that USACE would quickly create a standardized solution for the bed space issue in a way that it could be duplicated across the Nation as the need arose.[9] As a result, the USACE team opted to employ an integrated delivery method, as opposed to the more commonly used DBB approach—requiring the team to step out of its comfort zone. The integrated delivery method allowed the Chicago District to take an aggressive approach to the problem, enabling it to deliver five projects in less than 30 days. The team did not get bogged down in details; instead, it focused on quickly and safely creating ACFs in the interest of saving American lives.

The integrated delivery method requires the simultaneous synthesis of several people and systems. It forces all parties involved to come up with creative solutions and capitalize on everyone's greatest strengths. All stakeholders have a vested interest in the success of the project, and excessive blame does not fall heavily on one set of shoulders. This method can cause an increase in risk, but it also improves efficiency and allows the project to get started, and therefore completed, much more quickly.

Once the potential state-requested locations had been surveyed, rough estimates of the scope and cost were developed. Upon approval of the locations, the state submitted resource requirements to FEMA. FEMA then approved the MATOs, and the Chicago District initiated the performance work statements. Once the contract was awarded, the planning and execution of construction phases began, with little to no time wasted. Planning, execution, monitoring, and control then occurred simultaneously, allowing for increased productivity. The definitization team worked with contractors and stakeholders to define the scope; provide proposals; analyze; and negotiate for a firm, fixed-price contract. The planning phase ended once the contract was definitized.

Throughout this process, the Chicago District central command post monitored the progress for the five projects, held daily meetings, and reported to the division headquarters each day. The central command post enabled a constant flow of communication from field offices to the division. In this way, the projects were true joint Army and civilian endeavors that made use of Army reporting methods and civilian contractor violence of action to complete the mission.

In order to properly close out each project, representatives from the State, clinicians, and administrators were present during a preinspection and final inspection to ensure successful turnover to the owner of the ACF or the entity operating the particular site. The physical completion and turnover process required that a turnover letter for each facility be signed by the district engineer and presented to the State. A final inspection letter and completed Department of Defense (DD) Form 1354, *Transfer of Acceptance of DOD Real Property*,[10] was signed by a USACE representative, sent to FEMA, and then signed by a State representative. The closeout process was followed by fiscal closeout requirements, which included closing out government orders, following up on unpaid invoices, issuing FEMA memorandums requesting revocation of excess funds, and removing excess funds from the USACE Financial Management System upon the receipt of decreased mission assignment orders.

Between 20 March and 30 April 2020, the Chicago District—

- Designed and constructed more than 5,000 COVID-19 patient spaces.
- Completed six MATOs for five ACFs.
- Constructed $153 million worth of projects. (The district averages $100 million worth of projects per fiscal year.)

In the words of famed Army General George S. Patton, "A good plan violently executed now is better than a perfect plan executed next week."[11] The team from the Chicago District truly lived by those words to adequately support the people of the Chicago area and the Nation throughout the COVID-19 response mission. Colonel Reisinger was consistently quoted as saying, "Some capacity today is better than all capacity next month"[12] in order to convey to the engineers and contractors how vital it was to execute the mission violently and urgently, as opposed to executing it with an extremely calculated, yet much slower, approach that was closer to their comfort zone.

Since the onset of the COVID-19 pandemic, USACE has showcased itself as a versatile and progressive organization that is fully capable of reinventing itself at the drop of a hat to fully deliver vital military and public engineering services in peace, war, or even a pandemic—all for the U.S. government and the American people.

Endnotes:

[1]"Coronavirus Pandemic: Tracking the Global Outbreak," *BBC News*, 28 February 2020, <https://www.bbc.com/news/world-51235105>, accessed on 14 August 2020.

[2]Donald J. Trump, "Proclamation on Declaring a National Emergency Concerning the Novel Coronavirus Disease (COVID-19) Outbreak," 13 March 2020, <https://www.whitehouse.gov/presidential-actions/proclamation-declaring-national-emergency-concerning-novel-coronavirus-disease-covid-19-outbreak/>, accessed on 28 July 2020.

[3]Donald J. Trump, "Letter From President Donald J. Trump on Emergency Determination Under the Stafford Act," 13 March 2020, <https://www.whitehouse.gov/briefings-statements/letter-president-donald-j-trump-emergency-determination-stafford-act/>, accessed on 28 July 2020.

[4]*National Response Framework*, U.S. Department of Homeland Security, 28 October 2019, <https://www.fema.gov/media-library/assets/documents/117791>, accessed on 28 July 2020

[5]Thomas Brading, "Army to Help Convert Vacant Buildings Into Hospitals as COVID-19 Spreads," USACE, 26 March 2020, <https://www.nwd.usace.army.mil/Media/News-Stories/Article/2127538/army-to-help-convert-vacant-buildings-into-hospitals-as-covid-19-spreads/>, accessed on 28 July 2020.

[6]USACE Regulation 1180-1-9, *Design-Build Contracting*, 31 March 2012, <https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1180-1-9.pdf>, accessed on 31 August 2020.

[7]David F. Bucaro, personal interview, 28 April 2020.

[8]*Primer on Project Delivery*, American Institute of Architects and the Associated General Contractors of America, 2011, <https://www.agc.org/sites/default/files/Files/Programs%20%26%20Industry%20Relations/AIA-AGC_Primer_on_Project_Delivery_2nd_Edition-FINAL.pdf>, accessed on 28 July 2020.

[9]Brading.

[10]DD Form 1354, *Transfer and Acceptance of DOD Real Property*, September 2009.

[11]"What Advice are Venture Capitalists Giving To Startups in Light of the Coronavirus Crisis?", *Forbes*, 28 March 2020, <https://www.forbes.com/sites/allbusiness/2020/03/28/coronavirus-crisis-advice-venture-capitalists-giving-start-ups/#290cf0485a3a>, accessed on 14 August 2020.

[12]Aaron W. Reisinger, personal interview, 8 April 2020.

Captain McEldowney is a student in the Engineer Captains Career Course, Fort Leonard Wood, Missouri. She holds bachelor's degrees in English and sociology from the University of Illinois, Urbana / Champaign, and a master's degree in political and justice studies from Governors State University, University Park, Illinois.

COVID-19: USACE Memphis District Emergency Response

By Captain Alexander W. Burruss

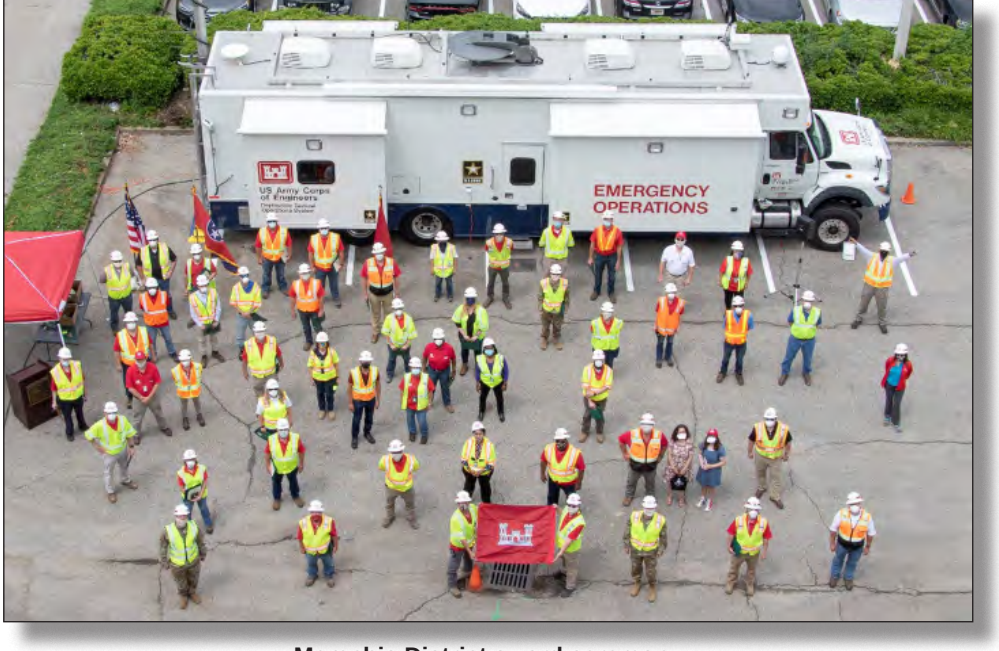
At the onset of the Novel Coronavirus (COVID-19) pandemic, the U.S. Army Corps of Engineers (USACE) collaborated with the Federal Emergency Management Agency to develop a plan for the rapid expansion of COVID-19 treatment spaces. USACE assigned each of its districts an area of responsibility, and the districts integrated into the local and state response agencies within their areas of responsibility. As local civil authorities conducted analysis and projected bed space requirements, USACE developed facility modification options for accommodating additional beds. Districts completed site assessments and provided project management support for converting existing buildings into alternate care facilities (ACFs). In April 2020, 3 weeks after the President declared a national emergency,[1] the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri, deployed more than 30 Soldiers in support of the USACE response effort; Captain Alex W. Burruss was deployed to the Memphis District, USACE Mississippi Valley Division, Tennessee, for more than 60 days. There, he assumed the role of the district operations officer.

Once on-site, Captain Burruss met with deputy district commander Lieutenant Colonel Nathan A. Molica to learn about the Memphis District mission. Next, he joined the emergency management team as the operations officer, responsible for relaying information requirements between higher headquarters and teams in the field. The Mississippi Valley Division area of responsibility includes most of the State of Wisconsin, which requested multiple site assessments and the construction of two ACFs. In addition, the Memphis District supported the Nashville District, Tennessee, by conducting site assessments and the construction of an ACF west of Jackson, Tennessee.

Shortly after arriving in Memphis, Captain Burruss deployed to Milwaukee, Wisconsin, to observe the completion and handover of the Wisconsin State Fair Park ACF, West Allis, Wisconsin to the State. That ACF followed the arena-to-health-care concept, which involved constructing 10-foot-by-10-foot patient care spaces inside the open floor of the exposition center. The project included the installation of an in-line oxygen system; modifications to heating, ventilation, and air-conditioning systems; and the construction of latrines, staff space, and a nurse call system. The facility provided the county of Milwaukee with an additional 500 nonacute-patient care spaces.

Memphis District commander and team

While in Milwaukee, Captain Burruss and a field team conducted a site assessment to construct an ACF at the Lotter House Correctional Facility. The rapid increase in COVID-19 cases within the prison system was a growing concern for the State, and the construction of an ACF at this facility would ease the staffing requirement created from transferring sick inmates to a traditional hospital. Captain Burruss noted lessons learned from the Wisconsin State Fair Park and Lotter House Correctional Facility ACFs and redeployed to Memphis.



Memphis District award ceremony

Once back in Tennessee, Captain Burruss helped State officials coordinate the ACF buildout of the Commercial Appeal building, located near downtown Memphis. The State had acquired the building, which had housed an old newspaper-printing facility, with an 18-month lease. The site was ideal for ACF conversion because it was located next to the Memphis Hospital District and there was existing logistical support infrastructure. The renovation involved significant effort, requiring the demolition of industry and commercial space and its conversion into patient care spaces. The State requested that USACE design the ACF primarily for nonacute COVID-19 patients. The facility now contains 401 patient care beds across four serviceable stories and a large warehouse area. It also contains space for medical staff to stabilize acute COVID-19 patients before transferring them to a hospital.

In addition to fulfilling his operations officer duties, Captain Burruss was also integrated into the Commercial Appeal ACF project management team. He shared the lessons that he had learned from the Wisconsin State Fair Park ACF project. During construction of the Commercial Appeal ACF, he monitored progress, assisted with quality assurance, and conducted stakeholder engagements. He ensured that the Tennessee Emergency Management Agency, the State Facility Management Team, and the State Medical Team were situationally aware of the progress and features of the facility. During the first week of the project, Captain Burruss helped integrate the 484th Forward Engineer Support Team–Advance, Huntsville, Alabama, into the project management team. The 484th provided expertise and technical oversight for the project.

The construction process was intricate and impressive. More than 60 different contracting companies worked onsite; many were local to the region and state. The construction team worked 24 hours a day, 7 days a week, for 30 days—without any lost time due to injuries. To save time, construction activities were completed in parallel, rather than according to the typical sequential schedules. Normally lengthy contract processes took days instead of months. By the end of the 30 days, nearly 200,000 project work hours had been amassed.

As the project neared completion, the State medical team requested additional work outside the original project scope. Consequently, the design team modified the original performance work statement, which had been based on the arena-to-health-care concept. However, because the multifloor concept is more complex than the standard model, the Commercial Appeal ACF required additional capabilities to meet medical staff requirements. The staff needed clean or "cold" space for breaks during shifts, and the space needed to be near the patient spaces and needed to include high-efficiency particulate air filtration and positive pressure, allowing staff to remove personal protective equipment. This change required a formal modification to the contract. Regardless of the additional work, the Memphis District was able to grant the State beneficial occupancy of the facility. Beneficial occupancy allowed the State to prepare the ACF for patients by stocking supplies and training staff.

The additional work was completed on 9 June 2020. This signified the end of the Memphis District role in the project and allowed for the complete turnover of the site to the State. Following the completion of his mission, Captain Burruss redeployed to Fort Leonard Wood.

Endnote:

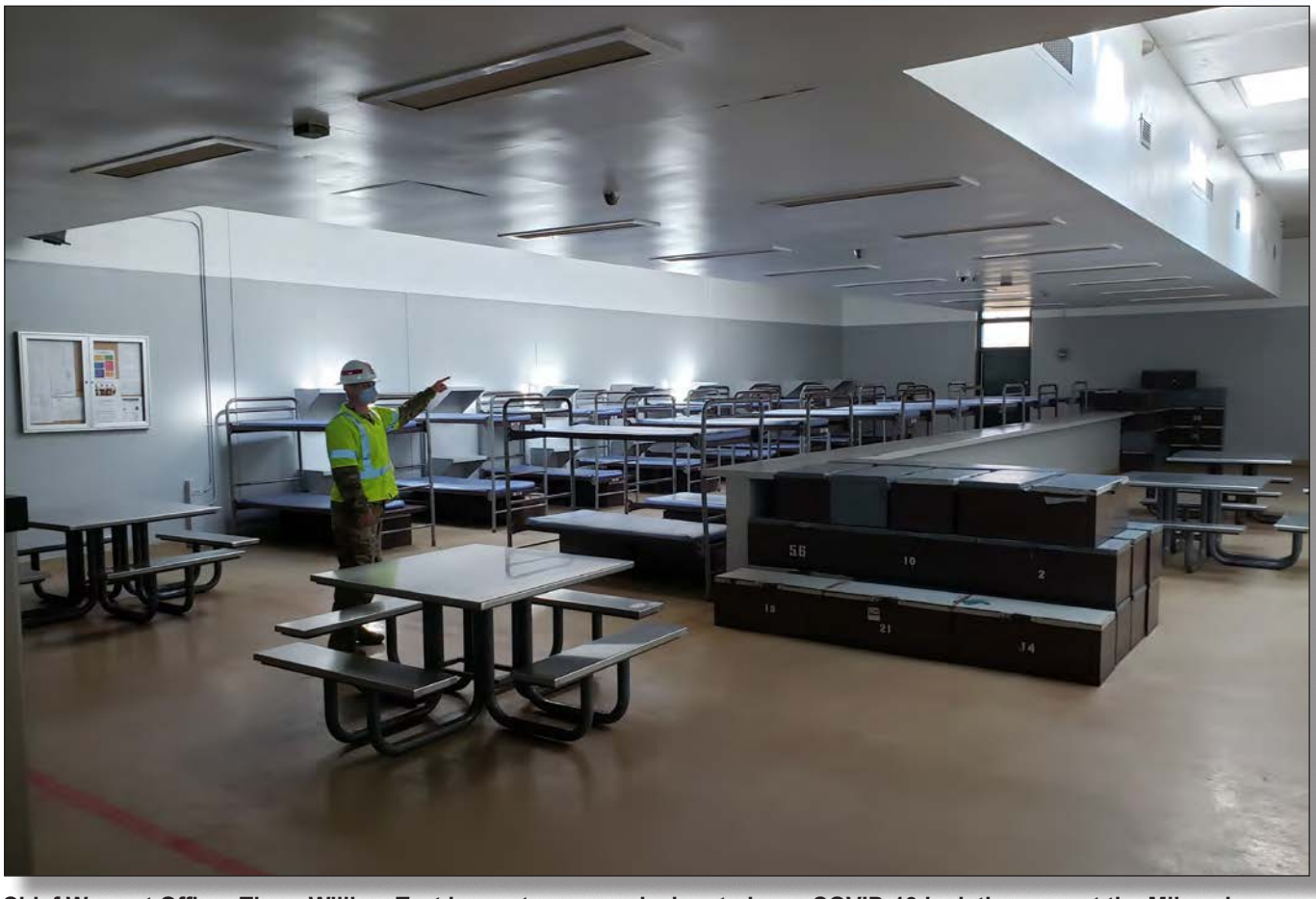
[1]Donald J. Trump, "Proclamation on Declaring a National Emergency Concerning the Novel Coronavirus Disease (COVID-19) Outbreak," 13 March 2020, <https://www.whitehouse.gov/presidential-actions/proclamation-declaring-national-emergency-concerning-novel-coronavirus-disease-covid-19-out-break/>, accessed on 9 October 2020.

Captain Burruss is now the operations officer for the 91st Engineer Battalion, Fort Hood, Texas. He holds a bachelor's degree in nuclear engineering from the U.S. Military Academy—West Point, New York, and a master's degree in engineering management from Missouri University of Science and Technology at Rolla.

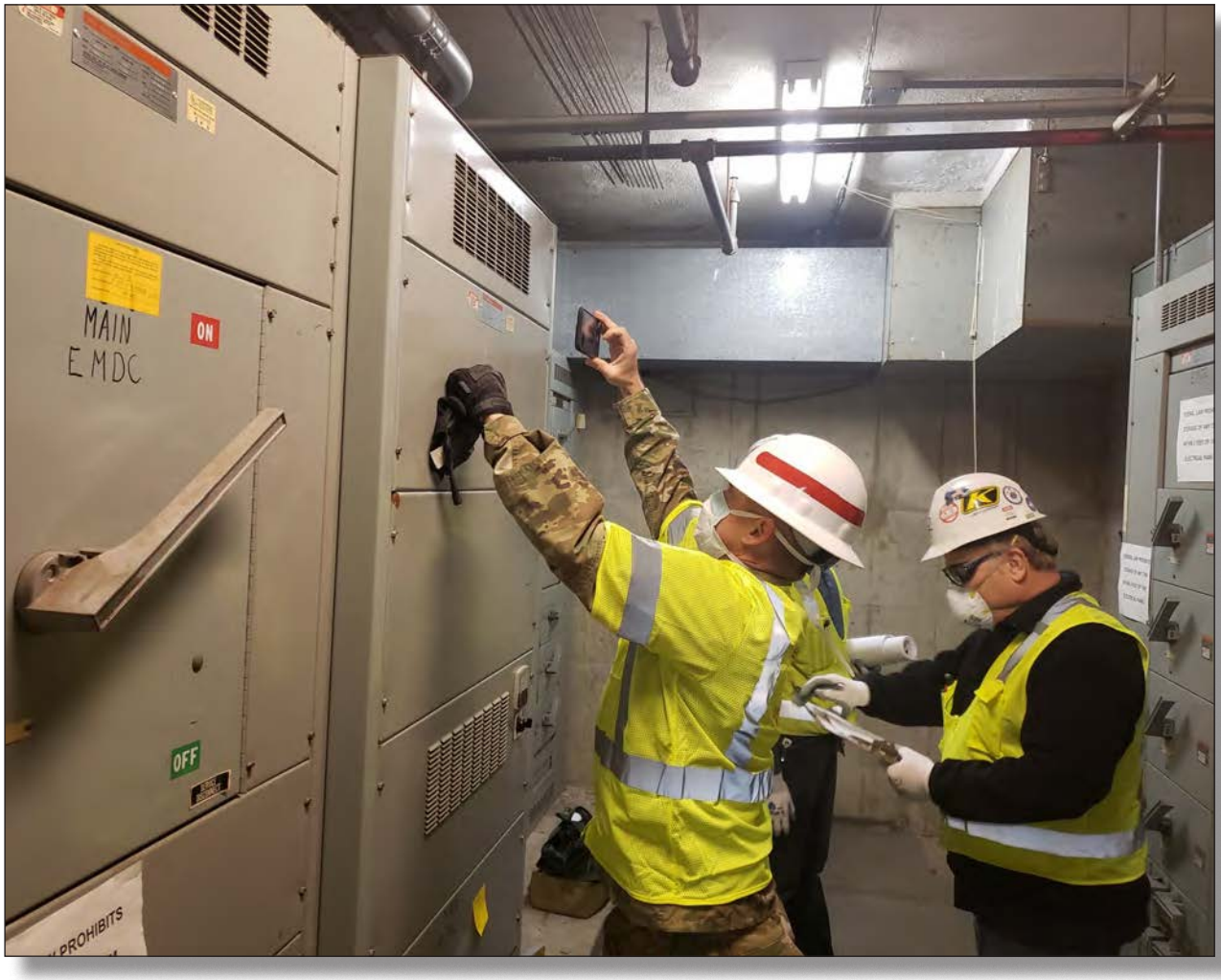
Building the Capability for the Response to the COVID-19 Pandemic

By Chief Warrant Officer Three Daniel W. Schwab and Chief Warrant Officer Three William S. Test

In early April 2020, the Department of Defense officially tasked the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri, to provide technical engineering assistance to the U.S. Army Corps of Engineers (USACE) in the battle against an invisible enemy, the Novel Coronavirus (COVID-19). USACE specifically requested the assistance of two chief warrant officer three Military Occupational Specialty 120A–Construction Engineer Technicians. USAES answered the call and flawlessly operationalized its pool of seasoned warrant officers, choosing Chief Warrant Officers Three Daniel W. Schwab and William S. Test. On 7 April 2020, these two warrant officers were forward-deployed to assist the USACE Saint Paul District, Saint Paul, Minnesota, in the Mississippi Valley Division.



Chief Warrant Officer Three William Test inspects a room designated as a COVID-19 isolation area at the Milwaukee County House of Corrections.



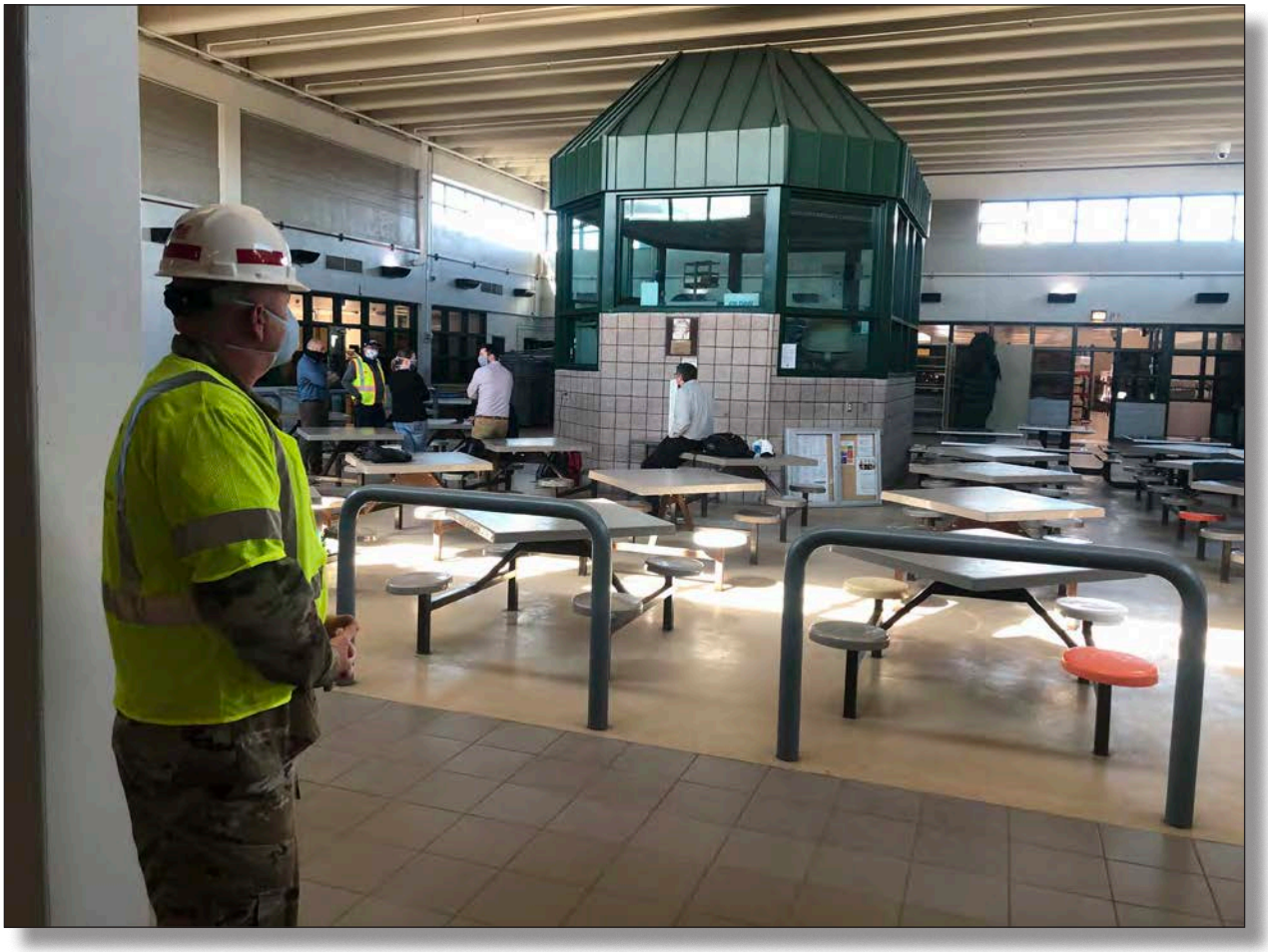
Contracting-team members conduct a power load assessment at an alternate care facility.

