A joint publication for U.S. Artillery professionals

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Fires

Globally Integrated Fires

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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. Fires is pleased to grant permission to reprint; please credit Fires, the author(s) and photographers.

Cover: SPC Brett Kelly, D Battery, 1st Battalion, 5th Field Artillery, attaches a fuse to a 155 mm artillery round during a live-fire field artillery table-12 certification Mar. 14 in Toruń, Poland. (SGT Jeremiah Woods/358th PAD)

Lt. Gen. James Dickinson
U.S. Army Space and Missile Defense Command/Army Forces Strategic commander

US Army Air and Missile Defense 2028

In response to an increasingly complex threat, we must chart a clear path forward to provide flexible, agile and integrated air and missile defense (AMD) forces capable of deploying, fighting and winning against any adversary.

To clearly communicate how the AMD enterprise is postured to synchronize efforts to execute multi-domain operations, defend the homeland and succeed in future operational environments, on behalf of the Army, the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command recently published the Army Air and Missile Defense 2028.

Incorporating input from subject-matter experts across the AMD enterprise, this roadmap provides the overarching vision for future AMD forces and describes how they are postured to support the Army and joint forces. It also articulates what must be accomplished to prevent and defeat an adversary's complex and integrated air and missile attacks through a combination of deterrence, active and passive defense and support to attack operations.

AMD forces are critical enablers within the multi-domain operation concept. For the Army to succeed in large-scale combat operations, our AMD forces must be able to execute three essential tasks across the multi-domain operations framework. AMD must protect maneuvering forces and their fixed and semi-fixed assets; defend critical assets in the theater and operational support areas; and converge to help create windows of opportunity in the air domain for joint forces to exploit.

AMD capabilities will span the multi-domain operations framework providing ballistic missile defense capabilities to protect assets in the strategic and tactical support areas; cruise missile and aircraft defense capabilities to protect assets in the operational, tactical support and close areas; counter-unmanned aircraft systems; and counter-rocket, artillery and mortar capabilities to support the fight in the close area.

We need integrated Fires, both offensive and defensive, across domains, regions and missions, using multi-mission, high demand, low density assets. Our future architecture will be layered and integrated utilizing the full suite of space, cyber, electronic warfare, as well as land and air sensors to match the best shooter with the best sensor. Offensive and defensive integration during multi-domain operations will enable neutralization of enemy missile forces prior to launch.

Bottom line: Army AMD must provide combatant commanders with a flexible, agile and integrated AMD force capable of executing multi-domain operations while defending the homeland, regional joint and coalition forces, and critical assets in support of unified land operations. To do this, the AMD enterprise will execute four lines of effort: Modernize and develop AMD capabilities; build AMD capacity for multi-domain operations; provide trained and ready AMD forces; and maintain forward presence and build allied and partner capacity.

Modernize and develop AMD capabilities

AMD is one of the Army's top six modernization priorities. The enterprise remains focused on modernization while balancing fiscal resources to ensure the timely development and implementation of those priorities. To achieve the AMD force of 2028, the Army is developing AMD capabilities to overmatch adversaries by prioritizing protection of the maneuver forces with the ability to defeat complex integrated attacks through the air domain.

Continued modernization of air

and missile defenses including the development and fielding of Lower Tier Air and Missile Defense Sensor (LTAMDS), Maneuver-Short Range Air Defense (M-SHORAD), Indirect Fire Protection System (IFPC), and Integrated Air and Missile Defense Battle Command System (IBCS) will result in a multi-mission AMD force capable of providing protection throughout the multi-domain operations battlespace framework. The Army has already begun the production of the interim M-SHORAD systems and has selected Iron Dome as the interim IFPC solution.

Build AMD capacity for multi-domain operations

The Army is also making investments in personnel and increasing AMD force structure by activating an air defense artillery brigade in Japan and a SHORAD battalion in Europe. These new forces, and those to come, will contain a mix of capabilities that are agile, rapidly tailorable and scalable.

A significant shift in Army AMD formations in the future will be multi-mission AMD battalions with a mix of capabilities such as: Terminal High Altitude Area Defense; Patriot systems; M-SHORAD; and IFPC. In addition, future formations will employ tailored, composite force packages at the battalion, battery or platoon level as missions dictate.

