A joint publication for U.S. Artillery professionals

November–December 2017

Fires

BATTLE READY

THE FIGHT BEGINS BEFORE SOLDIERS AND MARINES EVER ROLL ON TO THE BATTLEFIELD

Table of contents

Fires

Editor
Marie Berberea
Art Director
Rick Paape, Jr.
Assistant Editor
Monica Wood

The Fires staff can be reached by email at usarmy.sill.fcoe.mbx.fires-bulletin-mailbox@mail.mil or by phone at (580) 442-5121.

Disclaimer

Purpose

Originally founded as the Field Artillery Journal, Fires serves as a forum for the discussions of all Fires professionals, Active, Reserves and National Guard; disseminates professional knowledge about progress, development and best use in campaigns; cultivates a common understanding of the power, limitations and application of joint Fires, both lethal and nonlethal; fosters joint Fires interdependency among the armed services; and promotes the understanding of and interoperability between the branches, all of which contribute to the good of the Army, joint and combined forces and our nation.

On the cover:

Marines with Battery B, 1st Battalion, 10th Marine Regiment, fire the M777 towed 155 mm howitzer during the assault support tactics 1 exercise in support of Weapons and Tactics Instructors course 2-17 at Fire Base Burt, Calif., April 17. (Lance Cpl. Clare Shaffer/U.S. Marine Corps)

Fires

THE JOINT PUBLICATION FOR U.S. ARTILLERY PROFESSIONALS

You don't have to be an expert writer.

You are an expert in your field.

Share your knowledge with the Fires community.

READ. WRITE. BE RELEVANT.

http://sill-www.army.mil/firesbulletin

Fires Knowledge Network

A world of knowledge at your fingertips

https://www.us.army.mil/suite/page/130700

Brig. Gen. Randall McIntire
U.S. Army Air Defense Artillery School commandant

The return of Army short-range air defense in a changing environment

The continuing Russo-Ukrainian conflict has seen a transformation of the Russian military and the need for short range air defense with our maneuver forces. Included in the overall Russian transformation, per the Russian New Generation Warfare Handbook, is the blending of unmanned aircraft systems (UASs), electronic warfare jamming equipment, and long-range rocket artillery. The synchronization of effects of these elements has produced devastating consequences to Ukrainian forces. In addition, it was noted that the integration of self-propelled air defense systems and man-portable air defense systems in maneuver forces "shot the Ukrainian air force out of the sky."

Short-range air defense artillery units were historically embedded in Army divisions, providing them with an organic capability to protect their critical assets against fixed-wing and rotary-wing aircraft. However, in the early 2000s, these ADA units were divested from the Army to meet force demands deemed more critical at that time. Decision-makers accepted the risk that threat aircraft might have on maneuver forces and other critical assets because we believed the Air Force could maintain air superiority. Thus, the short-range ADA force post-2005 was reduced to two battalions of active component Avenger and counter-rocket, artillery and mortar batteries and seven National Guard Avenger battalions; none of which are organic divisional elements. Defense against air threats in maneuver forces is currently limited to that provided by organic weapons and maneuver personnel.

The last few years has seen an influx of threat capabilities in air and missile platforms globally with corresponding threats to the maneuver forces. The development, fielding, and use of UASs has also increased exponentially. UASs, as noted in lessons learned, have become increasingly common and important to operations by both sides in the Russo-Ukrainian conflict. Low, slow and small UASs, in particular, present considerable threats to maneuver forces and are difficult to detect and defend against by maneuver units. These UASs are consistently enhanced with surveillance, targeting and attack capabilities. Surveillance-capable UASs are commercially available throughout the world and can be modified with explosive devices to create lethal attack platforms.

While UASs are more common on the battlefield, attack helicopters continue to constitute the greatest single threat to maneuver forces. Some potential threat nations are growing their manned aerial fleets in both quantity and quality. Improved fire control and weapons capabilities enable them to fire from longer standoff ranges. More capable fixed-wing aircraft and cruise missiles are also being proliferated worldwide. New aircraft versions feature such enhancements as on-board jammers and lower radar cross sections. More capable cruise missiles are being developed and fielded in larger quantities. These cruise missiles feature longer ranges, lower altitude flight paths and increased accuracy. Each of these aerial platforms, by itself, presents a formidable threat to the maneuver force. Future threat tactics will likely see a synchronized mix of platforms in complex and massed attacks, particularly against the less mobile fixed and semi-fixed assets of maneuver forces.

The divestment of divisional ADA, continuing asymmetric threats, and the re-emergence of peer and near-peer adversaries have left our maneuver forces and key assets vulnerable to enemy air surveillance, targeting and attack from aerial platforms. Additionally, enemy indirect Fires threaten our ability to protect and sustain the force,

Soldiers from the 52nd Air Defense Artillery Regiment practice target engagement with a Stinger Missile weapon system, an element of short-range missile defense. (Staff Sgt. Kathleen Polanco/U.S. Army)

leading to potentially higher friendly attrition, loss of initiative and reduced freedom of action. Consequently, we'll struggle to get to the "close fight" with the current Fires portfolio.

To reduce the risk of the low-flying air threats, the Army is reinvigorating short-range air defense (SHORAD) by expanding the number of ADA short-range systems and growing ADA formations within the divisions. In the meantime, the Army is also exploring an option to temporarily introduce combat arms Stinger teams that are organic to the maneuver force.

SHORAD's role

SHORAD is defined as dedicated air defense artillery and non-dedicated air defense capabilities which enable movement and maneuver by destroying, neutralizing or deterring low altitude air threats to defend critical fixed and semi-fixed assets and maneuvering forces. Within this context and for the purpose of clarification, "non-dedicated" denotes organic active and passive measures collectively known as "combined arms for air defense." Fixed and semi-fixed assets denote permanent facilities and structures (e.g., air bases) and transient facilities and structures (e.g., assembly areas), respectively. Also, note "maneuvering" vice "maneuver" force; SHORAD capabilities are being designed to protect the maneuver force on the move, not just when it or its assets are stationary.

SHORAD vision

The SHORAD vision embraces three complementary, concerted Army efforts that address defense of the maneuver force, fixed and semi-fixed assets, and combined arms for air defense. These efforts encompass what we can do now, and where we want to be in the future. Our goal over the next few years is to develop and field capabilities across all three efforts that will mitigate the current vulnerability to our maneuver formations.

The first effort, defense of the maneuver force, is entitled M-SHORAD – Maneuver SHORAD. Today's divisional formations have no organic SHORAD capability and only a limited ability to detect aircraft in the air (two Sentinel radars in the division artillery). Without such capabilities, maneuver formations are exposed to potentially continuous surveillance by threat UASs and subsequent devastating attacks by fixed-wing and rotary-wing aircraft and artillery.

The objective M-SHORAD capability focuses on mobility and survivability compatible with the supported force. Ongoing SHORAD initiatives to lower operational risks and protect maneuver forces include training maneuver Soldiers as combat arms Stinger teams, improving the Stinger missile capability, and identifying a potential interim materiel solutions to protect the maneuver force until an objective M-SHORAD capability can be fielded.

- Initial training of 62 combat arms Stinger teams was started with European Command in July 2017. Training will continue with three follow-on courses for Forces Command units at Fort Sill, Okla., beginning in October 2017. Training and Doctrine Command will assess the initial teams in various training environments through 2018 to make a recommendation to the Army leadership on continuing this effort for some 600 additional teams (one per maneuver company).
- The Army acquisition community conducted an M-SHORAD demonstration with industry partners in September 2017 to evaluate interim M-SHORAD platforms that can mitigate current threats to maneuver forces until we are able to develop the objective M-SHORAD capability (one battalion per division).
- A proximity fuse enhancement for the Stinger missile is being developed. The proximity fuse will facilitate the effective

engagements of the low, slow and small UASs and increase capabilities against fixed-wing and rotary-wing threats.

- The objective M-SHORAD concept of operations has been developed and the Initial Capabilities Document, which defines the new capability requirements to associated capability gaps, was approved by the Army Requirements Oversight Council in June 2017.

In addition, conceptual underpinnings for the next generation of man-portable air defense are being drafted. This capability is essential when conducting future operations in urban and mega-city environments.

The second effort addresses the Army's fixed and semi-fixed assets. Current ADA systems, Avenger with Stinger missiles and the Phalanx gun system in counter-rocket, artillery and mortar units, will be replaced by the Indirect Fire Protection Capability (IFPC). The IFPC will provide enhanced firepower protection to critical, more stationary fixed and semi-fixed assets. Block 1 of the program is nearing a Milestone B decision and will soon transition to the engineering and manufacturing development phase of the acquisition process. Block 1 will provide the capability to defeat advanced UAS and cruise missiles threats, as well as fixed-wing and rotary-wing aircraft. It is projected to be initially fielded in early 2020. Block 2 is envisioned to add an enhanced protection capability (either an advanced missile or directed energy) against rockets, artillery and mortar projectiles in flight. In addition, the Sentinel radar is being upgraded with advanced antenna technology to increase its range and detection capability. This new variant, Sentinel A4, will also provide advanced electronic protection that is essential to survival on the modern battlefield.

M-SHORAD and the IFPC are complementary systems that provide a tiered defense of critical assets. The IFPC's strength lies in its capacity (magazine depth) for an engagement in defense of fixed and semi-fixed assets. Fixed and semi-fixed assets are at greater risk due to massed Fires and their more stationary (less mobile) natures. M-SHORAD trades capacity for mobility to maintain pace with supported maneuver forces who are less vulnerable to massed Fires and complex attacks due to their mobility.

The Army recognizes the need for more SHORAD formations. While complementary, M-SHORAD and the IFPC are not interchangeable without a significant loss in warfighting capability in each. These future ADA units must be designed with a mix of M-SHORAD and IFPC so they have the ability to protect the maneuver force and critical Army fixed and semi-fixed assets. This mix of capabilities will enable the use of air defense principles — mass, mix, mobility and integration.

Brig. Gen. Randall McIntire, the air defense artillery commandant, and Command Sgt. Maj. Finis Dodson visit students in the Maneuver-Stinger course. Instructors from the Air Defense Artillery Center and School at Fort Sill, Okla., teach maneuver Soldiers how to conduct short-range air defense operations at the 7th Army Training Command's Grafenwoehr Training Area, Gemany, from July 31 to Sept. 1, 2017. (Photo courtesy of 7th Army Training Command)

The third effort focuses on the combined arms contributions to air defense. This consists of actions taken by a unit's organic weapons and passive actions to reduce the potential effects of an aerial attack. These actions are secondary missions and are generally considered to be complementary to the protection provided by dedicated ADA formations. However, in many situations combined arms for air defense are the only air defense capabilities available to maneuver formations as ADA resources have always been insufficient to protect all of the force components. Even with anticipated growth, the ADA force will not have the number of units and systems to provide the required defenses throughout the force. Thus, it is incumbent upon units of all the warfighting functions to incorporate defense against

Seventh Army Training Command Soldiers participate in the Maneuver-Stinger course by practicing target engagement with a Stinger Missile weapon system at the Grafenwoehr Training Area, Germany, from July 31 to Sept. 1, 2017. (Photo courtesy of 7th Army Training Command)

aerial threats into their training programs. The Army Techniques Publication (ATP) 3-01.8, "Techniques for Combined Arms for Air Defense," provides some guidance for planning and training on how to defend against aerial threats. In addition to the ATP and training of Soldiers in maneuver companies as combat arms Stinger teams, "other initiatives underway look to repurpose existing equipment in the force and formulate non-kinetic effects to negate or kill the air threats." The aviation community is outfitting select Apache helicopters with L7A Hellfire missiles capable of air-to-air engagements of enemy helicopters and some tactical UASs. Several existing Army-ground electronic warfare programs have been repurposed to provide air defense defeat capability against small hand-launched UASs. The Cyber Center of Excellence is aggressively pursuing their Multi-Functional Electronic Warfare requirements documents. The Fires community has tested and deployed a repurposed variant of the Q-50, the lightweight counter-fire target acquisition radar in the brigade combat teams' Fires battalions, capable of detecting and tracking small UASs. Development of an air surveillance capability for the Q-53 counter-fire target acquisition radar is currently ongoing.

The ADA community, in concert with other TRADOC centers of excellence and the Army staff, is focused on quickly returning short-range air defense to enable freedom of movement and maneuver along the three efforts outlined in this paper. The future SHORAD force must be designed with the appropriate mix of M-SHORAD, IFPC and man-portable capabilities. Our adversaries will use complex integrated attacks; we will counter with a layered approach.

This is the first of a series of articles on SHORAD. Subsequent articles will address dedicated ADA and combat arms Stinger team forces and capabilities, aerial intelligence preparation of the battlefield and planning for air-ground integration, SHORAD mission command, and air and missile defense operations in maneuver formations.

"First to Fire!"

Brig. Gen. Randall McIntire is the 41st U.S. Army Air Defense Artillery School commandant and air defense artillery chief.

Howitzer technology

Changing the culture of field artillery

By Lt. Col. Daniel Blackmon, Maj. Bryan Fanning and Sgt. 1st Class Christopher Kimble

The young lieutenant stared anxiously at the field grade officer standing inside the fire direction center. "Is it safe to shoot, sir?" asked the lieutenant. "You tell me," replied the major.

This line of questioning and answering took place at firing points across the Pohakuloa Training Area on the "Big Island" of Hawaii in August 2016. Over the course of two weeks, 2nd Battalion, 11th Field Artillery Regiment prepared for, and finished, a Table XVIII battalion qualification. The battalion and its batteries struggled to employ howitzers fitted with new computers and software. Frustrated due to Soldiers' lack of faith in their training and equipment, the battalion commander removed all safety Ts from the fire direction centers and howitzers and directed that only field-grade officers supervising the fire direction centers hold the safety T; a significant break from field artillery doctrine. This emphasized that the battalion's troops were indeed trained and ready and had cutting-edge equipment to safely accomplish the mission.

The challenges experienced by the *On Time Battalion's* Table XVIII qualification stemmed from inexperience with new equipment, coupled with training under current doctrine. Soldiers of 2-11th FAR received updated software packages for the digital fire control system on their howitzers in April 2016. Prior to the new software, howitzer platoons updated their location from the center of the firing unit and computed muzzle velocity variations only after training. The new software allowed for continuous updates to each howitzer's individual location and instant calculations to the variations in muzzle velocity.

With technology changing the way Soldiers complete tasks, field artillery doctrine needs to also change. Particularly, computing post-occupation safety in the fire direction centers should be eliminated; the dispersal of towed artillery systems (if permitted) in the operational environment should be encouraged; and the ability of the commander to maintain maximum feasible centralized control should be emphasized.

Upgrades to the M777A2 and M119A3's digital fire control systems eliminate the need to conduct post-occupation safety during training. The long-taught Training Circular (TC) 3-09.81 (formerly known as Field Manual 6-40) requires the fire direction officer to conduct manual safety before occupying a firing point identified by a six or eight digit grid on a range card.[1] After the unit arrives to the firing point, the fire direction officer (FDO) updates the safety with a more accurate center location. FDOs transmit safety to the howitzers through a safety T with fixed left, right, minimum and maximum limits, based off the center grid to the firing unit. Similarly, TC 3-09.8 tests Soldiers in the fire direction center (FDC) on their ability to compute safety using the handheld fire direction computer, the Centaurs[2]. These two doctrinal requirements present a dilemma.

As mentioned, the modern software allows continuous updates to the howitzer's location with each howitzer producing its own individual technical firing solution for fire missions.[3] The fixed safety computational requirements do not and

1 US Army, Training Circular No. 3-09.81: Field Artillery Manual Cannon Gunnery (Washington, DC: Government Printing Office, 2016), 15-6.

2 Ibid., 6-9.

3 US Army, Army Training Publication 3-09.23: The Field Artillery Cannon Battalion (Washington, DC: Government Printing Office, 2015), 5.5.

cannot account for the subsequent movements of howitzers after arriving to a firing point, much less the precise location and ballistic information provided to the FDC by each howitzer. This becomes more problematic as individual howitzers move around the firing point or position area. If a howitzer moves far enough from the center grid of the firing point, the technical firing solution will likely appear unsafe to fire based off safety computations from the previous position. To meet the doctrinal training requirements, the FDO has to recalculate safety each time the center of the firing position changes. Even more frustrating for the FDC, is a howitzer battery firing into a small impact area. The smaller impact area means narrower limits in the safety T. When the FDC attempts to verify correct safety computations with the howitzer crews through a dry-fire mission, the howitzers positioned farthest from the azimuth of fire will likely present unsafe firing data, again, because of the precise computations provided by each howitzer. The frustration experienced by the FDC does not compare to possibilities in lost training time.

Crews can struggle, as shown during 2-11th FAR's Table XVIII qualification, to meet doctrinal requirements that do not pair with the current technology of the force thereby losing critical training time. Rather than continue computing post occupation safety, updated doctrine should reflect the need to use the modern systems to their full advantages and distribute digital safety Ts. The FDC sends digital geometries from their Advanced Field Artillery Tactical Data System to each howitzer section. As a secondary check, the FDC receives an alert message from the howitzer's computer if the geometries did not download properly. The FDC and howitzer sections conduct dry-fire verification based on the applied geometries as a tertiary check. This method returns training time and allows firing units to focus on movement tables, a skill greatly atrophied over the last 15 years. Two challenges arrive with this recommendation. First, although unwitnessed in 2-11th FAR's firing of thousands of rounds, errors in any one of the howitzer sections' computers could lead to unsafe shooting. Secondly, the greatest challenge lies in local range and training regulations requiring physical safety Ts on each gun and in the FDC. While the modern technology has proven to be safe, old requirements die hard.

Next, current field artillery doctrine falls short when acknowledging the modern software capabilities allowing towed howitzer sections greater dispersion. The doctrine encourages traditional formations and positioning howitzers in a smaller area.[4] Field artillery doctrine does acknowledge decentralized movement techniques based off modern howitzer capabilities, but seems to discourage these techniques by listing many disadvantages.[5] Dispersion and decentralized movements are not new to the M109 self-propelled howitzer community. The Paladin's superior mobility and existing digital computer capabilities should lend itself to adaptions in doctrine that are applicable to the towed M777 and M119 systems.

The lack of digital systems on the M119A2 forced batteries to shoot like, or similar data for all guns in a position area to achieve specific effects. The alternative was lengthy radio transmissions of passing individual technical firing data from the FDC to each gun. Howitzers fired similar data using terrain gun positioning corrections (TGPCs). TGPCs allowed howitzers in close proximity to fire a converged sheaf or achieve specific effects.[6] And like manual safety, the FDC must compute TGPCs after its firing unit occupies a new location.[7] These requirements forced howitzers to operate in close-knit formations. With the upgrades to the M119A3 and M777A2, gun positioning is essentially limited to the communications capabilities of a firing unit. As long as a howitzer section is able to maintain digital communication with the FDC, the Soldiers are able to compute firing data based on individual location. Viewed as a whole, the platoon or battery provides the commander with converged sheafs and required effects. The dispersion of modern howitzers also increases survivability.

The Russo-Ukrainian War has shown that dispersal of forces is necessary to avoid mass artillery barrages. Consequently, the U.S. Army Chief of Staff, Gen. Mark A. Milley stressed units must move constantly because if "you can be seen, you will be hit, and you will be hit fast."[8] Cannon battery doctrine highlights enemy indirect fire as the greatest threat to the field artillery and recommends dispersion.[9] The doctrine also lists armored forces, air attack and dismounted attacks as other threats to field artillery.[10] Towed artillery systems stand little chance against an armored or dismounted force given their lack of mobility and organic direct fire assets.

During 2-11th FAR's Joint Readiness Training Center rotation, small enemy elements destroyed numerous howitzers. These formations were typically hardened and concealed, but in a close perimeter. The dispersion of units may result

Cannon battery doctrine highlights enemy indirect fire as the greatest threat to the field artillery.

4 US Army, Army Training Publication 3-09.50: The Field Artillery Cannon Battery (Washington, DC: Government Printing Office, 2016), 3-7.

5 Ibid., 2-3.

6 TC 3-09.81, 12-16.

7 Ibid.

8 C. Todd Lopez, "Milley: Army on cusp of profound, fundamental change," USArmy.mil, October 6, 2016, https://www.army.mil/article/176231/milley_army_on_cusp_of_profound_fundamental_change.

9 ATP 3-09.50, 5-8.

10 Ibid.

in the loss of individual sections rather than platoons. The risk with dispersion is that platoon or battery direct-fire weapon systems are less effective outside of a close perimeter, leaving sections to defend themselves. The battery commander must weigh the threat to their force and choose appropriate defensive techniques.

Lastly, field artillery doctrine should emphasize the modern howitzer's capability to enable the commander to retain maximum feasible centralized control. Artillery battalion doctrine distinguishes between maximum and decentralized control. Doctrine defines maximum control as the battalion FDC fighting its batteries while decentralized control stresses platoon-based operations.[11] With the upgraded software, particularly in the M119A3, battalion commanders can now maintain maximum control of firing platoons. The automation at the howitzers caused the FDC to assume a broader role of performing tactical fire control and managing movement, with technical fire control as a secondary task.[12] Thus, the battalion FDC possesses the capability of sending tactical firing data directly to a platoon of howitzers.

Artillery doctrine correctly states that fewer firing units available characterize maximum centralized control.[13] With one artillery battalion supporting a brigade combat team and artillery brigades serving each U.S. Army corps, targets and requirements will likely outpace available assets. Maximum centralized control of a battalion's howitzers, therefore, becomes necessary in most instances. The battery-centric model of centralized control is necessary when a maneuver commander must mass its firepower at a particular decisive point or high value target. The platoon-centric model of centralized control arises when a maneuver unit identifies numerous critical artillery tasks, such as counterfire, suppression of enemy air defense, and emplacing minefields. The modern digital systems allow the FA battalion commander to now mass the effects of their battalion at any time. The greatest challenge with maintaining maximum control of platoons includes managing the movement of platoons and ensuring they are in positions to mass effects at critical times in battle. The requirement to maintain dispersion and avoid remaining stationary for too long compounds this challenge. The benefits, given a permissive operating environment, outweigh the risk.

Soldiers from 2nd Battalion, 11th Field Artillery Regiment, 2nd Brigade Combat Team, 25th Infantry Division, prepare an M777 howitzer for defense during a battle-period exercise during a field training exercise at the National Training Center, Fort Irwin, Calif. (Spc. Jacolby Young/NTC Operations Group)

The Soldiers of 2-11th FAR demonstrated the unique capabilities of upgraded computers and software on the M119A3 and M777A2 during a demanding training cycle in 2016, culminating in a JRTC rotation in February 2017. The modern systems call for the elimination of computing post-occupation safety during training, encouraging the dispersal of towed artillery systems and emphasizing the ability of the commander to maintain maximum feasible centralized control. The adoption of these recommendations serves to enhance home station training, though roadblocks exist with agencies managing ranges and training areas.