Chief Warrant Officers Three Schwab and Test arrived at the Saint Paul District office and immediately began working in the Mississippi Valley Division emergency operations center (EOC) in conjunction with the Minnesota EOC. Their task was to compile a list of viable locations to convert hotels to alternate care facilities. The warrant officers hit the ground running, immediately working with the State EOC to provide in-depth analyses of the feasibility, constructability, and estimated duration of construction for more than 50 sites in eight medical regions, eventually reducing the number of viable sites to 34. Schwab and Test assisted the State EOC in determining a rank order structure to "rack and stack" the 34 sites by region, constructability effort, cost, and time.

Next, Warrant Officers Three Schwab and Test were tasked to assist the State Health Department representative, U.S. Air Force Major Fernando C. Nacionales, with further analyses of the 34 sites and the selection of one viable site per medical region. The assistance of Schwab and Test was vital in selecting the final eight sites, which were presented to Minnesota Governor Tim Walz. Governor Walz approved construction in the event that the sites were required. Construction was immediately executed at one of the eight sites selected, Langton Place Rehabilitation Center, Saint Paul. Although the State of Minnesota did not choose to use the Saint Paul District for the actual construction, Schwab and Test were asked to remain on the project to continue with planning and evaluation. During their evaluation of the contractor proposal, Schwab and Test identified several overcharges within the cost estimate and immediately notified the State representative. The work of Schwab and Test ultimately resulted in a dramatic overall decrease in the estimate, saving the State of Minnesota about $2 million.

"The warrant officers hit the ground running, immediately working with the State EOC to provide in-depth analyses of the feasibility, constructability, and estimated duration of construction for more than 50 sites in eight medical regions . . ."

In the following weeks, Chief Warrant Officers Three Schwab and Test continued their technical-advisor roles with the State EOC. The State EOC Commander, Lieutenant Colonel Ryan P. Kelly, personally requested that they



Chief Warrant Officer Three Schwab inspects a room at the Milwaukee County House of Corrections.

assess a location that had been identified as a potential mass-fatality site for housing COVID-19 victims who might, unfortunately, succumb to the virus. The facility, which had previously served as a produce warehouse, consisted of approximately 86,500 square feet of cold-storage space that was deemed suitable for the intended purpose.

The USACE Saint Paul District Deputy Commander, Lieutenant Colonel Patrick J. Sullivan, identified Chief Warrant Officers Three Schwab and Test and asked them to provide much-needed technical support for a barracks-to-health-care conversion project at the Milwaukee County House of Corrections, Franklin, Wisconsin. The warrant officers received a mission briefing from the deputy commander upon their arrival on 30 April 2020. Over the next several days, the warrant officers participated in several key leader meetings, assisting the USACE team in developing modifications to the original scope of work. The warrant officers were extremely valuable in identifying aspects of the scope that had previously been overlooked by other personnel. They continued to assist the contracting-officer representative, Robert C. Vanoer, with documentation in an effort to flawlessly execute all aspects of the project. Demolition and construction officially kicked off on 4 May 2020 and continued through 23 May 2020. The project was completed ahead of schedule and $2 million under the initial budget.

After 30 days of full-throttle planning and executing to support the USACE Mississippi Valley Division and the States of Minnesota and Wisconsin, Warrant Officers Three Schwab and Test fulfilled their mission and returned to USAES. Their diligence, hard work, and can-do attitudes were recognized, and the Soldiers were awarded the Army Commendation Medal; the Humanitarian Assistance Medal; and Saint Paul District, Mississippi Valley Division coins by district commander, Colonel Karl D. Jansen.

Chief Warrant Officer Three Schwab is an instructor for the Military Occupation Specialty 120A Warrant Officer Basic Course, Fort Leonard Wood. His certifications include Occupational Safety and Health Authorized Construction Trainer and Certified Construction Manager.

Chief Warrant Officer Three Test is an instructor for the Military Occupation Specialty 120A Warrant Officer Basic Course, Fort Leonard Wood. His certifications include Power House Electrician, Industrial Electrician, Occupational Safety and Health Authorized Construction Trainer, and Certified Journeyman Lineman.

Great Lakes and Ohio River Valley Division COVID-19 Response

By Captain Marcie Y. Jhong

By the time the 554th Engineer Battalion, Fort Leonard Wood, Missouri, was directed to provide augmentation personnel to various U.S. Army Corps of Engineers (USACE) districts and divisions across the country, the Great Lakes and Ohio River Vally Division (LRD), Cincinnati, Ohio, was already waist deep in its mission to provide alternate care facilities (ACFs) throughout its area of operations. The federal building in which the division was headquartered was officially closed for business, and most of the personnel within the organization had been directed to telework; yet, the projects that were to be completed within a short timeline mounted.

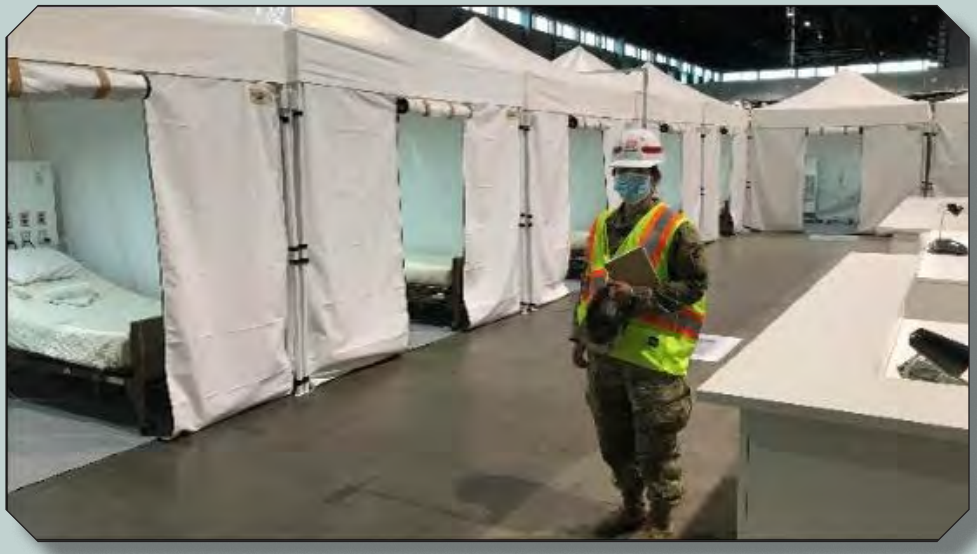
The 554th Engineer Battalion immediately directed its resources to meet mission requirements and prepared to deploy available personnel within days of initial notification. Captain Marcie Y. Jhong was among the group of personnel who volunteered for the mission. Captain Jhong had recently graduated from the Engineer Captains Career Course, and she felt that she had the tools and experience necessary to provide value to the mission at hand.

Upon arrival at the LRD headquarters, Captain Jhong was assigned as the battle captain of the LRD command post. Her initial responsibility was to manage project information flow within the seven subordinate districts of the division. She was in charge of division level quality control assessment for 132 site assessments in the division area of operations. As projects were initiated or redacted based on updated trends in infectiousness and the response from State officials, Captain Jhong worked to bridge the gap between resources and information from headquarters, USACE, to projects on the ground. She oversaw the completion of nine projects during the mission.

As projects neared completion, Captain Jhong conducted site visits to the TCF Center, Detroit, Michigan; McCormick Center, Chicago, Illinois; Sherman Medical Facility, Elgin, Illinois; and MetroSouth Medical Facility, Blue Island, Illinois, to ensure that the contracts were held to standard and that the facilities handover to the State authorities went without issue.

In conjunction with ongoing ACF projects, Captain Jhong helped plan and assess conditions for the reopening of the LRD headquarters to its employees. Additionally, she accompanied the LRD command team on multiple site visits—to a lock and dam, a fleet repair station, and two flood response sites.

On 29 May 2020, more than 7 weeks after deploying to Cincinnati, Captain Jhong oversaw the completion of her last project and returned to her original duty station at Fort Leonard Wood. She viewed her experience as an extremely positive one that has allowed her to serve her country during an unprecedented time and to gain a valuable perspective on the Engineer Corps scope of capabilities.



Captain Jhong at the McCormick Center

Captain Jhong is a recent graduate of the Engineer Captains Career Course, Fort Leonard Wood. She is now the assistant operations officer assigned to the 14th Brigade Engineer Battalion, 2d Stryker Brigade Combat Team, 2d Infantry Division, Joint Base Lewis-McChord, Washington. She holds a bachelor's degree in chemical engineering from the U.S. Military Academy–West Point, New York, and a master's degree in engineering management from the Missouri University of Science and Technology at Rolla.

LIVE EXPERIMENTATION DURING A GLOBAL PANDEMIC: ENGINEERS IN MSSPIX

By Mr. Jeremy T. Evans and Mr. Dennis G. Hutchinson

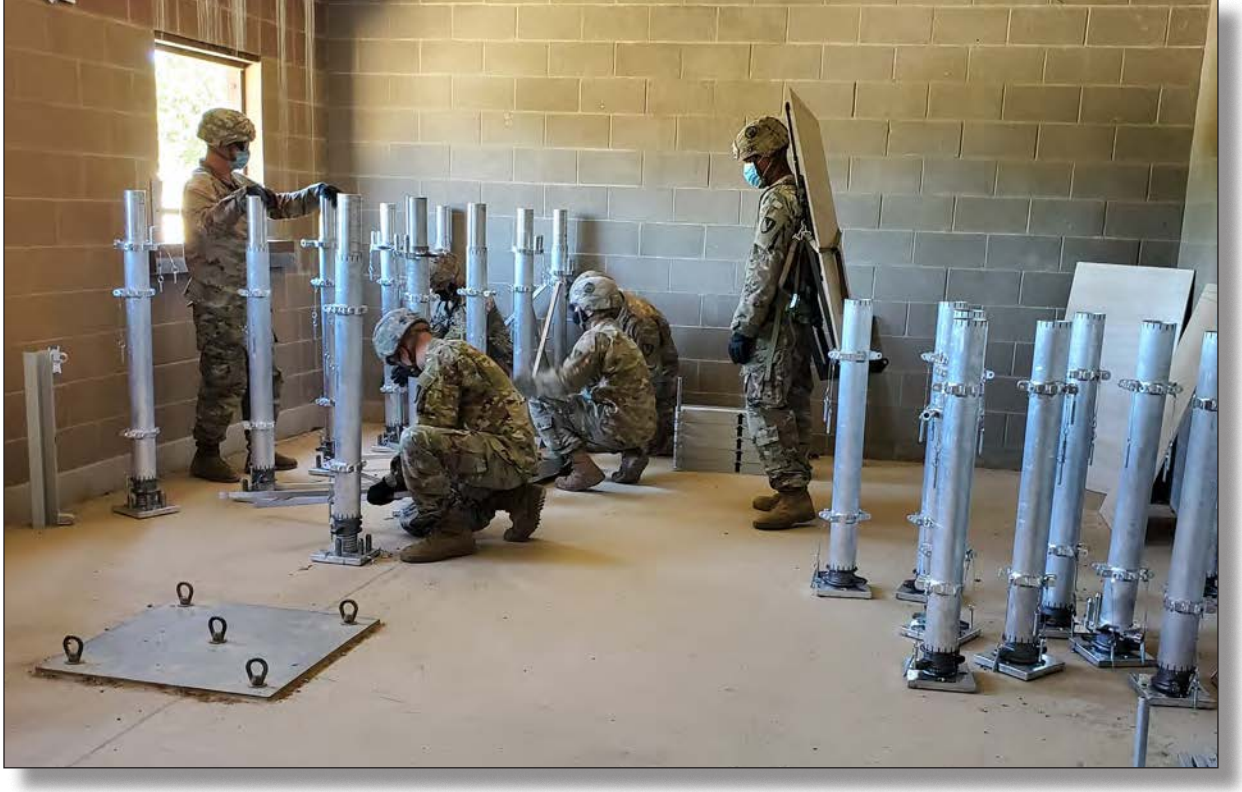
Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

Annually since 2018, the Maneuver Support Battle Laboratory, Fort Leonard Wood, Missouri, and the Sustainment Battle Laboratory, Fort Lee, Virginia, have executed the Maneuver Support, Sustainment, and Protection Integration Experiment (MSSPIX) and oversight for the experiment has been provided by the Joint Modernization Command, Fort Bliss, Texas. However, 2020 has been unlike any previous year; it has presented us all with numerous challenges and has forced us to adapt, professionally and personally.

Live experimentation is a crucial component of modernization; yet in the past, it has required travel and mass gatherings. Novel Coronavirus (COVID-19) control measures forced Maneuver Support Battle Laboratory planners to grapple with how they would conduct MSSPIX 20. For the portion of MSSPIX executed by the Maneuver Support Battle Laboratory, the solution came in the form of flexibility with regard to the timeline and location.

Initially scheduled to take place from 7 to 25 September 2020 at Fort Leonard Wood, MSSPIX 20 was divided into five different phases occurring at two different locations. This decision was made, in part, to accommodate the training schedule of experimentation forces while also minimizing the size of gatherings associated with MSSPIX 20. Other control measures used to mitigate the risk from COVID-19 included isolating the work cells where technologies were being used, allowing limited personnel to have access to multiple work cells, and recording cell entry and exit for all personnel.

MSSPIX 20 provided a venue for a better understanding of military problems and potential Army modernization solutions through experimentation in a multidomain-operation environment. The 2020 iteration focused on operational aspects of the tactical support area and close area and on supported reconnaissance, breaching, and sustainment capabilities. In addition, MSSPIX 20 provided the Army with an opportunity to shape research and development priorities necessary for defining requirements. While MSSPIX 20 included technologies addressing maneuver support, sustainment, and protection, this article addresses only the portion of MSSPIX 20 that was executed



Soldiers setting up an expedient retrofit for existing buildings.

by the Maneuver Support Battle Laboratory and, more specifically, those technologies employed by engineer Soldiers.

Activities for MSSPIX 20 started with a call for technologies, which went out through Army distribution channels and on the Contract Opportunities website in November 2018.[1] The call for technologies explained experiment objectives, identified capabilities desired for inclusion in the experiment, and prescribed the proposal process. After the closing date for proposals had passed, the focus shifted to technology selection. In order to be selected, a technology needed a sponsor from the Army Modernization Enterprise. To be a sponsor, an organizational representative was required to have interest in a technology, identify what was to be learned through experimentation with the technology, and specify how that learning would likely be applied.

The planning phase was next. During this phase—

- Vignettes to execute the technologies were developed.
- Required clearances were obtained.
- Experiment and analysis plans were created.
- Soldier support was requested.

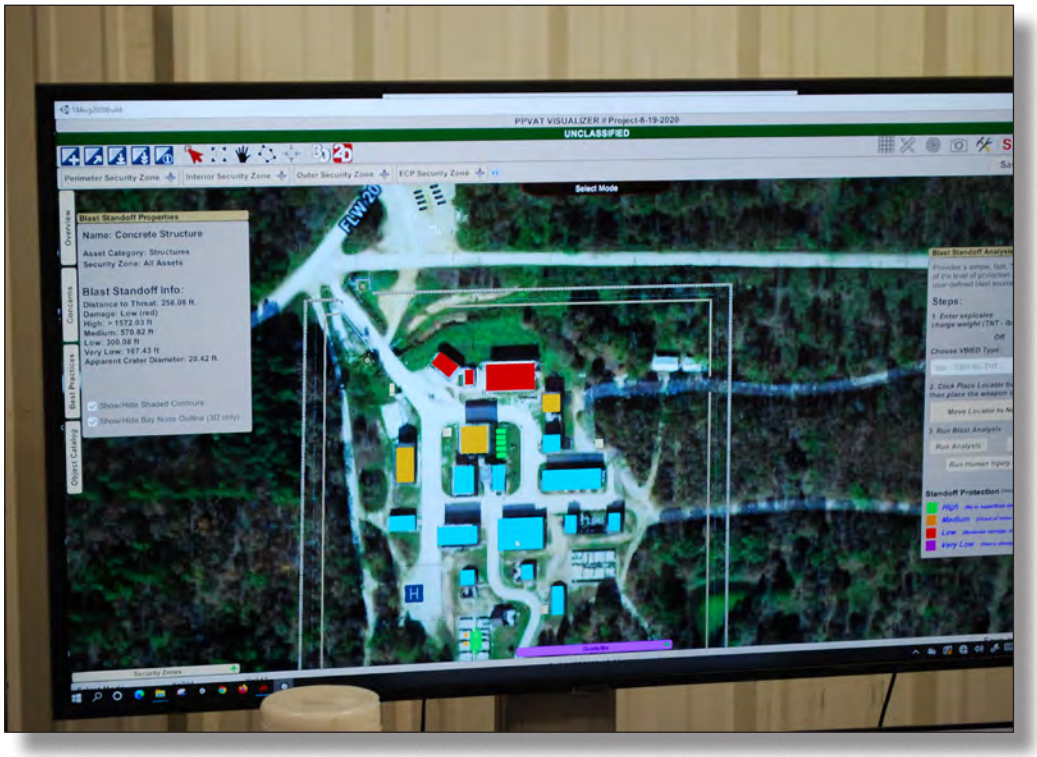
Following the planning, the experiment was executed.

A Soldier reviewing route data from the mobility system for crossing off-road and urban terrain.

The first phase of the experiment, which was executed from 17 to 20 August 2020 at Fort Leonard Wood, involved engineer Soldiers from the 5th Engineer Battalion, 36th Engineer Brigade, Fort Leonard Wood. During this phase, the Soldiers used three technologies currently being developed by the U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, Mississippi. The first technology used was the Protection Planning, Visualization, and Analysis Tool. For this technology, a combination of commissioned and noncommissioned officers planned and validated a protection scheme for an occupied urban area. The Soldiers received an operations order that provided

Deployment of the RAPID system with E-Glass ballistic panels installed.

information on mission, simulated enemy composition, and available construction assets. The Soldiers then collaborated on constructing a protection scheme using a preloaded satellite image of the terrain. The tool contains embedded protection decision support tools that guided Soldiers to employ doctrinally supported best practices when selecting protection measures. Once the protection scheme was designed, the Soldiers ran an analysis of the site with selected protection measures to determine risk and vulnerably to critical assets. Finally, the tool provided a bill of materials required to construct/emplace the measures selected. The next technology that was employed involved an expedient retrofit for existing buildings. This technology is comprised of a modular, lightweight ballistic with a blast wall retrofit that provides a rapidly deployable and recoverable system that requires no anchoring, tools, or equipment for setup or operation. The expedient retrofit for existing buildings was erected by an engineer squad in different rooms of varied sizes. All parts of the retrofit system are designed to be hand-transported, and the technology provider has designed a backpack system that allows a single Soldier to transport the E-glass panels and support structure components over distances and up stairways. The final technology used during the first phase was Ready Armor Protection for Instant Deployment (RAPID), which is part of the Modular Protective System. This technology consists of a quickly deployed wall designed to provide blast and ballistic protection to prevent intrusion and to deny line of sight



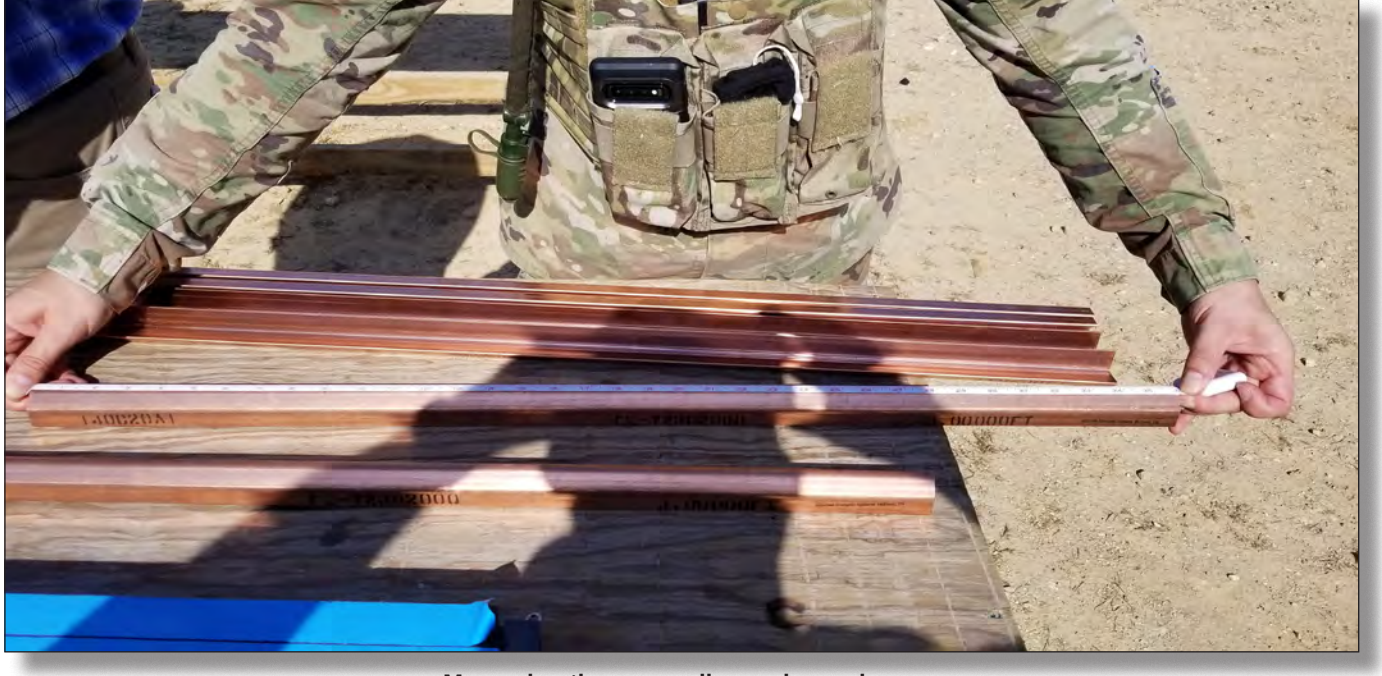
Protection planning overview

TYR Tactical Shield providing cover for Soldiers equipped with a Holmatro backpack kit

in an urban setting. Additionally, the technology includes a scalable and recoverable tool that can be tailored to meet specified threats. During the first phase, the RAPID system was used to control or block avenues of approach (paved roads) within a simulated urban area. A forklift was used to position a container express box containing the technology. To deploy the system, the Soldiers manually pulled the accordion-like structure into its full deployed length. Once positioned, the hydraulic pressure was released and the system was lowered onto the ground, creating a solid barrier. The Soldiers then attached the E-glass ballistic panels to the exterior to increase the protective capability.

The second phase of MSSPIX 20 was executed from 8 to 18 September at Fort Leonard Wood. Soldiers who participated in this phase originated from various organizations across Fort Leonard Wood, including the Maneuver Support Capability Development Integration Directorate; the Combat Training Company, 31st Engineer Battalion; the 35th Engineer Battalion; and the 169th Engineer Battalion. The first technology assessed during this phase consisted of a mobility system for crossing off-road and urban terrain. This technology, also developed by ERDC, is mounted in a ground vehicle and consists of a prototype warning system that displays obstacle information collected on board an unmanned aerial vehicle. The live data is combined with mobility models to update routes and provide situational awareness to ground forces. A combination of three noncommissioned officers and one lower-enlisted Soldier with Military Occupational Specialty 12B–Combat Engineer or 12T–Technical Engineer were used for the technology assessment. Next, Federal Resources© provided two technologies manufactured by Holmatro© Incorporated for assessment. First up was the Holmatro Door Blaster. This tool is designed to allow fast breaching of doors and offers remote operation when outfitted with the Door Blaster Pack. The MSSPIX 20 planning team identified installation buildings that were slated for demolition, and the tool was employed to breach several doors on those buildings. The Holmatro backpack kit provided to the Special Operations Command, MacDill Air Force Base, Tampa, Florida, contains cutting and prying tools with a quick-disconnect system. The operator wore a lightweight, electrically-driven hydraulic pump and had the option to quickly switch tools based on mission requirements. The Soldiers were also able to use the cutting capability of the system to breach a car door. Additionally, the tools were used to cut locks in a subterranean environment. The TYR Tactical Shield® with TYR Tactical Shield Dolly®, provided by TYR Tactical®, was also assessed. The TYR Tactical Shield Dolly was used with two TYR Tactical Shields to provide greater ballistic protection. These technologies were employed in concert with the Holmatro breaching tools to provide cover for the breach team as it moved toward the breach site.