Provide trained and ready AMD forces

Leveraging the 2018 Air Defense Artillery Training Strategy, the Army is developing flexible and adaptive AMD leaders and Soldiers who are able to master AMD's core competencies, expertly employ fielded systems and fully exploit new capabilities. Training will be tough, realistic, interactive, and battle focused. It will integrate into the Synthetic Training Environment and leverage virtual, constructive and gaming applications.

Maintain forward presence and build allied and partner capacity

By maintaining an extensive forward presence Army AMD assures allies and partners with a credible deterrent to adversaries. The continued cooperation toward interoperability with allies and partners significantly increases the capabilities of the combined defense.

Army AMD forces will continue to reduce barriers brought by foreign disclosure considerations to increase technical integration and interoperability. This will be necessary to emphasize a shared commitment to a combined defense.

Finally, Army Air and Missile Defense forces of 2028 will be ready to deploy, fight and win decisively against any adversary, anytime and anywhere. They will do so in a joint, multi-domain, high-intensity conflict, while simultaneously deterring others and maintaining the Army's ability to conduct irregular warfare. There is no single silver bullet to counter the rapidly changing and complex threat set; rather, we must have an assortment of capabilities available to counter the threat in any weather and in a denied, degraded, or contested environment. We owe this to our fellow warfighters and to the nation.

Lt. Gen. James Dickinson is the commanding general of United States Air and Space Missile Defense Command and ARSTRAT.

Soldiers with the 35th Air Defense Artillery Brigade, prepare to fire a Stinger missile using Man-Portable Air Defense Systems, during Rim of the Pacific Exercise 2018 at Pacific Missile Range Facility Barking Sands, Hawaii (Sgt. 1st Class Claudio Tejada/U.S. Army).

Lt. Gen. Donald M. Lionetti passes away

By David Christensen and Bobbi Lionetti, Foreword by Brig. Gen. Brian Gibson

The Air Defense Artillery community lost a giant of the branch, a friend to thousands, and a selfless Soldier with the passing of retired Lt. Gen. Donald Lionetti on March 6. His influence on our branch was irreplaceably monumental: from leading small units in Vietnam, to serving multiple tours in the Pentagon shaping Department of the Army decision making on equipment, organizations and people. He served the branch as the commanding general through the Desert Storm period, and to his penultimate assignment as the commanding general of the Army Space and Missile Defense Command. We are eternally grateful for he and his family's contributions and sacrifice on behalf of Air Defenders. His legacy will forever shape the branch. First To Fire!

Lt. Gen. Donald M. Lionetti was born in New Jersey on March 6, 1940, into a close-knit large Italian-American family. During his formative years, Lionetti was introduced to the value of hard work and genuine patriotism. His earliest memories were of the final days of World War II and the celebrations that followed in the New York City area. He would fondly recollect the return of his eight uncles, all enlisted Soldiers or Sailors, which would have a major impact on him for the rest of his life.

Lionetti excelled academically and athletically which led to the offer and acceptance of a congressional appointment to the U.S. Military Academy at West Point in 1957. During his time at West Point, he was an above average cadet. He fully immersed himself into activities. Most notably his excellent grades in Plebe boxing because, as he is quick to point out, "I was always a good bleeder."

During his sophomore year at the academy, he met one of the most important influences of his life. It would be here, at a social event, that he met the love of his life, Ms. Bobbi Tibbett. Lionetti would later reflect that "I would make many other important decisions over the years, but none as brilliant as this one." Their 58-year adventure, involved 33 moves and three children. Throughout the years, they would establish a nurturing environment within which these great children who, with their terrific spouses, produced three wonderful grandchildren. In an interview in 2010, Lionetti fondly remembered that "Throughout it all, Bobbi's cheerful and positive approach in every assignment contributed immeasurably to my successes. What a team!"

Lionetti commissioned in May 1961 and in August, he and Bobbi arrived at Fort Sill, Okla., to attend the Artillery Officer Basic Course, with officers who received initial assignment orders to Air Defense units moving on to Fort Bliss for further training. It was later on that Lionetti remembered that "So many of the young wives became pregnant we suspected it was the Oklahoma water." The couple welcomed their first child, Laura, who arrived in April 1962.