Soldier safety is always, and should be, the entry argument for these discussions. Education on systems and their capabilities, as the Soldiers of 2-11th FAR saw during their train-up, becomes critical. After our peers and supporting agencies understand the capabilities of the new systems, the training opportunities are endless. Ultimately, better training leads to a more lethal field artillery force capable of enabling maneuver forces to close with and kill the enemy.

Lt. Col. Daniel Blackmon is the 2nd Battalion, 11th Field Artillery commander at Schofield Barracks, Hawaii.

Maj. Bryan Fanning is the 2nd Battalion, 11th Field Artillery executive officer.

Sgt. 1st Class Christopher Kimble is the 2nd Battalion, 11th Field Artillery battalion master gunner.

11 ATP 3-09.23, 5-3.

12 ATP 3-09.50, 2-4.

13 ATP 3-09.23, 5-3.

Soldiers in the Maneuver-Stinger course receive engagement reports before employing the Stinger Missile weapon system. Instructors from the Air Defense Artillery Center and School at Fort Sill, Okla., teach maneuver Soldiers how to conduct short-range air defense operations at the 7th Army Training Command's Grafenwoehr Training Area, Germany. (Staff Sgt. Kathleen Polanco/U.S. Army)

Positioning air defense for re-introduction of M-SHORAD

By Maj. Trey Guy

There is not enough air defense to go around for what our senior leaders would like to do within the current, let alone future operating environment. That is continually highlighted with the strategic deployment of Patriot assets to the Central Command area of responsibility; counter rocket, artillery and mortar (C-RAM) deployments to Iraq and Afghanistan; new and emerging deployments throughout Pacific Command, and a multitude of other requests. As divisions and corps refocus on tactical warfighting, one of the requests that have come up more frequently is for short-range air defense (SHORAD) units/leaders to support exercises as the potential adversary reverts back to a near-peer air threat. While the air defense artillery branch, Fires Center of Excellence leaders, and others around the force initiate action to shape the future, I believe there is a plan that we can execute now to forge a stronger relationship with maneuver commanders both in the present and in the future.

Within the U.K. framework, the corps headquarters has a formation air defense cell (FADC), which is similar to what we have at the corps level in the corps air defense element (CADE). Both of these elements should provide the subject matter expertise to the corps commander and likewise divisional elements should do the same for their formations. The issue with the re-introduction of Maneuver-SHORAD to ADA after 15-plus years of "mothballing" capability in both systems and personnel, is that we cannot just regenerate it at the drop of a hat.

As a branch we are further along on the re-growth of the personnel capability, but managing the expectations of senior maneuver commanders is an important part of this long-term solution. In order to do this we must be willing to man division air defense airspace management (ADAM) cells and CADEs in the U.S. Army, FADCs in the U.K., and similar cells within NATO. Once these cells are sufficiently manned, the next step is to give them the training and tools to apply the division or corps commander's intent and

Soldiers in the Maneuver-Stinger course practice target engagement with a Stinger Missile weapon system. Instructors from the Air Defense Artillery Center and School at Fort Sill, Okla., teach maneuver Soldiers how to conduct short-range air defense operations at the 7th Army Training Command's Grafenwoehr Training Area, Germany. (Staff Sgt. Kathleen Polanco/U.S. Army)

assist subordinate formations. The training aspect of this, as discussed in an article featured on the Weekly Interceptor, is on track with programs like the Re-Redding Week prior to Command and General Staff College.

The shortfall is the manning of these cells, or personnel capacity, in both exercises and day-to-day fills. As a recent personal example, a field artillery colleague asked for any air defense information I could give him as he would be filling in leading division ADAM cell while also being the division deputy fire support coordinator. This was due to the division ADAM cell being manned under 50 percent, with no officer or senior non-commissioned officer. I know this is getting sorted out as we move forward, but this example highlights the potential inroads we can make: if we put the right leaders in division ADAM cells, then M-SHORAD starts to come back on line. With the overall shortages and high operation tempo for ADA there are many potential answers and all of them are likely not optimal. The branch will have to decide whether these positions are prioritized over others, or should be filled with someone of less experience (i.e., a key developmental assigned major filling in for a lieutenant colonel position at division or corps). Another possible solution includes additional personnel authorizations in order to fill the mandatory requisitions.

The system capability gap is one, as a combined and allied force, that will take longer to close. The current appetite for budgetary growth to increase capability within any of our allies is less than appealing, even though it is acknowledged there is a significant capability gap to protect the force from a near-peer threat. We should not present a one-size-fits-all solution for the U.S. and our allies. We should use allies and partners to fight smarter going forward with the creation of combined and integrated air and missile defense task forces. U.S. Army Europe and 10th Army Air and Missile Defense Command, among others, have laid the groundwork for such a task with exercises such as Tobruq Legacy 17. The exercise involved staffs and units from several NATO countries, along with CONUS-based air defense personnel and many others. Leveraging this type of training to forge partnerships will allow the wider air defense force to be more interoperable and therefore fight and train smarter. If we achieve this, it will aid the alliance in modern defense, and it will allow us all to focus on removing weaknesses while not lessening one of our potential adversary's strengths.

In summary, ADA and NATO allies are on the right path to reintroducing M-SHORAD into the operational environment. The steps we are making as nations, formations and individuals can and should be collated into a defined plan of action so we are focused on re-growing not only the personnel capability, but also the system capability.

Maj. Trey Guy is a member of the Air and Missile Defense Plans Headquarters Allied Rapid Reaction Corps – U.K.

Operation Tobruq Legacy 17 showcases capabilities range

By 1st Lt. Josef Danczuk

Sgt. 1st Class Kenneth Harrison, the A Battery, 5th Battalion, 7th Air Defense Artillery Regmianet, launcher platoon sergeant, briefs Romanian President Klaus Iohannis while visiting A Battery's tactical site. (Staff Sgt. Mark Kauffman/U.S. Army)

Soldiers of A Battery, 5th Battalion, 7th Air Defense Artillery Regiment, marched to Mihail Kogalniceanu Airbase in Romania, June 23. The road march spanned five NATO nations over 2,300 kilometers, and culminated with participation in Operation Tobruq Legacy 17. The unit deployed the Patriot Air and Missile Defense system, which includes Patriot Configuration III radar and Enhanced Launcher Electronic System launching stations. Despite the length of the journey to Romania and the potential difficulty of traveling through multiple nations by night, the battery flawlessly deployed the Patriot system to Mikhail Kogalniceanu Airbase.

This validated the battery's ability to rapidly deploy a historically long distance through Eastern Europe.

"I think the road march was a success," said Spec. Arthur Gould, an Enhanced Patriot launching station operator/maintainer from Fall River, Mass. "The Soldiers' motivation made the movement go very smoothly from start to finish. It's important because, for air defense, we need to be able to shoot, move and communicate. A movement like this proves we can do the move portion successfully."

Once at MK Airbase, A Battery immediately began preparations for Tobruq Legacy 17. This annual multinational NATO exercise combines numerous unique surface-based air defense systems from different nations into one combined air picture and one engagement kill-chain. It allows the participant nations to exercise their ability to work together with their NATO allies and partners. Cooperation occurs both on the technical side, by establishing data and voice communications links, and also the tactical side, by conducting air defense engagements and reporting.

A Battery provided a live-air picture from their radar that was passed digitally through a variety of tactical data information links all the way to the Joint Force Air Component commander (JFACC). The JFACC was able to integrate air pictures from three surface-based air defense operations centers (SBADOCs) located in Romania, Czech Republic and Lithuania. By efficiently establishing and maintaining

Romanian President Klaus Iohannis walks through A Battery's tactical site during a visit at Mihail Kogalniceanu Airbase. (Staff Sgt. Mark Kauffman/U.S. Army)

this data link, higher echelons had the tactical information they needed to command the combined air defense operations of multiple nations, stretching from the Baltic Sea in Lithuania to the Black Sea in Romania.

Sgt. Justin Foust, an early warning team leader from Eaton, Ohio, said interoperability exercises are extremely important for combined air defense operations.

"It was a great opportunity to see the direct impact that my role has on the battlefield, as well as having the chance to integrate air defense operations with our NATO allies." Foust said it was an excellent training event for new Soldiers who have never worked in a multinational environment before, as they gained valuable insight.

Such a large and important multinational air defense exercise was bound to attract the attention of distinguished visitors, and A Battery was excited to host these visitors and share information about the Patriot system with them. July 14, the president of Romania, President Klaus Iohannis, and the general of the Czech Army and chairman of the NATO committee, Gen. Petr Pavel, toured A Battery's tactical site. Soldiers from the battery provided information on how the Patriot system operates, including the capabilities of its radar, voice and data communications and engagement operations.

"It was a momentous occasion," said Cadet John Christian, an ROTC cadet from the University of South Florida. Christian was embedded with A Battery throughout the exercise, granting him the opportunity to learn how a tactical unit operates as he prepares to commission as a second lieutenant this December. "It was definitely the highlight of my time here and of my entire ROTC experience," he shared.

Overall, A Battery succeeded in all areas of Tobruq Legacy 17, demonstrating their commitment to maintaining a free, whole and at-peace Europe. The Soldiers rapidly deployed to a tactical site at Mihail Kogalniceanu Airbase in Romania, proving they can move anywhere on the European continent to provide air and missile defense to any asset. There, the battery conducted live-air defense operations, established information links to connect to NATO operations centers, coordinated with other air defense systems, and achieved the interoperability essential to combined air defense.

Finally, Soldiers of A Battery forged meaningful relationships with representatives of a variety of nations, from the local forces who assisted on the road march, to the President of Romania. By working directly with them and informing them of the battery's capabilities, the Soldiers enhanced mutual understanding among NATO allies and continued to assure them of A Battery's will and resolve to the overall defense of NATO.

First Lt. Josef Danczuk is a A Battery, 5th Battalion, 7th Air Defense Artillery platoon leader. He is a graduate of the University of Maryland College Park.

Forward observer
A lost art

By Sgt. 1st Class Robert Hance

Effective fire support requires an observer that understands the tasks to be accomplished and how these tasks support the overall operation. The observer must be able to accurately locate targets, understand which targets to attack, and effectively communicate what he sees to the rest of the fire support community.

— Army Techniques Publication 3-09.30, Techniques for Observed Fire

Artillery is the King of Battle. It enhances a maneuver commander's range and firepower, attributes to the attrition of the enemy in depth thus favorably shaping battlefield conditions and allowing friendly ground forces to gain a tactical advantage. This capability, when used effectively can win battles long before friendly ground forces ever engage in close combat. Effective artillery increases the speed maneuver elements can seize terrain, lower enemy moral and most importantly save friendly lives. The challenge is the field artillery's ability to provide Fires at the correct time and space regardless of the operational environment (OE). Failure to do so marginalizes our Army's strength and self-imposes an equal playing field for maneuver elements to fight on.

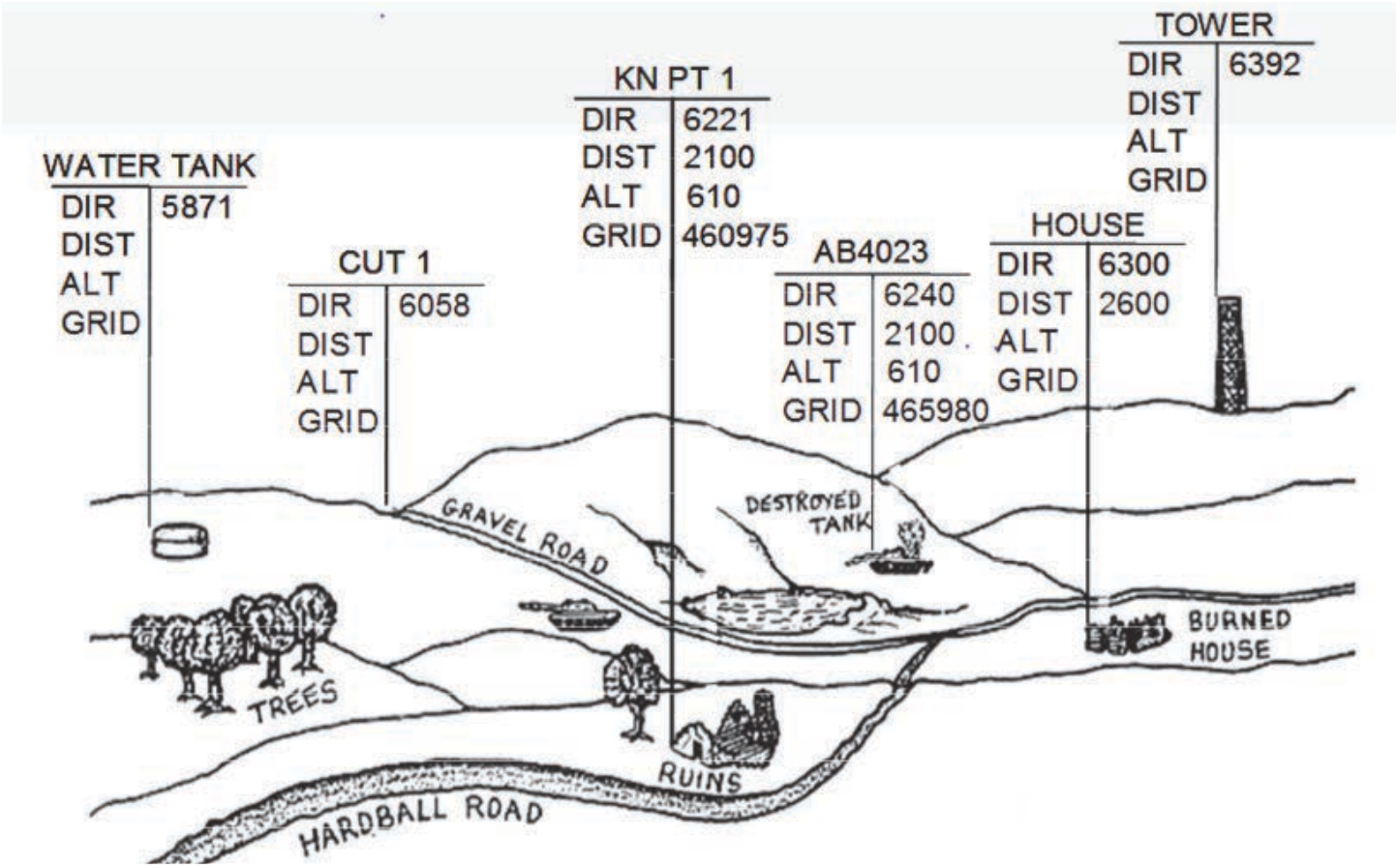


Figure 1. Example terrain sketch. (Army Techniques Publication 3-09.30/U.S. Army)

Company/troop fire support teams (FISTs) that trained at the Joint Multinational Readiness Center the past year experienced difficulties supporting their maneuver elements with indirect Fires during multinational integrated decisive action training environment (DATE) rotations. It was challenging for FISTs to quickly and effectively implement surface-to-surface Fires against targets in open or sparsely populated areas. Given the recent OE and the lack of required fire support coordination measures, fire supporters generally lack experience in multinational DATE rotations and the complexities associated with the integration of fire support and maneuver elements at the tactical level.

As the OE changed, fire supporters changed with it. They integrated close air support (CAS) and close combat attack (CCA) aviation, and have become masters at delivering precision munitions in urban areas. However, the most common training deficiencies JMRC fire support observer coach trainers (OCTs) note are individual fire support tasks that specifically support DATE rotations in preparation for unified land operations.

Deficiencies observed include the following individual fire support tasks:

- Constructing a terrain sketch.
- Locating a target by grid coordinates.
- Developing an observation plan.
- Planning company team fire support.

Skill Level 1: Construct a errain sketch and locate a target by grid coordinates

Terrain sketches are vital to observers for quick and accurate target location and help expedite relief personnel in orienting themselves to their areas of responsibility (Army Techniques Publication [ATP] 3-09.30, Techniques for Observed Fire, Aug. 2, 2013). This technique is especially effective in aiding interoperability efforts when relief personnel are from multinational units. When operating in a static environment, forward observers (FOs) should construct terrain sketches to facilitate calls for fire and battlefield reporting. Many FOs who rotate through JMRC fail to understand the importance of terrain sketches and how they can help them call for fire quickly and accurately without the aid of laser targeting devices.

Given an observer location, a map, compass and artillery binoculars, FOs are required to locate a target by grid coordinates within 250 meters (Training Circular [TC] 3-09.8, Field Artillery Gunnery, Nov. 15, 2013, with change 1, Sept. 8, 2016). Frequently in these degraded situations, the observer is unable to accurately locate targets and must correct errors in target location by adjusting Fires onto a target, thereby forfeiting surprise and minimizing effects on target (TC 3-09.8). Several times during training rotations, FOs were unable to accurately locate targets and call for fire in a degraded mode (See Figure 1 above).

For example, while in the defense, one unit was in position for several hours, overlooking an open area with several identifying landmarks and roads. While observing a possible avenue of approach for an opposing force (OPFOR) attack, company FOs neglected to construct a terrain sketch of the area. Once the FOs made visual contact with the OPFOR unit, FOs began the target location process. None of the four call-for-fire missions processed from that company hit their intended targets. All of the requirements for accurate fire were met, except accurate target location. Each mis-

	AA	LD	CP7	OBJ GREEN
FSO	INITIAL PREP / 1ST PLT	FIRE CA 3012 CFL CHUCK / 2D PLT	FIRE C1A GROUP / 3D PLT	ACS (CAS) 1400Z
1ST PLT	FA FPF	CFL CHUCK		MORTAR FPF
2D PLT	FA FPF	MORT PRI TGT CA 3014 CFL CHUCK		FA FPF
3D PLT	MORTAR FPF	CFL CHUCK	MORT PRI TGT CA 3017 / 2D PLT	FA FPF

Figure 2. Example fire support execution matrices (Field Manual 3-21.10/U.S. Army)

sion resulted in a target location error of 500 meters or more for each target. Failing to complete terrain sketches and lacking the experience in locating a target by grid coordinates without the help of laser targeting devices resulted in a slow first transmission for the call for fire and ultimately rounds impacting behind the targets. The unit forfeited the element of surprise without engaging enemy personnel with indirect fire. As a result, the unit was forced to engage in direct fire, which compromised their positions. Whether it was construction of a terrain sketch or locating a target by grid coordinates, fire supporters at the company and platoon level were unprepared to support their maneuver elements during multinational DATE rotations.

Skill Level 3: Develop an observation plan and plan company team fire support.

An FO is an observer operating with front line troops, trained to adjust ground or naval gunfire and pass battlefield information.[1] FOs are the link between commanders and indirect fire assets. When FOs fail to position in such a way to observe the battle, the first link in the chain is broken and Fires integration becomes far more difficult. Too often during rotations FOs were given tasks such as clearing rooms or operating as the platoon leader's radio operator, or were positioned in the back of a vehicle; of which provided less than ideal observation points from which they could call for fire.

Company/troop FISTs sometimes fail to develop observation plans that place observers in the best locations to observe Fires in support of the scheme of maneuver. During one rotation, a company was tasked with conducting an attack to seize an objective. Even though the company had organic 120 mm mortars and a battery of 105 mm howitzers in support, the FIST failed to develop an observation plan that assured multiple observers could spot targets. Only one observation post (OP) was occupied during the operation, creating a single point of failure. Also, the FIST identified observational dead space once they occupied the OP but was unable to adjust fire due to mission requirements. This hindered their ability to observe the enemy because no secondary observer was established. Triggers were not briefed nor coordinated amongst the FIST personnel, which resulted in several missed opportunities for calls for fire. A well-developed observation plan would have assigned primary and secondary observers, identified dead space early in the operation, and expedited calls for fire with trigger points, overwhelming the OPFOR with indirect fire.

Another rotation illustrated the lack of experience many company fire support noncommissioned officers (FSNCOs) have using fire support execution matrices (FSEMs) and rehearsals. FSEMs and rehearsals play a major role in the successful integration of fire support during DATE and unified land operations. A company that was ordered to execute an attack was unable to request timely indirect Fires because of a lack of synchronization between their FIST and the maneuver plan. The FIST did not publish a FSEM, nor did it rehearse the Fires plan with their FOs or their maneuver element. Platoon leaders and FOs were frustrated by slow mission processing times because they did not understand their order in the priority of Fires. The FIST was late to provide a smoke screen because a trigger point was never briefed to the FOs. FOs also stepped on each other's radio transmissions throughout the attack because they simultaneously requested fire missions, and because indirect Fires were not synchronized with specific phases of the operation.

A FSEM for a company may be as simple as a hand-drawn matrix listing the platoons, phase lines and minimal necessary information.[2]

A FSEM should contain the following at a minimum (See Figure 2, above):

- Priorities of fire.
- Final protective fire by type of indirect means (field artillery or mortars).
- Target numbers.
- Alternate elements for specific Fires.
- Airspace coordination areas and time on station.

The Army's recent operations in Iraq and Afghanistan did not emphasize fire support tasks (FST) with task, purpose, effects (TPE) for each operation, which has created a generational gap in experience and is a contributing factor to the lack of overall integration of fire support during multinational DATE operations observed at JMRC. During counterinsurgency (COIN) operations, fire supporters were more reactive than proactive in providing Fires, unconcerned with ammunition consumption, and had dedicated assets to troops in contact. Fire supporters did not focus on FSTs with TPE because the COIN fight was not linear in nature. Fighting to and through phase lines, against a near-peer adversary requires FST with TPE to maximize overall effectiveness. A FST is a vital part of the Fires plan which fire supporters receive so they can support the commander's scheme of maneuver (ATP 3-09.42, Fire Support for the Brigade Combat Team, March 1, 2016).

OCTs have also observed FISTs that fail to provide company commanders a concept of Fires plan that supports the opera-

1 Field Manual 3-09, Field Artillery Operations and Fire Support, April 4, 2014.

2 Army Techniques Publication 3-09.42, Fire Support for the Brigade Combat Team, March 1, 2016.

tion. The FOs in those companies did not understand engagement criteria and the importance of target selection standards. While one unit was conducting a breaching operation, the company FOs flooded their internal Fires nets with calls for fire requests. The requests were either unsuitable (requesting mortars against tanks) or did not support the mission at the appropriate time (the 2nd platoon FO requested Fires on dismounted troops while the 1st platoon FO was trying to request a smoke mission to obscure the enemy while his platoon breached an obstacle). The FOs simply did not understand the FST and how they tied into the overall operation. The commander and fire support personnel both have a responsibility that contributes to overall success in the integration of fire support.