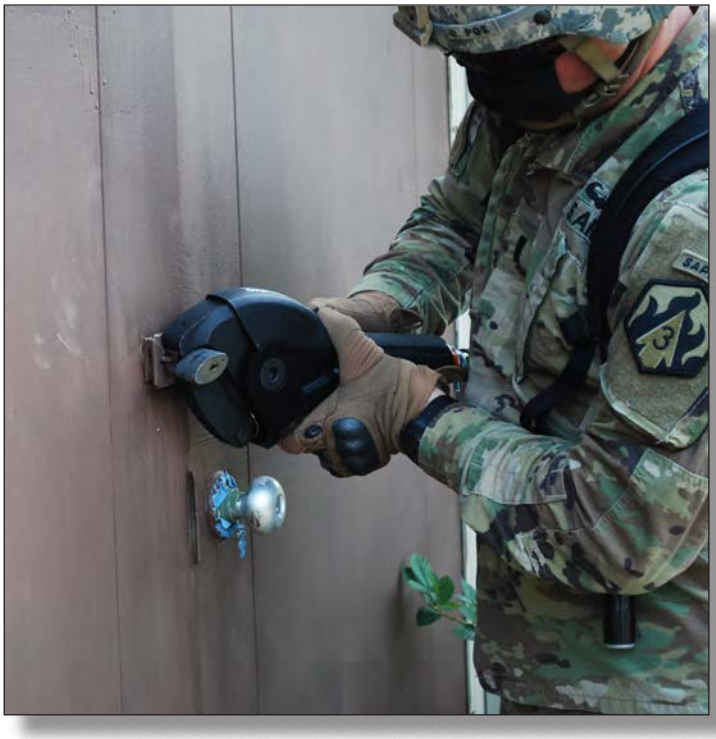
The third phase of MSSPIX 20 was executed on 6 November 2020 at Fort Leonard Wood. A copper linear shape charge, provided by Accurate Energetic Systems, LLC, was assessed. This technology consists of varying sizes and configurations of premanufactured charges, designed to reduce obstacles. Working in concert with the USAES Counter Explosive Hazard Center, Fort Leonard Wood, MSSPIX 20 planners leveraged Soldiers attending the 1st Engineer Brigade Urban Breacher Course. To ensure that Soldiers could achieve their learning objectives, they first used current doctrinal procedures to build linear shape charges to cut two sides of a steel plate. The Soldiers then used the copper linear shape charge to cut the other two sides of



Measuring the copper linear shape charge

the plate, allowing the Soldiers to observe the differences by minimizing the variables and keeping the material cut constant.

In mid-November 2020, ERDC hosted Soldiers from the 412th Theater Engineer Command, Vicksburg, Mississippi, in assessing two technologies developed to meet potential future applications with multiple cross-functional teams—remote assessment of infrastructure for ensured maneuver, which is designed to provide persistant monotoring of infrastructure, and subterranean detection software, which is a capability for imaging subterranean anomolies. The remote assessment of infrastructure for ensured maneuver focused on the user interface. Classroom discussions included conversations about potential modifications to the way in which the system displays the information, filter options, cross-system utility, and data manipulation for common operating picture creation to better inform commanders. Soldiers assessing the subterranean detection software used the analytical software to interpret subterranean void data collected from the Active Seismic Imaging System. This system included multiple improvements made based on Soldier feedback from a previous assessment during MSSPIX 19. The final MSSPIX 20 event, held in mid-December 2020, did not include technologies requiring engineer Soldiers.



Soldier cutting hardened lock with Holmatro tool

MSSPIX 21 is scheduled to be executed from 7 to 24 September 2021. Maneuver support and protection capabilities will be assessed at Fort Leonard Wood; sustainment capabilities will be concurrently assessed at Fort Picket, Virginia. There is currently a total of 30 technologies scheduled for assessment during MSSPIX 21.

The technology call for MSSPIX 22 is scheduled to be posted to the Contract Opportunities website at <https://beta.sam.gov/> March–May 2021.

Endnote:

[1]Contract Opportunities website, <https://beta.sam.gov>, accessed on 29 December 2020.

Mr. Evans is a retired general-engineering supervisor. He provides contract support as a senior military analyst for the Maneuver Support Battle Laboratory. He holds an associate's degree in technology from Pierce College, Puyallup, Washington, and a certificate in project planning and management from the University of Virginia, Charlottesville.

Mr. Hutchinson is a capability development experimentation analyst for the Maneuver Support Battle Laboratory. He holds a bachelor's degree in business administration from Columbia College, Missouri; a master's of business administration degree from Webster University; and a master's degree in project management from Western Carolina University, Cullowhee, North Carolina.

DEMINING IN THE DMZ

By Colonel John P. Lloyd and Major Mark S. Born

Korean DMZ

At 10:00 a.m. on 27 July 1953 in Panmunjom, Korea, the Korean War Armistice Agreement was signed under the authority of the Commander in Chief, United Nations Command (UNC), the Supreme Commander of the Korean People's Army, and the commander of the Chinese People's Volunteers.[1] The first article of the Armistice Agreement created a military demarcation line and the Korean Demilitarized Zone (DMZ). Approximately 4 kilometers wide, the DMZ separates North and South Korea—from the Yellow Sea (on the west) to the Sea of Japan (on the east). The UNC retained administrative authority of the 2-kilometer strip of the DMZ south of the military demarcation line, and the Democratic People's Republic of Korea (DPRK) retained control of the 2-kilometer strip of the DMZ north of the military demarcation line. Although the armistice called for the retreat of all combat forces from the DMZ, continued skirmishes after 1953 served to transform the area into a fortified barrier running the width of the Korean peninsula.

Through manmade fortification, revegetation after massive bombing during the Korean War, and inclement weather that has reshaped the terrain, the DMZ has become a large obstacle belt, developed and modified for more than 67 years, creating significant safety hazards to demining. The area of the DMZ south of the military demarcation line comprises 100.3 million square meters and contains a significant number of landmines (estimated at more than 1 million) as well as a significant amount of unexploded ordnance. Beyond the sheer number of explosive devices present, three factors increase explosive-hazard risks in the DMZ—time, mine drift as (a result of weather), and a lack of detailed documentation on minefield locations.

Overview of the Panmunjom Declaration and the CMA

On 27 April 2018, an inter-Korean summit was conducted between President Moon Jae-in of the Republic of Korea (ROK) (representing South Korea) and Chairman Kim Jong Un of the DPRK (representing North Korea). The summit took place in the Joint Security Area (JSA) at the historic South Korean Panmunjom Peace House. The two leaders publically declared a plan for the establishment of a "peace regime" for the Korean peninsula; the historic meeting resulted in signing the Panmunjom Declaration for Peace, Prosperity, and Reunification of the Korean peninsula.[2]

The Panmunjom Declaration paved the way for a second summit between the leaders in Pyongyang, North Korea, in September 2018. There, delegates from the two governments signed the "Agreement on the Implementation of the Historic Panmunjom Declaration in the Military Domain," otherwise known as the Comprehensive Military Agreement (CMA) on 19 September 2018.[3] Among the provisions of the agreement is a call for the transformation of the DMZ into

a peace zone and the establishment of consultation on military assurance measures for—

- The mutual withdrawal of guard posts.
- JSA demilitarization.
- Inter-Korean joint remains recovery.

With the support of UNC, the ROK government has proceeded with its implementation of the CMA.

Vision

At the 74th Session of the United Nations (UN) General Assembly, on 18 October 2019, President Moon Jae-in proposed the idea of transforming the DMZ into an international peace zone to the UN and its member states. "The DMZ is the common heritage of humankind, and its value must be shared with the whole world," said President Moon.[4] His words generated a sense of urgency among the ROK peace supporters as well as the momentum necessary to begin the historic process of demining within the DMZ for the first time since 1953. He also created an opportunity for global support, stating, "Cooperation with the international community, including the UN Mine Action Service, will not only guarantee the transparency and stability of demining operations, but also instantly turn the DMZ into an area of international cooperation."[5]

Arrowhead Hill

The location that was agreed upon by a trilateral body comprised of ROK, UNC, and DPRK officials for the construction of a connecting road for conducting mine clearance was Arrowhead Hill, also known as Hill 281. Arrowhead Hill, located in Cheorwon Valley, was a site of considerable fighting between UNC forces (namely, the United States, France, and South Korea), China, and DPRK during the Korean War. It is estimated that the north side suffered 6,700 losses, while the south side lost 14,332. Over 9 days of fighting, it is estimated that the U.S. Air Force dropped 2,700 bombs, China fired 55,000 shells, and South Korea fired 185,000 shells. In 2019, ROK military engineers located 455 mines and 5,754 unexploded ordnance items at the Arrowhead Hill.

Recovery Operations

On 1 October 2018, soldiers from the ROK and DPRK armies began clearing operations in both JSA and Arrowhead Hill, in accordance with the CMA. (According to ROK law, only the military is authorized to conduct demining operations.) In the JSA, both sides focused on clearing areas of potential mines and unexploded ordnance.

Although the CMA included a requirement for the verification of cleared areas, it did not specify the standard for clearance or who would conduct the verification. Due to the absence of agreed-upon demining standards between ROK and DPRK, comprehensive minefield documentation, mine action programs, and an organization that represented mine action within the international community, UN command engineers and U.S. Forces Korea, Camp Humphreys, South Korea, engineers agreed to support ROK mine action program development and to utilize the UN International Mine Action Standards (IMAS) as the foundation for mine action development.[6]

To achieve IMAS-compliant mine clearance, UNC enlisted the help of a U.S. Army Corps of Engineers quality control team from the Engineering Support Center, Huntsville, Alabama. The U.S. Army Corps of Engineers provided on-the-job training for ROK engineers, monitored ROK quality control operations, supplied external quality assurance measures, and provided certification for surface area clearance.

Clearance of the north side of the JSA, administered by the DPRK, was never verified to the same IMAS. Verification (or lack thereof) proved extremely critical, as two low-metallic box antipersonnel mines were detonated on the DPRK side of the JSA following the claimed clearance of mine hazards. Luckily, there were no injuries in those cases; however, these incidents, coupled with continued UNC insistence on clearance to the IMAS, served to highlight the lack of documentation on exact mine placement.

Upon completion of the first demining season in 2018,[7] UNC learned multiple critical lessons on mine actions in Korea. The first lesson learned regarded the value of published National Mine Action Standards, which are

Demining on Arrowhead Hill

Area clearance operations

standards that are developed by countries based on IMAS—but are more specific than IMAS. They also provide a cradle-to-grave process for demining, from planning to disposal to land turn-over. The next lesson learned focused on the development of an internationally recognized National Mine Action Authority (NMAA)[8] and a National Mine Action Center (NMAC).[9] The creation of a National Mine Action Authority and National Mine Action Center established international legitimacy for countries' mine action policies, procedures, and coordination with international governmental and nongovernmental organizations. A final lesson learned was that the U.S. military does not execute demining operations unless they are deemed operationally essential—which can lead to gaps in demining knowledge and experience. As a learning organization, it became critical for the UNC to understand this limitation and seek subject matter experts from the field.

UN command engineers and U.S. Forces Korea engineers focused on developing opportunities to increase knowledge, learn from international governmental/non-governmental agencies, and provide a mine action plan with support and oversight from subject matter experts in the mine action field. These actions support the achievement of a safe, transparent, and effective South Korean mine action program. Successful mine action initiatives have built a foundation to ensure that, in the future, the DMZ can indeed be transformed into a peace zone, as envisioned in the CMA and in President Moon's UN General Assembly speech.[10]

UN command engineer initiatives over the past year have included—

- Hosting a UNC demining workshop.
- Attending the National Directors of Mine Action Conference in Geneva, Switzerland.
- Visiting national mine action centers.
- Standing up a U.S./ROK/UNC demining steering committee.
- Visiting nongovernmental mine action organizations.
- Providing state engineers with mine action experience for the UNC staff.
- Enforcing standards for demining operations in the DMZ.

Even as a small engineer staff, UNC engineers were able to use available resources to help transform national policies and standards, which resulted in a successful 2019 Korean DMZ demining season.

Conclusion

For the past 67 years, the DMZ has been one of the most densely mine-laden and dangerous areas in the world. The CMA created an opportunity to facilitate change in the DMZ and ignited a spark that initiated the historic acts of strategically removing combat-related obstacles and recovering the remains of fallen heroes. These small steps led to immense results.

Peace is a process. UNC and ROK head into the 2020 demining season with great anticipation for continued success in reshaping the DMZ. For 2020 and 2021, UNC and ROK allies are planning to clear areas where the potential for remains recovery exists and to help advance president Moon's vision. UNC engineers and the Multinational Demining Committee continue to work across multiple lines of effort to socialize with countries affiliated with UNC, to send subject matter experts to observe and participate in demining efforts, and to continue working closely with ROK on creating mine action policies in accordance with international standards. These efforts include upgrades in the

(continued on page 69)

ROUGH-TERRAIN WATERBORNE OPERATIONS

By First Lieutenant Christian L. Pinkerton

As I sat, deafened and shivering in the doorway, I could barely make out the black silhouette of the treetops and the reflection of the green and red aircraft position lights from the lake somewhere beneath my dangling legs. The rotor wash from the UH-60 Blackhawk helicopter was whipping at my feet, when I suddenly felt the cast master hit my back and heard the command—"Go!" I gave my waterproofed rucksack a shove out into the night, and I followed after it. The frigid water immediately drained my lungs of oxygen on impact. I blindly swam in the dark until I felt my head break the surface of the water, exposing it to the roar of the helicopter. Turning toward the biting spray, I located the glowing Cyalume ChemLight® and waved it to signal to the cast master and pathfinder team, located somewhere in the darkness, that another castor was fine and headed for the shore.

57th Sapper Company boat operations

After chasing down my rucksack, identified by the soft green glow of a submerged ChemLight, I began towing the equipment toward the dim light of the pathfinder, located on the shore. Between the oscillations of the waves, I could make out other glowing objects, bobbing and headed in the same direction. It was at this moment that I noticed the growing rumble from the second UH-60 helicopter coming to drop the next lift of castors. I rolled

over into a backstroke just in time to receive a cold spray to the face and see the familiar faint green dots drop out of the slowly drifting silhouette of a Blackhawk. This was the final helocast of the cold night for the paratroopers of the 57th Sapper Company (Airborne).

From 17 to 18 March 2020, the 57th Sapper Company successfully executed 2 days of waterborne operations, which culminated in the first helocast operation conducted at Fort Bragg, North Carolina, in more than a decade. As an extension of their insertion mission in an austere environment, the sappers conducted hundreds of low-altitude (10 feet-above-surface-level) casts into Mott Lake from two UH-60 Blackhawks from the 2d Battalion, 82d Combat Aviation Brigade, Fort Bragg.

57th Sapper Company one-rope bridge

The company remains the premier organization for rapid engineer insertion into remote and undeveloped environments. The rough-terrain mission provides unique and valuable training for commanders. Reconnaissance, disaster relief, and battlespace development are just a few of the applications that the 57th Sapper Company provides through its ability to simplify logistics and quickly insert combat engineers directly where they are needed to accomplish their mission. Waterborne insertion is a natural supplement to the historical tree jumps that the sappers conducted late in 2019—and is just as effective, if not more so, under the right conditions. Helocast operations differ from traditional airborne operations in that they do not require parachutes; only an appropriate water depth and skilled personnel are required for execution.

Preparation was critical to the success of the training and safety of the Soldiers in the weeks leading up to the operation. A pathfinder team internal to the company initiated the process when it determined the minimum required dimensions of the cast zone by mixing size and safety buffers from helicopter landing zones with time/distance air assault planning factors based on the known airdrop speed of 10 knots. Next, divers from the 569th Engineer Dive Detachment, Joint Base Langley-Eustis, Virginia, conducted a hydrographic survey of the newly designated drop zones to ensure that they met a safe depth and were free of any subsurface hazards. Detailed coordination was conducted between the UH-60 crew and the pilots of the 2d Battalion, 82d Combat Aviation Brigade, since piloting during this type of event would be a first for the vast majority of them—especially with the finale of the operation consisting of a multiaircraft night cast. Multiple safety boats were requested from Fire and Emergency Services, Fort Bragg, to oversee the drops, and three rubber raiding crafts were requested from the 3d Special Forces Group, Fort Bragg, for small-boat training. Previous Sapper Leader Course instructors certified and rehearsed with

57th Sapper Company poncho raft

57th Sapper Company helocast

the new cast master teams, final updates were made to the company precast script and procedures, and Soldiers of the 57th Sapper Company conducted combat water survival assessments and rehearsals for the tasks of the following week.

The training days, modeled after the infamous Sapper Leader Course Lake Day, were designed to instruct the sappers on all aspects of waterborne operations. Most of Day 1 consisted of the platoons rotating through the following three stations: one-rope bridge over a finger of the lake, poncho raft construction and sappers swimming, and small-boat operations training. This culminated in a platoon competition, with the winner being rewarded by being excluded from physical training with the boats the following morning. The early risers completed a Sapper School-inspired boat physical training session, while the pathfinders emplaced drop zone markings, linked up with the safety boats, and established their ground-to-air communication position. All Soldiers were then transported to Campbell's Crossroads Landing Zone to execute precast rehearsals.

The overall goal of the operation was for all strong-swimming sappers to progress from the basic daytime Hollywood (equipment-free) cast,[1] through a daytime combat-equipped cast and, finally, to a nighttime combat-equipped cast. At 12:30 p.m., on a very clear and calm day, two UH-60s came into sight of the first several lifts of castors. The pilots conducted their final briefings, and the first lift of sappers was quickly headed to the lake; they were followed shortly thereafter by the second and then the third. By 5:00 p.m., 15 lifts (each carrying 6–8 castors)—for a total of 220 casts of 86 different castors—had been conducted at the southern end of the lake, all without issue or injury. The helicopters refueled while the cold, wet sappers were provided with two ChemLights each—one to attach to their life vest and one to attach to their rucksack. Darkness fell; and by 8:00 p.m., the sound of the first lift of night combat castors disappeared behind the tree line. In just under an hour and a half, six additional lifts delivered 60 combat-equipped castors into Mott Lake, bringing the training to a close.

The success of the heliocast event was undeniable. Thanks to deliberate risk mitigation and a focus on shaping the training to be realistic and repeatable, the 57th Sapper Company can continue to expand on its knowledge base and refine its skills during future operations.

We must work to maintain expert readiness regardless of the unique nature of the skill set required in our modernizing Army. We will continue to maintain our competencies and expand our insertion capabilities so that we will succeed at any mission for which we are called upon. Rough Terrain!

Endnote:

[1]The term *Hollywood* is derived from the way in which military divers are portrayed in movies—without equipment.

First Lieutenant Pinkerton is the assistant training officer, 20th Engineer Brigade, Fort Bragg. He holds a bachelor's degree in physics from the University of Nebraska–Lincoln.

Engineer Doctrine Update

U.S. Army Maneuver Support Center of Excellence Fielded Force Integration Directorate, Doctrine Division			
Publications Currently Under Revision			
Publication Number	**Title**	**Description**	**Tentative Publication Date**
ATP 3-34.10	*Engineer Platoons*	This new publication represents a collection of engineer platoon doctrine that serves as a one-stop shop for newly assigned platoon leaders, platoon sergeants, and platoon members.	2d quarter, fiscal year (FY) 2021
ATP 3-34.22	*Engineer Operations–Brigade Combat Team and Below*	This update, while incorporating the Field Manual (FM) 3-0, *Operations*, focus on large-scale ground combat operations, will include task force engineer tasks, enabler integration, and updates to brigade engineer battalion and echelon-above-brigade unit capabilities.	2d quarter, FY 21
ATP 3-90.4/ MCWP 3-34A	*Combined Arms Mobility*	This multi-Service publication will be updated with a revised chapter on deliberate gap crossing; it will focus on division/corps synchronization of effort across warfighting functions and domains.	3d quarter, FY 21
ATP 3-90.40/ MCWP 3-17.7	*General Engineering*	This multi-Service publication will be updated with comments from across the force, including equipment, construction authorities, and environmental considerations.	4th quarter, FY 21
ATP 3-90.8/ MCWP 3-17.5	*Combined Arms Countermobility Operations*	This multi-Service publication will be updated with and follow current U.S. mine policy restricting persistent row mining.	3d quarter, FY 21

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

Mr. Douglas K. D. Merrill, Telephone: (573) 563-0003; Captain Adrian W. Stark, Telephone: (573) 563-2732; Engineer Doctrine Team, e-mail: <usarmy.leonardwood.mscoe.mbx.engdoc@mail.mil>.

"War is not an affair of chance. A great deal of knowledge, study, and meditation is necessary to conduct it well."

—Frederick the Great,
Prussian King, 1740–1786

DRAGON'S TOOTH Reduction Experiment

By First Lieutenant Kendall J. Munsey

The 55th Mobility Augmentation Company (MAC), 11th Engineer Battalion, Camp Humphreys, South Korea, is responsible for a variety of operations to ensure maneuver capability and mobility, as well as survivability and force protection. The diverse mission requires the 55th MAC to provide subject matter expertise about mobility and countermobility on the Korean peninsula. The 55th MAC helps incoming rotational engineer units adapt to the Korean theater and prepare to "Fight Tonight!"

Mobility Challenges in Korea

One of the most common obstacle types used on both sides of the Korean Demilitarized Zone consists of dragon's teeth. Dragon's teeth are typically square or hexagonal fortifications of reinforced concrete used to restrict mounted mobility. They range in size from 1 to 6 cubic meters and are buried deep into the ground, posing a significant challenge when properly employed. In January 2020, the 55th MAC recognized that it lacked a standard operating procedure for breaching these obstacles. Because of this gap and the possibility of being tasked to overcome this type of obstacle, the company conducted a demolitions range, the purpose of which was to determine the most effective method of breaching the obstacles.

The 55th MAC initiated the operation by requesting its sister company, the 643d Engineer Support Company, Camp Humphreys, to construct three dragon's teeth for the 55th to destroy. The blocks were comparable in size to those typically found at the demilitarized zone.

The 55th MAC decided to focus on the employment of two different blasting techniques—one using an internal charge

and the other using a counterforce charge. The hypothesis was that the internal charge would be the most effective at reducing the obstacle and would become the preferred method of breaching.

Internal-Charge Breaching

An effective method of breaching a concrete obstacle involves placing a charge at the center of mass; however, depending on unit equipment, this may be impractical to achieve. Because the structure of dragon's teeth can vary, it was necessary for the 55th MAC to experiment with a different methodology. In this method, holes were created using saws, a halligan tool and sledgehammer and C4 was placed in the holes. If there was an advantage to the method, it was the incredible destructive power of the internally placed charge. The results were outstanding; the dragon's tooth was completely demolished. There was no need for any sort of debris removal. Time and resource requirements may make this method infeasible in a contested environment.

Counterforce Charge Breaching

An alternative to internal breaching involves the use of a counterforce charge. By simultaneously detonating two charges placed opposite each other, the concrete is effectively crushed. Two attempts were made to breach a dragon's tooth using the counterforce charge technique. During the first attempt, the quantity of C4 used was that suggested by doctrine and each charge was primed for simultaneous detonation. The results were underwhelming; the top of the dragon's tooth was severed from the base, but a significant chunk of the structure remained. The suboptimal results were thought to be due to charge placement and insufficient explosives.

Soldiers prepare a dragon's tooth for demolition.

An internal charge annihilates a dragon's tooth.

"The 55th MAC initiated the operation by requesting its sister company, the 643d Engineer Support Company, Camp Humphreys, to construct three dragon's teeth for the 55th to destroy."

The second attempt at using a counterforce charge produced far better results. By increasing the quantity of explosives and adjusting charge placement, the obstacle was effectively reduced. Although small chunks of rubble remained after the blast, they could be easily removed.

Takeaways

The 55th MAC demolitions range proved to be a very valuable learning experience for company Soldiers. They were able to witness the capabilities and limitations of the equipment first-hand. Assets like C4 have a wide

Soldiers inspect the aftermath of the first counterforce charge.

Small rubble left from the second counterforce charge.

variety of applications; however, in order to take advantage of its versatility, Soldiers must be familiar with how to properly employ C4. Demolitions training was used to train Soldiers on how to overcome a significant countermobility threat in Korea using available resources. Using demolitions in a counterforce charge and common modern demolitions initiators, the 55th MAC could reliably reduce dragon's teeth, even in a contested environment. In the future, the 55th MAC hopes to conduct further demolitions testing on larger obstacles.

First Lieutenant Munsey is the executive officer for the 55th MAC. He holds a bachelor's degree in engineering management from the U.S. Military Academy—West Point, New York.

Best Mapper Competition

By Major Joseph K. Byrnes, Captain Gabriel N. VanHaefner, and First Lieutenant Elizabeth A. Tarbox

Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

On 27 February 2020, the 517th Engineer Detachment (Geospatial Planning Cell [GPC]), U.S. Army Africa, hosted the first-of-its-kind Best Mapper Competition on Caserme Del Din, Vicenza, Italy. The competition consisted of 12 events that measured proficiency at warrior tasks and the core competencies of Military Occupational Specialty (MOS) 12Y–Geospatial Engineer. The purpose of the event was three-fold: First, it served as a mechanism to certify geospatial engineers on the individual tasks outlined in the mission-essential task list (METL); second, it set the framework for future collective-training progression and illuminated areas requiring refocus; and third, it challenged geospatial engineers' mental agility and physical stamina while increasing esprit de corps in a competitive environment.

A Soldier ascends the rope climb obstacle during the 2020 Best Mapper Competition.

History of Geospatial Engineers

Geospatial engineers maintain a key capability for the U.S. Army. Throughout the history of warfare, terrain has often dictated the outcome of a battle. Seizing and holding the high ground and other types of key terrain provide an unmatchable advantage. From General George Washington's astute understanding of the terrain and weather effects in crossing the Delaware River to General Dwight D. Eisenhower's extensive reconnaissance operations and tidal studies of the beaches of Normandy, France, terrain analysis has been a critical component of mission success and the preservation of equipment and resources. Notable efforts beyond warfare include President Thomas Jefferson's deployment of Captain Merriweather Lewis and Lieutenant William Clark to explore the newly acquired Louisiana Purchase and expand the United States westward by discovering and charting an all-water route from Saint Louis, Missouri, to the Pacific Ocean.

Today, as it has for more than 200 years, the Engineer Regiment trains and equips geospatial engineers to contribute to the ever-important capability of terrain analysis to enable increased understanding of the operational environment. Geospatial engineers serve in geospatial planning cells across the U.S. Army and are assigned at tactical through strategic levels in brigade combat teams and functional brigades, division headquarters, corps headquarters, and Army service component commands. Geospatial engineers collect, generate, and manage geospatial data to support the warfighter requirements and provide visualization decision aids for leaders.[1]

A Soldier navigates an obstacle during the 2020 Best Mapper Competition.