For the Lionetti's, early company-grade assignments in the U.S. and Germany were fun and rewarding. He served in strategic defense of the U.S. as a Nike Hercules launcher platoon leader in the Baltimore-Washington defense during the Cuban Missile Crisis of 1962. After that, Lionetti served with the Air Force at a NORAD Control Center in Saratoga Springs, N.Y., where he helped integrate the joint United States Air Force fighter - Nike missile defenses of the Boston NORAD sector. Their next assignment was to Germany where he was first assigned as a team commander for a German AF Hercules battalion, then as a detachment commander with the Third German Panzer

Grenadier Division where he was responsible for their Eight-Inch Howitzer and Honest John support. While in Germany, Don Jr. was born at the U.S. Army Hospital in Bremerhaven in July 1965.

Lionetti returned to CONUS and served at Fort Bliss with 15th ADA Group which participated in the training and deployment of M-42 Duster and Quad-50 battalions to Vietnam. After his deployment, he served as a battery commander in 1st First Field Force Vietnam Artillery, followed by promotion to major and served in the Corps Artillery as Assistant S-3 (Plans).

After attending the ADA Advanced Course at Fort Bliss, Texas, he earned a Master's Degree in Engineering from Arizona State University. During this time his son, Christopher arrived on the scene in 1970. Following his time at Arizona State University, Lionetti was assigned to West Point as an instructor of engineering subjects and formula translation programming. He next attended the Command and General Staff College with a follow-on assignment to the 3rd Armored Division in Germany. During this time he was fortunate to serve a year as executive officer in Lt. Col. Wally Arnold's ADA battalion, "where Wally was a terrific mentor." Following his tenure as executive officer the newly promoted Lt. Col. Lionetti relocated his family to Vilsek where he was responsible for the pre-command

courses at Seventh Army Training Command.

In June of 1977, Lionetti was entrusted with battalion command at Ramstein AFB, providing Chaparral and Vulcan protection for the air base as well as Sembach and Rhein Ordnance Barracks. While visiting the troops on the Vulcan range in Todendorf, Lionetti was heard to say, "almost as much fun as strafing," as he stepped away from the controls after firing. He next served in the office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS) Training Directorate under Maj. Gen. Jim Smith and then Maj. Gen. Sandy Melloy, two outstanding leaders. Lionetti was entrusted with the implementation of the Review of Education and Training for Officers (RETO) which brought us the Combined Arms Services and Staff School and also improved curricula for other TRADOC schools and programs.

Following his time on Army staff, Lionetti escaped to the National War College and after a year received a promotion and an assignment as a brigade commander. Posted to Fort Lewis, now Col. Lionetti was assigned command of the 9th Divisional Air Defense Artillery, consisting of a Hawk battalion, the divisional Chaparral-Vulcan battalion, and consolidated Stinger assets. The division was designated by Chief of Staff of the Army Edward Meyer as the high technology test bed (HTTB) and charged with working directly with defense industry to define a lighter, more agile division; deployable by no more than 1,000 C-141 sorties. This change increased the combat power and expedited deployability of a heavy division. Many innovations came out of the HTTB, to include Avenger, a pedestal mounted Stinger System and a lightweight 155 mm howitzer.

Back to ODCSOPS, he ran the Firepower Division developing and defending budget for field artillery and ADA systems with a platoon of superstars like Maj. Gen. James J. Cravens and Col. (R) Vinny Tedesco, Force Integration staff officers. He helped define the future with the two chiefs of branch and Lt. Gen. Jay Garner would later replace him. Lionetti was promoted to brigadier general and assigned as assistant commandant at the U.S. Army ADA Center and School, again "working for a fantastic leader and mentor," Maj. Gen. Don Infante. During his two years there, he revised the Officer Advance Course (OAC), Officer Basic Course (OBC) and pre-command courses with a new emphasis on small group instruction and again Jay Garner replaced him.