As stated by ATP 3-09.30, Techniques for Observed Fire, Aug. 2, 2013:

1-21. The maneuver commander also has the responsibility to ensure that observers understand what targets can be engaged, when they can be engaged and which targets are the priority for the operation.

1-22. Observers have a responsibility to ensure they understand the criteria for engaging targets established by the commander.

Although FOs do not prioritize targets in a vacuum, company and battalion FISTs advise commanders on which targets to engage. FOs should have a healthy understanding of engagement criteria so their observations and call for fire are prioritized, thus expediting the entire process.

Recommendations

The common fire support deficiencies observed at JMRC within the last year can be fixed by the battalion/squadron FSNCOs and below. TC 3-09.8 Change 1, Chapter 3, provides fire support leadership a standardized method of training and certifying fire support personnel assigned to their organizations to include training, documentation and qualification standards for all fire support personnel.[3]

Creating terrain sketches and locating targets using grid coordinates are both Skill Level 1 tasks. FSNCOs must utilize the three phases (crawl, walk, run) of lane training methodology described in FM 7-0, *Train to Win in a Complex World*, Oct. 5, 2016, to better assist them in creating a timeline for their training. FSNCOs should begin with the walk phase and provide an explanation and demonstration of supporting individual tasks. FSNCOs should use training and evaluation outlines (T&EOs) as their framework when developing the training situations. T&EOs provide FSNCOs an outline of task steps and measures and other evaluation criteria for evaluating tasks to the Army standard. T&EOs are the Army's source for specific conditions and standards and provide event planners resourcing guidance for developing events that train collective tasks.[4] These techniques will help FSNCOs focus on performance measures that are required for each individual task.

Training should be conducted quarterly and focused on developing terrain sketches and locating targets by grid coordinates in the call for fire trainer (CFFT), which is an excellent tool to use in honing Soldier's individual skills. During the walk phase, FSCNOs can use the CFFT to specifically train Soldiers on their individual skills in a controlled environment, maximizing time and resources. The difficulty can be adjusted to meet individual Soldier needs and the artillery simulator allows leaders to repeatedly train call for fire without safety concerns or ammunition considerations. Once Soldiers have displayed the required level of proficiency, the next phase should be physically occupying an OP and performing Skill Level 1 tasks while contending with weather and other physical elements. The bottom line is regardless of ordnance (conventional to precision munitions) or delivery platforms (cannon, mortar, CAS or CCA), the observer and FIST should always strive to attain the most accurate grid within given conditions and equipment limitations before sending any type of round downrange (TC 3-09.8). Performing Skill Level 1 tasks in different environmental conditions will better prepare FOs to provide accurate and timely fire missions that support their unit's scheme of maneuver while training at a combat training center (CTC).

Brigate/regiment FSNCOs cannot train what they don't know. Secior NCOs are charged with figuring out what aspects of their duties they need work on and educating themselves so they can train less experienced NCOs and Soldiers. Training plans that start at the brigade/regiment level, prior to executing FIST certification, will help to close the gereational gap in Fires knowledge and ensure proper TTPs are being trained. Battalion/squadron FSNCOs should conduct leader professional development quarterly to train company/troop FSNCOs on planning company team fire support. Utilizing the crawl, walk, run lane methodology, battalion/squadron FSNCOs should create scenarios that support upcoming operations for the unit. This will allow company/troop FSNCOs to train and rehearse different situations and begin to focus their energy on the challenges they will face during DATE rotations. Company/troop FSNCOs should work with commanders to develop company team fire support plans that support the maneuver scheme. FSNCOs should be actively engaged in the Fires planning process. They provide the necessary experience needed to create an executable Fires plan which will be instrumental in supporting the commander with indirect Fires.

Units preparing for combat training center rotations should emphasize FSEM and fire support and maneuver rehearsals at their home stations. Standard operating procedures should be established to formalize company/troop FSEMs and standardize information. This will help facilitate the planning process and create a common document that the commander and FIST both understand. Over the last decade, fire supporters have done an outstanding job overcoming the challenges of a COIN-centric fight and have become experts at delivering precision munitions in urban areas. Continuing to build on that success and technology will be important to future operations. However, the fire support community must still train and prepare for war against a near-peer adversary, always maintaining a level of proficiency in their individual core competencies, specifically the integration of Fires at the tactical level in preparation for unified land operations.

Sgt. 1st Class Robert Hance is a company fire support observer coach/trainer for the Timberwolves, Joint Multination Readiness Center, Hohenfels, Germany.

3 Training Circular 3-09.8, Field Artillery Gunnery, Change 1, Sept. 8, 2016.

4 Field Manual 7-0, Training in a Complex World, Oct. 5, 2016.

Soldiers from A Battery, 2nd Battalion, 20th Field Artillery, pose for a unit photo during their recent rotation to the National Training Center at Fort Irwin, Calif. (A/2-20th FA/Courtesy photo)

DISTRIBUTED ALTERNATIVE

Training in the National Training Center from home station

By Lt. Col. G. Damon Wells and Capt. Ryan Hamilton

NTC + MTC: Combining two critical resource rotations

It is undeniable that the training value of a decisive action National Training Center rotation is well worth the effort and cost, and the associated planning and preparing is valuable training for the leaders and staff. However, providing a unit the ability to get a similar training experience while incurring minimal cost and resource expenditure would provide a distinct advantage. With sufficient communications capabilities and architecture, both voice and digital communications and upper tactical internet (TI) can facilitate communication over long distances. A battalion that typically deploys in a division or corps support role can deploy a small element (company/troop/battery) to the NTC while establishing the battalion command post at their home station Mission Training Complex/Center (MTC). Additionally, virtual feeds from NTC can be fed into the higher headquarters at home station which facilitates an excellent training atmosphere for the battalion staff and commander.

The 2nd Battalion, 20th Field Artillery (Multiple Launch Rocket System) conducted a distributed NTC rotation from February to March of 2017 (17-04). Elements from A Battery, 2-20th FA and 67th Forward Support Company deployed to Fort Irwin, Calif., in early February 2017 to provide general support/reinforcing Fires for 52nd Infantry Division and 2nd Brigade Combat Team, 1st Cavalry Division. The battalion established the tactical operations center (TOC) outside the Fort Sill Mission Training Complex (MTC), placed Joint Combat and Tactical Simulation (JCATS) and Advanced Field Artillery Tactical Database Systems (AFATDS) operators in the MTC to simulate a constructive battery (B/2-20th FA), and executed mission command of the battalion through the use of upper tactical internet routed through the MTC to Fort

Soldiers assigned to 2nd Battalion, 20th Field Artillery, assemble an OE-254 antenna to use for communication at the National Training Center, Fort Irwin, Calif. (Spc. Ashley Marble/NTC Operations Center)

Irwin via the Joint Training and Experimentation Network (JTEN) and Harris High Frequency (HF) radios. The battalion TOC was established outside the MTC with full connectivity through the building due to the limited number of Satellite Transportable Terminal (STT) systems and teams, compounded by the need to maintain upper TI with the 52nd ID, 2/1st CD, and A/2-20th FA firing battery at NTC. The battalion employed the whole suite of Army Battle Command Systems (ABCS), including Joint Automated Deep Operations Coordination System, Command Post of the Future, Distributed Common Ground System-Army, AFATDS, Joint Capabilities Release (JCR), HF radio, and Secure Voice over Internet Protocol (SVOIP) phones at Fort Sill, Okla., and was fully operational with communications to Fort Irwin. B/2-20th FA was simulated through a pair of AFATDS and JCATS.

The distributed environment

A large geographic dispersion and the requirement for long-range communication systems is realistic for the echelons above brigade battalions, which are expected to provide Fires across an entire division or greater frontage. Subordinate companies, troops and batteries are going to operate at greater distances than most brigade combat team (BCT) units and can expect to remain geographically separated, potentially through an entire campaign. It is also feasible for an MLRS or High Mobility Artillery Rocket System unit to establish their command post in an allied nation, such as the United Arab Emirates, and deploy launchers to conduct raids to sustained operations in a different country. This precludes the command post from deploying into a hostile environment, and prevents the unit from tearing the TOC down and setting it back up, which can disrupt operations. This creates a greater reliance on long-range communication systems. It is essential units possess the ability to execute intensive training at the NTC, over vast distances and terrain, and simultaneously train the battalion command posts on the equipment, and the techniques inherent in the problem. Units like these are currently deployed and operate across national borders, but rarely conduct long-range communications training at home station.

A distributed CTC training rotation can be executed for units of varying sizes and missions. It certainly is not a novel technique, as units have been using long-range communications for decades, but many units have lost the ability to employ their long-range

radios and rely on their upper TI exclusively. Training opportunities are minimal, and organic experience and knowledge of these systems has degraded over the years. The organic ability to communicate over long distances, both voice and digital, is essential for units such as general support/reinforcing (GS/R) MLRS battalions from field artillery brigades.

A distributed architecture provides the advantage of exercising the mission command systems at the battalion level, without the cost of transporting dozens of vehicles and paying to move and feed hundreds of Soldiers on temporary duty. It allows a mixture of live, virtual and constructive units to operate together simultaneously, while fighting as part of a division-level operations scenario that is executed at the BCT level for the unit's specific training requirements. If properly planned and resourced, the unit can fully exercise every aspect of mission command with the live battery and BCT operations in the NTC, the live simulation feed from NTC and the constructive battery in the MTC.

The 2-20th FA distributed rotation was successful. In addition to conducting a long-distance communication (1,100 miles via HF) live fire in conjunction with a cross forward line of own troops raid, sending 24 M28A2 rockets into the impact area, the battalion simulated over 700 fire missions, including over 300 Army Tactical Missile System, Guided MLRS and the full MLRS family of munitions. With the batteries — simulated and live — distributed throughout two divisions' areas of operations, the battalion fired over 1,000 rounds throughout the rotation including daily 24-hour fire plans, counterfire and dynamic missions. Additionally, by using well-trained liaison officer (LNOs) teams and maximizing the use of upper TI and HF radio, the battalion participated in most of the planning and rehearsals with 2-1st CD and 52nd ID, including the technical FA rehearsals from sensor to shooter.

Lessons learned

Liaison teams are critical to the distributed rotation. Because they represent the commander and staff for many briefings and planning sessions, they must be well versed in a unit's mission, employment techniques, capabilities, limitations and the commander's intent. They must understand staff processes, battle tracking and how to integrate themselves into a BCT staff. They need to understand the field artillery tasks (FATs), the S2's role in targeting, counterfire procedures and MLRS munitions capabilities. This takes a leader that is experienced and confident. The LNO team may also need to interact with the platoon or battery on the ground if the higher headquarters is unable to communicate. A thorough understanding of the requirements of both the direct support unit and the GS/R unit is also important. This is not a job for the 'left over' second lieutenant, even when complemented with a strong noncommissioned officer.

They must also be properly equipped. The ability to communicate with the LNO team is essential; losing communication capabilities 1,000 miles away from the supported unit has the potential to substantially degrade operations. This problem set is also highly realistic and tests the very systems required for real-world operations. Synchronizing the LNO's equipment with the supported unit and the supporting unit is critical. Field artillery LNOs in a GSR role must have the capability to communicate to division, brigade, the DS battalion, and the GS/R battalion via multiple means. This might include SVOIP, FM, HF, CPOF, JCR, AFATDS, or any other method that keeps them tied into current operations and planning efforts. LNO teams will be part of the supported unit's planning efforts, but they will also be required to track current operations. For this reason it is also critical to provide a larger element than typical. A day and night shift with the capability to have someone dedicated to planning while simultaneously tracking the battle may equate to two LNO teams, but the expense of personnel will prove a valuable investment. It is necessary to provide an LNO package at each echelon of support to the outside units. In an artillery GSR role, for example, you may have LNO teams at division and brigade, but may also require one at the supported battalion level. The decision to place the LNO at the brigade or battalion level, or both, will be up to the supported unit and the artillery unit. Each LNO team may have one to three officers, two or three NCOs, and two junior Soldiers, but this short-term sacrifice will yield long-term benefits, and is essential for the success of the rotation and future combat operations.

Long-range communications

Essential to the distributed architecture execution is the ability to establish and maintain multiple long-range communication systems under varying conditions. The most prevalent and preferred solution is upper TI. The ability to communicate in real time and pass multiple megabytes of running estimates all over the world through e-mails, Ventrilo and CPOF is ubiquitous and well understood. However, with threats to the network through enemy electronic warfare and direct attack on the satellite network; in addition to difficulty in providing enough nodes to plug all company/battery headquarters into the network and have the bandwidth to support that many users is limited.

The high frequency band of the radio spectrum is becoming a regular part of Army operations again. Once heavily used and well understood as the best expeditionary long-range communications capability for brigades and battalions on the move, the ease of availability of upper TI led to a decline in usage over the last 15 years. The popularity of HF radio is resurging due to its long-range communications capability portability. Units can coordinate for HF training through U.S. Army Communications-Electronics Command or any locally garrisoned contractors. A three-day class was effective in training fire direction center personnel and MLRS launcher gunners to a sufficient level. Training should include hands-on with the unit's organic equipment that will deploy to the training center as well as the headquarters equipment that will remain at home station to ensure functionality. Enough time should also be scheduled to correct any faults found with the equipment prior to loading it for rail shipment to the training center.

A key component to the capability of the high frequency radio is construction of its radio programming application (RPA). This is the selection of frequencies that the HF radios will use to communicate across the atmosphere and reflect around the world. These frequencies are selected by experts who take range of the systems and specific variables involved between where the radios are communicating to pick a mix of these frequencies and allow the radios to pass signals across a frequency band to ensure effective transmission of signals. It typically results in two or three different RPAs that are switched by operators based on time of day and when specific atmospheric conditions are triggered. These frequency bands are also managed by the Federal Communications Commission and potentially other countries or international agencies when operating outside the U.S.

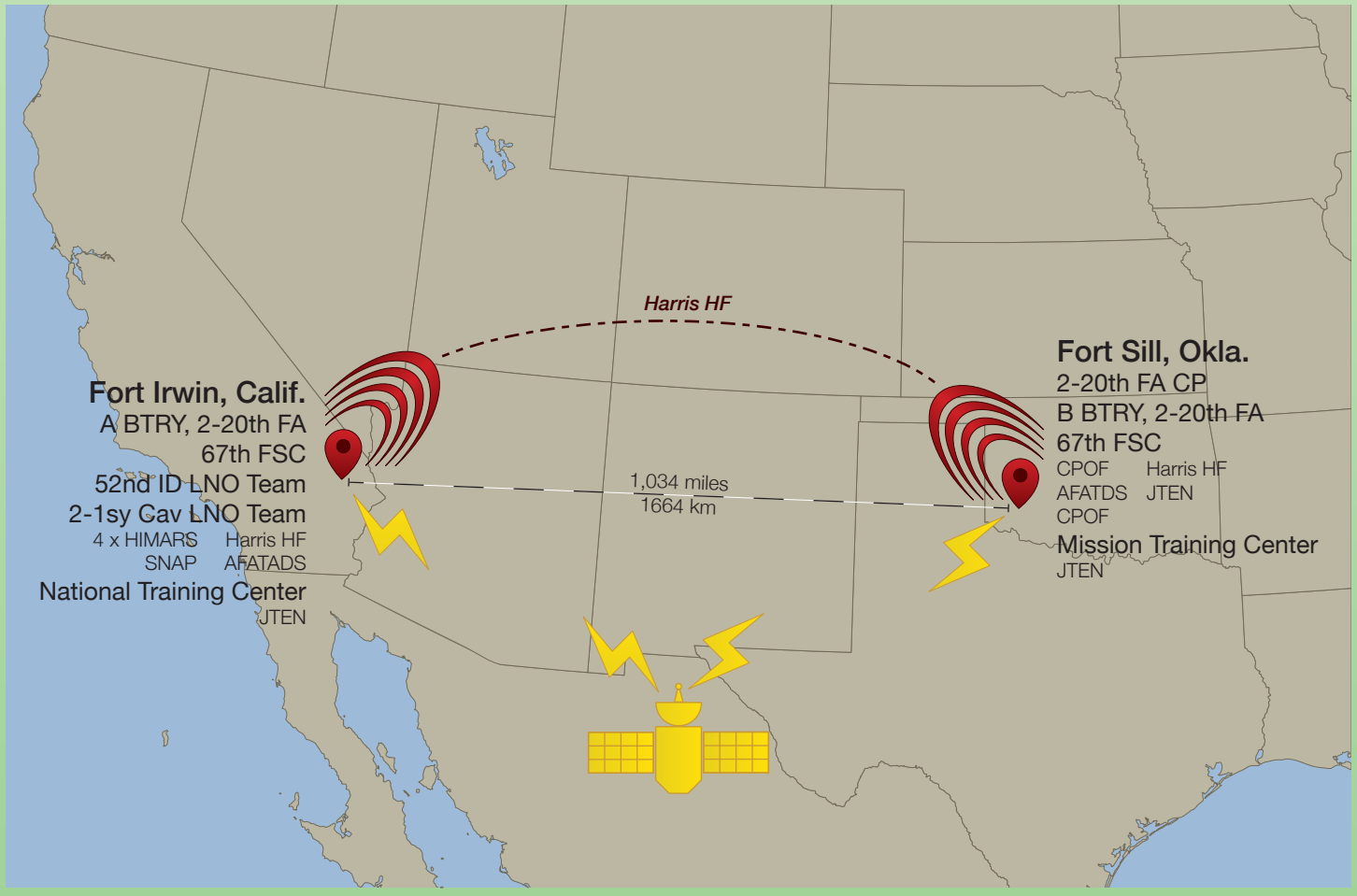


Figure 1. Units communicated over vast distances during the National Training Center rotation 17-04 to conduct fire missions.

Units need to look ideally six months in advance in order to begin requesting RPAs from applicable agencies.

Also, with the large number of communications systems available and the variety of conditions they are required to operate under, an effective and well-rehearsed Primary, Alternate, Contingency, and Emergency (PACE) plan is essential. Command and fire direction nets operate on different systems at different times for different reasons. Stationary elements also have greater communication options available than moving or displacing formations which likely necessitates a different PACE plan based on the situation. For example, when the platoon at NTC displaces, the STT or Snap Terminal will be down. High Frequency radio will be the only viable means of communication. By conducting a deliberate hand over to the platoon FDC for fire direction control prior to dropping upper TI, the battery was able to maintain firing capability on the move.

Progressive training option

During the 2-20th FA distributed rotation, the battalion TOC remained stationary at the MTC to maintain the JTEN connection. A more dynamic option could involve establishing a TAC at the MTC with HF radio and JTEN connection, and the battalion TOC in the home station training area with an STT. The STT would permit upper TI communications with the supported BCT, and the TAC at the MTC would be linked into the JTEN. The TOC could transmit fire missions to the TAC, which could transmit them into the MTC to the constructive battery. This would permit the home station unit to train on more intensive security operations, movement and positioning, CBRN operations, deployment of the tactical action center and jumping the TOC in addition to other mission essential task list (METL) related command post training. This scenario requires the use of an STT team, which may be a challenge for some units.

To truly train effectively, commanders must understand their wartime mission, their METL, and the conditions under which they will fight. For many units, fighting while greatly dispersed is becoming more the norm than not. The capability to provide lethal support over vast areas provides many advantages to commanders of supported units. Training for such a mission is difficult, as we are not typically able to practice operating over such vast distances outside an actual overseas deployments, due to the limited size of our posts and training centers. To overcome this obstacle, units can implement distributed training center rotations, deploying subordinate combat units to CTCs while establishing their headquarters at home station or another location in order to simulate actual wartime distances. This type of training validates both the equipment and the ability to conduct mission command over geographically dispersed areas.

Lt. Col. G. Damon Wells is the 2nd Battalion, 20th Field Artillery commander. Wells has a bachelor's degree in psychology and a master's degree in kinesiology from Texas A&M University.

Capt. Ryan Hamilton is the A Battery, 2nd Battalion, 20th Field Artillery commander.

THE BATTALION CHIEF FIRE CONTROL SERGEANT

By Master Sgt. Luis Alicea

While I served as an observer, coach, trainer (OC/T) at the Joint Readiness Training Center, in Fort Polk, La., many battalion chief fire control noncommissioned officers (BN FCNCOs) were operating in a non-standard capacity in their battalion. These non-standard duty positions created conflicting duties and responsibilities for senior fire direction members in the battalion. Some of these NCOs were not aware of their role as the primary trainer of all 13D field artillery automated tactical data system specialists in the battalion. Consequently, this was a product of current conflicts in Iraq and Afghanistan. The fire direction center (FDC) sections were, for the most part, operating autonomously throughout the battalions' area of operation, or operating in non-standard capacity while in theater. It is not that I am against autonomous operations; I believe operating autonomously creates a great working relationship between fire supporters, maneuver brothers and fire direction members. However, someone in the field artillery battalion must have oversight of the FDCs.

Soldiers in A Battery, 1st Battalion, 258th Artillery Regiment, 27th Infantry Brigade Combat Team, coordinate the transport of four howitzers during an air assault artillery raid at Fort Drum, N.Y. During the raid Soldiers in the advance party arrived first and established a fire direction center while simultaneously marking out locations for the placement of the guns. (Sgt. Alexander Rector/U.S. Army National Guard)

The BN FCNCO is the subject matter expert on all fire direction related tactics, techniques and procedures (TTPs). That Soldier is the teacher and master of all manual and automated gunnery techniques while setting the standard for fire direction officers (FDOs), fire control sergeants and fire direction centers in the battalion. The BN FCNCO recommends to the battalion command team and staff how, what, where and when FDC sections train on fire direction tactical and technical techniques and field artillery operations. They stay up-to-date on current doctrine and TTPs that relate to fire direction and field artillery operations and pass that knowledge to fire direction members in the battalion. In addition, they ensure all fire direction automated equipment is updated with the most current software and is fully mission capable at all times.

The BN FCNCO has always played a vi-

tal role in the field artillery battalion. The duties and responsibilities of this position continue to increase as the field artillery transitions into a more digital-based branch and away from "old school" manual gunnery. However, manual gunnery is the base for all automated artillery systems and the BN FCNCO should have a good understanding of it in order to understand the automated world of artillery. With the ever-changing Army, the BN FCNCO needs to be versatile and innovative in accomplishing daily duties and in teaching and mentoring techniques.