Preparation and Validation

In May 2019, the Army Capability Manager–Geospatial hosted an annual working group, which was attended by all seven GPCs, at Fort Leonard Wood, Missouri. The director of Army Capability Manager–Geospatial, Colonel Kevin R. Golinghorst, challenged the GPCs to design an event to validate individual tasks for geospatial engineers in a competitive format. The 517th Engineer Detachment (GPC) accepted the challenge and began initial planning efforts to execute the event at its home station in Vicenza, Italy, in the following months.

Planning began by establishing event categories as technical, tactical, or physical training to guide the design process and appropriately scope the event. Because the overarching purpose of this event was to certify individual level geospatial-engineer tasks, the technical aspect was weighted at 60 percent of the overall score, while the tactical and physical events were weighted at 30 percent and 10 percent, respectively. As the development of the event progressed, special care was taken to ensure that the Soldiers were physically and intellectually tested with high levels of intensity throughout the day to challenge their grit and mental agility.

The foundation of the competition was set within the METL for the GPC.[2] This list identifies the key collective tasks required of the unit and is comprised of supporting individual tasks performed by geospatial engineers. Table 1 shows the mission-essential tasks (METs) and the corresponding competition events for assessment.

Technical. The primary event of the competition was a nonstandard production test that challenged the competitors' mental agility, knowledge of ArcGIS™ geospatial software, time management, and spatial-analysis capabilities. A written examination covered a broader base of general geospatial knowledge and assessed competitors' regional knowledge of Africa. The final technical event was a test of the Soldiers' ability to receive a product and perform quality assurance and quality control measures prior to dissemination of the product.

Task	MET	Competition Event
05-SEC-6014	Analyze Geospatial Data	NSP, Geospatial Test, Quality Assurance/Control Test
05-SEC-6000	Collect Geospatial Information	NSP, Geospatial Test
05-SEC-6011	Generate Geospatial Data	NSP, Geospatial Test
05-SEC-6012	Manage a Geospatial Database	NSP, Geospatial Test
05-SEC-6005	Provide Geospatial Analysis and Intelligence	NSP, NSP Briefing, Geospatial Test
-	Warrior Tasks and Drills	ACFT, Land Navigation and Map Reading, CBRN, Medical Lane, Radio Communication, Weapons Test, Stress Shoot

Legend:
NPC - Non Standard Production

Table 1. METs and corresponding competition events

Tactical. Soldiers across the U.S. Army are expected to be proficient at the warrior tasks. The tactical assessment focused on the tasks that a geospatial engineer would encounter when deployed as part of an expeditionary

joint task force level command post. This meant that tasks involving weapons knowledge; land navigation; medical knowledge; and chemical, biological, radiological, and nuclear (CBRN) knowledge were emphasized more than other tasks, such as those involving improvised explosive device detection and detainee searches. Soldier Training Publication (STP) 21-1, *Soldier's Manual of Common Tasks for Warrior Skills Level 1,* currently categorizes the subject areas of individual tasks as shoot, move, communicate, and survive.[3] With these factors in mind, the tactical events shown in Table 2 were planned.

Physical. While many of the tactical tasks require that Soldiers be physically fit to perform, it was important to conduct an actual measure of physical ability. In line with the Army transition to the comprehensive Army Combat Fitness Test (ACFT), this event was used as the primary physical assessment. Additionally, Soldiers completed a 20-station obstacle course with round-robin lanes while ruck marching with a 35-pound rucksack between the obstacles, for a cumulative effort of 3 miles.

After the events were planned and validated by the officer in charge, a story map was created using the ESRI© ArcGIS website at <http://arcg.is/15jeaD> to provide a useful visual aide showing the flow of the event.

Execution

The competition planning resulted in the validation of 12 primary tasks, categorized into six event stations, which were executed in rapid succession over a 14-hour period. The competition included—

- **Event 1: ACFT.** The ACFT served as the primary physical assessment and was worth 10 percent (100 points) of the overall score. Soldiers conducted the ACFT in the operational camouflage pattern uniform and running shoes.
- **Event 2: Written Examination.** The written examination consisted of 35 questions on technical geospatial engineering topics, enterprise functions, database management, and general cartography. The final section required Soldiers to identify the 53 countries of Africa on a map to test their knowledge about the unit area of responsibility.
- **Event 3: Round-Robin Tactical Lanes and Obstacle Course.** Soldiers were assigned to groups with two cadre for command and control and directed to a specified lane. Upon completion of a lane test, Soldiers executed a series of obstacles en route to the next lane. Each lane consisted of a test on knowledge and a practical hands-on exercise.
  - **Lane 1: Land Navigation/Map Reading.** For this lane, competitors were given a standard 1:50,000 scale topographic map and tasked with finding the straight-line distance and the roadway distance between two points, performing intersections and resections, plotting points, and identifying terrain features. For the practical portion, they were tasked with using a lensatic compass to determine azimuth and with using their pace count to determine the distance to known points.
  - **Lane 2: U.S. Army Weapons Test and Stress Shoot.** Soldiers assembled an M4A1 and an M249 squad automatic weapon (which were disassembled and on a table) and performed functions tests. Soldiers moved to the engagement skills trainer range; donned improved outer tactical vests and advanced combat helmets; and performed 10 burpees, 10 pushups, and 10 four-count flutter kicks. With an elevated heart rate, Soldiers distinguished between enemy and

Subject Area	Event	Tasks Assessed
1. Shoot/Maintain, Employ, and Engage Targets With Individually Assigned Weapon System	Weapons Assembly and Disassembly	071-COM0032, 071-COM0029, 071-COM0033
	Stress Shoot	071-COM0028, 071-COM0027, 071-COM0030
2. Move/Perform Individual Movement Techniques	Obstacle Course	071-COM0503
	Land Navigation	071-COM1000, 071-COM1001, 071-COM1001, 071-COM1002, 071-COM1008, 071-COM1005, 071-COM1012, 071-COM1011, 071-COM1003, 071-COM0018, 071-COM1016, 071-COM0017, 071-COM1006, 071-COM1014, 071-COM1015
3. Communicate	Medical Test Medical Evaluation Medical Report	113-COM1022, 081-COM0101, 113-COM2070, 081-COM1001, 081-COM1005, 081-COM1023, 081-COM1054, 081-COM0099, 081-COM0069, 081-COM0048, 081-COM0013, 081-COM1007
4. Survive	CBRN Operations Test	031-COM1010, 031-COM1004, 031-COM1007, 081-COM1046

Table 2. Competition tasks

A Soldier assembles an M4A1 carbine and M249 squad automatic weapon during the weapons test.

friendly forces and engaged a series of 16 targets at varying distances.

- **Lane 3: Tactical Combat Casualty Care.** The tactical combat casualty care lane consisted of a 35-question test on assessing a casualty, treating various types of wounds, and evacuating a casualty. Soldiers then assessed and treated manikin "casualties" with multiple wounds amid simulated loud combat noise. Once the casualties were adequately addressed, Soldiers placed a single-channel, ground and airborne radio system into operation and called in a medical evacuation request.

- **Event 4: Nonstandard Map Production.** The nonstandard map production examination was the premier event of the day. This 3-hour test was a scenario-based practical exercise that tested the Soldiers' ability to quickly collect data; analyze the situation within the context of the stated requirement; produce a useful, informative product; print the product; and then conduct a 10-minute out-briefing about the assessment to a commander. Soldiers received an initial situation briefing of a medical crisis in Burundi and were tasked with identifying primary and alternate ports of debarkation, primary and alternate routes, and the most suitable sites for the construction of two field medical facilities. They were given a specified data set containing improvised explosive device threats from a violent extremist organization to enrich the route analysis and force them to weigh time with threat level. At the end of 3 hours, Soldiers briefed their product to the cadre, defending their choice of ports of debarkations, routes, and site selection.
- **Event 5: CBRN Casualty Evacuation.** While in improved outer tactical vests and advanced combat helmets, Soldiers tested their ability to don a protective mask in the allotted 9 seconds. With their protective masks on, Soldiers dragged a 90-pound sled a distance of 50 meters, sprinted 50 meters, high-crawled 50 meters, and then dragged the 90-pound sled another 50 meters. This test assessed the Soldiers' ability to move a casualty to a casualty collection point and conduct evasive maneuvers in a protective mask.
- **Event 6: Quality Assurance/Control Review.** The final event of the day required the Soldiers to perform a quality control review of a nonstandard map product of Agadir, Morocco, which contained 25 errors that required standardized corrections. This event required that Soldiers that Soldiers identify and explain the errors within 30 minutes.
- **Awards Ceremony.** The events culminated the following day with an awards ceremony in which the U.S. Army Africa Commanding General, Major General Roger L. Cloutier, and Command Sergeant Major Charles W. Gregory Jr. recognized the Soldiers who finished in the top three and 11 Soldiers who achieved certification. First place went to Specialist Tristan B. May, second place to Sergeant Joel W. Burkhart, and third place to Sergeant David D. Proctor.

Feedback

The competition ended, a winner was declared, and the critical—yet often forgotten—tasks of review, analysis, and retraining began. The 2020 Best Mapper Competition provided a unique opportunity for large-scale analysis that is not typical in GPCs, which—when deployed—are most frequently dispersed in specialized teams of no more than two to four Soldiers. Conducting large-scale individual certification allowed the unit to identify areas of weakness across the entire GPC and within the functional sections of Data Management, Map Finishing, and Geospatial Intelligence (GEOINT).

Soldiers conduct a sled drag while wearing the M50 protective mask.

For example, the Map-Finishing Section scored above average on the written examination and nonstandard map production, but underperformed on the quality assurance/control event. Based on a review of daily operations, this section began to primarily focus on standard map production. As expected, the GEOINT Section, which frequently works with nonstandard map products, outperformed the GPC average by more than 9 points. Similar trends were seen across each functional section throughout the technical portion of the competition.

Understanding these trends allows leaders within the organization to refine long-term training plans and increase cross-training to maximize proficiency across all METs, rather than focus solely on a specific functional subset. These efforts will ensure that perishable tactical skills are incorporated into routine training, such as sergeant's time training, and enable team level leaders to refine individual training plans to overcome identified weaknesses.

Lessons Learned

The planning and preparation for the competition started early—12 weeks prior to execution—and established a deliberate agenda of weekly in-progress reviews, with specific deliverables due at each meeting. The planning process incorporated multiple perspectives from officers, warrant officers, and noncommissioned officers, enabling frequent collaboration and producing a significantly better event. Additionally, feedback from Soldiers suggested that a more comprehensive study guide would be beneficial for deliberate preparation in the future. This led to an initiative to create a more cohesive standard operating procedure within the GPC and the acquisition of relevant quick-reference cards to increase warrior skills knowledge.

Ultimately, the opportunity for geospatial engineers to holistically compete in a validation of their core competencies increased the collective readiness of the 517th Engineer Detachment while also increasing the confidence and self-awareness of individual Soldiers. The competition proved a worthy investment in building the readiness of the geospatial engineers, while ensuring that they stand ready to enable warfighters at all echelons. The Best Mapper Competition will continue, and the 517th Engineer Detachment welcomes the greater Army geospatial enterprise to join—or even host—future events and to continue to share best practices across organizations.

Endnotes:

[1]Training Circular (TC) 3-34.80, *Army Geospatial Guide for Commanders and Planners*, 19 September 2019.

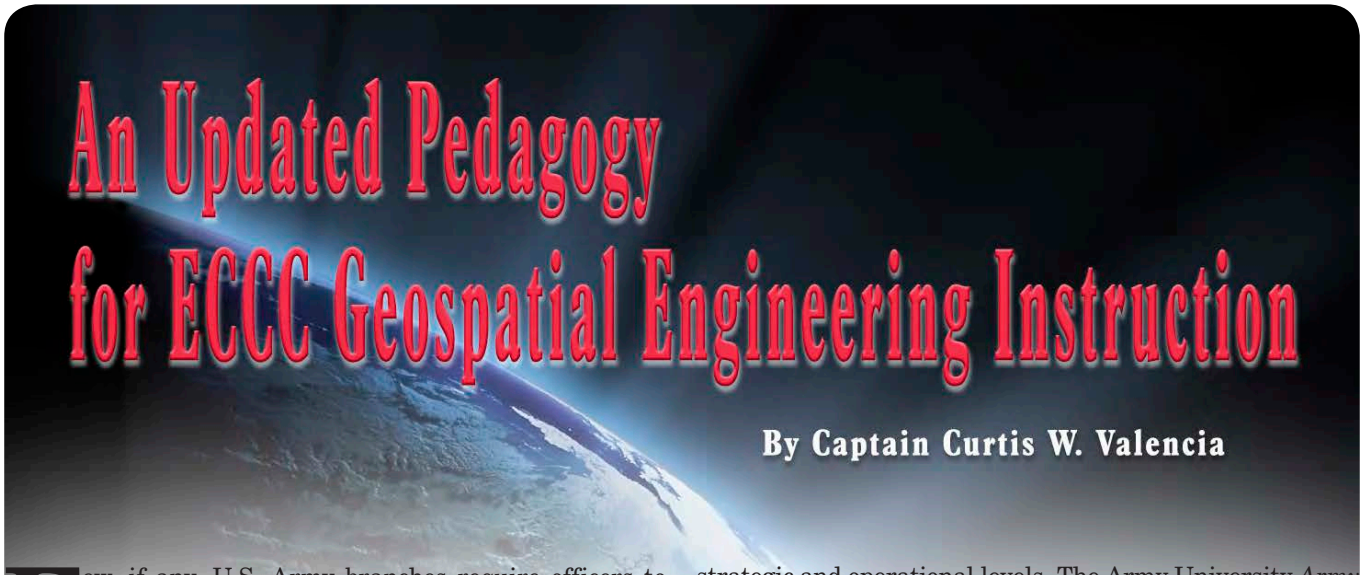
[2]Army Techniques Publication (ATP) 3-34.80, *Geospatial Engineering*, 22 February 2017.

[3]STP 21-1, *Soldier's Manual of Common Tasks for Warrior Skills Level 1*, 11 July 2019.

Major Byrnes is the officer in charge of the 517th Engineer Detachment. He holds a bachelor's degree in environmental design from the University of Colorado, Boulder, and a master's degree in environmental management from Webster University. He is a graduate of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, and he holds the GEOINT Professional Certification–Fundamentals credential.

Captain VanHaefner is the executive officer of the 517th Engineer Detachment. He holds a bachelor's degree in civil engineering from the Virginia Military Institute, Lexington, Virginia. He also holds the GEOINT Professional Certification–Fundamentals credential.

First Lieutenant Tarbox is the operations officer of the 517th Engineer Detachment. She holds a bachelor's degree in biomedical engineering from George Mason University, Fairfax, Virginia. She is a published author and contributor to peer-reviewed journals within the scientific community and is an inventor of patented low-power ultrasound technology.



An Updated Pedagogy for ECCC Geospatial Engineering Instruction

By Captain Curtis W. Valencia

Few, if any, U.S. Army branches require officers to have a knowledge set as wide and deep as the Engineer Regiment does. An engineer officer may be placed in a variety of units with vastly different mission sets, yet still be expected to have a strong understanding of the tasks at hand. Given that broad educational requirement, the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri, has tailored the educational priorities of the Engineer Captains Career Course (ECCC). USAES successfully exposes ECCC students to the conceptual and practical applications of most of the engineer disciplines. However, with most of the curriculum focused on combat engineering (offense and defense) and general engineering, geospatial engineering is only briefly introduced and the training is not practically effective. More deliberate instruction of geospatial concepts and capabilities is required if the Engineer Regiment expects officers to succeed in future operations.

The Army engineer is the expert on terrain management, either affecting the terrain through combat and general engineering or analyzing and understanding the terrain through geospatial engineering, as indicated in Field Manual (FM) 3-34, *Engineer Operations*, which states that "Engineer operations are unique because, regardless of the intended purpose, they are directly aimed at affecting terrain or at improving the understanding of the terrain."[1]

While Army geospatial engineering capabilities typically reside at the brigade echelon or higher, junior officers must understand the capabilities and practical applications of geospatial engineering in order to successfully leverage those assets in the operational environment. The current ECCC curriculum, however, contains only one full day of geospatial instruction, with several smaller modules attached to other blocks of instruction. A new geospatial pedagogy is required—one that not only ensures awareness, but also an actual understanding of geospatial engineering among future staff captains and commanders.

Fundamentally, pedagogy is the study and practice of teaching. While much of the literature on pedagogy focuses on theoretical or abstract aspects of teaching, the Army already understands the practical value of pedagogy at the strategic and operational levels. The Army University *Army Learning Strategy* links pedagogy to readiness, stating that ". . . leaders will require greater proficiency with key learning science principles such as how to design learner-centric efforts to mitigate performance issues."[2] Moreover, the *Army Learning Strategy* emphasizes that ". . . the use of less adept instructional design and delivery techniques leads to negative—not merely stagnate—outcomes."[3] Therefore, it is not only important that the correct information is transmitted from teacher to student, but also that the information is transmitted correctly. Neither the information nor the manner of instruction is currently leading to the desired end state in which ECCC students understand the geospatial-engineering subject matter.

". . . junior officers must understand the capabilities and practical applications of geospatial engineering in order to successfully leverage those assets in the operational environment."

The ECCC instructional model for geospatial engineering consists of a traditional lecture, with subject matter experts presenting information to the students. At best, the current pedagogy makes use of the initiation-response-feedback sequence to engage students. At worst, the current system subjects students to lectures without effective engagement. However, there are ways to improve the initiation-response-feedback sequence to better relate the material to personal and practical applications. Li Li, a senior lecturer in language education at the University of Exeter, United Kingdom, writes that "Referential questions are more personal and meaningful to students, as individual opinions and perspectives are respected and sought."[4] In application, this would mean the use of an initiation-response-feedback sequence that draws on ECCC student experiences with geospatial engineering as junior officers, either directly or through products and technologies used operationally. Such a change could help USAES better connect and reinforce

"Few, if any, U.S. Army branches require its officers to have a knowledge set as wide and deep as the Engineer Regiment does. An engineer officer may be placed in a variety of units with vastly different mission sets, yet still be expected to have a strong understanding of the tasks at hand."

the information being taught. Increased engagement could help students contextually frame geospatial engineering as applied to the operational environment, increasing understanding and retention.

As a discipline, geospatial engineering has characteristics of both an academic subject and a tradecraft. The science of how geospatial technologies work and the detailed use of those technologies to create geospatial products are too detailed for the scope of ECCC. However, the inclusion of student experience with geospatial engineering as junior officers in the education process would help prime the students to better understand the various assets they will use as staff captains and company commanders. In *Learning for Life: The Foundations for Lifelong Learnin*g, David H. Hargreaves, professor emeritus at the University of Roehampton, United Kingdom, argues that "When students are asked questions, particularly open rather than closed ones, they potentially have to think hard about the problem, rework existing knowledge, or apply it to a novel situation."[5] This is exactly what would happen if ECCC students were asked to include their operational experiences when interacting with the subject matter.

Hargreaves further promotes a vehicle that USAES could use to bridge the academic and tradecraft aspects of geospatial-engineering instruction—the project. The ECCC curriculum already takes advantage of projects to reinforce both general-engineering and combat-engineering subject matter. The general-engineering block of instruction includes a base camp type planning project, and the offense and defense modules require that students write and present operations orders. There is no reason that a geospatial-engineering project should not be included in the ECCC curriculum, either as a stand-alone project or as one aspect of the other projects for courses of instruction. The Army Capability Manager–Geospatial, Maneuver Support Center of Excellence, Fort Leonard Wood, maintains an index of geospatial-engineering tools that are available to Soldiers and can be leveraged to engage ECCC students, placing the capabilities at their disposal. For example, ECCC students could be required to develop map products for operation orders or military decision-making process modules using Army Geospatial Enterprise (AGE) GeoGlobe[6] (to name just one geospatial-engineering tool). This would decrease the workload of small-group leaders while educating and empowering ECCC students with knowledge and capabilities that they could use when on a battalion or brigade staff. Instead of viewing geospatial engineering as a much-talked-about but never-used domain, ECCC students could learn to practically leverage geospatial information and resources in the operational environment.

USAES has the Herculean task of educating junior officers for the varied and highly technical units that make up the Engineer Regiment. With the majority of the Engineer Regiment composed of either combat or construction units, it makes sense that the ECCC curriculum is focused on the combat-engineering and general-engineering domains. However, as resources across the Army are tightened and the pace of warfare increases, it is more important than ever for junior officers to understand the geospatial engineering domain, be aware of the products and capabilities that are available to them, and know how to leverage those capabilities in the operational environment. A deeper understanding of geospatial engineering could be attained by implementing an ECCC pedagogy that focuses on including and engaging students, while also applying geospatial capabilities in practical applications throughout the course. This could result in higher-quality junior engineer officers who are better able to leverage geospatial capabilities at the brigade, battalion, and company levels.

Endnotes:

[1]FM 3-34, *Engineer Operations*, 2 April 2014, p. 1-1.

[2]*Army Learning Strategy*, Army University, 24 July 2017.

[3]Ibid.

[4]Li Li, *Social Interaction and Teacher Cognition*, Edinburgh University Press, 6 March 2017.

[5]David H. Hargreaves, *Learning for Life: The Foundations for Lifelong Learning*, Policy Press, 2004.

[6]"AGE GeoGlobe," Army Geospatial Center website, U.S. Army Corps of Engineers, <https://www.agc.army.mil/What-we-do/Hydrology/>, accessed on 6 January 2021.

Captain Valencia is the commander of the San Diego–South U.S. Army Recruiting Company, Southern California U.S. Army Recruiting Battalion, 6th U.S. Army Recruiting Brigade, San Diego, California. He holds a master's degree in geological engineering from Missouri University of Science and Technology at Rolla.

By Major Nicholas P. Kirschten

As the Headquarters and Headquarters Company (HHC) commander of a field grade U.S. Army Reserve observer, controller/trainer (OC/T) unit, I—like so many others—have experienced both effective and ineffective communication and the resulting consequences. My experiences have been gained from serving with Regular Army, Army National Guard, and U.S. Army Reserve units. Communication is a common challenge and a common solution to mission success.

In preparing this article, I became aware of how much my writing skills had waned over time. The ideas in my head were clear, but they were inconsistent and incoherent in my written delivery. Like any other form of communication, written communication is a skill that can be sharpened or can become dull, based on the frequency of implementation and level of effort expended.

Communication is the process in which a communicator attempts to get an audience to see, feel, and understand what he or she wishes to express. Effective communication is adaptable to any situation, while remaining fitting in tone, pace, and sophistication. Communication can become twice as effective when trust is established, perspectives are understood, and the values of the communicator and the audience are respected. The audience desires feedback through verbal and nonverbal indications. Verbal indications often occur during after action reviews (AARs), when the communicator asks questions of the audience to ensure a shared vision. Misunderstandings breed frustration and further inefficiency; a lack of communication efficiency, in turn, is a key hindrance to progress. As leaders, OC/Ts, and followers, it is imperative that messages are understood. Simply put, communicators must "know their audience."

OC/Ts collect observations and structure discussions so that evaluated units develop awareness of their actions. Messages are delivered with an encouraging tone and summarized with a positive, forward-moving statement. This gives the evaluated unit confidence to review and reflect on internal practices, resulting in self-discovery and self-awareness. Also, during AARs, OC/Ts collect information about what needs to be sustained or improved, how to go about doing that, and who is responsible for execution. This process exemplifies effective communication through ownership of, and engagement, in actions.

Effective Communication

Of course, effective communication is far more valuable than ineffective communication. We are impressed when a message is delivered with value added; unfortunately, most communication is not as direct

as necessary. Many studies have shown that ineffective communication increases the cognitive load and results in a decreased understanding of the message being delivered. Effective communication, on the other hand, satisfies the needs of a culture that supports understanding—even if effective communication requires more initial effort or resources. Understanding the initial communication dramatically reduces the need for subsequent redundant communication efforts.

Leadership skills have waned during this generation—an observation made most evident through the supplemental and redundant communications required to ensure mission success. Our forces have come a long way from the hand-delivered orders or guidon flags used to communicate plans and changes during battle. We have become faster-paced organizations that must be able to give orders with "mission and intent," allowing leaders to execute with less guidance and oversight. Abundantly available mediums result in instantaneous and more effective communication and allow for varying degrees of changes in planning, Many studies as well as our own experiences remind us that most communication is nonverbal; therefore, voice enhancements and video communications allow us to better convey our message and communicate what we are seeing, feeling, and understanding.

Effective communication requires timely, responsive efforts by all concerned parties. As an HHC commander, I am in a unique position of being responsible for ensuring unit readiness without the luxury of daily formations or readily available resources and, often, with teams that are geographically dispersed. Fortunately, my unit is comprised of officers, noncommissioned officers, and a single specialist and is afforded a level of maturity and experience that is uncommon across the force. These leaders value their individual readiness; but unlike our Regular Army counterparts, our readiness is integrated into our civilian lives. We are charged with maintaining 95 percent administrative, medical, and physical readiness—much the same as any Regular Army unit. This level of readiness requires a small but reliable team of "full-time" Soldiers to support operations.

The most significant point of friction and frustration with communication between Regular Army and troop program unit Soldiers is time. The limited time spent together necessitates effective communication; the "one-third rule" drives our high level of readiness: We spend less than one-third of our time planning a mission and most of our time preparing and rehearsing for it.

Trust is vital to maintaining open communication and fostering an environment of development. Early on, efficient leaders prepare their vision, mission, and philosophy in their offices. Then, when sharing the vision, tone, and desired end state of a mission, trust in the leader allows the unit to autonomously navigate short-term and long-term requirements. Soldiers set their priorities based on what is communicated and individually entrusted. This ensures that the unit culture is supported and that communication is operative. Effective communication is achieved through effort, and effort leads to efficacy. However, communication is also a perishable skill.