At Peterson AFB, Lionetti served as Director of Plans (J-5) at United States Space Command. This command defined the requirements for National Missile Defense; and is where simulations and wargaming were invented to exercise the Battle Command System. Representing the biggest user of space products (the Army) he ensured requirements for future space systems did not neglect the needs of the terrestrial warfighter. Again he was selected for promotion and assigned to command at Fort Bliss, but Maj. Gen. Garner assumed command due to the delay of his confirmation list. So, when Lionetti finally arrived in November 1989, this time he replaced Garner.

His greatest fulfillment in uniform came as commanding general, US Army Air Defense Artillery Center and Fort Bliss. As chief of branch, Lionetti provided strategic vision, operational concepts and materiel requirements, which the Gulf War would later validate. He planned and deployed over 11,000 Soldiers to southwest Asia including most of the Patriot battalions, supported them overseas and cared for their families who remained at Fort Bliss. Despite his pleas to extend beyond two years in command, He became chief of staff, Training and Doctrine Command. Under Gen. Fred Franks' leadership, Lionetti synchronized the efforts of an 1,100 person staff during a period of significant redirection for the Army following the Gulf War.

The assignment as the commanding general, U.S. Army Space, and Strategic Defense Command was an honor for the recently promoted Lionetti. He was the senior Army spokesman for missile defense systems and the principal advocate of investment strategies for tailored space applications to support the warfighter. He was dual-hatted as commander, Army Space Command, and the Army component command of U.S. Space Command. World-class scientists and engineers in Huntsville staffed the research, technology and acquisition element of the command. The command operated the Kwajalein Missile Range for the Department of Defense which scored accuracy of offensive ballistic missiles and provided the sensors to evaluate incoming reentry vehicles for the development of missile defenses. Army Space Soldiers operated strategic communications systems globally and provided satellite imagery through Major Army Commands to warfighters. After two years in this position Lionetti retired from active duty and once again Garner was ready to take over.

After retirement, Lionetti established a successful consulting business, but after a few years he was enticed to work full time as Vice President for Air and Missile Defense Systems at Lockheed Martin, Orlando, Fla., where he supported the development of Medium Extended Air Defense System, a new multinational AMD system. After that, he returned to consulting for the defense industry in fields of his expertise. Lionetti even tried golf, but found the game anything but relaxing, and gave it up after a few years. He eventually learned that to hit the ball further, you must swing easier, but said, "I came to my senses about golf and now just work for Bobbi, and we love spending time with our children and grandchildren."