The following article highlights some duties and responsibilities of the BN FCNCO and some TTPs to increase the effectiveness in the training of all fire direction members in the battalion, consequently, increasing the battalions' effectiveness and timeliness in providing artillery Fires. This is not all encompassing, but it will paint a picture of what I believe are the basics to establish a fire direction training program in a battalion or even division artillery (DIVARTY).

Although, I am discussing the duties of the BN FCNCO, whether this is a sergeant first class or staff sergeant is immaterial. The BN FCNCO is the subject matter expert

in all fire direction operations to include linking all Army Battle Command Systems (ABCS). The BN FCNCO develops the battalion's FDC section through aggressive training plans, which include manual gunnery, independent secondary checks, automated gunnery, digital linkage throughout the brigade with all artillery automated systems (Advance Field Artillery Tactical Data Systems, Computer, Meteorological Data-Profiler, Forward Observer Software/System, Command Post of the Future) and most importantly, standardizes fire direction centers within their battalions for ease of operations and continuity. In order to conduct such training the BN FCNCO needs an FDC standard operating procedure separate from the battalion's tactical standard operating procedure (TACSOP) outlining all fire direction TTPs, tracking mechanism and load plans. A separate SOP is needed because FDC sections should be operating as a miniature command post and need a comprehensive SOP to ensure understanding of the standards to the lowest level. It is also highly recommended there be digital sustainment training (DST) plans, a Fire Direction University standard curriculum, and commitment from the command group to achieve said tasks. With the implementation of DIVARTY, the establishment of fire direction standards should be easier for BN FCNCOs through collaboration with the DIVARTY senior fire control sergeant. This creates a shared visualization of the fire direction training program.

The primary duty and responsibility of the BN FCNCO is to determine and develop the training strategy for all 13D tasks in accordance with the published Army doctrine Training Circular (TC) 3-09.8. They must teach and mentor all battery and platoon-level FDC sections to include the FDC section chiefs and fire direction officers (FDOs). They develop the roadmap for DST progressively linking all field artillery automated systems, and the curriculum for Fire Direction University and any other fire direction-related training. In addition, the BN FCNCO shares their experience and expertise to assist the BN FDO and operations officer (S-3) in the development of the field artillery support plan and in the military decision making process (MDMP). By doing so, the battalion gains a better perspective of their FDC's capabilities and vulnerabilities in processing fire missions in support of their mission and/or the maneuver battalion's mission. Furthermore, as the field artillery branch transitions 105 mm battalions into a multi-functional field artillery battalion that includes 155 mm howitzers, the BN FCNCO's responsibilities will increase. The BN FCNCOs ability to understand the differences in weapon systems, ammunition characteristics, capabilities and fire mission processing between the 105 mm and 155 mm howitzers is an asset to the battalion and fire direction community.

Artillery paratroopers assigned to the 82nd Airborne Division Artillery, reviews fire mission data in the tactical operations center, Grafenwoehr Training Area, Germany. (Staff Sgt. Kathleen Polanco/U.S. Army)

In order for the BN FCNCO to accomplish the mission they need to prioritize fire direction training tasks in accordance with TC 3-09.8, TC 3-09.81, and any other artillery doctrine deemed necessary for training and understanding of the standards. Processes and training need to be outlined and endorsed by the battalion commander in order to standardize crew drills, FDC sections, and have a shared understanding of the standards amongst all the FDC sections in the battalion. SOPs must have performance measures and clear, concise guidance. If a standard is too vague and/or a Soldier cannot understand the standard, then the standard is no good. A great tool in developing SOPs is Army doctrine, the Combined Arms Training Strategies (CATS) found on the Army's Training Network and the Field Artillery Lessons Learned webpage on Army Knowledge Online. In addition, CATS is a great enabler and beneficial in developing DST plans as it breaks down performance measures for the Advance Field Artillery Tactical Data Systems and the Centaur handheld digital computer. These tools will also help the BN FCNCO build continuity books for the battalion fire direction program.

After SOPs are established, blocks of instruction are given and FDC sections are certified there should be a field training exercise (FTX) that includes tactical assembly area operations, advance party procedures, occupation crew drills and fire mission processing. Fire mission processing includes all fire missions dictated in TC 3-09.8 Table V (Dry Fire), and all types of fire missions an FDC section may face during an FTX, combined arms live-fire exercise, fire support coordination exercise, and any other training events that need support from a field artillery FDC section. Nevertheless, with the ever-changing Army BN FCNCOs there is a need to stay focused on refining and updating SOPs and TTPs in order to keep their FDCs current and relevant.

BN FCNCOs need to establish training strategies/plans to build their FDCs manual and automated gunnery techniques and knowledge based on feedback and lessons learned from FTXs, warfighters, and combat training center rotations. I recommend battalions schedule FDC University at least

once quarterly and DST every month to help determine strengths and weaknesses in fire direction members. By doing so strengths and weaknesses in, the fire direction members the BN FCNCO can tailor training to focus on those areas. They can also take these training opportunities to introduce new doctrinal changes and/or TTPs to the fire direction members in the battalion. This allows the BN FCNCO to advise the battalion commander and command sergeant major on matters concerning the fire direction members and sections. Support from the command group is invaluable in developing fire direction training. Training will not only strengthen the fire direction members' knowledge but it will also build confidence and help them refine their skills. In a field artillery battalion nothing is more important than the training of Soldiers on their standards of precision.

BN FCNCOs need to spend time with the batteries and platoon FDCs as much as possible. This helps them standardize the battery and/or platoon FDCs in accordance with the published standards. Furthermore, it helps them identify if the training conducted at the battery and platoon level is realistic and efficient and meets the overall battalions' goal. The goal is to ensure the Soldiers are trained in all aspects of fire direction and duty positions within an FDC, which will help in the event that Soldiers need to be moved from batteries and placed in another FDC elsewhere.

By having the BN FCNCO visit the firing batteries, the leaders and Soldiers begin to understand the role of the BN FCNCO, their training plan, and the way ahead for the fire direction program. Furthermore, the BN FCNCO can evaluate the effectiveness of the SOPs, TTPs and training plans. This will promote and create a great working relationship with the battery FDOs and FCNCOs and help the Soldiers interact with the BN FCNCO. Moreover, it builds strong FDC sections and a fire direction member in the battalion.

The BN FCNCO also serves as the manager of FDC personnel in the battalion. The BN FCNCO should brief the commander and the commander sergeant major monthly on FDC manning shortfalls and/or issues. The BN FCNCO should seek help from the S-1 NCO in charge to track Soldier gains and losses to paint an accurate picture to the command group. Simply creating a spreadsheet in accordance with the battalion modification table of organization and equipment can help in tracking Soldiers in an FDC. The spreadsheet will have a Soldier's rank, name, duty position within the FDC, arrival date, expiration term of service date (ETS), date estimated return from overseas, if overseas, and any other pertinent information that needs to be recorded for situational awareness. This spreadsheet is then sent to all FDC section chiefs on a monthly basis for update and/or corrections. With this spreadsheet the BN FCNCO can recommend Soldier moves and balance out the FDC sections in the battalion. Balancing the FDC sections creates an environment for Soldiers to succeed and get promoted. Consequently, this creates a better fire direction community within a battalion. A big part of this spreadsheet is to help the BN FCNCO make decisions on what is best for the battalion and not for a particular battery or FDC section.

The BN FCNCO is the mentor of all fire direction members in the battalion. The mentoring duties create a developmental relationship with all FDOs and FDNCOs. As a senior NCO, they use this time in the battery or platoon FDCs to teach staff sergeants and sergeants in all aspects of fire direction while building rapport with fire direction Soldiers.

Mentoring may come easier to NCOs who served as an observer, coach/trainer, instructor, or drill sergeant, however; to others it is a challenge. Nevertheless, once a good mentoring program is established it is easy to maintain. With my experience as an OC/T, I was able to quickly implement lessons learned and best practices from JRTC in my battalion that helped tremendously in the mentorship of my fire direction members. During FTXs, the BN FCNCO should spend time with each FDC section to learn and observe their individual abilities, crew drills, fire direction procedures and other field artillery tasks that the battery may conduct. Furthermore, it gives the BN FCNCO the ability to assess FDCs in live fire situations and austere environments.

The mentorship of the battery and platoon-level FCNCOs is a combined effort between the BN FCNCO and the BN FDO, consequently, also mentoring the battery or platoon FDO. The relationship between the BN FCNCO and FDO is one of mutual respect and understanding by knowing each other's experience and strengths. The BN FDO should be either a senior lieutenant or captain, who has served as a battery or platoon FDO at some time in their career. Their understanding of tactical and technical fire direction may be limited to experience as a battery/platoon FDO, but nevertheless, it is invaluable to the overall fire direction program and the battery or platoon FDOs. Many times getting an FDO that has prior experience may be difficult. However, this can still work as long as the FDO is receptive to suggestions and at times mentorship from the BN FCNCO.

A personal interest should be taken by the BN FCNCO to mentor his FDO. This will allow a shared visualization on the way ahead for the battalion's fire direction program. Together they work on building their knowledge of artillery operations and dedicate themselves to the overall coaching, teaching and mentoring of the battalion's fire direction members. The BN FDO and FCNCO share the workload in developing the battalion's fire direction training strategy, DST plan, and most importantly developing the FDC leadership. They are the key to success in the FDC training program and development of young fire direction members.

The development of fire direction leaders in the battalion can be conducted in many forms. The BN FCNCO should propose a plan to develop leaders in programs such as FDC University, held once quarterly, and fire direction synch meetings, to validate and/or update SOP/TTPs. The BN FDC leadership will develop the classes and subject for all meetings and formal classes. The classes should be taught in a progressive manner (crawl-walk-run) in order to build a solid foundation of fire direction knowledge. Ultimately, the goal is to cross-train fire direction members in all aspects of artillery operations, which can include capabilities brief of artillery weapon systems, aspects of fire support, MDMP and ammunition management.

Master Sgt. Luis Alicea is a 13Z field artillery senior sergeant. He's currently a military science instructor at Indiana University. His first military occupational specialty in the Army was 13E (fire direction specialist) before he became a 13D (field artillery automated tactical data system specialist). He served in Fort Bragg, N.C., Germany, Fort Polk, La., and Joint Base Elmendorf-Richardson, Alaska. Alicea deployed to Saudi Arabia, Hungary and Iraq with several rotations.

How to properly change inventory from commander to commander

By Capt. Matthew Johnson

In January of 2017, the Quartermaster School, Logistics Training Department, began work on an initiative to create a Property Accountability Virtual Playbook (PAVPB); a computer-based training resource that promotes property accountability and improves Army readiness.

Army leaders have the responsibility to achieve and sustain Army readiness, and to ensure Soldiers have the right types and quantities of equipment needed to fight and win on the battlefield. The Department of the Army's excess equipment and Financial Liability Investigations of Property Loss (FLIPLs) derived from inventories indicating that the Army is attacking the problem, but that challenges remain with Soldier knowledge of property accountability principles.

To address the knowledge gap, the U.S. Army Quartermaster School assembled a team of experts spanning several different organizations to design and develop an interactive training product, the PAVPB, with an overall objective of improving property accountability across the Army.

Interactive training

The PAVPB is an online computer-based interactive virtual 3D training resource designed to teach users about property accountability by demonstrating the proper way to conduct a change of command inventory. The target audience for the PAVPB is non-logistician leaders across the Army from commanders to sub-hand receipt holders.

The change of command is one of the most important types of inventories conducted at the tactical level. It is the one time that a company commander will be fully dedicated to property accountability for all the equipment in the unit. It forms the baseline inventory process for not only change of command, but all types of inventories to include cyclic and sensitive items. The user will learn about the people, property and processes that are encountered during the pre-inventory, inventory and post-inventory phases of a change of command inventory.

The Property Accountability Virtual Playbook (PACPB) displays virtual representations of an M2 .50 caliber machine gun, an M250B machine gun and an M110 sniper weapon system. Soldiers attending the U.S. Army Quartermaster School participate in the computer-based training. (Courtesy illustration)

Resources

PAVPB users will participate in interactive inventories of a Stryker ICV, Abrams Tank and three different weapons systems. It includes tactics, techniques and procedures and best practices that have been collected from units and subject matter experts across the Army. It explains the roles of the officers, warrant officers and noncommissioned officers who are involved in the change of command process and work to help ensure property accountability. With the Army's transition from the Property Book Unit Supply Enhanced to the Global Combat Support System – Army (GCSS-Army), the PAVPB will familiarize the user with new terminology inherent to GCSS-Army. It will also link users to valuable property accountability and Command Supply Discipline Program resources and references to assist all who have responsibility for property.

Collaboration

The collective efforts of numerous organizations, to include the Maneuver Center of Excellence at Fort Benning, Ga., the Ordnance School at Fort Lee, Va., and GCSS-Army developers in Midlothian, Va., yielded impressive results toward the creation of the final product, the PAVPB. Great care was taken to ensure the program is user friendly and does not require CAC card access to use. It's also adaptable for mobile versions and touch screen deployment in the future. The PAVPB can be published on multiple platforms to include Sustainment One Stop, Army Training Network and additional public facing websites. After receiving feedback from the field and incorporating the results of beta testing, PAVPB was made available across the Army. The Property Accountability Virtual Playbook provides Soldiers with a valuable resource that delivers training on property accountability and promotes Army readiness. It can be accessed at http://www.cascom.army.mil/index.htm.

Capt. Matthew Johnson is the Logistics Training Department deputy director for the Quartermaster School at Fort Lee, Va.

A pilot flying an AH-64D takes-off from a tactical assembly area at the Joint Multinational Readiness Center in Hohenfels, Germany during Combined Resolve VIII. (Courtesy photo)

When four eyes are better than two

Integrating the AH-64 Apache into a Fires observation plan in the post-COIN era

By Capt. David Williams and Chief Warrant Officer 2 Keith Eastman

In his prefacing remarks to The U.S. Army Functional Concept for Fires 2020-2040 (February 2017), Maj. Gen. Brian McKiernan, Fires Center of Excellence and Fort Sill commanding general, enjoined leaders to develop unorthodox solutions to face future complex and integrated threats. To heed McKiernan's injunction, the Fires community must reexamine how, as a branch, we previously employed fire support assets in the counter-insurgency (COIN) era. We must develop novel ways to fight against a near-peer adversary, whether in a decisive action training environment (DATE) or in actual combat.

Based on our experiences as a battalion fires support officer (FSO) and aviation mission survivability officer (AMSO) for 1st Battalion, 501st Attack Reconnaissance Battalion at Combined Resolve VIII, a European rotational force exercise at the Joint Multinational Readiness Center, a great place to start is with the AH-64D/E Apache attack helicopter.

The Apache, as many know, is an American four-blade, twin turboshaft attack helicopter with a tandem cockpit, outfitted with a 30 mm chain gun, and four stub-wing pylons carrying a mixture of Air to Ground Missile (AGM) 114 Hellfire missiles and Hydra 70 general purpose 2.75" guided and unguided rockets. Simply put, it is the most versatile and lethal mobile fire support and reconnaissance platform, particularly against armored targets. So without belaboring the vast differences in COIN versus DATE tactics, which we trust this bulletin's readership is familiar with, a brief discussion on attack aviation employ-

ment in COIN is necessary to understand how the Apache can (and should) be used in a DATE with regard to Fires.

Figure 1 illustrates a typical and reactionary way in which the Apache was employed in a COIN scenario. In this concept sketch, an air weapons team (AWT) conducts a hasty attack in support of (ISO) troops in contact (TIC). It was very common in COIN for an Apache to serve as an on-call quick reaction force (QRF) while conducting a pre-planned mission. In this case, the AWT pull-off from its reconnaissance/collection at the named area of interest (NAI) in Figure 1. The AWT is then tasked to establish an attack by fire (ABF) position, which is laterally de-conflicted with both indirect fire targets. Fires could still theoretically be integrated in this example, but as we shall see there are certainly more imaginative ways of incorporating all Fires while keeping the aircrews safe.

Figure 2, on the other hand, is an illustration of how the Apache can (and should) be employed to support maneuver in a DATE scenario. Here, one AH-64 company conducts a deliberate attack to defeat an enemy counter-attack while another ARB company establishes a screen for a combined arms battalion's (CAB) main attack against a mechanized infantry company. This plan, as opposed to the QRF/TIC mission illustrated above, is measured and harmonized so the full force of attack aviation, maneuver, and Fires can be borne against the enemy. In Figure 2, ABF's are integrated rather than de-conflicted with Fires, enabling the targets to be prosecuted while the aircrews destroy an armor company and an air defense section in the engagement area. As implied in the illustration, the Apache companies are inside the air defense section's threat envelope. This positioning is purposeful, and the remainder of this article will explain why fire supporters (provided there is proper understanding and risk mitigation) are at full liberty to use the Apache to not just prosecute, but also observe targets. Even targets that most threaten the aircraft itself: enemy air defense artillery.

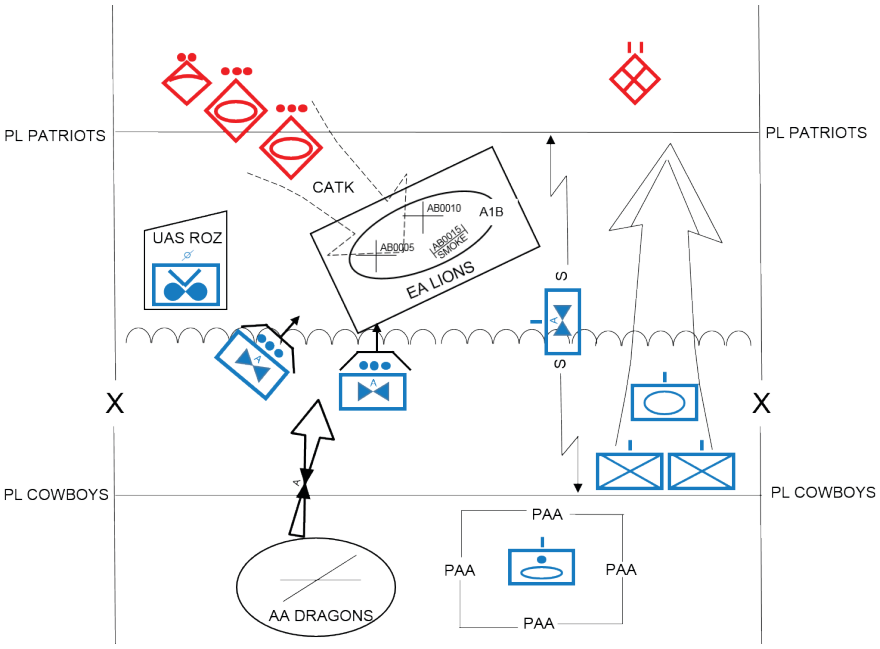
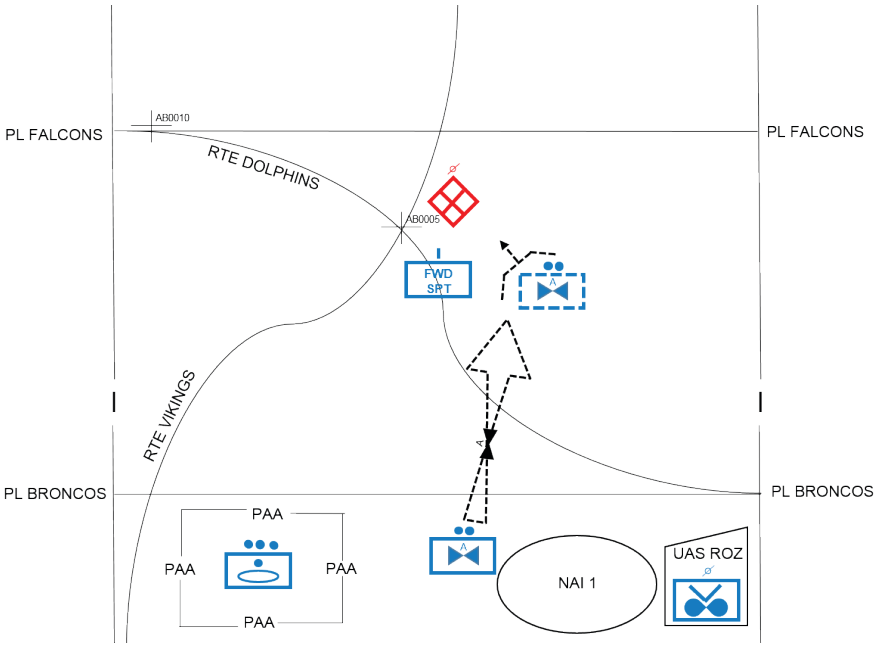


Figure 2. Two attack helicopter companies conduct a screen and deliberate attack in a decisive action training environment scenario. (Capt. David Williams/U.S. Army)

Figure 1. An air weapons team pulls off from its reconnaissance mission to service a troops in contact mission in a prototypical counter insurgency-era fight. (Capt. David Williams/U.S. Army)



This final point will seem counter-intuitive if not unorthodox to the Fires community. Under what circumstances should we assign attack aviation to not only destroy, but be a primary observer for enemy surface-to-air (SA) targets? The following shows, thanks to the aircraft's fire control radar (FCR), ways the Apache is actually designed to recognize, target and destroy SA threats and how 1-501st ARB successfully employed the FCR at Combined Resolve VIII to suppress an ADA target.

First, we must establish what the Apache's FCR can do for Fires. The FCR is a mast-mounted radar system with the ability to acquire stationary targets beyond eight kilometers, see Figure 2. It can process approximately 1,000 targets in its database, and can display more than 200 at once, depending on the pilot's preferences, within the tactical situation display (TSD). The major trade-off BCT fire support coordinators (FSCOORD) need to understand is that aircraft mounted with a FCR lose about 15 percent of their total playtime due to the additional weight of the system. Figure 3 is an illustration of the FCR page within the TSD inside the cockpit. Paired with the FCR, is its radio frequency interferometer (RFI) that sorts incoming air defense radar

Figure 3. The fire control radar in ground targeting mode as depicted in the pilot's tactical situation display screen. Circles represent wheeled vehicles. Boxes represent tracked vehicles. Triangles represent air defense artillery threats. (Chief Warrant Officer 2 Keith Eastman/U.S. Army)

pulses, computes azimuth to target, identifies signal emitters and determines threat priority. As Figure 3 shows, the RFI is able to distinguish between wheeled, tracked and air defense threats, both moving and stationary. It can also distinguish differing air defense threat signatures by merging and then matching the signature based off its internal database. In the example in Figure 3, the FCR and RFI were able to identify an SA-6. Furthermore, when pilots triangulate the same target on two azimuths, the crews are able to engage the target with a radar-guided AGM-114 (L) missile or generate an eight-digit military grid reference system to use in a call-for-fire (CFF). The target location error (TLE) associated with the FCR and RFI is classified. Fire supporters who may be interested in obtaining the category value may contact U.S. Army Aviation and Missile Research, Development and Engineer Center.