Standards

Standards are set through perceptions and pride. Each standard of readiness is communicated through both specified and implied tasks. Specified tasks are less ambiguous and easier to measure than implied tasks, but they do not necessarily signify the true pulse of a unit. Implied tasks reflect the morals and virtues (fitness, health, diet) of an individual or a unit. Intuitively, fewer specified tasks necessitate more implied tasks, which allows teams more autonomy. Implied tasks convey a sense of trust and allow for creativity. They allow subordinate leaders to freely think about the most suitable path to success. Leaders who can solve problems and overcome challenges are more likely to get support from their units and are more likely to help other commanders "see around corners." In the words of General George S. Patton, "Never tell people how to do things. Tell them what to do, and they will surprise you with their ingenuity."[1]

Conclusion

Balancing the art and science of communication is fundamental to the continued success of our profession. Learning and establishing the best communication channels based on familiarity, ease, and necessity—balanced with the best approach to implementing the chosen strategy—will result in measureable success in any organization. A question that OC/Ts might frequently ask of evaluated students is: "What is your intended task or purpose?" Such a question would foster clear feedback and effectively promote the efficacy of the communication within the team.

Fluid communication facilitates the way in which adaptable organizations build and enhance their messages. It is essential that each leader hone his or her communication skills. Take a moment to record your thoughts and—

- Determine how easy or difficult it is to convey your message.
- Practice your delivery until you cannot get it wrong. (Do not simply practice until you get it right.)

We owe it to ourselves, our profession, the Army, and the Soldiers whom we lead.

Endnote:

[1]George S. Patton, "Thoughts on Business Life," *Forbes* website, <https://www.forbes.com/quotes/3327/>, accessed on 30 April 2020.

Major Kirschten is the commander of HHC, 2d Battalion, 346th Regiment, Camp Shelby, Mississippi. He holds a master's degree in business administration from Cameron University, Lawton, Oklahoma, and is a project management professional.

Robotics for Engineer Operations

By Dr. Ahmet Soylemezoglu and Ms. Danielle M. Williams with contributions from Mr. Charles C. Ellison, Mr. Jordan D. Klein, Mr. Israel J. Lopez, Dr. Anton Netchaev, Dr. Dustin S. Nottage, and Mr. William (Jacob) Wagner

The U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, Mississippi, Robotics for Engineer Operations (REO) project is developing unmanned engineer support capabilities to allow operations in global navigation satellite system (GNSS)-denied, -unpredictable, and -challenged environments at beyond-visual-line-of-sight (BVLOS) standoff distances. The goal of REO is to reduce risk to combat engineers by enabling unmanned engineer operations such as obstacle reduction and removal, route maintenance and repair, and fighting-position preparation. REO adapts currently available engineer platforms, such as bulldozers and excavators, and improves upon them by implementing multimodal sensing, model-driven machine controls, and artificial intelligence/machine learning-based autonomy for use in the operational environment.

Performing combat engineering tasks inherently interacts with the environment, whether moving obstacles or digging fighting positions. When these operations are performed in an unmanned manner (through teleoperation or autonomously), the engineer operator loses the critical feedback that is relied upon during normal operation. The lack of environmental feedback during remote operations means that a knowledge of detailed engineering characteristics of the operational area (such as soil conditions, slopes, and presence of obstacles) is necessary. REO is developing a system for multimodal mapping and semantic segmentation

A Soldier teleoperates the Caterpillar 308 8-ton, mini-hydraulic excavator during MSSPIX 20.

The Caterpillar 308 8-ton, mini-hydraulic excavator and the site characterization platform begin a mission to map and remove an obstacle.

of environmental features to aid the operator in the remote performance of these combat engineering tasks. The maps are an integral part of autonomous operation of engineer platforms.

In the past 2 years, REO has developed an autonomous site characterization platform based on the Army's Squad Multipurpose Equipment Transport unmanned ground vehicle. Additionally, through its Collaborative Research and Development Agreement with Caterpillar, Incorporated,© ERDC has acquired a BVLOS teleoperated Caterpillar 308 8-ton, mini-hydraulic excavator and a BVLOS teleoperated Caterpillar 299D3 compact track loader. The site characterization platform is outfitted with a sensor payload that includes multiple light detection and ranging (LiDAR) sensors, an inertial measurement unit, an automated cone penetrometer, and hyperspectral cameras to create the semantic site model.

Similarly, the BVLOS teleoperated mini-hydraulic excavator and the compact track loader are equipped with four cameras that provide a 360-degree camera feed as well as operator control units that provide access to all standard functions of the machines. All of the platforms use military grade encrypted radios for telemetry and are configured to run military software, such as the Robotic Operating System–Military and the Robotic Technology Kernel from the Ground Vehicle Systems Center. As software capability gaps become apparent while adapting to specific engineering uses, ERDC takes advantage of open-source technology (where possible) or develops new in-house capabilities. This allows ERDC to leverage existing Army capabilities; fill in the gaps; and reduce dependency on specific companies, software, or hardware during future development.

The REO user interface was developed using the Android Tactical Awareness Kit (ATAK), a mapping engine that allows for precision targeting, intelligence, navigation, and generalized situational awareness. ATAK is a program that

"The goal of REO is to reduce risk to combat engineers by enabling unmanned engineer operations such as obstacle reduction and removal, route maintenance and repair, and fighting position preparation."

is used by Soldiers in the field. REO takes advantage of the ATAK plug-in architecture to support features and vehicle operations by—

- Switching between teleoperation mode and autonomous mode.
- Displaying the position of the vehicle on a geopositioned map.
- Commanding the vehicle to execute a user-defined mission route.

Using the widely-available ATAK system ensures swift adoption and integration of REO technology and will reduce the barrier to entry for Army engineers.

The 2 years of development culminated in a successful demonstration of ERDC's near-real-time autonomous site modeling/mapping and BVLOS teleoperation of the Caterpillar 308 8-ton, mini-hydraulic excavator in a GNSS-denied environment during the Maneuver Support, Sustainment, Protection, Integration Experiment (MSSPIX) held at Fort Leonard Wood, Missouri, the week of 14 September 2020.

Dr. Soylemezoglu briefs Army leaders on REO capabilities for combat engineers during MSSPIX 20.

During the event, REO demonstrated three different use cases. First, the site characterization platform was deployed to Training Area 230—a military operations in urban terrain site—in teleoperation exploration mode without any a priori information. A three-dimensional site model of the area was constructed without relying on GNSS positioning. In the second experiment, recent geospatial data of the training site was loaded into the ATAK interface to initiate the mission. The site characterization platform was assigned multiple navigation goals on the geospatial map and successfully traversed them while mapping the area. Finally, in remote operation mode, the Caterpillar 308 with a hydraulic shear attachment cut through triple-strand concertina wire. The excavator was teleoperated from a base station located approximately 200 meters away from the obstacle BVLOS. The operator relied completely on the onboard cameras and remote controls to navigate to the concertina wire and defeat it. Senior Army leaders from the Joint Modernization Command, the Maneuver Support Center of Excellence, the U.S. Army Engineer School, and the Maneuver Support Battle Laboratory attended and observed the demonstrations.

For the upcoming MSSPIX 21, REO will conduct a Soldier assessment of capabilities. In addition to what was demonstrated during MSSPIX 20, a BVLOS teleoperated compact track loader will be used to defeat an obstacle to mobility, such as a tank ditch or log obstacle. The REO site model will also be updated to include semantic labels relevant to Army engineers. As the site characterization vehicle maps an area, the system will autonomously identify, mark, and geotag items of interest for the operator. This will allow for improved situational awareness and better planning and decision making for the combat engineer.

Throughout the development cycle, which ends in Fiscal Year 2027, REO will continue to make use of Soldier-led experiments to receive and incorporate feedback from critical stakeholders and to ensure that capability gaps for the engineer Soldier are addressed. The system that ERDC is currently developing will serve as a force multiplier and will reduce personnel risks during future engineer operations.

Dr. Soylemezoglu is the program manager for REO research and development at ERDC. He holds master's degrees in engineering management and manufacturing engineering and a doctorate degree in system engineering from Missouri University of Science and Technology at Rolla.

Ms. Williams is a research geographer at ERDC. She holds bachelor's and master's degrees in geography from Kansas State University, Manhattan.

Advising Foreign Security Force Engineers

By Major Jared S. Baldwin

In 2019, the 2d Security Force Assistance Brigade (SFAB), Fort Bragg, North Carolina, deployed to Afghanistan in support of Operation Resolute Support. Engineer Advisor Team 2511 was comprised of a post command team leader, a senior combat engineer sergeant, a combat engineer advisor, and a construction advisor. The team was assigned to the Train Advise Assist Command (TAAC)–Capital, Kabul, and later moved to TAAC–North, Mazari Sharif. Team 2511 advised SFAB maneuver commanders, local Afghan National Defense personnel, and security forces in the areas of combat engineering and horizontal- and vertical-construction tasks. Team members learned some lessons that may benefit other engineer advisor teams on future advising missions.

Advising With NATO

An integral part of Operation Resolute Support mission success consisted of the contributions of the many North Atlantic Treaty organization (NATO) countries that had operational control over select TAACs. Team 2511 had the unique opportunity to work alongside Turkish and Macedonian engineers at TAAC–Capital and German engineers at TAAC–North. The team supported their advising efforts below the Afghan National Army (ANA) corps level.

Team 2511 spent roughly half of its time in TAAC–North in expeditionary deployment conditions on small bases, assisting maneuver advisor teams that were colocated with ANA units from the 209th and 217th Corps, based across northern Afghanistan. TAAC headquarters staff sections did not have the capacity to train and advise below the ANA corps level, leaving the TAAC–North senior engineer advisor to focus his efforts solely on the ANA corps engineer. The TAAC–North senior engineer advisor relied heavily upon information provided by the ANA corps engineer to assist in parallel planning and advising efforts. Unfortunately, the corps engineer was unable to validate personnel numbers or equipment readiness or confirm if operational information was reaching company level leadership. Through integration with the TAAC–North senior engineer, Team 2511 obtained information while also providing training to the engineer, route clearance, and explosive ordnance disposal (EOD) companies. By acting as the connective tissue, the team assisted in synchronizing engineer efforts across ANA echelons.

A key part of integrating with the TAAC senior engineer advisor was the ability to avoid mission failure. The team learned through the senior engineer advisor that the ANA corps commander wanted to conduct a clearance operation along a particular stretch of enemy-held Highway 1. The plan called for ANA maneuver elements to clear the route and then use ANA engineers to construct a few platoon size

Soldiers integrating with a maneuver advisor team in Kabul

A Soldier instructs ANA engineers on route clearance.

battle positions to secure and hold the terrain. After a few advising engagements, it was discovered that ANA engineers did not have the capability or resources to construct the battle positions. This was a setback to the clear, hold, and build concept. Team 2511 informed the TAAC–North senior engineer advisor of the shortfall and advised the ANA corps engineer to search elsewhere for the construction capability.

Advising Under Decentralized Conditions

The mission set sometimes does not allow for the task force, company, or team to be colocated on the same operating base. In such circumstances, the entity must exercise mission command to decentralize advising efforts across the operational area and accomplish the mission.

The initial mission of the Team 2511 higher headquarters was to advise the Afghan National Police units responsible for operating the Kabul City gates and the ANA *kandaks* (battalions) tasked to defend the capital of Kabul. The mission focused on enhancement of the Kabul City gates; force protection posture; and mobility, countermobility, and survivability training for the ANA. Kabul City gate personnel and ANA *kandaks* were advised by different maneuver advising teams. In order to provide the required engineer capability, Team 2511 separated, aligned, and integrated with the maneuver advising teams. Synchronization was key before and after separate missions to gain situational awareness of gate force protection construction progress and any training required by the ANA *kandaks*. As much as the team wished to operate as one, covering separate areas and advising at the point of need were mission-essential.

Advising Foreign Security Force Partners

Some ANA commanders see the SFAB advisor as someone who can accomplish what they could not or someone who will solve all of the unit issues based on preconceived notions or previous interactions with U.S. counterparts. During engagements, the advisor must be forthright, with the purpose centering firmly on the principles of training, advising, and assisting.

Team 2511 had the opportunity to meet numerous ANA maneuver and engineer commanders in Kabul and across TAAC–North. Most of the ANA commanders had little or no experience in working with U.S. advisors or had previously worked with U.S. advisors who provided their units with ample supplies and resources. Based on previous experiences, some ANA commanders expected Team 2511 to provide fuel, sandbags, and air support. In an attempt to manage expectations, the team began informing ANA commanders that support would be provided in the form of training on the equipment, advising the commander and staff on operations, and leveraging logistical support through the advisor network. Some commanders were disappointed; they wanted immediate material and operational support—not a commitment to follow through with supply requests or discuss training plans. As team members continued to travel across the country, they believed it best to lay out expectations in advance to set the tone for current and future engagements. Although the reactions were unchanged, this approach gave the team a chance to get ahead of the curve and focus on unit readiness and training. Over time, questions regarding sustainment led to questions regarding upcoming missions. These discussions inevitably led to opportunities for the team to share thoughts and appropriately advise the commanders about partner force plans. The ANA commanders grew to understand that the team, which was trained differently than previous advisors, was a team with which they could build rapport through training and honest advising rather than through dependency.

Managing Advising Expectations

Foreign security force counterparts may operate vastly differently than SFAB or other NATO advisors. The advisor must then shift from a doctrinal mindset to one that supports the ANA initiative—and that's okay.

The ANA mission was to construct a small, platoon size battle position to secure key terrain around Highway 1. During planning, the discussion focused on the battle position location, size, and layout and the bill of materials on hand. Referencing the map of the operational environment, the TAAC–North senior engineer advisor and Team 2511 identified key terrain that would be easily defendable and had clear fields of fire and suitable access routes for construction. After considering the proposed location, the ANA corps engineer insisted on using an alternate location that had a high ridgeline on one side, a river on the other side, and poor access roads for the construction of entrance/exit roads. The decision of the ANA corps engineer not to use the proposed location caused confusion and frustration among the team members. The senior engineer advisor and the team wanted the construction to succeed, giving the ANA soldiers tactical advantages over the enemy. After several discussions, the ANA corps engineer and the TAAC–North senior engineer managed to agree on a location that provided better fields of fire. As expected, ANA engineers encountered issues with bringing in heavy equipment to berm and fill the force protection bastions. They were forced to use less-capable and less-effective equipment, which resulted in a final product that was less than perfect by Team 2511 standards. However, the ANA took the initiative to plan, resource, and build the battle position with little help, which was the ultimate desired goal of advising.

Team 2511 was also required to manage expectations when it came to route clearance operations. The team met with an ANA EOD company and observed its route clearance tactics to establish a baseline and identify strengths and shortfalls. This particular unit demonstrated that it was very familiar with some of the U.S. Army reporting procedures, but it used nondoctrinal methods for detection. Team members explained and demonstrated some U.S. Army doctrinal methods for early detection in the hopes that the EOD unit would adopt them; however, the EOD commander was skeptical and reluctant to incorporate them. The team stressed how the doctrinal methods would be beneficial to the ANA during clearance operations. Team members informed the EOD commander that training his unit on early detection methods would have significant benefits during operations and that training on these tactics would continue during every engagement. Although the team would not be able to verify whether its efforts paid off, it had trained to standard and planted the seed with the EOD company. In the end, it was up to the brave ANA soldiers of the EOD company to clear the stretch of Highway 1. Success was up to them.

A Soldier inspects equipment before training.

Handling Technology Challenges

In an established forward environment, the reliability of the communications network to provide the ability to communicate between echelons is often taken for granted. The people of Afghanistan, including those in the ANA, have become accustomed to reliable mobile telephone and Internet networks that allow the real-time exchange of information at a moment's notice. However, due to technology, communication during deployment was difficult at times.

At TAAC–North, Team 2511 advised ANA units that were geographically separated from the team by a rotary wing flight of an hour or more. The team saw each unit for a period of 1 week once a month and called for visits in between to build rapport, gather information, and set training conditions. The operational area was so vast that the mission required the use of different mobile subscriber identity mobile cards for each location. A setback occurred in one area when the local mobile telephone tower was turned off, eliminating telephone and message communication with the ANA partners; it would be a few days before Team 2511 could get back to its location, and gathering information was essential to synchronizing efforts with TAAC. With the help of some NATO partners in the area, messages were able to be sent and received over secure platforms—without a break in advising—until the functionality of the cellular telephone tower was restored.

Major Baldwin is the leader of Team 2511, 5th Battalion, 2d SFAB. He holds a bachelor's degree in criminal justice from Stephen F. Austin State University, Nacogdoches, Texas, and a master's degree in geological engineering from Missouri University of Science and Technology at Rolla.

The 9-0-Deuce:

A Brief History of the 902d Engineer Company

By Captain Giancarlo C. Rindone and Captain James "Beau" Wasson

In April 2019, U.S. Army Europe (USAREUR) deployed a small group of engineers from the 902d Engineer Construction Company, Grafenwöhr, Germany, 300 miles away, to Karliki, Poland, to build infrastructure to facilitate a large influx of U.S. Army Soldiers to the small Polish training area. USAREUR tasked the company to construct a 3-mile-long, semi-improved gravel road with two 3,000-square-foot concrete turn points and a 5,000-square-foot steel targetry warehouse foundation. The 902d deployed with its two horizontal-construction platoons, a vertical-construction platoon, and a field maintenance section to complete the projects in time for the arrival of the 1st Armored Brigade Combat Team, 1st Infantry Division.

902d officers circa 1944

The engineers who traveled along an unimproved sand road to conduct route reconnaissance from a railhead to a tank firing range and expeditionary logistic supply point in western Poland found that the general area was quiet, rural, and heavily vegetated except for a 1,000-acre sandy field. The vehicles could not travel more than 10 miles per hour because potholes and remnants of a World War II era cobblestone road were scattered along the route. What should have been a 5-minute drive took 25 minutes. A local Polish citizen taking advantage of an all-terrain vehicle zoomed by. This sole road is part of an underdeveloped Polish training area. In less than 1 month, a Polish mechanized company would move into the area for a field training exercise. In less than 2 months, the 1st Armored Brigade would arrive by rail to the training area to serve as part of Operation Atlantic Resolve. In a matter of 6 weeks, the 902d managed to complete $800,000 worth of construction and deploy to Hungary for follow-on missions. As impressive as the recounting of this single deployment is, it is only a snapshot in the long, rich, and unique history of the company.

The 902d Engineer Construction Company was originally

902d Reproduction Platoon circa 1945

constituted as the 902d Engineer Air Force Headquarters Company at Mitchel Field Army Air Base, Long Island, New York, on 21 April 1942. Over the next year and a half, elements of the newly minted company deployed to New Hampshire, Connecticut, Virginia, and Michigan to conduct surveys, construct training facilities, and provide training in the art of camouflage. The 192 Soldiers of the company set sail for England aboard the U.S. Army Transport J. W. McAndrew on 27 February 1944. Upon arrival, they were assigned to the Ninth Engineer Command of the Ninth Army Air Force and they began preparing for the invasion of Europe. The company, with its unique reproduction platoon, was entrusted with reproducing top secret military plans and constructing facilities in support of training for Operation Overlord. On 7 June 1944, elements of the company crossed the English Channel to assist in defeating Festung Europa. Altogether, from 6 June 1944 to 21 March 1945, the 902d built more than 300 airfields in France, Belgium, Holland, Luxembourg, Austria, and Germany.

As part of its occupation duties, the 902d began the construction and rehabilitation of permanent airfields. The

The 902d constructs a bridge in 1984.

A 902d company photograph taken in 1989

company was awarded the Meritorious Unit Commendation for exceptionally meritorious conduct from 1 April 1944 through 8 May 1945. It was also recognized for its contributions to the Normandy, Northern France, and Rhineland campaigns with campaign streamers.

The unit was inactivated just before Christmas of 1947 and was dormant for 20 years. On 26 May 1967, it was reactivated and redesignated as the 902d Engineer Company (Float Bridge) at Fort Belvoir, Virginia. In its new role, the "Deuce" had the multifaceted mission to provide training support to the U.S. Army Engineer School (USAES), Fort Belvoir, and to deploy worldwide as a U.S. Army Forces Command quick-response force. The 902d was unique in that every type of bridge in the Regular Army inventory was assigned to the unit during this period. The 902d demonstrated its readiness and expertise in July 1970, when the company was alerted to provide two 180-foot M4T6 bridges at Great Bridge, Virginia. The bridge crewmembers maintained the bridge sections for 38 days, and more than 170,000 vehicles crossed without incident. The company continued to deploy in support of civil authorities for more than 2 decades.

The 902d secures a command observation post in Afghanistan in 2001.

In the immediate aftermath of the devastating Hurricane Agnes in June 1972, the Soldiers of the 902d utilized their training and equipment to provide emergency rescue and rafting operations in order to rescue civilian flood victims in Fairfax, Alexandria, and Occoquan, Virginia. A week later, the company deployed to Pittston, Pennsylvania, to help salvage damaged property and alleviate destruction; then to Lancaster, Pennsylvania, to construct an M-2 bailey bridge; then to Laceyville, Pennsylvania, to operate an M4T6 raft; and finally, to Ellicott City, Maryland, to recover a railroad car. The 902d continued to provide emergency bridging to civil authorities at

Hilton Head, South Carolina, in March 1974 and at Siloam, North Carolina, in June 1975. In January 1983, in response to the tragic crash of Air Florida Flight 90 in the Potomac River, Washington, D.C., the 902d provided an emergency floating platform to assist with rescue operations.

On 15 February 1990, after 2 decades at Fort Belvoir, the 902d followed USAES to Fort Leonard Wood, Missouri. In January 1991, the 902d deployed 35 bridge specialists to the Middle East within 72 hours to support the growing need for engineers during Operation Desert Storm. Following Operation Desert Storm, the company maintained a high operational tempo, supporting USAES and multicomponent training exercises until it was inactivated on 15 September 1994.

At the height of the Global War on Terrorism, the Army called the 902d into service once again. The company was reactivated in Schweinfurt, Germany, on 15 July 2008 and was designated as the 902d Engineer Company (Vertical). The 902d, then known as the "Gladiators," put its new vertical-construction skills to the test by deploying to Padarevo, Bulgaria, to repair a kindergarten as part of the North Atlantic Treaty Organization (NATO) Joint Task Force–East humanitarian civic-assistance training. The company returned to the Middle East on 23 October 2010 and was based at Camp Arifjan, Kuwait. From there, the 902d provided support across the Central Command area of responsibility. The company constructed pre-engineered buildings, foundations, communications towers, wood frame structures, entry control points, and maintenance facilities throughout Kuwait and Afghanistan. On 14 October 2011, the company reconsolidated and redeployed to Schweinfurt and began preparing for relocation to Grafenwöhr in April 2013.

The 902d circa 2009

On 1 January 2014, after relocating to Grafenwöhr, the 902d deployed to Mihail Kogălniceanu Air Base, Romania, to build a personnel transit facility. Despite frigid temperatures and gale force winds, the Soldiers completed the construction on schedule to accommodate the flow of Soldiers into and out of European and Central Asian operating areas. In January 2015, the company deployed Soldiers to Liberia to build Ebola treatment facilities to stop the spread of the deadliest outbreak of Ebola in history. In the summer of 2015, after returning from Liberia, the Soldiers deployed to Läsna, Estonia, to build wood frame structures to support NATO training rotations. Following its mission in Estonia, the company was transformed from an engineer company (vertical) to an engineer construction company. Under this new designation, the company had horizontal- and vertical-construction capabilities and an expanded mission.

In January 2016, the 902d deployed one of its newly minted horizontal-construction platoons to Rena Leir, Norway, to conduct winter engineer training and participate in Exercise Cold Response. The training served to build on a close, enduring relationship with the 5th Company of the Norwegian engineer battalion. In the summer of 2016, the 902d returned to Läsna, where the two new horizontal-construction platoons built 2.5 miles of road and the vertical-construction platoon poured 250 cubic yards

902d project board, Afghanistan 2011

A photograph of the 902d company taken in 2019

of concrete. The company returned home in the fall of 2016 to conduct live-fire exercises and field the Ultimate Building Machine® (UBM)—a machine that bends steel to rapidly create durable steel frame structures. In May 2017, with the new UBM, the 902d convoyed from Grafenwöhr to Powidz, Poland, to construct an aviation headquarters facility. The company simultaneously deployed a horizontal-construction platoon to Hohenfels, Germany, to support maneuver units. In August 2017, the company returned to Grafenwöhr to begin preparations for Exercise Allied Spirit, which was to take place at at the Joint/Multinational Readiness Center, Hohenfels, in October 2017. During Exercise Allied Spirit, the 902d provided 24-hour support to maneuver elements by digging antivehicular ditches, constructing obstacles, and repairing airfields.

The Gladiators continued to build training area capacity in Eastern Europe by constructing two helicopter landing pads, an ammunition holding area, and a half-mile-long road in Trzebień, Poland, in 2018. Upon completion of construction in Trzebień, the 902d convoyed more than 745 miles to Rukla and Pabradė, Lithuania, for Exercise Saber Guardian. In Lithuania, the Soldiers built wood frame structures, roads, tank ditches, berms, and assorted obstacles in support of NATO forces.

In July 2018, the 902d returned to Grafenwöhr, convoying more than 810 miles without incident. Upon arrival at Grafenwöhr, the company quickly reset its equipment to prepare to deploy to Hohenfels for Exercise Combined Resolve XI at the Joint/Multinational Readiness Center. During Exercise Combined Resolve, the Soldiers endured freezing temperatures, snow, rain, and ice to provide mobility and counter-mobility operations in austere conditions.