Russian artillery fire control for large-scale combat operations

By Lester Grau and Charle Bartles

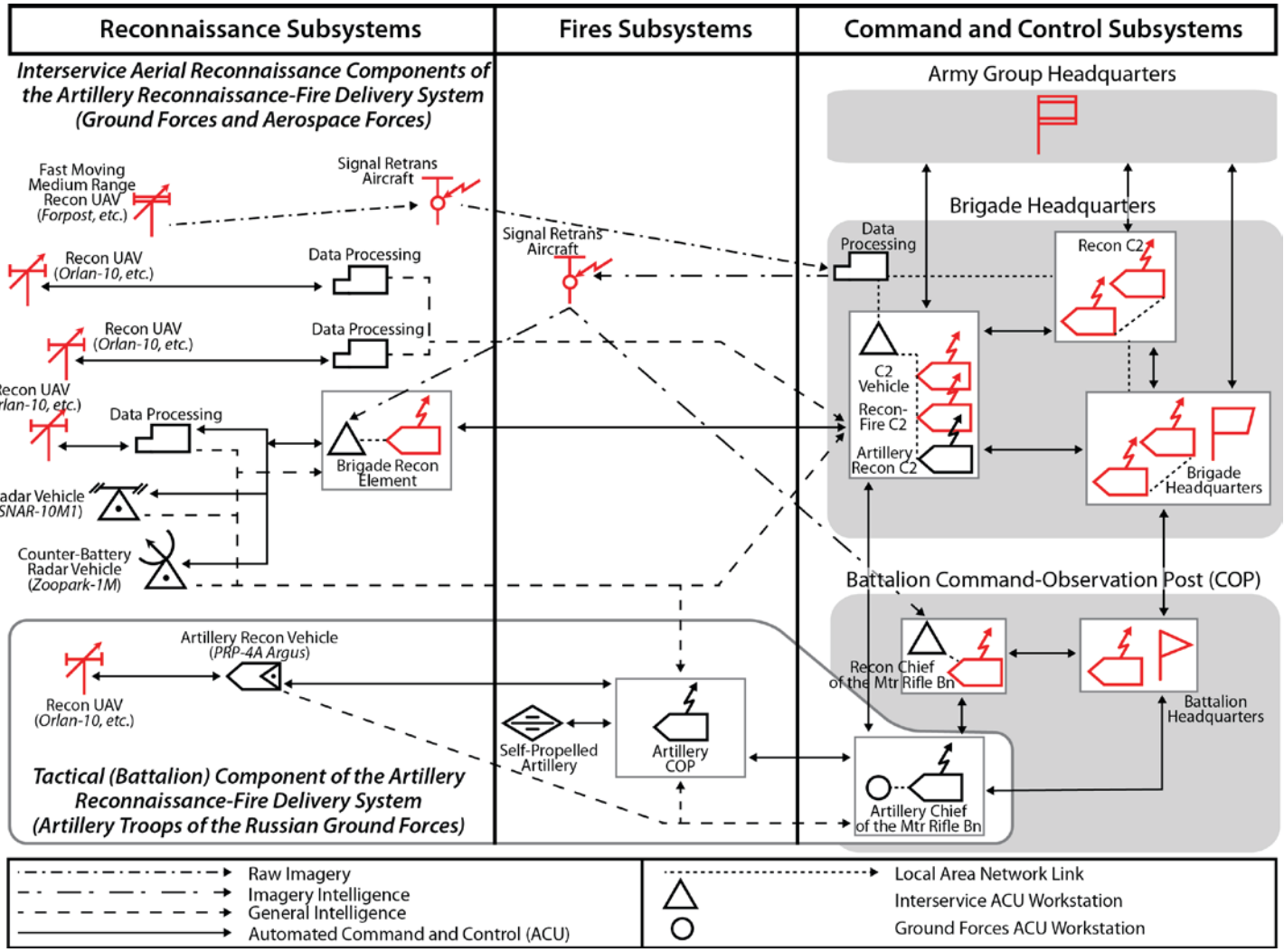
Armed conflict begins with reconnaissance. Experience shows that without reconnaissance- there is no information, without information- command and control is impossible, and without command and control- victory is impossible.[1]

Theory of implementation: The Reconnaissance-Fire System

The Soviet Union, and now Russia, have long worked on the development of twin concepts for the detection and assured destruction of high-value targets in near-real time. The Reconnaissance-Strike Complex (RYK) was designed for the coordinated employment of high-precision, long-range weapons linked to real-time intelligence data and precise targeting provided by a fused intelligence and fire-direction center.

1 *Lieutenant Colonel A. Artemyev and Lieutenant Colonel (ret) O. Kharchenko, "Aerial Reconnaissance: The Emergence of Aerial Photography as a Means of Supporting Combat Operations," Armeyskiy Sbornik [Army Digest], August 2018. Army Digest is the authoritative tactical journal of the Russian Ministry of Defense.*

Figure 1. The tactical reconnaissance-fire system where (at the top) the reconnaissance data from a variety of UAVs and radar are fed into the maneuver brigade headquarters (Courtesy illustration).