So with a firm understanding of the FCR and its capabilities in a DATE scenario, the FSO and AMSO could begin deliberate planning, like we did at Combined Resolve VIII. We used the Aviation Mission Planning System (AMPS), specifically Falcon View software, coupled with digital terrain elevation data and line-of-sight (LOS) analysis tools. Using intelligence provided by the S2 distributed common ground system and the Fires section's Advanced Field Artillery Tactical Data System (AFATDS) current situation graphics, we templated the threat on the AMPS system, and then accurately displayed threat engagement and acquisition ranges as depicted in Figure 4 for the templated enemy target. This allowed for attack-by-fire and support-by-fire selection, and route planning for aircrews as the aviation S3 section began detailed mission planning. In this specific case, the FSO and AMSO pre-coordinated with the BCT air defense airspace management and brigade aviation element (ADAM/BAE) to establish formal airspace control areas using the keypad method. This method assigned a predetermined three-by-three kilometer box a letter, and then each grid square within that box a number from one to nine. In working with the ADAM/BAE, we were given sufficient keypads to provide freedom of maneuver from the forward arming and refueling point along our route, to the holding area, up to the release point and finally at our ABFs. Within each keypad we never rose over 300 feet above ground level (AGL), and stayed one kilometer away from all position areas for artillery and terminal area hazards. We never had to shut off artillery batteries when moving to the target areas.

In the example provided in Figure 5, 1-501st ARB conducted a deliberate attack against a surface-to-air missile (SAM) system during Combined Resolve VIII (Figure 4 is a slight adaptation to the actual engagement the battalion conducted in order to not promulgate the "answers to the test" to future Joint Multinational Readiness Center rotations). As during the rotation, we stipulated that aircraft stay below 50 feet AGL with digital terrain elevation data level 2 installed on the AMPS. Our S2 provided a location of a suspected enemy SAM in vicinity of VIP Hill at JMRC. The AMPS generated the shaded red portion in Figure 4, which showed the area in which the SAM system could engage air targets above 50 feet AGL. The yellow shaded area represents where the SAM could detect air targets. Using the analysis from the AMPS, we then built two ABF positions of approximately one kilometer in length that afforded the aircrews to mask and unmask. We assigned a single AWT with one FCR-equipped and one non-FCR aircraft due to number of available aircraft to support the mission. In theory this attack could just as well have been executed with a platoon or even a company of Apaches.

The FCR-equipped aircraft established itself at the western ABF 2.4 nautical miles (NM) to the target at a heading of 43 degrees. The non-FCR aircraft occupied the eastern ABF at 2.1 NM to target at a heading of 349 degrees. The FCR aircraft conducted an FCR scan in ground targeting mode, and received a priority target on its TSD after the crew's first unmasking of its FCR, which took about six seconds. The aircraft moved to another hide-site along its ABF, unmasked again, and established a secondary target on its TSD. As with the intersection method in land navigation, the crew

then established a grid coordinate of the SAM system by triangulating off these two separate azimuths. This crew then passed the coordinates to the non-FCR aircraft via its Longbow net. This entire process, unmask-mask-unmask-mask, and then target coordinate generation took approximately 30 seconds.

At this point the AWT had two options. They could engage the target with AGM-114 (L) model Hellfire ("fire-and-forget") missile, which receives target information from the FCR to destroy the target. Or, instead generate a call-for-fire to the FSO for adjudication of fire support coordination measures. The aircrews chose option two using FM secure direct to the FSO. After doing so, the fire mission was generated on the AFATDS by the FSO and digitally transmitted to the supported maneuver BCT for assignment to a firing battery. Being that air defense artillery was number one the high-payoff target list for that phase, the mission was prosecuted with an artillery battery and was successfully suppressed.

It is worth explaining how the crews conducted a battle damage assessment (BDA) when, by the letter-of-the-law, Fires were unobserved. The crews again had two options. First, they could unmask after the fire direction center and FSO announced rounds complete on the target. The crews could have detected using their forward looking infrared (FLIR) system, or possibly a RQ-7 Shadow if operating as a manned-unmanned team (MUM-T) to establish BDA. Alternatively, the crews could have unmasked and rescanned the target area, and by using simple intuition knew if the target was destroyed when its radar signature was eliminated or degraded to such an extent that it was no longer recognized as an ADA system. Again, the aircrews chose option two.

With all this deliberate planning and FCR capability in mind, the ARB Fires cell

Figure 4. An aviation mission planning system generated threat analysis against a surface-to-air missile (SAM). Areas shaded in red represent where the SAM can engage air targets. The yellow portion indicates where the SAM can detect air targets. (Chief Warrant Officer 2 Keith Eastman/U.S. Army)

provided a new capability to the BCT fire support element. From intelligence to targeting, to terrain and threat analysis, the FSO and AMSO incorporated the nomination process of a target up to the BCT Fires cell into their standard operating procedures. From there, the FSO can build a task, target, location, observer, delivery, attack guidance and communication plan (TTLODAC) for inclusion into the BCT's concept of Fires (CoF). Without having to dedicate or endanger ground observers organic to the maneuver battalions or an unmanned collection asset, the ARB FSO enabled the BCT to observe, destroy and assess a HPTL threat using the FCR as both the detection and observation asset. Figure 5 illustrates an example TTLODAC the FSO generated for inclusion into the BCT's target synchronization matrix and CoF.

Several years ago the Army made a conscious decision to make the AH-64 Apache the military's top armed reconnaissance platform when it phased out the OH-58 Kiowa Warrior as the sole observatory armed aircraft. Combat aviation brigades (CAB), as a result, were constituted with a lethal mixture of manned-unmanned aviation assets. As an element of the division's CAB, the ARB uses its organic MQ-1C Gray Eagle and Apache airframes to "provide(s) accurate and timely information collection, provides reaction time and maneuver space, and destroys, defeats, delays, diverts or disrupts enemy forces in support of the combined arms team," (Field Manual 3-04 Army Aviation July 2015). Furthermore, the CAB's attack reconnaissance squadron (ARS) has an even greater reconnaissance capability than the ARB. The ARS possesses organic RQ-7 Shadows, while the Gray Eagle Company, though organic to the ARB, is typically retained by the division commander. Either way, as the Army becomes fully invested in combating "multiple, complex, and integrated" threats as McKiernan put it, the Apache needs to be thought of as current doctrine dictates. It should not be employed as an attack-pure platform kept in reserve until a TIC happens. When has

Figure 5. Example of fire support planning for an attack reconnaissance battalion using air defense artillery and maneuver targets. (Capt. David Williams/U.S. Army)

TF IRON DRAGONS CONCEPT OF FIRES											
OPN: CbR VIII				ARB FEC FIRE SUPPORT PRODUCT							
PH	FST	TGT#	Description	Location	ALT	SOURCE/ ACCURACY	OBSERVER	DELIVERY	Attack Guidance	ASSESS	COMMO
II	3	HD0001	BMP PLT	32UQV 11322 56007	395m	IMAG/ CATI	P: AH-64 A: FO	P:FA A: CAS	1 x AGM/ vehicle	P: AH-64 A: FO	P: BDE FIRES LAN A: BDE FIRES FM (VF)
II	1	HD0015	SA-6	32UQV 07378 60999	452m	FCR	P: AH-64 A: RQ-7	P:FA A: HIMARS	BTRY 9 HE/VT	P: AH-64 A: FMV	C: JCR E: Transverse

FIRE SUPPORT TASKS
FST 1: PROVIDE SEAD ON ENEMY AIR DEFENSE IOT PROVIDE FREEDOM OF MANEUVER FOR BCT
FST 2: PROVIDE SUPPRESSION AND COUNTERFIRE IOT NEUTRALIZE ENEMY ABILITY TO MASS IDF ON BCT
FST 3: PROVIDE DISRUPTION FIRES IOT DENY ENEMY'S FREEDOM OF MANEUVER

AH-64D Apache helicopters fly in an echelon-left platoon formation across Latvia during Operation Summer Shield. (Courtesy photo)

an Army ever kept its reconnaissance in reserve? The Apache should be resourced as an "aero-scout," capable of finding the enemy, calling for fire, observing, reporting and destroying with organic weapons if needed. And complementing its vast array of sensory equipment, the AH-64 Echo model is equipped with Link 16 software, allowing it to transmit fire missions digitally via Longbow nets directly to an AFATDS with pre-built URNs for each aircraft. Or, it simply can CFF via FM secure.

The broad consensus among the military's top brass is that the next armed conflict will pit the United States against a near-peer adversary. This adversary will be equipped with Tier 1 and 2 weaponry, capable of neutralizing our air superiority, operating in conjunction with non-state actors, and using both electronic warfare systems and information operations. It is incumbent, then, for the Fires community to disenthrall ourselves from how we delivered and integrated Fires in the COIN-era to a new age where our enemies will possibly attain land warfare parity with our military. In that possible future, Fires need to be synchronized in fashions that seem unorthodox — like having Apaches observe and directly engage with organic weapons or indirect Fires against short and medium-range ADA threats. Just take another permutation of how the Apache was employed during Combined Resolve. When released by the BCT commander, his RQ-7 was married with an Apache AWT to conduct MUM-T. In just one hour, two Apache crews, using the Shadow to lase and designate targets, destroyed an enemy armor platoon and its accompanying SAM system at an average range-to-target of 7.3 kilometers with no loss of aircraft.

This article is not intended to convince BCT and division FSCOORDs that the Apache is a panacea for all things Fires. Certainly we, the authors, believe BCT fire supporters should be cognizant of the capabilities the Apache provides beyond pure "attack," and at the very least they should consider using it as the primary or secondary observer for some (but not all) targets. We argue that the Apache provides maneuver commanders, and their FSCOORDs, with additional options that hitherto may not have been considered, particularly from an observatory and reconnaissance perspective.

An over-reliance on ground observers or unmanned systems to establish optimal observation posts or ideal field-of-view sites is not only unimaginative, but simply assumes the enemy will allow us to fight in ways we have grown accustomed in the last 15 years. We do not believe the next enemy will afford the opportunity to use derivative tactics from the COIN-era, particularly against their SAM systems. The Apache, equipped with the Modernized Target Acquisition Designation Sight, FLIR, the pilot night-vision sensor, MUM-T, and, yes, the FCR, which is specifically designed to collect and target literally almost a thousand targets at once, is perhaps the premier sensor platform available to the division commander and should be employed as such.

Capt. David Williams was formerly the 1st Battalion, 501st Attack Reconnaissance Battalion fire support officer at Fort Bliss, Texas. His previous assignments include 3rd Battalion, 321st Field Artillery Regiment fire direction officer, platoon leader, and liaison officer at Fort Bragg, N.C. He is a graduate of the Field Artillery Captains' Career, Precision Fires, Joint Firepower, and Joint Fires Observer courses.

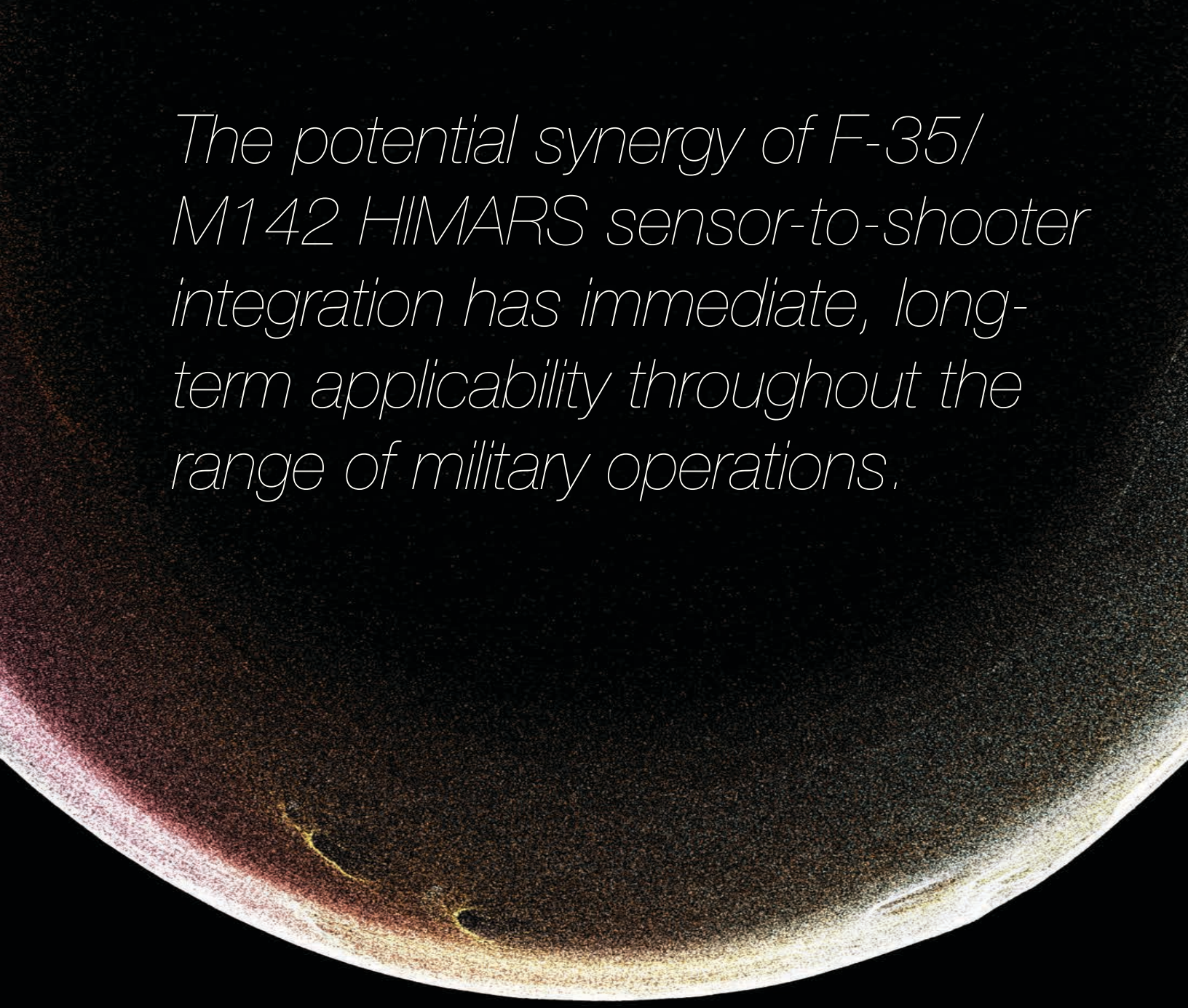
Chief Warrant Officer 2 Keith Eastman is the 1st Battalion, 501st Attack Reconnaissance Battalion aviation mission survivability officer at Fort Bliss, Texas. His previous assignments include 3rd Squadron, 6th Cavalry Regiment aviation mission survivability officer and 1st Battalion, 4th Attack Reconnaissance Battalion company-level pilot in command at Fort Hood, Texas. He is a graduate of the Warrant Officer Advanced and Aviation Mission Survivability Officer courses. He holds a Bachelor's degree in Aviation Flight Operations from Daniel Webster College, Nashua, N.H.

A lethal combination

F-35 Joint Strike Fighter and M142 HIMARS sensor-to-shooter integration

By Col. Joe Russo

The potential synergy of F-35/ M142 HIMARS sensor-to-shooter integration has immediate, long-term applicability throughout the range of military operations.



The multi-role F-35 Joint Strike Fighter (JSF) represents a revolutionary advancement in air dominance capability with enhanced lethality and survivability in hostile, anti-access airspace environments. The aircraft combines fifth generation fighter aircraft characteristics — advanced stealth and integrated avionics with a comprehensive integrated sensor capability. The M142 High Mobility Artillery Rocket System (HIMARS), likewise brings a revolutionary surface-to-surface Fires capability to the 21st Century battlefield, delivering precision munitions at ranges and accuracy previously only delivered by aircraft. The potential synergy of F-35/M142 HIMARS sensor-to-shooter integration has immediate, long-term applicability throughout the range of military operations to support:

- Naval expeditionary forces capable of supporting the establishment of sea control — denying sea lanes/access to adversaries, and conducting operational maneuver from the sea in anti-access/ area denial (A2/AD) environments.
- Over the horizon targeting in support of ship-board HIMARS employment.
- Phased attrition of A2/AD defenses.
- Deep shaping and counter Fires targeting/engagement — distinctly beyond, and complementary to current and emerging ground-based weapon systems and sensors.

Battery D, 2nd Battalion, 14th Marines conducted a command post exercise and Guided Multiple Launch Rocket System (GMLRS) live-fire annual training April 15-29 aboard Marine Corps Air Station Yuma, Ariz., and the Marine Corps Air Ground Combat Center in Twenty-nine Palms, Calif., to conduct a full mission profile C-130 borne, GMLRS live-fire exercise in support of Weapons Tactics Instructor (WTI) Course 17-2 Final Exercise 1 and Assault Support Tactics Course (AST) -2.

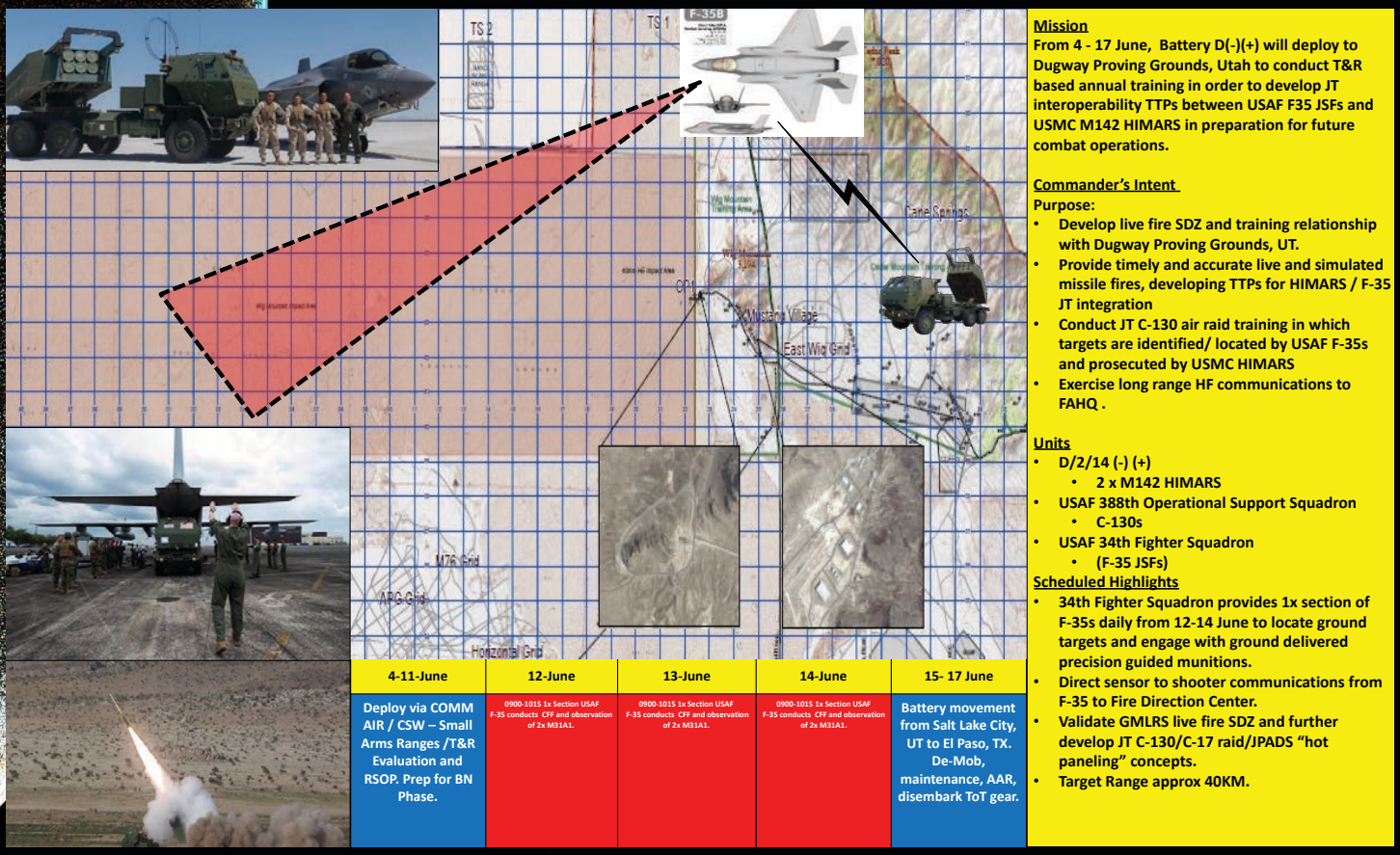


Figure 1. A mission slide from the F-35 Joint Strike Fighters and High Mobility Artillery Rocket Systems (HIMARS) integration exercise. HIMARS from D Battery, 2nd Battalion, 14th Marines, and F-35s from Marine Fighter Attack Squadron 211, 3rd Marine Aircraft Wing participated in the exercise. (Courtesy illustration)

Training highlighted the capabilities of the M142 HIMARS, and integration between the M142 HIMARS and F-35 JSF. D Battery fired four GMLRS Unitary rounds during the exercise. The GMLRS Unitary round is capable of precisely striking targets at ranges in excess of 84 kilometers with a blast-fragmentation warhead.

M142/F-35 JSF integration included HIMARS live fire in parallel with AST-2 in the Chocolate Mountain Training Range on April 19, engaging targets identified and relayed from F-35 JSFs from Marine Fighter Attack Squadron 211, 3rd Marine Aircraft Wing. This phase of training additionally marked the first ever GMLRS live-fire conducted in support of WTI.

14th Marine Regiment Force Artillery Headquarters liaison personnel integrated with the direct air support center (DASC) to enable a manual connection of the digital loop between F-35 sensors and the HIMARS platoon operations center/fire direction center. (Of note, a division-level fire support coordination center (FSCC) was not available to participate in this training). This manual step reflects the key lesson learned regarding the necessity of integrating F-35 aircraft with Marine Air Ground Task Force command and control (C2) systems. While the F-35 maintains a robust digital messaging capability via Link 16 and Variable Message Format (VMF), it cannot transmit a digital call for fire (CFF) using the current version of the Advanced Field Artillery Tactical Data System (AFATDS). Our intent was to clearly identify this challenge, highlight the deficiency by means of a live-fire integration exercise, and then gather the input of subject matter experts from Lockheed Martin, Marine Aviation Weapons and Tactics Squadron -1, Marine Corps Tactical Systems Support Activity and Marine Corps Systems Command regarding requirements and future solutions.