This brings us to the intrepid engineer reconnaissance team in Karliki. By May 2019, the Gladiators had completed the construction of critical infrastructure. The 3-mile-long semi-improved gravel road connects the railhead to nearby staging areas and mounted weapons ranges. The two new reinforced concrete slabs, integrated into the road, will increase the longevity of the road against tracked-vehicle use. The reinforced concrete foundation will enable the future construction of a 5,000-square-foot warehouse. With these projects completed, the 902d conducted a multimodal deployment of a horizontal platoon and maintenance element to Szentes, Hungary, to provide support for a NATO gap-crossing operation. After successfully supporting the gap crossing, the company redeployed and reconsolidated in Grafenwöhr. In August 2019, the 902d built a cross-section of a concrete airstrip at the Grafenwöhr Training Area to provide an airfield demolition and repair training asset to USAREUR units. The time at home in Grafenwöhr was short-lived.

Bracing themselves against subfreezing temperatures, the Soldiers of the 902d once again headed to the Joint/Multinational Readiness Center to support NATO forces in January 2020. The Gladiators had faced these conditions many times before. This time, however, the 902d was the only American force in a multinational, Polish- and Dutch-led task force. Working with its NATO allies, the 902d enabled defensive operations and subsequent rapid breaches for counteroffensive operations. After a brief respite, the Gladiators returned to Grafenwöhr and immediately began focusing on increasing their lethality through ranges and field training.

Throughout its 78-year history, the 902d Engineer Construction Company has always had a unique role and mission. The Soldiers of the 902d maintain a connection to the company heritage through the symbolism of their distinctive unit insignia: The red coloring and vertical shovel represent the Corps of Engineers, the blue coloring and horizontal perforated steel planking represent the unit connection to the Army Air Corps and its role in building airfields, and the motto "We Will Conquer" embodies the fighting spirit of the Soldiers of the company.

Today, the 902d maintains a high operational tempo, providing critical construction and combat capabilities throughout Europe. Despite the company's history as an engineer Air Force headquarters company, an assault float bridge company, a vertical-construction company, and an engineer construction company, the indomitable spirit of the Soldiers of the 902d has remained the same. Wherever the Gladiators go, one thing is certain: We Will Conquer.

Captain Rindone is the commander of the 902d Engineer Construction Company. He holds a bachelor's degree in civil engineering from the U.S. Military Academy—West Point, New York, and a master's degree in civil engineering from Missouri University of Science and Technology at Rolla. He is a certified project management professional and professional engineer.

Captain Wasson is a project manager in the New Orleans District, U.S. Army Corps of Engineers in Louisiana. He holds a bachelor's degree in engineering management from the U.S. Military Academy—West Point, New York, and a master's degree in engineering management from Missouri University of Science and Technology at Rolla. He is a certified project management professional and a certified associate in engineering management.

("Demining in the DMZ," continued from page 41)

latest mine and unexploded ordnance technological advances and creating partnership synergy with professionals in nongovernmental organizations. Lastly, and most importantly, UNC engineers contribute to reconciliation on the Korean peninsula through the removal of mines.

Endnotes:

[1]*Agreement Concerning a Military Armistice in Korea*, UN, 27 July 1953, <https://peacemaker.un.org/koreadprk-militaryarmistice53>, accessed on 3 August 2020.

[2]*Letter Dated 6 September 2018 From the Representatives of the Democratic People's Republic of Korea and the Republic of Korea to the United Nations Addressed to the Secretary-General*, UN, 6 September 2018, <https://digitallibrary.un.org/record/1640603?ln=en>, accessed on 3 August 2020.

[3]"Agreement on Implementation of the Historic Panmunjom Declaration in the Military Domain," National Committee on North Korea, 18 September 2018, <https://www.ncnk.org/sites/default/files/Agreement%20on%20the%20Implementation%20of%20the%20Historic%20Panmunjom%20Declaration%20in%20the%20Military%20Domain.pdf>, accessed on 3 August 2020.

[4]"Full Text of President Moon Jae-in's Speech at the 74th UN General Assembly Session," Yonhap News Agency, 25 September 2019, <https://en.yna.co.kr/view/AEN20190924010500315>, accessed on 3 August 2020.

[5]Ibid.

[6]International Mine Action Standards, IMAS Organization, 2001, <https://www.mineactionstandards.org/>, accessed on 3 August 2020.

[7]The demining season is determined by weather conditions that permit the activities necessary for removal of mines and unexploded ordnance. The length of the season depends on the location, but the season generally consists of warmer months with little precipitation, as lower temperatures can cause freezing and excess precipitation can cause unsafe conditions.

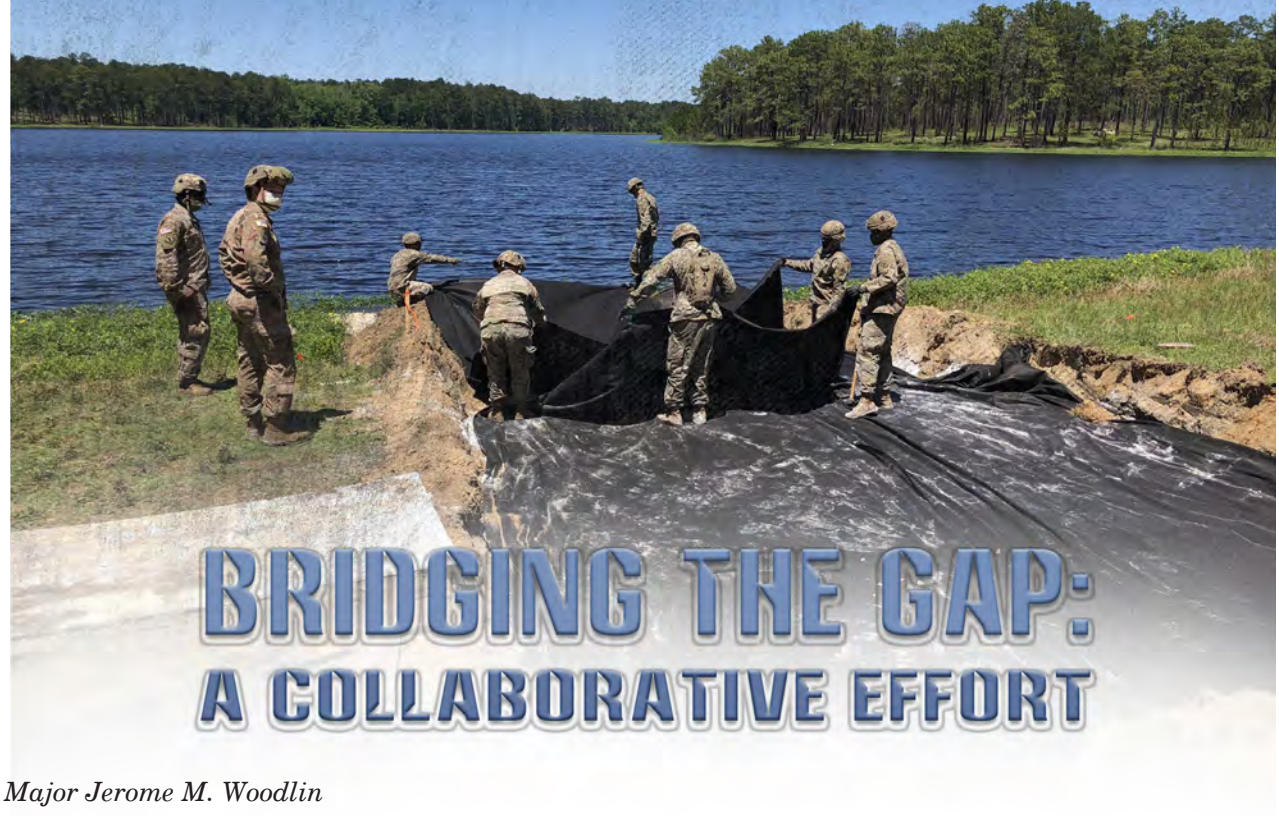
[8]"Full Text of President Moon Jae-in's Speech."

[9]"UN Officials Discuss Support for President Moon's Vision for DMZ Mine Removal," Yonhap News Agency, 17 February 2020, <https://en.yna.co.kr/view/AEN20200217003600325>, accessed on 3 August 2020.

[10]"Full Text of President Moon Jae-in's Speech."

Colonel Lloyd is the command engineer for U.S. Forces Korea. He is the chair of the Demining Committee for the UNC. He holds a master's degree in strategic planning from National Defense University, Washington, D.C.

Major Born is the command operations engineer for U.S. Forces Korea. He is also the UNC mine action officer and liaison with ROK engineers. He holds a master's degree in geological engineering from Missouri University of Science and Technology at Rolla.



BRIDGING THE GAP: A COLLABORATIVE EFFORT

By Major Jerome M. Woodlin

According to Army Doctrine Publication (ADP) 3-90, *Offense and Defense*, "Wet-gap crossings are among the most critical, complex, and vulnerable combined arms operations. A crossing is conducted as a hasty crossing and as a continuation of the attack whenever possible because the time needed to prepare for a gap crossing allows the enemy more time to strengthen the defense. The size of a gap, as well as the enemy and friendly situations, will dictate the specific tactics, techniques, and procedures used in conducting the crossing."[1]

The Third Infantry Division (3ID) recently conducted a wet-gap crossing leader professional development session in the greater Fort Stewart, Georgia, area as a part of the Lieutenant General Michael E. Kurilla (XVIII Airborne Corps Commander) Corps Leader Forum. A wet-gap crossing is a complex operation that begins with the critical steps of site selection and preparation. Upon mission assignment, one of the first problems that 3ID identified was determining the location of a site suitable for executing wet gap-crossing operations. After staff analysis and the presentation of courses of action, Major General Antonio A. Aguto, 3ID Commander, decided that the wet-gap crossing would occur on Pineview Lake (Pond 1), in the Fort Stewart Training Area.

An equipment operator uses a hydraulic excavator to cut the surface for a designed slope.

Surveyors verify water depth for a ramp.

Pond 1 is located on the western boundary of the Fort Stewart Training Area. The maximum dimensions of Pond 1 are 800 meters in width by 1,000 meters in length. The pond serves as a recreation site for Fort Stewart Soldiers, civilians, and retirees to enjoy kayaking, fishing, and other water sports. Depending on the time of year and the amount of rainfall received, the water level of the pond rises or falls, preventing or enhancing opportunities for activities.

In November 2019, the 3ID notified the 92d Engineer Battalion, Fort Stewart, of a ramp emplacement project for a wet gap-crossing exercise on Pond 1, scheduled for July 2020. Upon receiving notification, the Operations Section, 92d Engineer Battalion, inquired about conceptual plans and products regarding how the wet-gap crossing would be conducted on the selected site. Additionally, the survey and design officer in charge inquired about ramp design and construction to support the wet-gap crossing operation. The 3ID informed the 10th Brigade Engineer Battalion, Fort Stewart, that the 1st Armored Brigade Combat Team, Fort Stewart, would take the lead on developing the concept of operation for the exercise and that the brigade design engineer, 926th Engineer Brigade, Montgomery, Alabama, would take the lead on design.

Army maneuver units rely on Army engineer units to provide gap-crossing capabilities. The engineer unit that most commonly provides gap-crossing capabilities is the multirole bridge company (MRBC). A brigade engineer battalion has organic gap-crossing capabilities, but not enough to support gaps that are larger than 18.3 meters. An MRBC has the capacity to bridge one 213-meter gap or two 107-meter gaps and requires a minimum depth of 2 meters in order for bays to expand when placed in a body of water. At the time of site selection for the wet-gap crossing operation, Pond 1 depths were unknown. Planners assumed that since the depth of the pond supported personal boat launching, the pond could support an MRBC bay launch.

As planning progressed, the U.S. Army Reserve units of the 361st MRBC, Spartanburg, South Carolina, and the 310th MRBC, Fort A. P. Hill, Virginia, received warning orders to provide support to the 3d Battalion, 69th Armored Regiment, Fort Stewart, and the 1st Armored Brigade Combat Team for the wet gap-crossing exercise. Meanwhile, the

"Army maneuver units rely on Army engineer units to provide gap-crossing capabilities. The engineer unit that most commonly provides gap-crossing capabilities is the MRBC."

92d Engineer Battalion continued coordination with the 926th Engineer Brigade design engineer for a design of the ramps to support the wet gap-crossing exercise. Over a planning period of 4 months, with in-progress reviews occurring over holiday leave, the initial concept of operation and design for the wet-gap crossing were distributed to stakeholders for bottom-up feedback and refinement. The concept identified the requirement for engineer dive support to determine the depths of the pond and construction support to emplace up to seven ramps as launch points for the MRBCs.

The 92d Engineer Battalion has an engineer dive team and construction support assets organic to its organization. The battalion assigned the 569th Dive Detachment and the 526th Engineer Construction Company to support the mission. The 569th is one of five Regular Army dive

An equipment operator uses a loader to place gravel.

detachments stationed at Joint Base Langley–Eustis (JBLE) with three additional dive detachments. The 526th is one of the two battalion construction companies. After receiving the mission, issuing a warning order, and conducting a site reconnaissance, the 526th began refining the plan to construct the ramps and accomplish the mission. The 569th completed a side sonar scan and determined that the pond was deep enough to support emplacement of the improved MRBC ribbon bridge bays. The ramps were constructed so that they were 20 feet wide by 40 feet long, with a 15 percent slope along the last 20 feet of ramp leading into the water. This slope enabled the end of the ramp to descend to a depth of 2 feet below the surface of the water, allowing for unobstructed equipment launching. Construction of the ramps occurred in three phases.

The first phase of construction consisted of excavation of the site and construction of the ramp base. A few different methods were used for excavation. When soil conditions permitted, a D6 bulldozer cut and pushed material into the water, creating a temporary dam. When soil conditions could not support heavy equipment, a 240D hydraulic excavator removed soil from the site. Once excavation concluded, the ramp base was constructed. This included—

- Stretching geotextile fabric over the length of the ramp.
- Adding 12 inches of #4 (1–2-inch diameter) gravel.
- Covering the gravel with another layer of geotextile.

After the base was complete, the surface was constructed.

The second phase of construction began with the creation of the ramp surface. Four 20-foot by 10-foot sections of Geocell™ panels were filled with 8 inches of gravel. An additional 4 inches of gravel was laid on top of the Geocell panels to protect them from heavy-equipment traffic.

During the third phase of construction, equipment operators placed loose stone at the end of the ramp to assist users in recognizing it as the end.

The execution of this construction project occurred under Novel Coronavirus (COVID-19) conditions. The 92d Engineer Battalion briefed and received approval from Major General Aguto to execute the construction on 27 April 2020, with a "no-later-than" completion date of 15 June 2020. Only 30 of the 42 days allotted to complete the project were actual workdays. Each ramp took approximately 3 to 5 days to construct, and the company completed the project ahead of schedule.

While the MRBCs rehearsed the execution of the wet-gap crossing exercise, the boat operators discovered spoils on the banks of Pond 1. The spoils, which created an inability to properly set the ramps, required removal. At the time of the rehearsals, the Soldiers of the 526th who executed the project were in preventive quarantine due to COVID-19 mitigation and the battalion assigned the equipment platoon of the 530th Clearance Company to remove the spoils. The company accomplished the mission and the wet-gap crossing exercise was a success.

Having the appropriate equipment and experience saves time. The Soldiers who designed and constructed the seven ramps in support of this wet-gap crossing exercise had no previous experience in executing this type of mission. When a pandemic is factored in, mission accomplishment becomes even more difficult. The leaders and Soldiers of the 92d Engineer Battalion demonstrated how to live the motto *"Essayons."*

Endnote:

[1]ADP 3-90, *Offense and Defense*, p. 1-33, 31 July 2019.

Major Woodlin served as the operations officer of the 92d Engineer Battalion, 20th Engineer Brigade, during the wet-gap crossing exercise described in this article. He holds a bachelor's degree in construction management from the North Carolina Agricultural and Technical State University, Greensboro, and a master's degree in real estate development from Auburn University, Alabama.

Introducing Sappers to Gap Crossing

By First Lieutenant Gene J. Schreck

Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

How many sappers and how much time does it take to conduct line-of-communication bridging operations? These were the questions that were to be answered at the Yakima Training Center, Washington, in August 2020. With no experience in wet-gap crossing operations, the 2d Platoon, 571st Sapper Company, 864th Engineer Battalion, was directed to conduct gap-crossing operations using the Acrow© 700XS prefabricated bridge system. This article highlights how the mission was accomplished and discusses lessons learned. The goal is to provide a baseline of knowledge and expectation for units with little to no experience in conducting gap-crossing operations using the Acrow 700XS system.

2d Platoon included 24 sappers, seven horizontal-construction engineers, and two wheeled-vehicle mechanics. Horizontal-construction engineers were essential due to the heavy use of engineer equipment such as the hydraulic excavator (HYEX) and 30-ton bucket loader. There was enough manpower available to complete the mission, allowing for a greatly needed and forgiving work-rest cycle, considering that temperatures exceeded 110°F. Novel Coronavirus (COVID-19) mitigation measures were also put in place to ensure Soldier safety throughout the exercise. All Soldiers remained in a bubble while at the Yakima Training Center, they wore masks while staying in the barracks, and their temperatures were checked twice a day. However, facemasks were not worn during the actual exercise due to safety concerns regarding heat casualties and to allow for clear communication. Interaction with people outside of the platoon was limited. There were no COVID-19 cases, and no Soldiers demonstrated symptoms during the operation.

The 571st is one of the first non-bridging units to conduct gap-crossing operations of this scale. The exercise took place in two phases. The first phase consisted of an instructional operation led by a subject matter expert; the second consisted of a confirmation operation without guidance. At the start of the mission, the 571st did not have a working knowledge of the bridge system. For future units conducting gap-crossing operations, a clear understanding of the equipment that will be required is critical to mission success.

Essential Equipment

The minimum equipment necessary for constructing a successful crossing using the Acrow 700XS system includes—

- **HYEX.** The HYEX is as the primary equipment asset and is required for Day 1 construction.
- **Levels.** Bubble levels or laser levels are required for preparing the bridge construction site.
- **Cribbing**. The following items are required for cribbing:
  - 32 feet of 4-inch by 4-inch wooden planks.
  - 32 feet of 2-inch by 4-inch wooden planks.
  - Six pallets of 0.5-inch-thick wood for leveling the rollers on the construction site.
- **Chain**. Four sets of 14-foot-long chain, with hooks on either end, are needed in order to lift, tie down, and transport equipment and to secure the bucket loader to the bridge.
- **D-handle pickets.** Three-foot-long D-handle pickets with maximum 1.5-inch-diameter solid metal poles are used to slam pins into tough-to-reach gaps as well as to lock the bridge in place.

Once on-site, the bulk of the equipment, which was tightly packed inside six 40-foot containers, was pulled out with the use of a 6-ton forklift, which allowed for maneuvering inside the containers. The use of this small forklift avoided the need to connect chains to the equipment to drag it out of

Figure 1. Soldiers placing rollers during site layout

the containers. After the equipment was inventoried, it was transported to the gap-crossing site, approximately 5 miles away. The recommended transportation equipment consists of a palletized load system with at least four flat racks and an M870 trailer to transport the longer pieces of equipment.

Site Layout

The first task at the gap-crossing location was to conduct site layout, which entailed removing vegetation, leveling dirt, and placing rollers, as shown in Figure 1. Leveling the dirt was a larger undertaking than originally anticipated due to the tolerance requirements of the rollers. The rollers needed to be within 0.25 inch apart across the site. Insufficient time and effort went into the site layout process during the first phase of the exercise, and that was manifested during the first bridge launch. The launching process was greatly hindered by the uneven surface that resulted from inaccurate leveling of the dirt and placement of the rollers and overnight settling of the ground. Consequently, the bridge constantly needed to be jacked up and releveled, adding well over an hour to the launch process.

General Construction Method

The construction process is broken down and organized based on the number of bays required by the bridge. Bays serve as the building blocks of the bridge and act as joints between sections. Each bay is approximately 14 foot long by 10 feet wide, weighs in excess of 4,000 pounds, and is composed of two side walls, with transoms bolted between them. The side walls are comprised of two panels connected by cross braces. Transoms are large I-beams that connect the left and right walls together. The side walls serve as linking points between the bays, and are joined by driving pins into eyelets. Figure 2 shows a transom being lifted into place with a HYEX.

The general bridge construction process is systematic and repetitive and can be learned in 2–3 days of training. Bridge construction starts by building the nose, which is similar to a full bay, except that the side walls have single panels, making the nose much lighter. The next step involves building the desired number of bays, adding

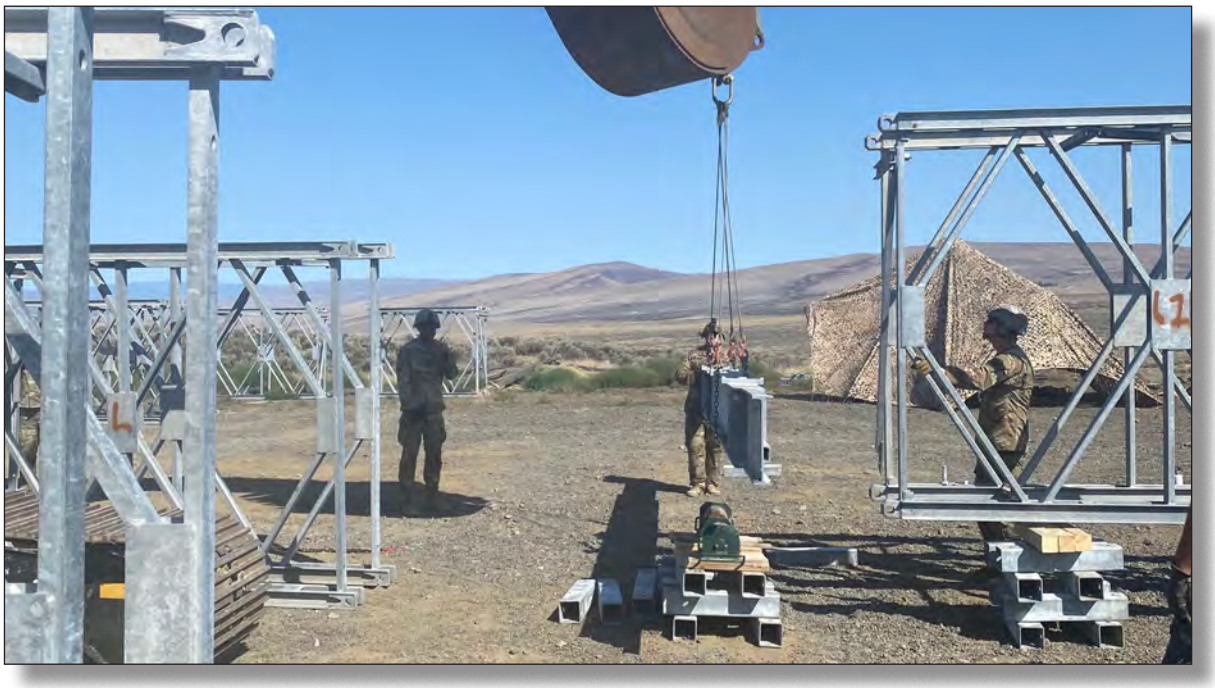


Figure 2. A transom is lifted into place.

Figure 3. A forklift is used to launch the bridge across the gap.

decking, and then placing counterweights at the ends of the bridge to correct the center of gravity. The counterweights consist of stacks of decking that allow for the bridge to safely span the gap. Once all steps are completed, a final check is made to ensure that the bridge is ready for launch. The bridge is then pushed across the gap, primarily through the use of heavy engineering equipment. (During this phase of the exercise, a 30-ton bucket loader with forklift attachments was used to move the bridge forward, as shown in Figure 3. Use of the bucket loader allowed for making small adjustments to the height and glide path of the bridge.) Once the bridge is fully across the gap, the near side is jacked down, ramps are added, and decking is constructed. The bridge is then ready for use.

There are specific requirements for the number of bays, length of the nose, and amount of counterweight needed to safely launch each bridge. These factors are determined by the distance of the gap, bank conditions, and the maximum weight of vehicles to be supported. For this specific operation, the span covered a distance of 25 meters and the banks were already improved. These factors were used to determine that the bridge needed to have four nose bays, six bays consisting of double panels, and 11 stacks of decking counterweights.

Task Organization

To complete this exercise, the platoon was separated into left, right, and center teams and a heavy-equipment crew. Each right, left, and center team was composed of five sappers, and the heavy equipment crew was composed of seven construction engineers. The noncommissioned officer in charge of each team was assigned tasks that entailed rigging loads, hammering pins in place, bolting cross braces, moving transoms into place, and ensuring Soldier safety. The heavy-equipment crew split its time between the HYEX and 30-ton forklift. The HYEX served as a crane by attaching load-lifting equipment by the cables suspending the transom, as shown in Figure 2. It moved the transoms and side walls into place, while the 30-ton forklift was used to prepare more loads for transport, allowing the HYEX to remain stationary and speeding up the construction process.