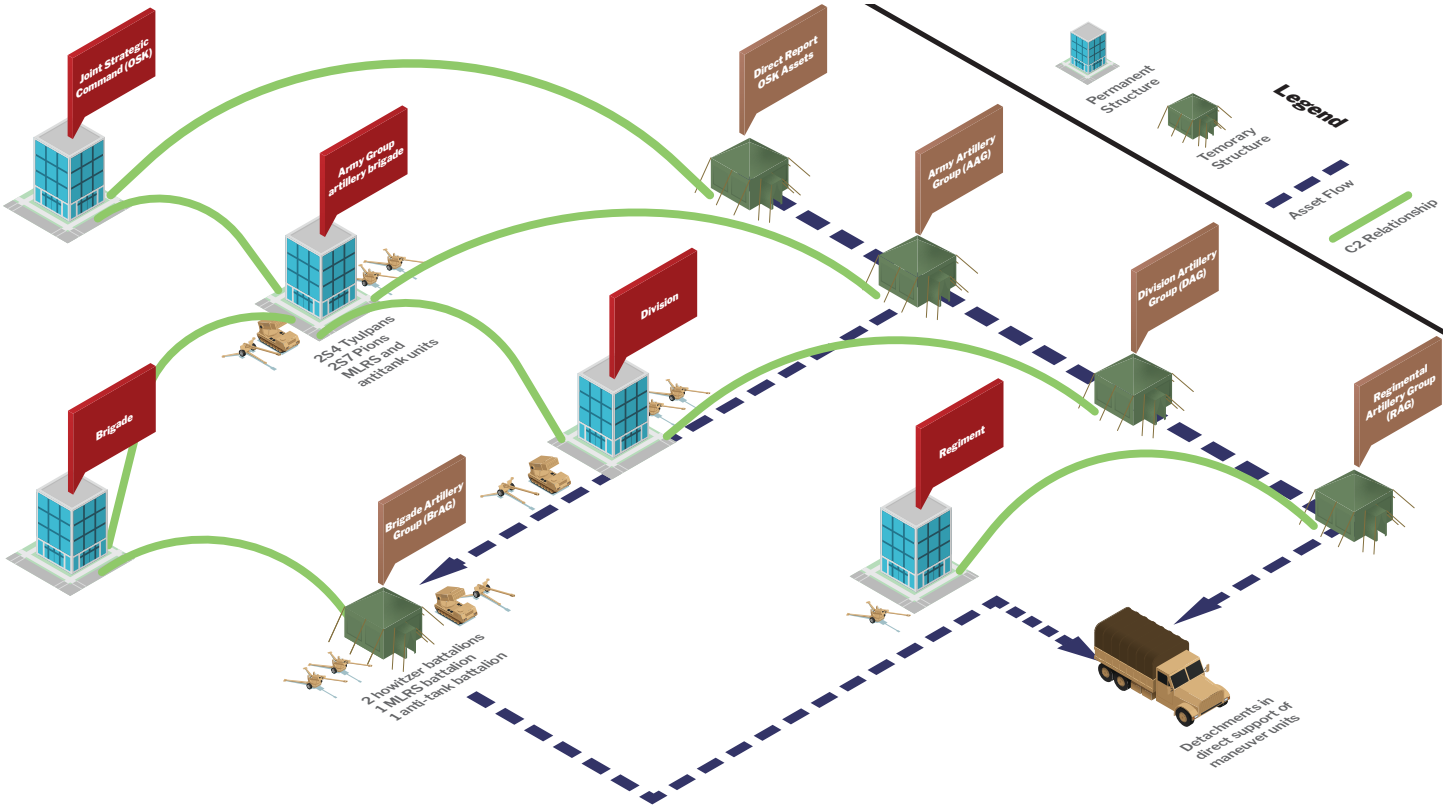


Figure 2. The Russian Artillery Group System (Rick Paape/Courtesy information).

The RYK functioned at operational depths using surface-to-surface missile systems and aircraft-delivered "smart" munitions. The Reconnaissance-Fire Complex (RYK) was the tactical equivalent. It linked intelligence data, precise targeting, a fire-direction center, and tactical artillery to destroy high-value targets in near-real time. The Soviets were making good progress in the development of both systems before the Soviet Union collapsed. After a period of chaos and adjustment, Russia is back on track and modernizing her armed forces. Part of that modernization is the fielding of a functioning and renamed reconnaissance strike system (RYS) and reconnaissance fire system (ROS). The Reconnaissance-Fire System has now been successfully deployed, and battle tested. RYS not only includes tube and rocket artillery, but also ballistic and cruise missiles; strike aviation; and ship and coastal naval Fires. This centralized system permits tasking Fires at all levels of combat, from front line artillery to deep strike aviation, through rear area missile strikes, at both the tactical and operational depths. If the ROS proves to be successfully implemented by way of the improved Strelets reconnaissance, command and control, and communications system (KRUS), the Russian Federation will gain a significant capability for directing Fires at both the tactical and operational levels of war.