The C-130 raid package (executed April 23-24) originated from Marine Corps Airstation Yuma, Ariz., and flew with M142 HIMARS launchers and the platoon operations center aboard C-130 aircraft from 3rd Marine Aircraft Wing. After landing at the Marine Corps Air Ground Combat Center expeditionary airfield at Twenty-nine Palms, the HIMARS platoon established communications with the FSCC and prosecuted aviation (rotary-wing) acquired targets with two additional GMLRS in support of a battalion-sized air assault. This phase of training was executed in order to refine, and further demonstrate the utility and flexibility of M142 tethering to strategic lift aircraft. It also amplified the critical importance of this concept when considering the logistical sustainment of precision munitions.

Training objectives:

- Identify/highlight the digital disconnect between the F-35 JSF and AFATDS for future development.
- Conduct M142/F35 sensor-to-shooter training (command post exercise/live fire supported by VMFA 211 JSF aircraft).
- Further exercise HIMARS aircraft-airfield tethering tactics, techniques and procedures (TTPs).

- Conduct GMLRS live fire/Chocolate Mountains surface danger zone (SDZ) validation and further enable future training and integration with MAWTS-1.
- Further exercise long-range high-frequency (HF) communications employment (voice and digital).
- Further develop force artillery headquarters integration concept.
- Further develop HIMARS employment aboard C-130 aircraft/ Joint Precision Airdrop System (JPADS) employment (hot paneling). JPADS enables the M142 to maintain a GPS signal while in flight, thus decreasing the time required for a launcher to deliver missile Fires after debarking the aircraft.

F-35 data links/MAGTF C2 system gaps

The F-35 JSF employs advanced sensors capable of identifying, and precisely locating targets. HIMARS has the ability to deliver all-weather, day or night precision long-range missile Fires. The integration of the JSF's advanced intelligence surveillance and reconnaissance (ISR) targeting capabilities with the range and precision of HIMARS Fires offers a significantly enhanced ability to shape deep battlespace, while minimizing aircraft exposure and decreasing target decay that often occurs when mensuration of target coordinates is required.

The F-35 is capable of transmitting target coordinates via Link-16, VMF, or Multifunctional Advanced Data Link (MADL) messages. MADL is a low probability of intercept and low probability of detection datalink that is optimized as a fighter-to-fighter data link. Link-16 and VMF offer avenues to digitally send formatted weapon employment quality target coordinates and other specifically formatted messages from the F-35 to MAGTF C2 systems. Notably, this cannot be done directly with current versions of AFATDS. Additionally, an executable digital CFF cannot be transmitted from the F-35 to the current version of AFATDS.

At WTI 17-2, participating F-35 crews identified two separate targets using their advanced, on-board sensors. The coordinates, which were passed to the DASC and subsequently to the HIMARS platoon fire direction center (FDC), required no further refinement. Both targets prosecuted by the

Our intent was to clearly identify this challenge, highlight the deficiency by means of a live-fire integration exercise, and then gather the input of subject matter experts.

HIMARS/F-35 sensor-to-shooter package directly impacted their respective targets at ranges of approximately 23 km from the launchers. While it must be noted that the sensor-to-shooter package was facilitated by a voice CFF, the aircraft's advanced sensor acquisition of precision targets, at night, and requiring no additional mensuration was truly the take away, and an indicator of the enhanced combat potential of the tethering of these systems. On a broader scope, the F-35's ability to identify and locate targets, and rapidly transmit targeting data to ground-based Fires systems, be they rocket, missile or cannon, has tremendous potential to complement ground-based target acquisition capabilities in support of both ground combat element (GCE) and MAGTF counter-Fires.

In addition to GMLRS, both Marine Corps and Army HIMARS units currently have the ability to employ Army Tactical Missile System at ranges in excess of 162 miles. The ability of F-35s to penetrate enemy airspace-defenses, precisely identify targets, and relay those acquisitions to ground-based precision Fires systems at standoff ranges offers a revolutionary capability to the MAGTF/JFC deep-shaping effort.

Current TTPs to address the digital gap

The F-35 can pass limited digital traffic to Common Aviation Command and Control System (CAC2S) located in the DASC, but there is no digital CFF interoperability between CAC2S and AFATDS. Any information passed digitally to the CAC2S has to be manually entered into AFATDS to be sent to the battery or platoon FDC.

The F-35 can pass targets of opportunity using a voice CFF to the DASC or FSCC. This then must, likewise, be manually entered into an AFATDS and sent digitally to battery or platoon FDC.

Of note, while common for ground command and control agencies to have AFATDS operators, it is uncommon in the DASC and other senior air command and control agencies to have skilled AFATDS operators, knowledgeable in precision, surface-to-surface Fires employment.

In the interim, integration between the F-35, DASC, FSCC and HIMARS FDCs should be exercised to implement best TTPs. This will reduce kill-chain times and standardize employment of a liaison element to provide skilled AFATDS capability to air command and control agencies. Ultimately, the revolutionary combat effectiveness of this pairing can only be truly realized when the means to transmit a digital CFF from the aircraft to AFATDS can be established.

Integrating with the 34th Fighter Squadron

From June 4 -17, Battery D(-) 2/14th again deployed to Dugway Proving Grounds,

EXERCISE OVERVIEW

- On 19 April, 1/D/2/14, VMFA 211 and members of the MAWTS-1 staff executed the first "sensor to shooter" GMLRS live fire integration of the M142 HIMARS and F-35 JSF in support of WTI 17.2.

- Training was conducted in order to further integrate HIMARS planning into the WTI curriculum, validate a newly developed GMLRS live fire SDZ in the Chocolate Mountains TA, enhance HIMARS/C-130 tethering concepts, and to further identify TTPs/digital communications requirements/shortfalls between the F-35 and MAGTF C2 systems.

HIGHLIGHTS

- **1 D 2/14 HIMARS platoon supported by 2 x VMFA 211 F-35 AC fired 2 x GMLRS in the Chocolate Mountains TA ISO AST-2.**
- **2 x GMLRS direct hits on targets exclusively (no additional target mensuration required) acquired by F-35 sensor systems.**
- **FAHQ personnel integrated w/ DASC in order to reconnect the CFF/digital loop between the F-35 and the Platoon FDC.**
- **Chocolate Mountains GMLRS SDZ validated.**
- **C-130/M142 Tethering/JPADS "hot paneling" concepts of employment further validated.**

UNITS

- **1st Platoon, Battery D 2/14 (El Paso)**
- **VMFA 211**
- **MAWTS-1**
- **VMGR 352**

Figure 2. The exercise overview from the F-35 Joint Strike Fighters and High Mobility Artillery Rocket Systems (HIMARS) integration exercise. HIMARS from D Battery, 2nd Battalion, 14th Marines, and F-35s from Marine Fighter Attack Squadron 211, 3rd Marine Aircraft Wing participated in the exercise. (Courtesy illustration)

Utah, to develop joint interoperability TTPs between Air Force F35 JSFS and Marine Corps M142 HIMARS.

The overarching intent of the exercise was to:

- Develop a live-fire GMLRS SDZ and training relationship with Dugway Proving Grounds.
- Provide timely and accurate GMLRS missile Fires, developing TTPs for HIMARS/F35 joint integration.
- Conduct joint C-130/HIMARS-raid training in which HIMARS and Multiple Launch Rocket System family of munitions are transported to a firing point by strategic lift aircraft and engage targets identified by USAF F-35s.
- Exercise long-range HF communications in order to refine C2 in a SATCOM denied-degraded operating environment.

The exercise highlighted the first joint live-fire integration between HIMARS and USAF F-35s. The 34th Fighter Squadron provided one section of F-35s daily from June 13-14 to locate ground targets using onboard sensors to be prosecuted by HIMARS precision guided munitions. Direct sensor-to-shooter communications from F-35s were employed via ultra-high frequency voice communications from the aircraft to the battery FDC and then digitally transmitted from the FDC to launchers. Targets were engaged at ranges of approximately 42 kilometers with all GMLRS achieving effects on targets. All target locations were provided by USAF F-35s.

Way ahead

To develop the revolutionary capabilities of both the F-35 JSF and M142 HIMARS, several key actions must now occur. We must:

- Resolve the digital CFF divide between F-35 JSF and AFATDS.
  - Software?
  - Hardware/translator?
  - Commonality of digital communications?
- Identify ground combat element MAGTF ISR requirements of the F-35.
- Identify MAGTF staff requirements (structure/processes/systems) for the management of what could conceivably become overwhelming volumes of information provided by the F-35.
- Develop joint interoperability TTPs/systems/processes between the Air Force, Marine Corps, Navy F-35's and MAGTF C2 systems.

The Marine Corps Operating Concept and Marine Corps Force 2025 each challenge the service to innovate to meet the needs of a dynamic, 21st Century battlefield. Status quo however, will not suffice, and the importance of developing innovative solutions to these significant service-level challenges is paramount.

https://www.f35.com/about/capabilities

Col. Joe Russo, is the 14th Marine Regiment commander. He's deployed to Okinawa, Japan; Eastern Africa and South West Asia in support of Operation Southern Watch; participated in Operation Enduring Freedom I, Operation Iraqi Freedom I and Operation Enduring Freedom V.

FCoE, Ukrainian leaders talk Fires defense

By Marie Berberea

Russia has created a disturbing footprint in Crimea and Eastern Ukraine that has the United States and NATO concerned about future conflict. To stall their efforts, the Fires Center of Excellence has played a major role in helping the Ukrainian Army build up their Fires defense and more.

"Ukraine wants to become a NATO nation, but Russia doesn't want them to be a NATO nation. Russia wants to have a buffer zone," said Col. Heyward Hutson, U.S. Field Artillery School assistant commandant.

"We're trying to assist the Ukrainians in either holding what they've got in Eastern Ukraine, or developing capabilities and the capacity to regain their internationally recognized territory," said Hutson. "The problem is a lot of Eastern Ukraine is pro-Russia so the civilian population there is divided."

Better defense

A U.S. presidential decree in 2015 provided the Ukrainians with two Q-36 radars, a phased-out U.S. capability. That November, a team from U.S. Army Europe, FCoE and U.S. Army Security Assistance Training Management Organization conducted four weeks of operator training there.

"The major mechanism of injury for the Ukrainian soldiers in the [anti-terrorism zone] was indirect Fires," said Pat Macri, USSATMO Ukrainian security assistance training manager. "The initial radar systems they got were the lightweight counter mortar. The Ukrainians took a system that our Soldiers work well at best and took it to the next step. They actually synchronized it with all of their systems, but they wanted to take it to the next step and cover more areas of the battlefield."

Ukraine received four additional Q-36 radars six months later and training by U.S. Army Communications-Electronics Command with support from the FCoE and USSATMO.

"This time instead of just training on the Q-36, we decided to have kind of a holistic approach," said Macri. "One of the things we noticed was they were operating correctly, but they were failing to understand the capabilities, how to maneuver them on the battlefield and how to properly maintain them."

To solve this problem, the U.S. team showed their brigade, battalion and platoon commanders how to tactically employ the radar system to support fire and maneuver efforts. Then the Ukrainians moved into another identified gap of training: radar maintenance.

"That went extremely well and what we actually did was create a corps of radar maintainers for the Ukrainians. Then we rolled into the Army Basic Instructor Course to basically teach them how to teach. The whole idea is to get them to be self-sustaining because it had been identified that this is going to be a continuous training effort and obviously FCoE and the Army doesn't have the bandwidth to keep supporting it," said Macri.

After seven trips to Ukraine, the FCoE and USSATMO believe the next step is to build observer coach trainers into their artillery structure.

"What happened from the FCoE's perspective is we were asked to support a mission and go in and train the Ukrainians on radars, which we did and I think we did very successfully, but as we did that we uncovered more critical problems," said Hutson.

Talks have gone beyond the Q-36 and now Ukrainian leadership is looking to build its own Fires Center of Excellence. Hutson supports the idea, but said there are other concerns he feels should be addressed like the lack of a noncommissioned officer role in their ranks.

"I told them that's what makes the United States Army so dangerous, so lethal, because we rely very heavily on our NCOs to make decisions. If they're going to meet the NATO standard then they're going to have to become a little more progressive in their structure."

Macri said Ukraine is spinning up all its warfighter functions in an effort to defend itself and further its goal to join NATO.

"They are working to be NATO interoperable by 2020. Whether they meet this goal is entirely up to their progress on implementing the required changes within their military." said Macri.

Representatives from the Fires Center of Excellence and U.S. Army Europe traveled in September to visit with the Ukraine Army to discuss the way ahead for their artillery defense. (Courtesy photo)

The AN/TPQ-53 system (shown here in its fully upgraded configuration) is the Army's next-generation counter-fire target acquisition radar. It is scheduled to replace the EQ-36 QRC in 2019. (Paul Salce/Lockheed Martin Corp.)

Untying the Gordian Knot

A tiered approach to radar coverage revisited

By Maj. Andrew Johnston

In the past, radar coverage for U.S. Army brigade combat teams and division artillery (DIVARTY) was viewed as a complicated if not intractable problem. Past attempts at "cutting" or "untangling" this knot resulted in a tiered multi-system approach. Multiple radar systems and additional sensor platforms were required to protect the force from the threat-set present in Iraq and Afghanistan. However, the battlefield of the future requires increased capability and flexibility from fewer sensor platforms and electromagnetic spectrum emitters in smaller, more geographically dispersed units. Fortunately, a significant paradigm shift in sensor management is possible with targeted investment in the coming years.

Jan. 31, 2017, marked a milestone for the AN/TPQ-53 program as Lockheed Martin rolled the 100th Q-53 off the assembly line in Syracuse, N.Y. On March 30, 2017, the Army awarded Lockheed Martin a full-rate production contract for the production of an additional 74 systems. From its humble origins in the Multi-Mission Radar Science and Technology Objective and EQ-36 Programs, the Q-53 has emerged as the world's most advance weapons locating radar, providing a capability described by the 101st Airborne Division fresh from a deployment, as a "game changer." The C-130 capable, Q-53 is replacing both the AN/TPQ-37 and AN/TPQ-36 FireFinder radars in the Army inventory. A detailed modernization strategy that utilizes pre-planned product improvements (P3I) and receives adequate funding will enable the Q-53 to serve as the key platform for a multifunction Fires sensor capability over the next 25 years.

Pre-planned product improvements

P3I consist of three key upgrades to modernize the platform for Army 2025 and beyond. These upgrades will consist of software enhancements, a refreshed signal data processor (SDP) and transition to Gallium

Nitride (GaN) Transmit/Receive Modules (T/R).

Initial work focuses on planned software improvements to increase range and accuracy of the system and provide improved projectile classification. Updates simplify clutter mitigation and enhance electronic protection features of the system. New software increases the system's ability to correctly classify rockets, artillery and mortars down to the subtype. These changes serve to improve the system's reliability and availability, resulting in fewer system aborts and less downtime in the field.

A planned transition to Next Generation Graphical User Interface allows a common user interface on both the Q-50 and Q-53 radar systems. It reduces the training requirements and eases potential issues in the transition of operators between radar systems.

Key hardware changes mitigate technical obsolescence in current low initial rate production systems. A new improved SDP features faster processing and improved cooling with open architecture to accommodate future growth. Radars in the in force today rely on Field Programmable Gate Arrays to convert signal data received by the antenna into computer language for processing. Like all modern computer systems, the hardware underlying the Q-53 is subject to Moore's Law in that processing capacity has increased significantly since the first system was produced in the late 2000's. A redesigned SDP uses commercial-off-the-shelf technology consisting of single board computers and graphical processing unit cards. The chassis design features efficient conductive cooling and reduced power consumption, greatly increasing the performance of the system. This modernization effort alone increases the processing power of the radar by two-and-a-half times the original capacity, while allowing significant capacity for future growth.

The T/R modules on board the Q-53 are 10 years old and obsolete. They will be replaced with the now affordable GaN technology. Currently, Q-53 radars consist of 1024 T/R modules in groups of eight, called an octapack. Today these modules use Gallium Arsenide high power amplifiers to transmit and receive radio frequency energy. Commercial industry has transitioned to GaN, a newer technology commonly used in Blu-Rays, LED televisions, and the latest smartphones. GaN technology, overtime, is less expensive, features improved reliability, requires less energy consumption and produces less heat. The thermal efficiency of GaN T/R modules creates an additional benefit as fully populated GaN array will allow for a significant increase in the range of the radar. In fact, when combined with the new SDP, it may be possible to see doubling in the range capabilities of the system.

Counter unmanned aerial system

Separate from planned program of record (PoR) efforts to improve the Q-53 is a developmental effort aimed at new and emerging threats. Under this effort Lockheed Martin is developing a Q-53 air surveillance capability and integrating an identify friend or foe capability into the Q-53 radar. This two-year effort will see the Q-53 potentially add the ability to detect and classify unmanned aerial systems (UAS) at ranges greater than the Q-50, which grew out of the LSTAR and BSTAR (air surveillance) efforts. This effort could be become the foundation for true multi-mission radar capability at division and brigade combat levels in the Army. Adding air surveillance capability to the Q-53 provides cross domain sensing capabilities to maneuver commanders and will posture the Fires force for success on the battlefield of 2025 and beyond. Additional future capabilities could include ground, sea surveillance, or extended range providing additional sensor capabilities to a field artillery brigade, division, or other future Fires formations at the strategic level.

AN/TPQ-50

With its evolution from a Special Operations Command requirement to a PoR, the Q-50 CTA Radar adds considerable capability, in its specific role as a short range 6400 mil radar, to Army formations. The Q-50, like its predecessors the Q-48 and Q-49, consists of a modular radar, with an antenna composed of 24 columns mounted on a central mast. The Q-50 adds a dedicated M1151 Humvee prime mover as a component of the system and a 5kw generator for dedicated power. While not nearly as capable as the Q-53 in terms of range or accuracy, the Q-50, can provide close-range 360-degree coverage, freeing the Q-53 to support the "deep fight" in a potential high intensity conflict with a near-peer. Additionally, the Q-50 is configured to accompany forcible entry units during parachute or air assault operations. This unique capability makes the Q-50 ideal for protecting friendly drop zones, helicopter landing zones, C2 nodes, assembly areas and forward arming and refueling points where friendly forces face the greatest threat from enemy special operators and mortar teams infiltrating behind the forward line of troops.

As this threat evolves to include small Class I and Class II UAS capabilities, the Fires Center of Excellence continues to experiment with the potential of adding air search capability to a system similar to the Q-50. Future capabilities may include enhanced CTA performance, air search, or multi-mission capability and/or an on-the-move capability. The key to future technology insertion in the Q-53 program will be technology readiness level of new potential technology and the amount of resourcing provided to the program.

Maj. Andrew Johnston is the Training and Doctrine Command Capability Managevr for Field Artillery Brigade/Division Artillery acquisition staff officer.

An AN/TWQ-1 Avenger air defense system fires a missile over the Black Sea at Capu Midia Training Area, Romania on July 19, 2017. The drill allowed gunners to fire live missiles as part of Tobruq Legacy, an air defense exercise where the U.S. and its NATO Allies and partners share new knowledge, techniques and strategies to enhance air defense capabilities in Eastern Europe. (Pfc. Nicholas Vidro/7th Mobile Public Affairs Detachment)

10th AAMDC demonstrates new capabilities during Tobruq Legacy 2017

By Chief Warrant Officer 2 Kevin Kruthers

During an early July air and missile defense exercise, U.S. Army Europe and members of nine other NATO nations coordinated a complex operation in Eastern Europe involving 2,000 Soldiers, short- to long-range defense systems, network integration and the introduction of new battlefield options and capabilities.

The third annual Tobruq Legacy exercise, held in the Czech Republic, Romania and Lithuania, was the largest yet. Soldiers employed short-range, anti-aircraft artillery guns and missiles such as the ZU-2 and SA-6 and medium- to long-range missiles like Hawk and Patriot. For the second consecutive year, the U.S. Army also used a prototype of Raytheon's Dismounted Patriot Information Coordination Central. DPICC is a portable version of a tactical Information Coordination Shelter (ICC), which fits into five handheld cases.

The 10th Army Air and Missile Defense Command planned the first deployment of the Pa-

triot Air and Missile Defense System to Lithuania for the exercise however, air transport availability ruled out an ICC. The 10th AAMDC solved the issue by using DPICC. As a result, when junior Army leaders deployed to Lithuania alongside Soldiers from the South Carolina Army National Guard, they brought along Patriot's full capabilities without depleting them in other exercise locations.

The hardware also provided joint Patriot interoperability, a significant reduction in logistics and personnel footprint, and is set for fielding in the fourth quarter of fiscal year 2017 under an urgent material release to U.S. forces to relieve stress on the current Patriot force.

DPICC was previously used in Tobruq Legacy 16 to integrate Patriot units in Germany with 10th AAMDC forward-deployed forces in Slovakia. Another 10th AAMDC unit — C Battery, 5th Battalion, 7th Air Defense Artillery — deployed to Sweden in September 2017 with a DPICC in support of Aurora 17, the largest defense exercise for Sweden in more than two decades. The smaller hardware showed how it will expand capabilities for the 10th AAMDC, which is a relatively small command force in comparison to others.

Chief Warrant Officer 5 David Jones, 10th AAMDC command chief warrant officer, acknowledges the capabilities of the DPICC, especially operating in a joint force environment.

"DPICC is the type of innovative, scalable and game-changing capability needed to enable the 10th AAMDC commander to integrate and interoperate with U.S. and multinational forces to provide integrated air and missile defense protection of the European Command commander, supreme allied commander or other joint/combined forces commander's critical asset list," Jones said.

Other U.S. participants in this year's exercise included 31st Air Defense Artillery Brigade; 5th Battalion (Patriot), 7th Air Defense Artillery Regiment; and 2nd Battalion (Avenger/Sentinel), 263rd Air Defense Artillery Regiment, South Carolina Army National Guard. Just as in the two previous Tobruq exercises, the 10th AAMDC played a pivotal role, this time with a new major objective of network integration and interoperability for multinational air defense capabilities within regional surface-based air defense operations centers — a first for NATO and USAREUR.

The exercise met and supported all five pillars of U.S. Army Europe: Empowering junior leaders; Army Reserve and National Guard support; allies and partners; regionally allocated forces and dynamic presence. The 10th AAMDC is USAREUR's executive agent for all theater air and missile defense operations and air missile defense force management. Additionally, the 10th AAMDC and its joint and multinational operations support full-spectrum operations under the European phased adaptive approach.