Results

The time required to complete each section was recorded in order to gauge improvement and estimate construction times for future operations. Time comparisons are shown in Table 1. The instructional phase revolved around learning how to construct the

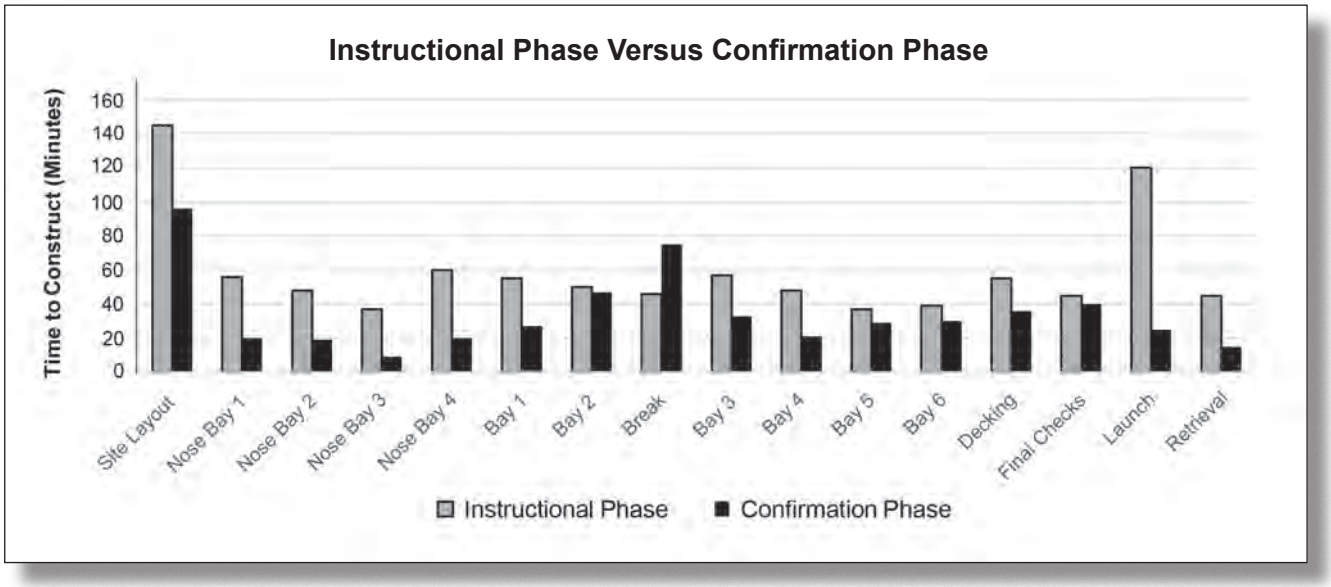


Table 1. Data collected at Yakima Training Center showing construction time comparison

sections. The subject matter expert allowed Soldiers to make mistakes so that they could learn how to correct them for the future. This added considerable time to the process, but it paid off during the confirmation phase, as the platoon was able to fix the issues as they arose. Both phases were relatively limited, so major assumptions cannot be made from the data; however, a few simple conclusions can be drawn.

Before starting the instructional phase, the subject matter expert indicated that, for planning purposes, construction of each bay was assumed to take 1 hour. For the first portion of that phase, the HYEX was unavailable and the nose portions were built by hand. Manipulation of the 1,000+-pound pieces of equipment into place proved to be as challenging as it sounds. The platoon did come to appreciate the presence of the HYEX for the construction of subsequent bays. After working with the equipment and gaining a better understanding of the building process, the confirmation phase took approximately half of the time of the instruction phase.

The site was generally flat, causing the site layout process to go much quicker than it would with steeper terrain. Very experienced HYEX operators also made the construction go much quicker since the operators were comfortable maneuvering equipment while Soldiers worked on the ground. With these two factors, construction speeds were consistently faster than the planning factor of 1 hour per bay. This is particularly notable, given that Soldiers were working in temperatures in excess of 110°F. Using the 30-ton forklift to push and manipulate the bridge during launch prevented the need to jack the bridge up every time the glide path was off, also resulting in time savings during the mission.

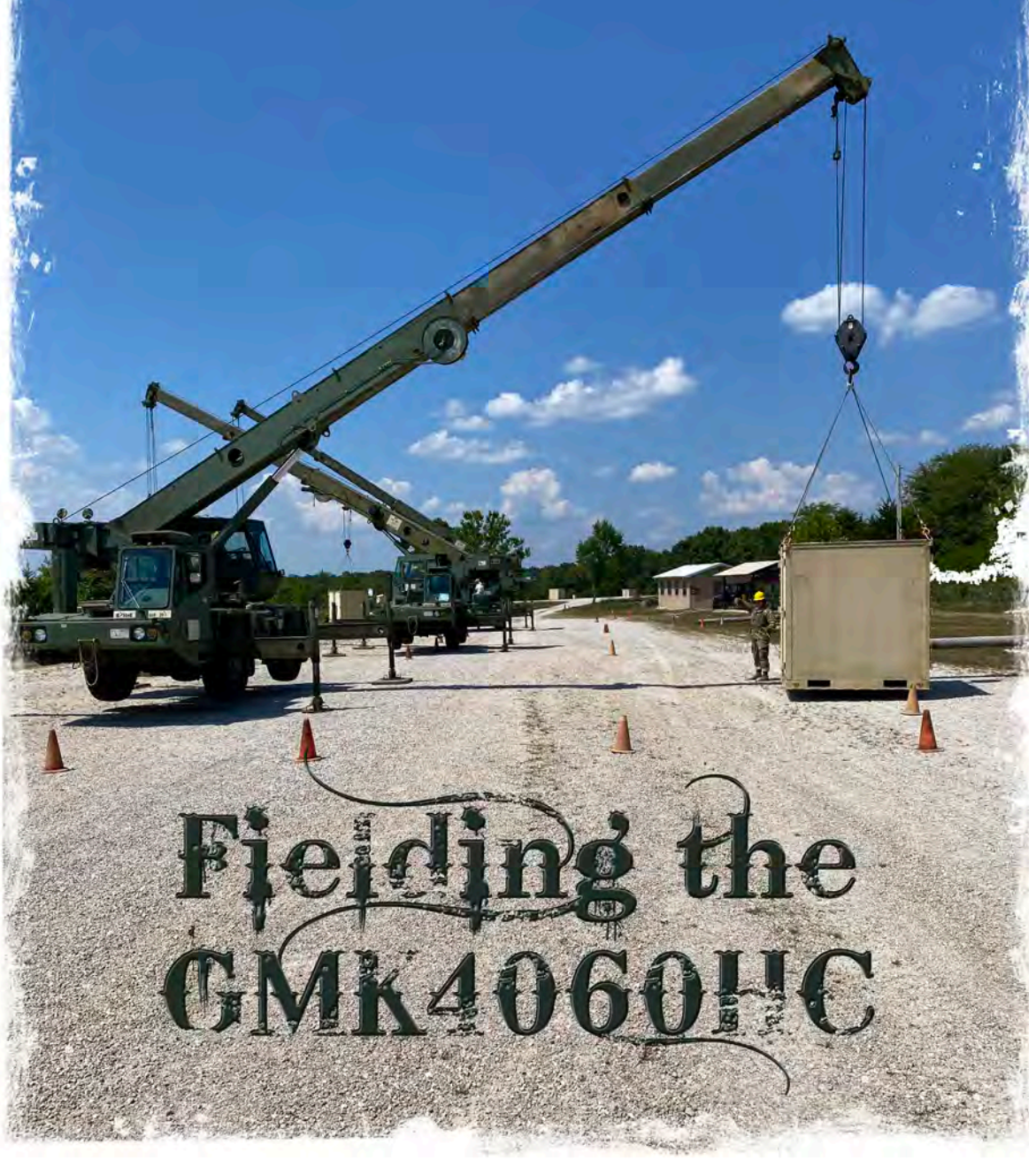
The equipment proved to be easy to take apart and transport. 2d platoon was able to fully disassemble all components, load them onto flat racks and M870 trailers, and transport them back to the equipment yard in less than half a day. The size of the bridge may have made this process faster than most; however, the speed at which the bridge was broken down and moved was surprising.

Bridge spanning gap-crossing site

Conclusion

Having trustworthy and capable noncommissioned officers is critical to mission success. Every portion of the bridge construction requires leaders to step up and take responsibility for completing team tasks. Early integration of the attached construction engineers into the platoon was instrumental in ensuring unit cohesion. The platoon gained a significantly stronger understanding of the construction process during the confirmation phase and was able to cross the gap in half the time of the instructional phase. A platoon of 24 sappers and seven construction engineers proved to be sufficient manpower to construct the bridge. After 3 weeks of training, the Soldiers of the 571st felt confident in conducting follow-on line-of-communication bridging missions.

First Lieutenant Schreck is a platoon leader for the 571st Sapper Company, 864th Engineer Battalion, 555th Engineer Brigade, Joint Base Lewis–McChord, Washington. He holds a bachelor's degree in hydrology from the University of California, Santa Barbara.



Fielding the GMK4060HC

By Sergeant Major Donald S. Collier II

Full fielding of the Grove Manitowok K-Series 4060 (GMK4060HC) heavy crane depends on the implementation of simulators, national accreditation, and prioritization of multirole bridge companies (MRBCs).The fielding of the GMK4060HC comes at a time of tremendous change within the Horizontal-Skills Division (HSD) at the U.S. Army Engineer School (USAES), Fort Leonard Wood, Missouri. The implementation of simulators focused on reducing the costs of fuel consumption, and on-site equipment requires the attention of every division chief at Training Area 244. A shift from operating time on actual heavy equipment to simulator training time upends the traditional program of instruction (POI), creating the need to revisit it. Additionally, HSD crane instructor accreditation and the conduct of mobile training teams consume the focus of key personnel. Over the next year, HSD will maximize its efforts to train Soldiers currently residing in, or moving to, high-priority units that require personnel to be trained on the 60-ton crane.

Heavy-Equipment Simulators

Implementation of heavy-equipment simulators understandably initiates an overhaul of labor, equipment, and POI considerations at Training Area 244. Furthermore, in order to understand the full effect of the machines on the HSD table of distribution and allowances, an anaylsis of new training on simulators is required. Six of the 10 HSD training annexes, which include training for the additional skill identifier of C4–Crane Operator, will receive simulators over the next 2 years. Many USAES leaders intend for these machines to reduce the hefty fuel requirements and equipment-to-personnel ratios needed to train the equipment operators of tomorrow. However, this does not mean that we can rename the so-called

Soldiers and civilians train on the GMK4060HC.

"million-dollar hole" the "half-million-dollar hole" anytime soon. Instead, an expectation of many changes during the Training Area 244 simulator transformation is more realistic.

Repurposing of buildings to facilitate the addition of simulators requires contract support from the Department of Public Works, Fort Leonard Wood. HSD received specific instructions from the U.S. Army Program Executive Office of Simulation, Training, and Instrumentation, Orlando, Florida, regarding the heating, cooling, electric, and dimension requirements of each building. Next, representatives from Applied Visual Technology Simulations©, Orlando, must validate that the buildings meet the specifications prior to the installation timeline. Outfitting the buildings with operational simulators marks the start of the POI revision process.

With the help of the Directorate of Training and Leader Development, USAES revision of the POI is the last step in converting to the use of simulators for training. Crane Operator Course instructors will teach Soldiers to operate the 22-ton crane and the new 60-ton heavy crane. This addition will extend the course by 2 weeks, for a total duration of 5 weeks and 2 days. Additionally, the POI will include two hands-on testing fields. Adding the heavy crane to the POI and training the instructors on the new piece of equipment has led HSD to seek national accreditation for those who complete the Crane Operator Course.

National Accreditation

The Crane Operator Course is currently undergoing a national accreditation process through the National Commission for the Certification of Crane Operators (NCCCO),[1] which has been in existence for 25 years and is represented by contractors, labor unions, rental firms, business owners, government agencies, manufacturers, distributors, consultants, and many others. Two civilians who work in HSD are leading the national accreditation initiative—Mr. Desmond A. Walker and Mr. Jack R. Ulrey, who are prior military members serving as the primary course instructors. They are the first Army civilian instructors to go through the NCCCO process. Facilitating local instruction, leading mobile training teams, and equipping the training site with crane simulators represent only a few of their responsibilities in seeking national accreditation. The ability of Mr. Walker and Mr. Ulrey to certify students will depend on their successful completion of the NCCCO process.

The NCCCO requires that all accreditation candidates complete written and hands-on examinations and that they graduate from the Examiner's Course. The computer-based written examination can be taken at one of 438 regional test facilities throughout the United States. The hands-on examination requires that the operator demonstrate proficiency at moving objects at an accredited testing site. The Examiner's Course certifies individuals to test others on their ability to complete the hands-on portion of the certification process. After obtaining the credentials to test students, the civilian instructors will shift their focus to the fielding of the 60-ton crane.

MRBCs

The U. S. Army Corp of Engineers (USACE) possesses the only significant capability to conduct rapid dry- and wet-gap crossings for the U.S. military. Strategic maneuver of the U.S. military depends on the MRBC ability to bridge the gap. There are only four MRBCs in the Regular Army: the 74th MRBC, Fort Hood, Texas; the 50th MRBC,

Fort Leonard Wood; the 814th MRBC, Camp Humphreys, South Korea; and the 502d MRBC, Fort Knox, Kentucky. The limited number of MRBC units means that these units remain in high demand and high priority.

Lieutenant General Todd T. Semonite, USACE Commanding General and Chief of Engineers, acknowledged an insufficiency in North Atlantic Treaty Organization bridges, as many of those bridges cannot withstand a load greater than a Military Load Classification of 70.[2, 3] River crossings present a problem in Eastern Europe since six major rivers exist between Germany and Estonia: the Danube, Dnieper, Elbe, Oder, Rhine, and Volga Rivers.[4] Furthermore, river-crossing concerns in Korea led the 814th MRBC to relocate from Fort Polk, Louisiana, to the Korean peninsula. Ensuring that MRBCs possess the ability to maneuver in regions of concern is dependent on the proper training of MRBC Soldiers during the Crane Operator Course.

Obtaining the C4 additional skill identifier from the Crane Operator Course is a prerequisite to conducting new-equipment training on the GMK4060HC heavy crane. Obtaining the C4 additional skill identifier does not require instruction on the new crane itself. Units can reserve a seat for their qualified heavy-equipment operators during any available class. HSD is exploring the option of conducting insert classes within the Army Training Requirements and Resource System for newly graduated basic trainees and Regular Army Soldiers who are scheduled for a permanent change of station to an MRBC during fiscal year 2021.

GMK4060HC

Conclusion

The inclusion of the GMK4060HC heavy crane in the Crane Operator Course comes at a time when the way that HSD trains operators is under revision. The implementation of simulators, national accreditation, and a focus on MRBCs is leading HSD to prioritize, ensuring acquisition of the 60-ton crane at the unit level.

By the second quarter of 2021, HSD plans to run its first nationally certified Crane Operator Course. Over the next year, HSD plans to include the historical Army 22-ton crane and the new 60-ton heavy crane in the course.

Moving the Engineer Regiment into the future of warfare is dependent on adopting the most up-to-date training techniques and equipment. HSD looks forward to assisting the Regiment in implementing those changes at Fort Leonard Wood and elsewhere.

Endnotes:

[1]"National Commission for the Certification of Crane Operators," <https://www.nccco.org/nccco/about-nccco/introducing-nccco>, accessed on 24 November 2020.

[2]"Mind the Gap: The Army Looks to a New Assault Bridge for Heavy Armor Maneuvers in Europe," *Breaking Defense*, <https://breakingdefense.com/2019/10/mind-the-gap-the-army-looks-to-a-new-assault-bridge-for-heavy-armor-maneuvers-in-europe/>, accessed on 24 November 2020.

[3]Bridge classification is a process to calculate bridge carrying capacity used by the North Atlantic Treaty Organization.

[4]"Mind the Gap."

Sergeant Major Collier is the chief instructor for HSD. He holds a bachelor's degree in history and a master's degree in international relations from Norwich University, Northfield, Vermont.

Brigade Engineer Battalion Fire Support

By Captain Kent D. Homrighausen

In a brigade combat team (BCT) or regiment, battalions/squadrons typically have a fire support team (FIST) that consists of one battalion fire support officer (FSO) who is a Military Occupational Specialty (MOS) 13A–Field Artillery Officer captain, one battalion fire support noncommissioned officer who is an MOS 13F–Joint Fire Support Specialist sergeant first class, one company FSO who is an MOS 13A first lieutenant or second lieutenant, one company fire support noncommissioned officer who is an MOS 13F staff sergeant, and one forward observer (FO) and one radio telephone operator who are MOS 13F privates through sergeants per platoon. However, brigade engineer battalions (BEBs) do not have MOS 13 Series fire support personnel to provide fire expertise. This article discusses why BEBs should have FISTs and support options.

Captain Kent Homrighausen serving as a company FSO.

In force-on-force operations, BEBs are typically in charge of the rear area and are divided across the brigade for different support functions. FISTs are not usually employed with BEBs. Engineer companies are normally tasked out, and attached to, a maneuver battalion that has its own FISTs that can provide local fire support to engineers who are colocated with maneuver units.

The human intelligence, signal intelligence, and unmanned aerial systems elements of a military intelligence company are typically tasked across the brigade to support maneuver units and the brigade headquarters; therefore, other battalion FISTs must provide support for those attached elements. The same applies for the signal company. This leaves military police personnel, who usually comprise just a platoon size element.

While the BEB priority for assigned or attached FIST personnel is low, after seeing multiple rotations at the Joint Multinational Readiness Center, Hohenfels, Germany (where Soldiers train for force-on-force operations and BEBs suffer significant losses to opposing forces [OPFORs] that manage to penetrate the defensive lines of maneuver battalions), I believe they require this support in some form. Once the OPFOR is in the rear area, there is little that a BEB can do to prevent being decimated—especially if it is by an enemy armored force. While it may be possible to shift fire to limit OPFOR movement and capabilities, the BEB has no fire support experts to direct this shift in fire.

During each rotation at the battalion headquarters, I spoke with the BEB staff about the fires plan and who is in charge of it. Every BEB staff member told me that they either have no fires plan for the rear area or that they were provided with the grid coordinates of a few targets upon which to request fires should OPFOR reach those locations. However, except for requesting from higher headquarters that the grid be fired upon, staff members do not know how to call for fire. Even if they do manage to get the predetermined target fired upon, they have no idea how to adjust fire or what to do after the target is hit. Most BEBs designate the battle captain in the tactical operations center, typically an operations (S-3) captain, to act as the coordinator for fire.

A BEB route clearance patrol

The BEB employs elements that conduct movement on their own within the area of operations (AO) and could, therefore, encounter an enemy force, resulting in a situation in which fire support may be critical to mission success. A route clearance team may have an escort when conducting movement around the battlefield, but neither the route clearance team nor typical route clearance escorts are accompanied by a FIST. While members of the route clearance team can call for fire, the lack of trained fire support personnel diminishes the likelihood of accurate and timely fire support. The same applies to the forward support companies that are responsible for conducting resupply missions across the AO.

BEBs frequently employ military police who conduct movements throughout the AO. Due to their flexibility and gun truck capabilities of high mobility, light armor, and weapon systems, the military police are frequently employed to escort BEB organic assets, such as the forward support companies, or set up traffic control points throughout the AO. With the wide coverage of the AO and the use of traffic control points (which act as observation posts), FOs could observe possible targets and increase the lethality of military police movements should they encounter an OPFOR.

Assigning a full FIST to BEBs is the first option proposed to address the lack of fire support. While this proposal would benefit the BEB, it is also the proposed action that is least likely to occur. Not only would the manning of a full FIST in a support battalion be an issue, but some of the FIST members would also be sparcely used in companies that are attached to maneuver units with their own FIST members.

Another possible option would be to assign a partial complement of FIST members to BEBs. The BEB could be assigned a small team that is structured to best support its needs. A first lieutenant and staff sergeant could serve as the battalion level FSO and fire support noncommissioned officer, respectively. An FO and radio telephone operator could serve as the company level FIST members for the engineer companies and military police platoon, but would not be assigned to the military intelligence company, to the signal company or, for the engineers, at the platoon level.

A third option would be to specifically attach FIST members to the BEB for operations, exercises, or individual missions as needed. The FIST members would be requested by the BEB and provided from the field artillery brigade, division artillery, or field artillery battalion, if available. After the task was completed, they would return to their organic field artillery organization. Because the attachment would be for a specific task, either of the two previous options (full FIST or partial FIST) could be utilized.

Finally, the simplest possible option would be for the BEB to designate and properly train a coordinator for fire support. At the local level, the coordinator could contact the supporting field artillery unit and any FIST element to establish fire support training or attend preexisting training together. For official training, the BEB could send its designated representative to the Joint Fires Observer Course and Joint Firepower Course. The representative would then be properly trained for directing fires for BEB operations.

While there is currently no requirement for a FIST in the BEB, it is imperative that BEBs gain some form of trained fire support. The proposed options need not be standard across the force, but may be standard for all armored BCTs, infantry BCTs, or Stryker BCTs. The main point is that BEBs need some form of fire support. With the focus of the military transitioning from counterinsurgency to force-on-force operations, fires will become an even more crucial aspect for all operations. The need for trained fire support personnel will increase across all operations.

Captain Homrighausen is the chief of analysis for the security office (G-2), Maneuver Support Center of Excellence, Fort Leonard Wood, Missouri. He holds a bachelor's degree in justice systems from Truman State University, Kirksville, Missouri.

Increasing Countermobility Effectiveness in IBCTs

By Major Michael P. Carvelli

If professional journals and books provide a clue about how we, as an Army, are discussing current trends and future requirements, then we are not giving enough credence to one of the three types of combat-engineering capabilities—countermobility.[1] The Army University Press published a nine-volume set entitled *Large-Scale Combat Operations*, which includes almost no elements of defensive operations.[2] Thematically, this set discusses military deception, combined arms maneuver, cross-domain fires, sustainment, maneuver, mobility, information operations, special operations, and close combat. Of the three types of combat-engineering capabilities (mobility, countermobility, and survivability), only mobility is a focused topic.

The lack of coverage regarding defensive-oriented operations, including countermobility and survivability, can become a prevalent problem if units do not actively address these operations at home station. The topics discussed in this article have been derived from experiential learning with infantry brigade combat teams (IBCTs); however, most of the proposed solutions can be applied beyond this singular formation.

Trends

IBCTs, which are lighter than armored brigade combat teams (ABCTs) and Stryker brigade combat teams (SBCTs), are mostly dismounted, with some motorized elements. Because IBCT Soldiers are limited to the equipment in their rucksacks, they tend to be assigned to mobility or countermobility during dismounted operations—and IBCTs are not as well-equipped with countermobility assets as ABCTs or SBCTs. As most dismounted infantry units focus on the attack, a selection bias occurs in which dismounted sapper squads support situational and live-fire exercises with mobility (explosive) breaching capability. But why does this bias occur? And what can we do to address it?

First, home station training tends to focus on mobility over countermobility. Engineers progress through the engineer qualification tables, from Table I—Leader Task Certification to Table VI—Platoon Qualification Field Training Exercise (see Table 1). The training strategy impacts equal weight to mobility (and other tasks) and countermobility/survivability. We must adhere to the equal

	Prerequisites		*Live*			
	Table I	*Table II*	*Table III*	*Table IV*	*Table V*	*Table VI*
Squads and Platoons	Leader Task Certification	Individual Soldier Task Certification	Mobility, Reconnaissance, React to Contact, STT, STX, L	Countermobility, Survivability, STT, STX, L	Squad Certification, STX, L	Platoon Qualification Field Training Exercise
Recommended Days Required to Train	5	10	5	5	3	3 (31 Total Days to Train)
Training Days Remaining on the Critical Training Path to Collective Task Proficiency	26 (31 - 5 = 26)	16	11	6	3	Collective Task Proficiency

Legend:
L - live
STT - sergeant's time training
STX - situational exercise

Table 1. Sample training strategy for engineer qualification tables[3]

"Commanders and staffs must actively seek countermobility training opportunities for engineer units."

distribution of training time, as the engineer qualification tables are designed to ensure that our formations have the requisite skills. Where the plan may go awry is with Tables V and VI. It is much easier to conduct Bangalore and brazier breaches than it is to employ craters and mines in training areas. As mines are not available and the rules for employing buried demolitions (cratering charges) vary with each installation, mobility training is the easier choice. It is incumbent on commanders and staffs to resource countermobility collective training events at home station within the applicable rules and constraints.

Second, infantry companies focus on mobility as they progress through their company level live-fire exercises. Because engineer companies—specifically sapper platoons—tend to support infantry live-fire events with mobility, this demand can interrupt or dilute countermobility training. When a BCT conducts collective training at a combat training center, it can, unfortunately, be the first time that infantry and engineer Soldiers execute countermobility in a situational or live-fire training exercise. This this is due to infantry battalion live-fire training progression requirements. Although necessary, this mobility-focused training path can be an impediment to engineer countermobility training progression. Commanders and staffs must actively seek countermobility training opportunities for engineer units.

Next, conducting countermobility training is difficult. It requires more resources (wire, pickets, mines, demolitions, heavy equipment, capable training areas) than mobility training does. Engineers are not allowed to employ mechanical means or demolitions required for abatis obstacles at some installation training areas. The opportunity to execute an abatis is rare in a Soldier's career. Furthermore, the availability of training mines is rare outside of combat training centers. Volcanos and modular pack mine systems are neither readily available nor on all units' modified tables of organization and equipment. An IBCT field artillery battalion rarely, if ever, employs the family of scatterable mines in a training environment. U.S. policies limit the use of different types of mines as well as the use of mines in certain geographic areas.[4] Mobility training becomes the preferred choice by default.

Finally, our way of thinking causes us to favor mobility over countermobility training. The framework of offense versus defense inhibits our ability to consider employing hasty defenses after each offensive operation. Each time that a unit conducts an attack, it must secure and consolidate gains (except in a planned raid). The enemy generally has the ability to conduct a counterattack, which requires some level of countermobility and survivability to protect the force. When commanders decide to establish a consolidation area (particularly in the offense, as the friendly force gains territory), the transition from the attack to a hasty or deliberate defense enables freedom of action.[5] This is true even in an infantry company. Whether mounted or dismounted, as the company maneuvers from objective to objective, it applies the protection warfighting function. Using terrain for cover and foliage for concealment, the company protects its forces. If time allows and if it has the capacity, the company can emplace point obstacles to reduce the risk or increase the chance of destroying enemy armor, with or without attached engineers.

Acknowledging these trends and remaining aware of them during training and operations provide the mental framework necessary to address countermobility shortcomings.