The army group to which the brigade belongs also provides data from reconnaissance aircraft and satellites to its subordinate brigade (See Figure 1). The brigade processes this data and passes data for immediate fire engagement to the artillery battalion (bottom). The artillery battalion also has its radar and UAV reconnaissance to provide targeting data.

Task organization and the artillery group system

Perhaps the most interesting aspect of how the Russians organize Fires is how they conduct the command and control of their artillery assets. In garrison, artillery assets are assigned to their respective units, as typically depicted in standard line-block charts, but when engaged in combat, Russian units typically form 'Artillery Groups.' Artillery Groups can be formed at the Army group (combined arms armies, tank armies, and army corps) through regimental-level and consist of the unit's organic artillery, in addition to attachments from higher, but minus detachments to lower echelon units. Artillery groups are a doctrinally defended asset and are typically protected by air defense and electronic warfare assets. In terms of command and control, the unit's deputy commander for artillery or senior artillery unit commander typically commands the artillery group. The Joint Strategic Commands possess tactical artillery assets (heavy MLRS) but do not form artillery groups, so they pass their assets directly to the Army Artillery Group (AAG), or Division Artillery Group (DAG)/Brigade Artillery Group (BrAG) if no AAG was formed. As a rule, assets are usually only pushed down to the

next lower level. Of particular note, the Iskander-M SRBMs/GLCMs (SS-26 Stone/SSC-7) are not part of the artillery groups. These high-value assets are likely a special reserve for the army group commander, and so are not put under the command of the artillery group.

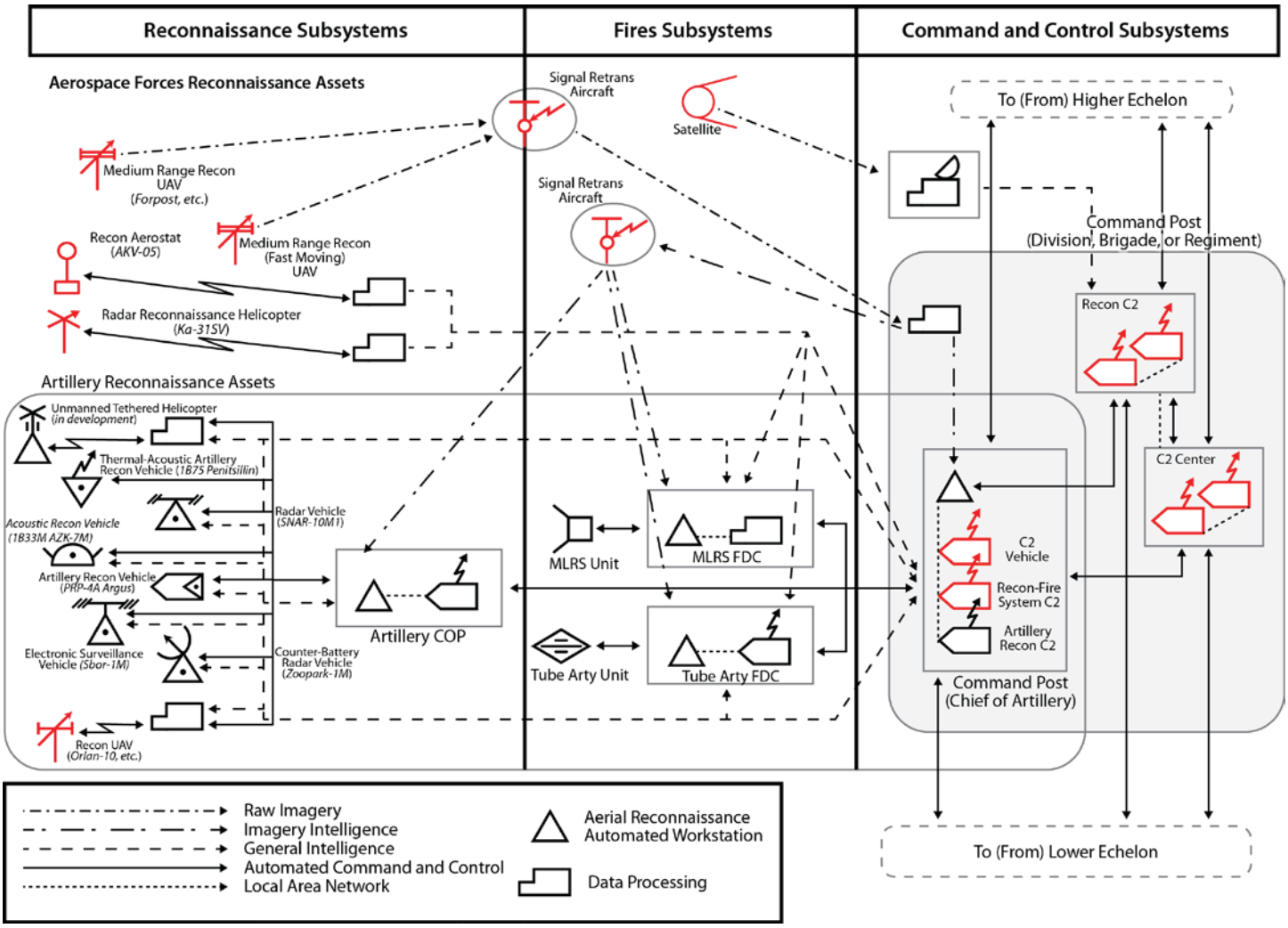
Also, the range of the Iskander (500km), allows it to remain much farther in the rear, so there is no need to have it physically located with the other artillery assets, which puts it at less risk of an enemy strike. At the brigade and regimental level, detached assets are put under the direct control of motorized rifle and tank battalion commanders in direct support of their missions. The artillery group system is essential for understanding Russian tactical and operational-level Fires, as it explains how assets are subordinated.