Chief Warrant Officer 2 Kevin Kruthers is a 10th Army Air and Missile Defense Command, United States Army-Europe, air and missile defense tactician/technician.

Pvt. James Fricks, a gunner with Company C, 2nd Battalion, 263rd Air Defense Artillery, 263rd Army Air & Missile Defense Command, slides into the gunner's seat of an AN/TWQ-1 Avenger air defense system in preparation for a live-fire demonstration at Capu Midia Training Area, Romania on July 19, 2017. (U.S. Army Pfc. Nicholas Vidro/7th Mobile Public Affairs Detachment)

Countering future threats by maintaining manual gunnery proficiency

By Capt. Michael Wish

It may seem obvious that Marines and Soldiers are already training for the next fight, but the real question is, are they training for the right fight? A great number of past predictions have failed to accurately determine who the next adversary would be or how they would be fought. In 1991, who could have predicted the events of 9/11 and the following decades-long war with Afghanistan? Two years later was anyone desperately trying to remake the military for an insurgency fight in Iraq? What fight should artillerymen be preparing for in 2027? While the field artillery cannot know exactly what the next conflict will entail, it can identify potential adversaries and threats, design training to produce a flexible force ready for several scenarios and creatively reimagine doctrine to remain prepared for any threat.

For many years following sustained counterinsurgency operations in Afghanistan and Iraq, many senior artillerymen have perpetuated a belief that the artillery community has "lost its relevancy" and is fighting to get it back. Units in the force and fleet were told to get back to the basics as if line units could no longer accomplish the mission of the firing battery. To some extent there is reason to believe that proficiency in the field artillery was lost, given the high rate of nonstandard missions artillery units were asked to conduct. Furthermore, artillery units who did provide kinetic Fires in support of maneuver units were usually static at relatively permanent fire bases and often only providing precision guided munitions in order to avoid collateral damage. However, the loss in proficiency, whether perceived or real, has resulted in a large-scale movement to realign the artillery community with pre-9/11 doctrine while at the same time increasing the community's technological edge, especially in fire direction. Unfortunately, this course of action fails to consider future adversaries and threats.

Multiple recent articles across military journals have identified the greatest emerging threat as electronic warfare (EW). In fact, in the most recent Fires issue, an article cited the Journal of Asymmetric Warfare, which concluded that Russia far outmatches the U.S. in tactical EW.[1] Despite this widely accepted reality, serious efforts are underway to "modernize" the field artillery through the implementation of new technologies and by eliminating manual gunnery equipment and procedures. These efforts exacerbate the problem with a force that is already over-reliant on technology. Military experts in the civilian world are recognizing this growing problem as well. In the publication, The National Interest, Jacquelyn Schneider states that "the U.S. may be coming to a point in which the utilization of digital technologies that has made the U.S. so effective and so lethal has developed into a dangerous digital dependency."[2]

This digital dependency is all too clear; in the last few years manual gunnery instruction was completely removed from the 13J Advanced Individual Training (AIT) program of instruction (POI).[3] Furthermore, the non-commissioned officers attending the Advanced Leaders Course (ALC) receive only 12 training days on manual gunnery, focusing on muzzle velocity management and manual cannon safety computations, the latter of which is not applicable in combat scenarios. The Basic Officer Leaders Course (BOLC), Marine Artillery Officer Basic Course (MAOBC) and the Marine Artillery Operations Chief Course (MAOCC) are the last bastions for in-depth manual gunnery, and even BOLC's manual gunnery instruction is under assault. New technologies should and are being implemented, along with the training to properly employ systems, but they should not create a critical vulnerability in the very fight they are supposed to assist with.

"The danger is that with digital dependency comes both extreme capability and extreme vulnerability so that, paradoxically, the U.S. may at the same time be both more militarily effective and less secure."[4]

Proficiency in manual processes has already started to degrade, evidenced by reports from Joint Readiness Training Center and the National Training Center. The Center for Army Lessons Learned has identified multiple failures in this area. In fiscal year 2015, the Combat Training Center observed that "units rarely meet all five requirements." From the NTC Impressions Report 2015, "Unit was challenged in completing the necessary data on the [Department of the Army Form 4504 Record of Fire]."

A recent JRTC trends slide deck specifically stated that units could not transition to manual means for determining data and if they were not fully digital capable and were unable (not degraded, but actually unable) to provide Fires. Improving firing data through registrations, using manual forms and determining data in a manual setting are skills that are continually degrading.

Large risks are being taken through increased digital dependence in the field artillery. The Army has already cut the survey

1 Journal of Asymmetric Warfare, 'Tactical EW and Cyber: Russian versus U.S. Capability', Vol. 1, Issue 2, August 2016.

2 Schneider, Jacquelyn, et al. "America's Digital Dependency and the Capability/Vulnerability Paradox." The National Interest, The Center for the National Interest, Sept. 6, 2016, nationalinterest.org/blog/the-buzz/americas-digital-dependency-the-capability-vulnerability-17601. Accessed Oct. 1, 2017.

3 13J AIT is the entry-level school for soldiers who will determine technical fire direction in the Fire Direction Center.

4 Schneider, Jacquelyn, et al. "America's Digital Dependency and the Capability/Vulnerability Paradox." The National Interest, The Center for the National Interest, Sept. 6, 2016, nationalinterest.org/blog/the-buzz/americas-digital-dependency-the-capability-vulnerability-17601. Accessed Oct. 1, 2017.

"If you're asking if we've degraded our analog skills based upon technology and the increase of technology, of course we have. And I agree we can't lose the ability to do those things analog-wise."

—Sergeant Major of the Army, Sgt. Maj. Dan Daily

and meteorological (MET) military occupational specialties, meaning in a degraded environment without the GPS, Army FA will not be able to account for the second and fourth requirements for accurate predicted fire: accurate firing unit location and accurate meteorological information. When unable to account for the five requirements a unit could easily register, but along with the usual drawbacks of registering (enemy target acquisition, ammunition expenditure, etc.), units lack experience and technical knowledge in registrations because they don't train for them. After all, if the digital systems are always functioning in a training environment and there is no EW threat, then a unit is always meeting the five requirements. This simply won't be the case in the next large-scale conflict.

The second and third order effects of removing manual gunnery instruction are far reaching. The most obvious one will be an inability to troubleshoot digital systems, especially when the accuracy of Fires needs improving. An excellent example of such troubleshooting in action are the recent efforts of 1st Battalion, 7th Field Artillery Regiment's leaders who refused to accept "good enough" as an appropriate answer to achieving the goal of the FA. In their Fires Bulletin article, "Every mil matters; one battalions fight against error," Lt. Col. Jim Collins and Capt Joshua Herzog expertly describe their practical application of manual gunnery knowledge as well as a "renewed culture of exacting standards," as they isolated and resolved errors, a process which would not be possible without a deep knowledge of manual gunnery.[5] Just as in mathematics when a student must learn how to add, subtract, multiply and divide before using a calculator, so too must the fire direction officers (FDO) and operations chiefs understand the theory by which our systems operate, not just "button-ology."

Using manual gunnery as a tangible method for instructing theory and the application of artillery systems to tactical and technical fire direction has the benefit of also preparing Marines and Soldiers to fight in a digitally degraded environment, which is also exactly how they should train. While every artilleryman should be highly capable and efficient with current digital systems and their employment, every training evolution should include an EW attack to various systems. A simulated GPS failure should require a response by the gunline to lay the howitzers by "glass and iron." Communications failures will result in the fire direction centers inability to receive updated MET, forcing chiefs and FDOs to take active steps to improve firing data. The scenarios are as endless as they will be on the next battlefield, and the FA needs to be prepared for that eventuality.

Potential adversaries, threats and results from worse-case scenario training will affect artillery doctrine as it moves into the future. No longer can batteries maintain firing positions for more than a few volleys before receiving counter-battery fire from the enemy. This means future doctrine will not only include contingencies for degraded environments, but also accounting for continuous and emergency displacements, which provide for an incredibly complex and dynamic combat environment where degradations are compounded by constantly changing positions.

The future of FA will undoubtedly benefit from advances in friendly tactical EW, but it would be unwise to wager the entire capability of the artillery community on that eventuality, especially in the short term. The FA must continue to implement manual gunnery theory and procedures in its educational system, provide realistic training scenarios that leverage every artillerymen's capabilities across the entire spectrum of fully automated and degraded artillery operations, and update its doctrine to deal with the very real EW threat that could actually mean a loss in relevancy for FA. Perhaps the FA needs to heed the warning of Sergeant Major of the Army, Sgt. Maj. Dan Daily. "If you're asking if we've degraded our analog skills based upon technology and the increase of technology, of course we have. And I agree we can't lose the ability to do those things analog-wise."[6]

Capt. Michael Wish is the Marine Artillery Officer Basic Course officer in charge for gunnery at Fort Sill, Okla. Previously, Wish was a fire direction officer and a platoon commander with Sierra Battery, 5th Battalion, 11th Marines, where he deployed to Afghanistan. Later he became the executive officer for Tango Battery, 5-11th Marines, which had a cannon platoon attached, for his second deployment to Afghanistan.

5 Collins, Jim, and Joshua Herzog. "Every mil matters: One battalion's fight against error." Fires, 2016, pp. 56–60.

6 Tan, Michelle. "Back to basics: Army dials up traditional soldiering once again." Army Times, Army Times, July 5, 2016, www.armytimes.com/news/your-army/2016/07/05/back-to-basics-army-dials-up-traditional-soldiering-once-again/. Accessed Oct. 3, 2017.

Calling for improvements on US Army's cannon artillery

By Capt. Joseph Schmid and Capt. Adam Wilson, Jr.

"We are at a place in technological history where maneuver cannot close with and destroy the enemy by itself. We must rely on Fires to shape the battlefield and create favorable force ratios through attrition of key enemy systems so that maneuver, once again, can win the day."

—Maj. Gen. Christopher Cavoli—

The launcher for a Russian BM-30 Smerch multiple rocket launching system outside the Sait-Petersburg Artillery museum. (Wikimedia)

Following the recent presidential election, regional tensions skyrocketed as the North Korean military demonstrates its ability to launch an intercontinental ballistic missile (ICBM) capable of ranging portions of the U.S. mainland. Exploiting these disturbing events China and Russia, in a bid to consolidate regional power within the Pacific at the expense of U.S. political and military strategic objectives, released a joint statement. Russian President Vladimir Putin remarked "We've agreed to promote our joint initiative, based on the Russian step-by-step Korean settlement plan and Chinese ideas to simultaneously freeze North Korean nuclear and missile activities [as well as] U.S. and South Korean joint military drills."

North Korea's seemingly unending ICBM launches serve as a catalyst for regional Pacific powers to exploit what many perceive as a waning U.S. ability to keep peace in the Pacific. If the U.S. government were to comply with this joint statement and halt our annual defensive military drills on the Korean peninsula, it would not only leave South Korea open to invasion by a regime bent on unifying the Korean peninsula, but we would also be signaling to the global community the time of solitary U.S. influence within the Pacific is at an end.

As leaders in Congress, the Pentagon and the White House deliberate on the most appropriate broad political, economic and military responses available to our nation, we, as 25th Infantry Division Field Artillery officers, wish to isolate the Fires capacity of three of the biggest players in the Pacific: Russia, China and especially the Democratic People's Republic of Korea (DPRK). After clarifying the Fires capabilities and limitations for each nation we will turn our attention to those of the U.S. How do our domestic cannon and rocket artillery systems match against the Russian 2S35 Koalitsiya or the Chinese A-100 series Multiple Rocket Launcher (MRL)? If we become embroiled in a regional conflict on the Korean Peninsula how will we employ an artillery force, who for the last 15 years has been combatting a low-intensity counter-insurgency fight? If conventional force on the Korean Peninsula is identified as the only realistic option for the U.S., we would be facing the largest artillery force in the world, a drastic change from counter-insurgency missions in Afghanistan and Iraq.

After reviewing Fires capabilities and limitations of near-peer and rogue nations within the Pacific region, we suggest three shifts in the mindset of our Fires leadership to better align ourselves for possible conflict on the Korean peninsula. First, we must consolidate all M777 howitzers at the corps level in order to set conditions for massing. Second, we must quickly find an

A PLZ-05 self-propelled howitzer. (Courtesy photo)

extended range munition in order to counter the overmatch when facing the DPRK. And third, we must rely on the ability of the M119A3 to act as a fast moving artillery piece able to outshoot, outmaneuver and over communicate against the larger and more cumbersome systems available to Russia, China and the DPRK.

If we hope to understand why our artillery needs physical capabilities and operational employment improvements, we must review those foreign pieces it is most likely to be tested against in the Pacific. While the United States has been busy in Iraq and Afghanistan, countries like Russia, China and North Korea have made significant technological improvements to their key artillery systems. Most evident is the potential range overmatch and high rate of fire each system brings to the battlefield. For example, the 2S35 Koalitsiya is one of the great self-propelled artillery improvements Russia fielded in March of 2015. The 2S35 self-propelled howitzer has a maximum range of 70 kilometers. It has been reported that the Russian's are building a 2S35 variant that contains 2x 152 mm or 2x 155 mm tubes in an over under internal self-feeding configuration capable of holding up to 70 complete rounds. This advancement will enable a single system to deliver up to 48 rounds in a three-minute burst. Also, the Russian 9A52 MRL has an increased maximum range from 90 to 100 kilometers. Additional improvements to the 9A52 are the level of accuracy and speed at which it delivers the eight rockets it carries.

North Korea brings a robust artillery package in its conventional attempt to reunify the Korean Peninsula to include the 170 mm Koksan self-propelled howitzer and the KN-09 MRL. With a range of 60 kilometers, many argue the 170 mm Koksan was engineered specifically to reach the South Korean capital from the demilitarized zone. However, its impressive range is somewhat nullified by a relatively slow one-to-two round per five minute rate of fire. On April 25, 2017, Kim Jong-Un watched as his country's military massed an impressive 400 of these howitzers in a live-fire drill in celebration of its 85th birthday. Furthermore, the KN-09 MRL is the culmination of decades of rocket artillery experimentation. Originating from the Russian 300 mm BM-30 Smerch, this rocket artillery piece has a range of up to 200 km and its eight launch tubes are contained in two pods. On June 8, 2017, North Korea used this platform to fire four KH-35 anti-ship missiles into the sea, declaring their military now had the ability to strike a U.S. aircraft carrier. If true, this capability actually puts North Korean rocket artillery ahead of our Multiple Launch Rocket System (MLRS) and High Mobility Artillery Rocket System (HIMARS). Currently there are discussions of using these systems in a mobile land anti-ship capability.

China, as a burgeoning world power, seems to want to dominate Asian nations through solid economic plans such as its "One Belt, One Road" policy. As of now, of the three nations discussed China is the least threatening militarily to the U.S. However, as China continues to realize its potential as a regional leader and their policies become misaligned with U.S. intent (South China Sea) we must factor in Chinese Fires capabilities in order to present a full regional depiction. China's AR1A 300 mm MRL system, unveiled to the public during the International Defense Exhibition IDEX 2009, possess a formidable 150 km range capable of shaping in terms of U.S. doctrine beyond the fire support coordination line. A crew of four People's Liberation Army (PLA) soldiers can expend two pods of five rockets within five minutes. Moving to China's canon artillery, the PLZ-05 is a Chinese tracked self-propelled armored 155 mm howitzer designed and manufactured by the China North Industries Group Corporation. The PLZ-05 can range up to 39 km providing responsive Fires for PLA groups arrayed across the battlefield. China's Fires community consists largely of rocket and heavy self-propelled artillery types able to deliver large amounts of firepower at the expense of mobility.

Lt. Col. Joshua Thibeault, who works at the Army Capabilities Integration Center, co-wrote an article relaying the effectiveness of Russian artillery in the recent conflict in Russia/Ukraine. In "Russia's New-Generation Warfare," Thibeault made some startling observations. First, at least 80 percent of all casualties against the Ukraine were produced by Russian artillery. Additionally, four trends emerged from the nearly 45 months of conflict. The trends include the use of dual-purpose improved conventional munitions, scatterable mines, top attack munitions and thermobaric warheads that have a significant impact when used in pre-planned and massed strikes (a return to true artillery preparation Fires). Russia adopted the concept in the 1980s from the original father of fire support, Germany's Georg Bruchmuller of WWI, "The main objective of fire strike as an offensive is to inflict as much damage on the enemy as is necessary to prevent him from putting up an organized resistance, thereby creating the necessary conditions for successfully carrying out combat operations."

The second trend is the use of direct fire tubed artillery by both Russia and Ukraine out to 6 km for the purpose of suppression of anti-tank defenses and as anti-tank weapons. The third trend is the extended range of application of artillery largely due to innovation with extended-range unmanned aerial vehicles (UAVs) used as observers

along with extended-range radars to locate enemy artillery units. Additionally, the improvements to technology, systems and munitions to gain a range advantage of cannon artillery significantly contributes to Russian success. The final trend is a focus on counter battery, to force the enemy artillery to move continuously, which prevents them from being used, meaning they cannot fire their systems (disruption).

What do these trends have to do with the United States Army's posture and readiness against a near-peer enemy? Thibeault made an assessment that the Russians have at least a 3 to 1 advantage in cannon artillery over the United States Army. Russia also has an advantage in munitions mentioned above and the ability to mass Fires at the division and corps level with ease. Thibeault notes the importance of relearning camouflage, concealment and deception to counter the use of UAV. But in order to counter the disadvantage the United States Army faces against near-peer threats like Russia, China, and North Korea we must look to make system improvements rather than to focus on tactics, techniques and procedures we should already be doing (Thibeault).

Russia's use of electronic warfare to detect electromagnetic emissions would allow them to easily find our artillery assets. Additionally, the ability to control or jam our GPS signals and deny the most basic of communications compounded with the ability to pre-detonate or cause our munitions to dud if they contain an electronic fuze could greatly change the outcome of a battle. As mentioned, the current employment of Russian artillery tactics is in large, a shared view by North Korea, China and Iran. Although at different levels of technology in their use of artillery, all believe in the massing of brigade and above Fires assets and leading with artillery to shape and win battles. The concept of winning the battle by coordination and synchronization of massed Fires and effects is traditional, but still very relevant and perhaps where we need to focus.

In making the case for traditional cannon artillery, let's talk about the systems themselves. The primary artillery delivery systems of the United States Army are the M119 (105 mm towed artillery), M777 (155 mm towed artillery), M109 (155 mm self-propelled artillery), M142 HIMARS (self-propelled) and the M270 MLRS (self-propelled).

In fighting for traditional cannon artillery, the M777 is a system we may not need in a near-peer fight. The M777 is a towed 155 mm howitzer, admired by the Marines, loved by the Army, and yet the builders (United Kingdom) of the system do not use it. The United Kingdom stays clear of the M777 because they believe the hydraulic components and its versatility are a liability.

The M777 should be reduced back to a corps-level asset, leaving none in the brigade combat teams (BCTs). Every corps should have a battalion of M777 (three batteries of eight howitzers each), enabling corps to task organize a battery to a division for the purpose of support area security and enabling family of scatterable mines and Excalibur use in the BCTs. The reality is the M777 is a great system, but not in a near-peer fight. The crews of an M777 would be rendered incapable of keeping up with maneuver forces during an extended operation from emplacing and displacing to prevent being struck by enemy counter fire, causing them to be ineffective and at risk of destruction by enemy artillery or risk to mission. Commanders want increased range abilities and compared to the M109, the M777 is much cheaper, but in reality, can we support a long-term, high-tempo operation with an M777? Even looking at an air assault or an airborne operation, the prime mover cannot be delivered with the system, and the system is too heavy to move one to three kilometers by hand (it's possible with the M119). Additionally, 155 mm ammunition is heavy; the amount brought for the fight is limited by assets available (155 mm ammunition weighs 100 lbs while the 105 mm ammunition weighs 33 lbs). Whether air assaulted or air dropped, the M777 can't perform survivability moves, or keep a low signature. It requires larger crews when compared to the M119, and with minimal ammunition the effects it brings are limited to what the air platforms can carry.

By consolidating M777s into a corps-level asset, operational level designers can better plan, prepare, execute and assess fire strikes leveraging the emerging operational Fires command to create a desired mass effect at the right time and place in support of a major maneuver operation. The M777 becomes a weapon system used solely for the artillery's historic mission of mass preparatory or barrage Fires against an enemy who will bring exorbitant amounts of men, weapons and equipment to a traditional linear fight. Because it is consolidated at the corps level, M777s can arrive in mass to planned points on the battlefield and deliver devastating effects. The relatively highly maneuverable M119 howitzer steps up and becomes the sole supporter of the brigade "knife fight."

The most versatile cannon artillery system the United States Army has is the M119. The system is a towed 105 mm howitzer, primarily used by United States Army light BCTs. This system was originally produced by the United Kingdom and an updated version is still used by them today. It is a versatile system that can be dropped with prime movers, air assaulted with prime movers, pulled by a five-man crew for survivability moves or to tuck into tree lines easily in what was common practice known as an artillery hide. A hide is a camouflaged shelter or location used to conceal from the view or notice of enemy forces, often used as a temporary bed down location. Moreover, the 105 mm ammunition is less than half the weight of the 155 mm ammunition used by the M777 and contains charges with the projectile for ease of use making it a more desirable system.

The M119 should be used at the brigade and below level, only if capability shortfalls and solutions to them are addressed. In the event light units lose the M777 (if it was moved back to a corps-level asset) the artillery battalion that supports the light BCT should remain at three cannon batteries, but expand to 8x M119's per battery to facilitate the three infantry battalions they support and the one infantry squadron. This also improves the ratio of the aforementioned tube disadvantage of the United States artillery to the near-peer enemy threat. Most importantly, stressing the need to extend the range on the M119 to approximately 20 km without the need of a rocket assisted projectile (RAP), and approximately 24 km with RAP would make this system a next generation, more versatile weapon. To achieve this, the United States Army does not need to build a new system, but simply to improve the M119 much like the current version of the United Kingdom's 105 mm towed howitzer, the L118. The United Kingdom extended the tube by about one foot, equating to one additional turn of rifling. Additionally, they pushed on their manufactures to produce a better tube that allows more rounds per minute for extend-

Soldiers of the Royal Artillery are pictured firing 105 mm light guns during an exercise. Commonly known as the 'Gunners,' the Royal Artillery provides firepower to the British Army. They are responsible for finding the enemy using a variety of high-tech equipment and then, when required, striking them using everything from explosive shells to advanced precision rockets. (United Kingdom Dept. of Defence)

ed periods of time without damaging the tube. They also pushed their manufactures to produce a more efficient projectile to increase muzzle velocity, and ultimately increased the L118's range.