Engineer Countermobility Planning

Commanders and staffs have many engineer planning tools at their disposal when conducting operations and considering countermobility. Several doctrinal publications address bills of material and rates of work, which help to initiate planning.[6, 7] However, units must modify these items to fit their own version of reality. For example, specified antivehicular ditch dig rates for various blade teams do not account for operator skill, visibility, soil conditions, or weather.[8] Leaders must continually refine unit standard operating procedures to reflect the time and assets that are realistically required to emplace obstacles.

One technique for successfully accounting for operator skill, soil conditions, and weather factors with echelon-above-brigade engineer units involves the use of a liaison. An engineer support company has a Military Occupational Specialty 120A–Construction Engineer Technician, who can liaise with the BEB staff. This warrant officer provides a critical link in realistic countermobility and survivability planning. Similarly, the construction engineer technician in a BEB operations section can serve as the BEB liaison to the IBCT staff, enhancing the capability of the assistant brigade engineer. The distribution of these warrant officers creates liaisons at echelon, enabling BCT and BEB planning efforts with realistic planning factors.

Another critical element of countermobility planning is the disposition and distribution plan for obstacle sustainment requirements. The empowerment of obstacles is a supply-intensive effort; engineers need construction materials, barrier materials, and demolitions during different parts of an operation. The use of configured combat loads (CCLs) can help (see Table 2, page 84). Specifically focused on future engineer needs, CCLs reduce the time required to build obstacle packages. However, not every plan survives first contact.

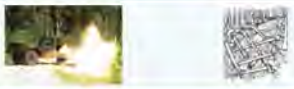
CCL	Intent	Obstacles	Example
A	Fix Dismounted Threat	• 300 Meters Triple Standard Concertina Wire • 300 Meters Tanglefoot	
B	Fix Mounted Threat (Point Defense)	• Two 11-Foot Rows Concertina Wire • Two 50-Foot Deliberate Road Craters	
C	Fix Mounted Threat (Area Defense)	• 11-Foot Row Concertina Wire • 50-Foot Deliberate Road Crater • 300 Meters Triple Standard Concertina Wire	
D	Antiarmor Ambush	• 10 Selectable, Lightweight Attacks Munitions • Abatis (75 Meters of Obstacle Depth)	
E	Survivability (Dismounted Infantry Company)	Construction Materials for— • 24 Two-Man Fighting Positions (Crows Foot). • Six Listening Posts/Observation Posts. • Six Machine Gun Fighting Positions.	

Table 2. Five intent-focused CCLs for countermobility and survivability

To configure the combat loads, commanders and staffs must analyze the terrain and the enemy. The steps of intelligence preparation of the battlefield cover this analysis, but engineers can do more. Working with the IBCT geotechnical intelligence team to identify where enemy armor cannot operate due to seasonal weather can prove useful. The obstacle effort can be reduced if enemy armor is further restricted due to hydrology. Using the enemy situational template created by intelligence staffs can help determine probabilistic obstacle requirements. With this knowledge, engineer units can more accurately determine their basic countermobility load. Beyond the basic load, sustainers must place CCLs with distribution teams, including company trains, field trains, and the brigade support area. Commanders need distribution plans based on the battlefield framework, the phase of the operation, and triggers that enhance the transition from offense to defense or vice versa.

Whether platoon leaders or company commanders, task force engineers embedded in maneuver battalion staffs can increase the network of knowledge across the IBCT and provide realistic planning factors. Brigade engineer planners, BEB operations and logistics teams, and task force engineers form a network that reports the CCL status across the IBCT operational area. This effort reinforces successes and can mitigate failures when IBCTs execute hasty and deliberate defensive operations. This network allows the IBCT and BEB to synchronize all engineer assets.

Synchronization of Engineer Assets

A well-known task organization framework concept that could be useful involves a company team, commonly referred to as a team dig. With this company team organization, all blade assets are traditionally placed under a single company command—either in an engineer support company or another engineer organization. All blade assets are centralized in the command to execute countermobility and survivability tasks for the organization that the company supports. This team concept also includes a synchronization matrix focused on maximizing the blade capability.

This organizational concept is flawed for two reasons. First, it limits the synchronization of engineer assets to blades only. It fails to include high-mobility engineer excavators, which provide hasty countermobility and survivability support through the use of the bucket, backhoe, and chainsaw attachments. Second, it omits sapper squads/platoons. Although these sapper units are typically task-organized to infantry battalions, their efforts to construct obstacles as part of the brigade obstacle plan are not included in overall synchronization if that is solely a team dig function.

The team dig approach can work if commanders and staffs consider the operational framework and phasing of the operation. Consider a combat training center rotation in which an IBCT controls three infantry battalions, a reconnaissance squadron, an engineer battalion, a fires battalion, a support battalion, and a direct-support aviation task force. All of these units require some form of countermobility and survivability capability during different phases of the operation. They experience these needs at differing places—in the deep, close, or consolidation areas of the IBCT. It is possible that blades are required for digging antivehicular ditches near the forward line of troops, defilade positions for M119s and M777s in the close area, and protective positions for AH64s in the consolidation area. The sheer size of the IBCT area of operations is larger than that which a single engineer company headquarters can effectively command and control. Thus, it is the responsibility of the IBCT engineer battalion to synchronize and manage.

Consider the team dig concept, and reflect on the points that Captain Gregory M. Shepard makes in his article entitled "Team Dig Versus Organic Task Organization: Observations from an OTC at the NTC,"[9] when he discusses sustaining and prioritizing the needs of the ABCT across its area of operations. IBCTs need to understand the limits of a company headquarters in synchronizing multiple operations for eight battalions in a large-scale combat operation. An expanded engineer synchronization matrix that includes blades, high- mobility engineer excavators (HMME), and sapper units is a helpful tool. The hidden problems with this approach include the limited number of light equipment trailers and the requirements for bulk fuel, construction materials, demolitions, and maintenance. Once commanders and staffs identify these concerns and mitigate the risks, engineers can implement actions in varying formations and unique operations.

Formations, Actions at the Halt, and Forced Entry

We tend to understand the basic load of an individual or crew-served weapon system, but not potential basic loads for countermobility needs. If a dismounted engineer squad were to cross the line of departure, planning to reduce a single dismounted breach lane, then it would have the demolitions required to perform this mission. However, the leaders would be unlikely to assess the potential countermobility needs after assisting in seizing the objective. Some useful questions that leaders might ask when considering countermobility for the mission include—

- What is the demolition requirement for this breach lane?
- What else can we do with these demolitions if we bypass the obstacle?
- What other demolition components should we carry to employ this combat load in other situations?

Consider an engineer squad supporting an infantry company and carrying two brazier charges' worth of components to execute one dismounted breach. If the squad does not need to use these demolitions, or only needs to employ one of them, how many other components could it bring to create an abatis if the enemy can employ a vehicle? Could the squad members carry a few selected lightweight attack munitions for an antivehicle ambush? The abatis and selected lightweight attack munitions provide different capabilities when added to the combat load. The brazier breach employs C4 explosive, detonation cord, and initiators for other uses. A few additional demolition items can expand the capability of the squad and enable countermobility.

If the engineer formation is mounted, leaders might ask a similar set of questions. In this case, it would be more likely that the engineer formation could add construction materials (concertina wire, barbed wire, pickets) to its basic load. This would increase its ability to conduct countermobility operations as it performed actions at short and long halts. Leaders could add HMMEs to mounted formations, as the equipment is capable of maintaining the tempo of the formation, further increasing hasty countermobility and survivability operations. However, enemy identification of these capabilities can trigger actions to destroy the HMEE. Similar ideas apply to blade and gap-crossing capabilities.

Forced-entry operations offer different challenges. When units conduct air assaults, leaders must invest special consideration, as not every countermobility asset fits neatly inside, or slung underneath, a helicopter. The same applies to airborne operations. Demolitions are smaller than construction materials and add to countermobility. Soldiers can easily carry shape charges, crater charges, and block explosives inside aircraft. Leaders must apply risk mitigation measures to initiators, as necessary, to keep the operation safe.

Conclusion

To maintain the necessary balance between training and knowledge of the three elements of combat engineering across the Engineer Regiment, we must account for, and plan to improve, our countermobility capability. When offensive operations halt, stall, or achieve their objective, units must defend the newly found gains. Whether hasty or deliberate, countermobility operations preserve combat power, protect critical assets, and allow offensive operations to continue.

Endnotes:

[1]Field Manual (FM) 3-34, *Engineer Operations*, 2 April 2014.

[2]*Large-Scale Combat Operations*, Army University Press, September 2018, <https://www.armyupress.army.mil/Special-Topics/Hot-Topics/LSCO/>, accessed on 5 November 2020.

[3]Training Circular (TC) 3-34.150, *Engineer Qualification Tables*, 24 September 2019.

[4]"Landmine Policy," Department of Defense, 31 January 2020, <https://www.defense.gov/Newsroom/Releases/Release/Article/2071692/landmine-policy/>, accessed on 29 December 2020.

[5]FM 3-0, *Operations*, 6 October 2017.

[6]Army Techniques Publication (ATP) 3-90.8, *Combined Arms Countermobility Operations*, 17 September 2014.

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

[8]*Blade teams* is the author's term for bulldozers, including the D5, D6, D7, armored combat earthmover, and deployable universal combat earthmover.

[9]Gregory M. Shepard, "Team Dig Versus Organic Task Organization: Observations From an OTC at the NTC," *Engineer*, January–April 2020, pp. 44–46.

Major Carvelli is the operations officer for the 326th Brigade Engineer Battalion, 1st Brigade Combat Team, 101st Airborne Division (Air Assault). 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.

Horizontal-Construction Engineers Supporting Maneuver

By Captain Nathan N. Swanson

Editor's note: *Appropriate social distancing protocols were followed, masks were removed for the purpose of the images in this article.*

After two rotations as an observer/coach-trainer (O/CT) augmentee and one as a horizontal-construction engineer platoon leader, I hope to give back to the U.S. Army Engineer Regiment by providing a valuable discussion on how to best employ horizontal-construction engineers to support maneuver. This article makes two points: It is a duty to maximize horizontal-construction engineer employment, and all leaders are responsible for doing so.

When my horizontal-construction platoon emplaced 700 meters of antitank ditch on a cold, wet, rainy/snowy, November evening at the Joint Multinational Readiness Center, Hohenfels, Germany, I couldn't help but smile and be proud; on the downside, that was the only planned horizontal-obstacle effort for the 72-hour defense. For the next 48 hours, the D7 bulldozers were not employed; instead, they sat idle behind the lines. Feedback from rotation to rotation indicates that this is a trend. Leaders underemploy horizontal-construction engineer assets. The maneuver commander, task force engineer, engineer commander, platoon leader, and noncommissioned officers are the leaders responsible for employing engineer assets to leverage maneuver commander positions.

A 700-meter antitank ditch, Hohenfels

The Joint Multinational Readiness Center is one of three Army central training centers. It serves as the training area for brigade size training exercises conducted by U.S. forces in conjunction with allies and partner nations. The first half of the exercise is normally focused on defense, followed by a focus on offense during the second half. On defense, horizontal-construction engineers support maneuver by shaping the terrain—emplacing antitank ditches, vehicle positions, and berms. On offense, horizontal-construction engineers improve rear areas by berming the brigade

support area. Joint Multinational Readiness Center statistics indicate a low percentage of "dig time" on both defense and offense. During the rotation in which I participated as a horizontal-construction platoon leader, we dug the aforementioned 700-meter antitank ditch in approximately 9 hours over the course of one night and then sat idle. Digging for 9 hours resulted in a dig rate of 12.5 percent based on the total amount of dig time available on defense (72 hours).

The maneuver commander wanted a 700-meter antitank ditch to be constructed without vehicle fighting positions. He was concerned that the bulldozers would give away the location of the antitank ditch if vehicle fighting positions were constructed. We satisfied the commander's requirement by completing the requested antitank ditch. At that point, the maneuver commander indirectly requested that we integrate with the combat engineers, laying wire and pounding pickets. I did not jump on the opportunity, knowing that we had four D7 bulldozers with which to provide support and that we were horizontal-construction engineers—not combat engineers.

Was it right for us to lay idle for the next 48 hours? Were those 48 hours wasted, considering that the mission was complete? If it had taken 72 hours to complete the antitank ditch, then would we have been considered successful since we would have had a 100 percent dig rate? We were capable of providing much more than 700 meters of antitank ditch in 72 hours; thus, we should have provided more. Army Doctrine Publication (ADP) 6-0, *Mission Command: Command and Control of Army Forces*, states, "Disciplined initiative refers to the duty individual subordinates have to exercise initiative within the constraints of the commander's intent to achieve the desired end state."[1] We had the duty of providing maximum horizontal-construction engineer support to enable a successful defense. In a perfect world, horizontal-construction engineer support would consist of the emplacement of one obstacle after another, according to the order of priority necessary to support the mission.

Who's fault was it that 48 hours of dig time were wasted? Was it the maneuver commander's fault? Was it the task force engineer's fault? As the platoon leader, was it my fault? Or was it the fault of the noncommissioned officers? Upon realizing how quickly we had completed the antitank ditch, the maneuver commander should have requested more from us. He could have asked for decoy vehicle fighting positions to give away a false location. The task force engineer should have realized that we could put in more effort and, thus, should have planned for more. As the platoon leader, I should have better communicated our capabilities to the maneuver commander during planning and more aggressively pursued dig work in the remaining

A D7RII bulldozer emplaces a vehicle protective position.

A D7RII bulldozer is transported with a light-equipment trailer at the Joint Multinational Readiness Center.

48 hours. The noncommissioned officers should have shared more of their experience and subject matter expertise to produce a better plan and aggressively pursued dig work during execution.

During my second rotation as an O/CT augmentee, a horizontal-construction platoon leader really took the initiative. He completed all of the assigned obstacle construction with more than 24 hours left to set up the defense. He made known his available dig assets and requested more obstacles for emplacement. Although his command notified him that there was no other requested dig effort, the platoon leader decided that his horizontal-construction platoon and its valuable assets would not sit idle for 24 hours. Instead, he had the platoon emplace an antitank ditch across the entire battalion area of operations engagement area. In the after action review, the maneuver commander stated that the obstacle had not been emplaced in the correct area, but did not deny its usefulness. A permanent-party O/CT indicated that he was the best platoon leader in the brigade because, in the absence of orders to meet the maneuver commander's intent, he had taken the initiative and put his blade assets to use, understanding the big-picture mission and desired end state. Did the platoon leader's actions constitute disciplined initiative, or did they represent gross disobedience to orders and command authority? Were the platoon leader's actions right (as stated by the O/CT) or wrong—or somewhere in the gray area between right and wrong? Paragraph 1-45, ADP 6-0, states, "The commander's intent . . . helps subordinate and supporting commanders act to achieve the commander's desired results without further orders . . .."[2] The platoon leader took disciplined initiative to meet the *commander's intent*; therefore, his actions were right.

It is a duty to maximize horizontal-construction engineer employment, and all leaders are responsible for doing so. Former Secretary of Defense James (Jim) Mattis states in his book entitled *Call Sign Chaos: Learning to Lead*, "You don't control your subordinate commander's every move; you clearly state your intent and unleash their initiative."[3] Furthermore, General Mark A. Milley argues that leaders should be empowered to take "disciplined disobedience to achieve a higher purpose."[4] To accomplish the duty of maximizing horizontal-construction engineer employment, superiors must enable initiative and subordinates must seize it.

Endnotes:

[1]ADP 6-0, *Mission Command and Control of Army Forces*, paragraph 1-59 p. 1-11, 31 July 2019.

[2]Ibid.

[3]Jim Mattis, *Call Sign Chaos: Learning to Lead*, Random House, 3 September 2019.

[4]Todd C. Lopez, "Future Warfare Requires 'Disciplined Disobedience,' Army Chief Says," 5 May 2017, <https://www.army.mil/article/187293/future_warfare_requires_disciplined_disobedience_army_chief_says>, accessed on 30 December 2020.

Captain Swanson is currently attending the Civil Affairs Qualification Course, Fort Bragg, North Carolina. He is a graduate of the U.S. Military Academy–West Point, New York.

Demolition of Mansfield Maintenance Bays

By First Lieutenant Anne M. Schreiner

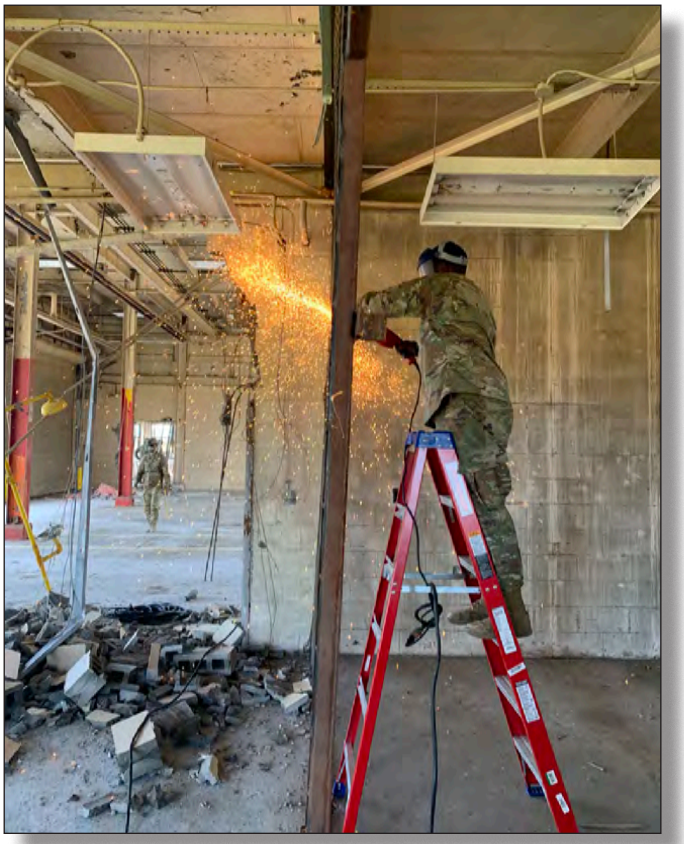
In the summer of 2020, the 502d Multirole Bridge Company (MRBC), 19th Engineer Battalion, Fort Knox, Kentucky, teamed up with the Fort Knox Department of Public Works (DPW) to demolish two maintenance bays. Both buildings had been erected in the early 1940s as part of the build-up to World War II, and both buildings were located in the 19th Engineer Battalion Mansfield Motor Pool. The buildings had been condemned for years, were filled with asbestos, and occupied approximately half an acre of valuable real estate in the motor pool.

3d Platoon, 502d MRBC, was assigned to oversee project execution. 3rd Platoon is a horizontal-construction platoon made up of 23 Soldiers; it possesses construction equipment ranging from a D7 bulldozer to a hydraulic, electric, pneumatic, petroleum-operated equipment kit. 3d Platoon's manpower and access to battalion equipment allowed the project to proceed with minimal assistance from outside contractors. The platoon augmented its organic capabilities with equipment from other companies, including dump trucks and a skid steer from the 42d Clearance Company, Fort Knox; a hydraulic excavator, BOMAG© roller, water distributer, and grader from the 15th Engineer Construction Company, Fort Knox; and BROCO® torches from the 541st Sapper Company, Fort Knox. Coordination with DPW and the Ginn Group, Fort Knox, provided the unit with straw wattles, silt fencing, power tools, a fork-lift, and a sky lift.

Predemolition photograph of one of the Mansfield maintenance bays

The planning phase started by identifying the safest approach for building removal. After consulting with DPW, the 19th Engineer Battalion survey and design team, and the 19th Engineer Battalion leadership, 3d Platoon concluded that the first step should be the implementation of its environmental plan. Next, the platoon would remove internal structures, followed by the walls. Finally, the bulldozer would be used to compromise strategically located I-beams in order to collapse the building on itself.

One of the stipulations of building removal involved separating metals from the rest of the debris so that the metal could be sent to the Fort Knox Recycling Center. During the initial walk-through of the site, Staff Sergeant Kyle Ferguson, platoon sergeant, 3d Platoon, and noncommissioned officer in charge of the project, pointed out that the majority of the internal pipes, electrical boxes, air ducts, and cages, could potentially become lost in the debris or difficult to remove once the buildings were down. In an attempt to recycle as much metal from the building as possible, 3d Platoon started the demolition process by removing internal items for recycling. Internal structures were removed using the hydraulic, electric, pneumatic, petroleum-operated equipment kit and a rented scissor lift. Soldiers used sledgehammers and crowbars to dismantle the dry wall and drop ceiling. Pipes, electrical boxes, doors, and windows were removed from each maintenance bay.



A Soldier removes an internal structure.

Demolition of a maintenance bay

With internal structures removed, 3d Platoon used the skid steer to knock down exterior concrete masonry walls. The walls easily came down, allowing for the quick removal of debris before moving on to the main structure.

Although the initial plan involved using the bulldozer to degrade the I-beams and to bring down the structure, unforeseen challenges were encountered. For example, the I-beams were surrounded by reinforced concrete bollards to prevent vehicles from damaging the structure while it was in use. The bollards quickly stopped the D7 bulldozer in its tracks. The strategy was then adjusted, and the bulldozer was used to tap and loosen the I-beams. Once complete, the hydraulic excavator was brought in and used to pull the overhead I-beams down. The platoon methodically worked from the east to west end of each building, pulling the main frame of each bay over in less than a day. This change allowed Soldiers from 15th Engineer Construction Company to spray sections of the crumpling building with the water distributor (a previously unused technique) while the hydraulic excavator brought the building down, immediately forcing airborne debris to the ground.

Debris was separated into piles of recyclable materials and waste. Recyclable materials were transported to the post recycling center. A total of 206,880 pounds of metal was turned in at the recycling center, earning the Army $11,275. Waste was removed using dump trucks and light-equipment transporters with M870 trailers and was transported to the landfill. Waste included concrete, rock, gypsum tiles, vegetation, and soil. The vegetation that was removed from the job site was replaced with gravel, creating an improved area for the 502d fleet.

Excavator demolition on a maintenance bay

At the beginning of the project, 3d Platoon had no experience with demolition of buildings this size. The platoon began with the eastern building, where the removal of internal structures took 4 days. Upon gaining experience and confidence with the equipment, the Soldiers completely removed the internal structures from the western building in just 2 days. After breaking through the initial learning curve with the first building, the same task for the second building was executed in half the time. This increase in efficiency became a theme throughout the project. A final analysis of the equipment, materials, and labor used to complete the project indicated that the Army saved a total of $384,000 by contracting this project to the 19th Engineer Battalion.

Site cleanup

3d Platoon, led by First Lieutenant Anne M. Schreiner and Staff Sergeant Kyle Ferguson, undertook a similar but larger project for the U.S. Army Cadet Command at Potts Motor Pool Fort Knox, in August 2020. That task included demolishing three larger maintenance bays with the help of 4th Platoon, 42d Clearance Company, led by First Lieutenant Shane M. Marit and Sergeant Jeremy D. Meccariello. The platoons successfully demolished the maintenance bays, which stood adjacent to three additional maintenance bays undergoing renovation by civilian contractors. 3d Platoon, 502d MRBC, eagerly incorporated the lessons learned from the Mansfield demolition project, improving efficiency and procedures for the Potts Motor Pool project and saving the Army approximately $303,908. Freeing up the extra space significantly expanded the motor pool, creating additional room for the 502d MRBC and the Cadet Command.

First Lieutenant Schreiner is a platoon leader for the 502d MRBC. She holds a bachelor's degree in engineering management from the U.S. Military Academy–West Point, New York.

ENGINEER WRITER'S GUIDE

Engineer is a professional-development bulletin designed to provide a forum for exchanging information and ideas within the Army engineer community. We include articles by and about officers, enlisted Soldiers, warrant officers, Department of the Army civilian employees, and others. Writers may discuss training, current operations and exercises, doctrine, equipment, history, personal viewpoints, or other areas of general interest to engineers. Articles may share good ideas and lessons learned or explore better ways of doing things.

Articles should be concise, straightforward, and in the active voice. If they contain attributable information or quotations not referenced in the text, provide appropriate endnotes. Text length should not exceed 2,000 words (about eight double-spaced pages). Shorter after action type articles and reviews of books on engineer topics are also welcome.

Include photos (with captions) and/or line diagrams that illustrate information in the article. Please do not include illustrations or photos in the text; instead, send each of them as a separate file. Do not embed photos in Microsoft PowerPoint or Word. Save digital images at a resolution no lower than 200 dpi. Images copied from a website must be accompanied by copyright permission. Please see the photo guide <https://home.army.mil/wood/index.php/download_file/view/5278/676> for more information.

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

Articles submitted to *Engineer must* be accompanied by a security release by the author's unit or activity security manager prior to publication; the security release *cannot* be signed by the author. All information contained in the article must be unclassified, nonsensitive, and releasable to the public. *Engineer* is distributed to military units worldwide. As such, it is readily accessible to nongovernment or foreign individuals and organizations.

We cannot guarantee that we will publish all submitted articles, photographs, or illustrations. They are accepted for publication only after thorough review. If we plan to use your article in an upcoming issue, we will notify you. Therefore, it is important to keep us informed of changes in your e-mail address and telephone number. All articles accepted for publication are subject to grammatical and structural changes as well as editing for style.

Engineer is published once a year; in March, the article deadline is 15 December. Send submissions by e-mail to <usarmy.leonardwood.mscoe.mbx.engpb@mail.mil> or on a CD in Microsoft Word, along with a double-spaced copy of the manuscript, to: Managing Editor, Engineer Professional Bulletin, 14010 MSCoE Loop, Building 3201, Suite 2661, Fort Leonard Wood, Missouri 65473-8702.

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

ENGINEER'S CREED

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

I pledge

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

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

PIN: 206935-000