Today, our cannon tubes would melt and become dangerous if we were to fire as we did in WWI or WWII. Data from WWI shows field guns fired an average of six rounds per minute for about three hours of preparation Fires and five rounds a minute for the creeping barrage; light field howitzers fired an average of four and a half rounds per minute for about three hours of preparation Fires and four and a half rounds a minute for the creeping barrage; heavy field howitzers and 100 mm guns fired an average of two and a half rounds per minute for about three hours of preparation Fires and two and a half rounds a minute for the creeping barrage; heavy guns (150 mm and above) fired an average of one and a half rounds per minute for about three hours of preparation Fires and one round a minute for the creeping barrage, as all these systems were used at the same time (massing and artillery preparation Fires). Seeing that our tubes for both the 105 mm and the 155 mm could not sustain long operations with high volumes of fire, we need to address this disadvantage. As for an increased range from a more efficient propellant, the L118 compared to the M119 has a range advantage of 5.6 km for standard range. That's right, the same system as the United States Army slightly modified, the L118 has a standard range of 17.2 km to our 11.5 km standard range and with RAP they are able to increase range to 20.6 km, where we can range out to 19.5 km using RAP. In comparison, the M109 only has a standard range of 18.2 km while the M777 standard range sits at 22.2 km, giving the systems a slight edge over range, but the L118 would out-fire our 155 mm systems with number of rounds, speed of firing, versatility and survivability. I believe the United States can develop an improved 105 mm howitzer that can at least match the capabilities of the L118, and exceed the range it achieves with RAP out to 24 km. Lastly, the potential ability to bring the M119 to the front lines as a rotary wing and UAV deterrent is a real possibility nested with a short-range air defense system in need of much improvement. Building new innovative munitions similar to the effects of killer junior (which is a technique of employing artillery direct fire air bursts, that involves a howitzer firing a high explosive shell fuzed with a mechanical time, super quick artillery fuze set to cause an airburst over a target in very close proximity to the gun's position) to essentially target the predictive path provided by air tracking systems like Tactical Airspace Integration System and fire a bird shot type munition that ranges 5 km-10 km could counter both UAV and rotary wing. This ability would allow for a low signature system on the front lines that combats the enemy threats designed and equipped to kill friendly lead Mid-tier Networking Vehicular Radio (MNVR).

Transitioning to the M109, this system is a self-propelled 155 mm tubed howitzer.

I have never been in a heavy BCT to get first-hand experience of this system in regards to its specific quirks (I have been told maintenance is the largest concern), but this system could be the future of near-peer fighting. Just looking at how responsive it is in receiving missions, mobility, emplacement and displacement times (increase chances of survivability) and protection of troops tops the priority list of systems to focus on for future operations. However, in its current form it is not ready to fight the near-peer fight and enable MNVR to close with and destroy the enemy. Similar to the need of an extended range with regards to the M119, the M109 is currently on its seventh version and still, we have not pushed the manufactures to increase the range of the system or improve the tube to handle a more robust rate of fire. I believe very strongly the United States Army needs to push on our manufactures, to develop a M109 with a standard range of 45 km and an extended range of 55 km. Why these ranges? First, most near-peer enemy artillery outnumber that of the United States Army. Additionally, most near-peer artillery has a range advantage over that of the United States Army's artillery. The current range disadvantage means we, the United States Army, will not be able to take a breath, or transition to a defense because out-ranged and outnumbered by enemy artillery means, the enemy artillery will be able to keep us off balance without fear of counter fire. An increased range to the artillery systems we currently employ would also mean the range or location of a division deep fight would be increased to shape and attrite the enemy forces in a larger area. The traditional battlefield geometries have remained relatively unchanged over the years. What has changed is the technology to observe targets through the use of UAV's and other space and air assets. If we can see clearer and shape deeper, ultimately we will be able to destroy more of the enemy force before it gets to the brigades in the close fight. Greater attrition of enemy forces before they enter the close fight will ultimately reduce friendly casualties while maintaining the initiative and position of relative advantage.

With regard to the M270, it is clear the systems themselves are amazing, capable and the primary surface-to-surface assets used to shape the deep fight at the division level and higher. The only area that needs improvement is the cost analysis and range capability. First, cost is an issue for most things in the United States Army across the board. If it takes too much money and too much time to build key munitions at the quantity we need, it seems like a difficult road to success in the near-peer fight. We want to be able to action targets at 35 km if needed but, at the same time with the same munition be able to range out to 100 km with an accuracy of 100 meters without the use of GPS-type hardware making it less vulnerable to electronic warfare. Additionally, this rocket needs to be at a price that is affordable so that the Army can fire potentially thousands per day and not over extend the military budget or stockpile. The Army Tactical Missile System is a great asset in need of little focus in regards to changes or improvements other than the ability to fend off electronic attacks while in flight. The focus should be a cheap, accurate rocket that can range out to 100 km without electronic systems that can be jammed and, as mentioned, early if needed, hit a close target without changing rocket pods. All of these offered technological changes increase capabilities while simplifying the amount of rounds we use and have in stockpile. If these changes could be made to the existing M30 and M31, the M26 and M26A1 would no longer be needed depending on what is cheaper.

In discussing the potential problems, assessments and solutions regarding the United States Army artillery community, systems from sister services that could potentially balance out the disadvantages the Army currently faces are not considered. If the addressed system modifications, doctrinal considerations, organization adjustments and leadership improvements are addressed, artillery will reign once again as the King of Battle and the answer to modern conventional warfare. The intent of this article is to spark open-minded conversations about where the Army artillery branch will be in the future compared to the artillery specific assets and capability our enemy may have. At a minimum, it will trigger more people to contribute in the professional development and advancement of our beloved branch. Lastly, this article could give our non-artillery personnel an idea of what we want to do for them compared to what we have and hopefully intrigue them enough to want to join the conversation and push for change in support of artillery.

What has changed is the technology to observe targets through the use of UAVs and other space and air assets.

Capt. Joseph Schmid is the 25th Division Artillery, 25th Infantry Division current operations officer. He holds a B.A. in English from West Florida University. During his career, he attended Field Artillery Basic Officer Leaders Course and Captains Career Course at Fort Sill, Okla. He served in the 82nd Airborne Division as a fire support officer and fire direction, platoon leader for A Battery, 1st Battalion, 73rd Cavalry Regiment, and as a B Battery, 2nd Battalion, 319th Airborne Field Artillery Regiment executive officer. He is now stationed at Schofield Barracks, Hawaii.

Capt. Adam Wilson Jr., is a 25th Infantry Division assistant fire support officer. He holds a M.A. in History from Liberty University. During his career, Wilson attended Field Artillery Basic Officer Leaders Course and Captains Career Course at Fort Sill, Okla. He served in the 82nd Airborne Division as a platoon fire direction officer, platoon leader, battery executive officer, and as a 2nd Battalion, 319th Airborne Field Artillery Regiment as a fire direction officer. He is now stationed at Schofield Barracks, Hawaii.

First Lt. Bryce Starratt (right), A Company, 1st Battalion, 503rd Infantry Regiment, 173rd Airborne Brigade fire support office, stands beside Latvian Army forward observers critiquing mortar accuracy down range through his binoculars during a combined, joint, live-fire exercise at Adazi Training Area, Latvia. Starratt called in mortar fire on multiple designated coordinates on the range and worked with his Latvian counterparts on troubleshooting problems in accuracy. (Spc. Seth LaCount/Michigan Army National Guard)

'Wait one'

Developing the brigade fire support officer

By Maj. Gregory Tomlin

Many direct support field artillery battalion commanders argue that only their most experienced officers should lead platoons, command batteries, or serve as executive and operations officers. This rationale leads the majority of FA lieutenants, captains, and majors to fill a fire support officer (FSO) billet as soon as they report to a new unit. While selecting appropriate officers for leadership positions remains essential for the success of any battalion, the FA community may not be offering maneuver commanders with the most capable FSOs by sending new-arrivals directly into the combined arms fray.

Indeed, the complexities of an FSO's responsibilities require a mastery of both the employment of howitzers and the integration of joint Fires, which makes the learning curve steep for officers trying to familiarize themselves with the capabilities of a direct support battalion and the array of lethal and non-lethal assets available to a maneuver commander. This article focuses on preparing brigade FSOs, however, the argument remains salient for grooming company and battalion FSOs as well. Reserving FSO billets for the most experienced FA officers, those who have already served in the direct support battalion as an executive or operations officer, will advance the Fires Center of Excellence's focus on developing joint Fires experts and the Chief of Staff of the Army's priority of improving operational readiness.

Integrating joint Fires

Training Circular 3-09.31 charges the brigade FSO with "developing the fire support plan based on the commander's planning guidance and commander's intent."[1] The preponderance of a brigade combat team's preplanned and counterbattery targets relies on the FA battalion as the primary shooter since direct support howitzers

1 Training Circular 3-09.31, "Fire Support Training for the Brigade Combat Team Commander," Nov. 15, 2013, 1-1.

provide the most responsive and lethal delivery system in the joint Fires inventory. Brigade-level planners depend less on other weapon systems because maneuver battalion commanders covet employing their organic mortars to shape the fight at their echelon, and the unpredictably of weather or changing division priorities makes attack air and close air support less reliable. An FSO who previously served as an FA battalion executive or operations officer possesses firsthand knowledge of the distinct capabilities and limitations of the firing batteries and target acquisition platoon, including occupation times, ammunition resupply rates, and requirements to sling-load M777s for an out-of-sector gun raid. This is particularly beneficial if the FSO spent company-grade years working with an artillery system different from the one in the direct support battalion's inventory. Starting as an executive or operations officer also affords the major a year of mentorship under the FA battalion commander who, as the brigade fire support coordinator (FSCOORD), depends on the FSO to represent them in brigade planning efforts. Such a background would enable the FSO to more expediently and confidently advise the brigade commander on how best to employ howitzers and radars to achieve the desired effects and free the FSCOORD to devote more attention to their own battalion staff and the responsiveness of the firing batteries.

First Lt. Erik Solenberger (left), a fire support officer, and Sgt. Jerame Burns, a fire support noncommissioned officer, both with B Company, 1st Battalion, 38th Infantry Regiment, 4th Stryker Brigade Combat Team, 2nd Infantry Division, pause to review a map of the location of their observation post during a fire support team certification Feb. 22 on a training range. The OP occupation was the final task in the week-long certification. (Spc. Kimberly Hackbarth/4th BCCT, 2nd ID)

A pre-existing professional relationship between the brigade FSO and battalion fire direction officer (FDO) ensures that the brigade fire support element (FSE) and battalion fire direction center (FDC) conduct digital system sustainment training (DSST) as part of their garrison battle rhythm. Too often in motor pools, tactical fire support and technical fire direction DSST occur in virtual stovepipes that fail to validate a fire plan prior to live-fire training. A disciplined unit that conducts integrated DSST in garrison – sending a digital call for fire from a company forward observer up to the brigade FSE, across to the battalion FDC and down to a platoon gun line – will more likely complete thorough Fires rehearsals in the field with significantly less time spent troubleshooting digital communications. After-action reviews from combat training centers (CTCs) frequently note that units do not conduct proper rehearsals, due to competing priorities and curtailed timelines prior to crossing the line of departure.[2] Often units must condense their preparation period because FSEs and FDCs find themselves racing the clock to gain digital and voice connectivity in time to deliver preparatory Fires. However, when the brigade FSO and battalion FDO personally oversee garrison DSST, a CTC Fires rehearsal becomes routine for all parties involved, requiring less time for resolving communication issues and more time for validating the details of a fire plan.

Proficiency with planning FA Fires does not abrogate the FSO's responsibility for integrating all available joint Fires. Rather, the less time that a brigade FSO requires to learn about the capabilities of the direct support FA battalion, the more remains for considering how other systems, both lethal and non-lethal, can best support the scheme of maneuver in the deep and close fight. Coordinating, integrating and synchronizing joint Fires requires close collaboration among many brigade staff elements: Intelligence, operations, Fires, protection, aviation, sustainment, legal, public affairs, special forces and Air Force liaisons, and representatives from attached units, often including psychological operations and civil affairs teams. Multi-warfighting function tasks related to fire support include establishing the rules of engagement, clearing air space, and monitoring ammunition resupply rates. Although Joint Publication (JP) 3-09 identifies the operations officer as the commander's principal staff advisor

2 Center for Army Lessons Learned Newsletter, "Decisive Action Training Environment at the National Training Center, Vol. IV," No. 16-30 (September 2016), 28, 50.

Second Lt. Whitney Davis, acts as a Fires support officer inside a Bradley Fighting Vehicle during the Field Artillery Basic Officer Leader Course at Fort Sill, Okla. (Marie Berberea)

for managing this process, rarely can they commit the necessary time due to personal involvement in current operations.[3] For an FSO to competently assume these responsibilities on behalf of the operations officer, it is most helpful if the FSO previously ran battalion staff meetings as an executive officer or multiple iterations of the military decision-making process (MDMP) as an operations officer. In particular, developing either a "purple kill box" or joint air attack team may be considered the most sophisticated form of joint Fires planning, but the process becomes less intimidating when the FSO already knows the FA portion of the plan by rote.

Equally as important as MDMP, sound Fires planning and execution depends on the brigade staff adhering to the joint targeting cycle. JP 3-60 credits the targeting staff process with linking "intelligence, plans and operations across all levels of command and phases of operations," making it more than solely the responsibility of the intelligence section (S2).[4] The FSO is the most appropriate officer to lead the brigade staff through the joint targeting cycle, beginning with target development and prioritization and culminating with an assessment of affected targets. If relegated to the FSE's targeting officer and the S2's collections analyst to develop autonomously, target nominations may lack critical operational considerations, such as the feasibility of weapon systems to range a target, availability of special munitions and location of sensors or observers. Target nominations stand a greater chance of gaining the brigade commander's approval during a targeting board when the FSO applies the commander's intent for Fires to the entire joint targeting cycle.

In addition to lethal targeting, the FSO must consider the integration of non-lethal methods for shaping brigade operations, especially due to the recent elimination of the brigade information operations officer, under the revised 2016 Modification Table of Organization and Equipment (MTOE) for the brigade combat team. The current MTOE includes a non-lethal targeting officer (131A warrant officer) within the brigade FSE and assigns the brigade FSO as the rater for the electronic warfare officer.[5] Brigades have conducted non-lethal targeting to influence, co-opt or deter the enemy and host-nation populace for more than two decades, dating back to the Balkan peacekeeping missions, and it remains an integral part of current operations in Afghanistan and decisive-action CTC rotations. However, brigades often trivialize the engagement warfighting function by narrowly focusing on the destruction of the enemy through maneuver and Fires, or because commanders do not provide sufficient guidance to the staff for integrating non-lethal assets.[6] For an FSO who understands joint Fires, the leap from writing a lethal Fires plan to integrating information operations, psychological operations and civil affairs assets into a non-lethal engagement plan should not be daunting. To further aid the FSO, previous experience as a battalion executive or operations officer who has incorporated air defense or military police attachments into an FA support plan (FASP) will underscore the importance of bringing Reservist and National Guard units into the brigade fold as soon as they arrive in a tactical assembly area.

Once the brigade commander approves the target list, the FSO remains the most experienced staff officer for integrating multiple warfighting functions through the execution of the Fires plan. A constant dialogue with the air liaison officer (ALO) ensures visibility of the status of target nominations submitted to the combined air operations center. It cannot be assumed that the Air Force will place all target nominations on the air tasking order, and the FSO, who understands the FSCOORD and commander's priorities with greater depth than the ALO, may need to personally contact the division FSE to advocate for select targets deemed essential to the operation. The brigade aviation officer and air defense artillery officer may also need the FSO's support in de-conflicting airspace when it requires contacting battalion operation officers to delineate altitudes between an unmanned aerial system (UAS) and cannon fire, or when establishing an air corridor allowing Apaches to reach their aerial attack by fire position. This complex synchronization is greatly aided by an FSO comfortable in multi-echelon, cross-warfighting function coordination, much of which comes from having run a battalion staff.

During the high operational tempo of a decisive-action CTC rotation, it is tempting

3 JP 3-09, "Joint Fire Support," Dec. 12, 2014, II-4.

4 JP 3-60, "Joint Targeting," Jan. 31, 2013, I-6.

5 The current MTOE is available to account holders at the U.S. Army Force Management System website, https://fmsweb.fms.army.mil/protected/secure/req_account.asp.

6 Gregory M. Tomlin, "More than a Campaign of Platitudes: Effective Information Operations for the Battalion/Task Force and Company/Team," Armor Vol. 65, Num. 3 (May/June 2006).

for a brigade to underestimate the importance of completing a battle damage assessment (BDA) on engaged targets. However, JP 3-60 considers BDA an "integral component" of the targeting cycle that the staff should consider early in the planning process, rather than treat as a separate, post-engagement requirement.[7] The integration of intelligence and operational sensors, potentially involving forward observers or aviation assets, into the scheme of maneuver and Fires plan requires an FSO adept at coordinating with both the S2 and operations officer. If maneuver battalion commanders do not receive a requirement within the brigade's synchronization matrix issued with the operations order to position observers or deploy a UAS, they will assign these organic assets to support their own fight. Individuals responsible for collecting BDA should participate in the Fires rehearsal to confirm that they will be in the right position at the specified time to assess effects. An FSO who has prepared an FASP synchronization matrix to bound forward firing batteries as an operations officer or coordinated a Paladin battalion's refuel-on-the-move as an executive officer will understand the significance of tasking BDA observers within the brigade Fires plan and operational synchronization matrix.

Established reputation

Brigade executive and operations officers typically serve within the brigade for a year at the battalion level and compete among other majors for these nominative positions. Both are recognized by their peers as the senior majors in the organization, and they often serve as the rater for other majors on the brigade staff. More significant than rewarding them for past performance, the brigade commander selects his premier staff officers based on their ability to lead planning efforts without having to first familiarize themselves with the organization's standard operating procedures, battle rhythm, and personalities. With a year already under their belt in the brigade, these majors are known quantities to battalion command teams, and they have developed a professional network with peers across the brigade, if not the division.

Under the re-established division artillery (DIVARTY) construct, the brigade FSO no longer works for the brigade operations officer; rather, he is rated by the FA battalion commander and senior rated by the DIVARTY commander. This correction to the rating scheme is important, not only for enabling the FSO's performance and potential to be assessed against his FA peers across the division, but also for two practical reasons. First, as an officer rated by DIVARTY leadership, it reaffirms that the FSO's primary duties lie with training and certifying the hundred-plus officers, noncommissioned officers and Soldiers assigned to the FSE. Too often over the past decade, brigade operations officer abused their authority by directing FSOs to primarily serve as plans chief or civil affairs officer, all the while ignoring the atrophy of critical fire support skills. Second, if the FSO first spent a year as the direct support battalion executive or operations officer, they enjoyed an opportunity to collaborate with the brigade executive and operations officers while they too served at the battalion level. This afforded them time to build trust and foster a positive working relationship through shared training experiences, deployments and participation in field-grade professional development sessions.

Assuming the position of brigade FSO in the second year of serving in the organization allows an FA major to become a known quantity among the maneuver battalion commanders prior to joining the brigade staff. As the rater for the battalion FSOs, the brigade FSO can more effectively mentor and counsel the FA captains after discussing their performance with the battalion commanders with whom they interact on a daily basis. In some direct support battalions, the maneuver battalion commander serves as the intermediate rater for their battalion FSO which further necessitates the need for the brigade FSO to ensure their perception of a battalion FSO's performance matches the views of the maneuver commander. An armor or infantry commander who established a rapport with a brigade FSO the year prior, as either a battalion executive or operations officer, will more likely share candidly initial expectations and periodic assessment of their own FSO.

Brigade FSOs should also be able to speak with maneuver commanders and their operations officers about the status of their mortar platoon and sections. Increasing numbers of brigade combat team commanders assign the brigade FSE as proponent for mortar certifications. From administering written safety tests to evaluating the timeliness and accuracy of live Fires, brigade fire support NCOs serve as external evaluators to ensure the integrity of a battalion's certification program. Upon completion, the FSE maintains memoranda for record signed by the maneuver battalion commander, making them available to the FSCOORD and brigade commander as required. For an FSO to manage a brigade-wide mortar certification program, it is beneficial to have already worked with an FA battalion master gunner to conduct howitzer gunnery tables. As an FSO, an FA officer with gun line experience can ensure that maneuver planners schedule sufficient time, ammunition and training areas to properly conduct a mortar platoon or section evaluation.

Paradigm shift

Speaking with DIVARTY commanders and Pre-Command Course students, Fires Center of Excellence leaders have advocated for a paradigm shift in the FA culture, whereby commanders assign their majors as executive or operations officers before sending them to integrate joint Fires as the brigade FSO. Department of the Army centralized selection boards choose lieutenant colonels to command FA battalions based on earning superior ratings in numerous FA and fire support billets, thus ensuring that they have the right balance of experience to serve as a brigade FSCOORD. Therefore, it would be appropriate for the most experienced major in the FA battalion to represent the FSCOORD by integrating joint Fires during brigade planning sessions, leading the brigade staff through the joint targeting cycle, managing the combined FSE-FDC DSST, and providing oversight for the brigade mortar certification program. With a year's experience running the day-to-day mission of a direct support battalion, an FA major will arrive on brigade staff with expert knowledge of how the firing batteries can feasibly support the brigade commander, which leaves greater time for integrating the broader array of lethal and non-lethal assets into combined arms operations.

Maj. Gregory Tomlin, PhD, is the Targeting Doctrine and Policy Branch chief, Directorate for Intelligence, the Joint Chiefs of Staff. He has served as a fire support officer, from the company through brigade levels, in the 1st Infantry, 2nd Infantry, and 1st Armored divisions.

7 JP 3-60, D-4.

In the next issue of Fires

Jan.-Feb. 2018, The 2017 Red Book. The Red Book recaps a year in review for the Fires force including Reserve, National Guard and Marine units. The 2017 Red Book will highlight U.S. Army Field Artillery, Air Defense Artillery and U.S. Marine Corps artillery unit activities at the brigade-level and lower.

The deadline for submissions is Dec. 1, 2017. Submissions should capture significant events, such as deployments, training, etc., for the past year. Send your submissions to usarmy.sill.fcoe.mbx.fires-bulletin-mailbox@mail.mil or call (580)442-5121 for more information.

A Soldier, assigned to the 69th Air Defense Artillery Brigade, plots his location during the orienteering portion of the 2017 Forces Command Best Warrior Competition at Fort Bragg, N.C., Aug. 21, 2017. (Spc. Hubert Delany, III/U.S. Army)