Proposed Army group-level artillery fire control

The aggregated Reconnaissance-Fire Systems (ROS) of the combined arms armies are equipped with advanced systems of Fires, reconnaissance, automated command and control, and support for conducting operational strikes and tactical Fires. These can be integrated into a common combined arms automated command and control system, a hybrid Reconnaissance Destruction System (RPS) for real-time effective fire engagement of the enemy. The Artillery Troop's ROS has a modular configuration within the combined arms force. The module includes command and control elements and forces that are capable of performing relatively independent fire engagement missions against enemy targets. The ROS modules at each level of combined arms command (combined arms army, tank army, army corps, division, brigade, regiment or battalion tactical group), include an artillery command post linked to a reconnaissance command post or artillery reconnaissance command post and the ROS command and control center. These elements likely interface through the Strelets reconnaissance, command and control, and communications system (KRUS), which will be discussed in greater detail. Organic and attached formations are linked by the KRUS as well.

The ROS command post is in-

Figure 3. The Tactical Module of the Artillery Troops' Reconnaissance-Fire System (ROS) in the Reconnaissance Engagement System (RPS) (Courtesy illustrations).



cluded in the command post of the chief of artillery for the combined arms force at each level. Its real-time missions include: receipt and analysis of target data, status of subordinate force elements, terrain data, hydro-meteorological data on the target areas and other information necessary for the execution of missions; planning and coordination of the actions of forces and means of engagement; and command and control of strikes and fire. At the same time, forces and assets of organic and attached artillery are integrated horizontally (among themselves at the same level of command and control in the module) and vertically (among forces and assets of different echelons of command and control among modules of different combined-arms force elements), forming reconnaissance, command and control, fire engagement, and support subsystems of the combat arm's ROS. These forces and assets of ROS subsystems must be integrated with similar forces and assets of other branches and combat arms by a common interbranch RPS of the combined arms combined formation. Proposals on the layout of the reconnaissance fire system and its modules are of great importance in the conception of the ROS configurations. The layout of the ROS and its modules depict their composition and structure, i.e., the aggregate of elements and established ties between them. Figure 3 shows the formation and ROS tactical modules organizationally included in the RPS.

Figure 3 shows the information integration of reconnaissance data from satellites, aviation, operational and tactical UAVs, radar, communications and equipment signature intercept, and other sensors. The integrated data provides an integrated threat picture which allows commanders at different levels to determine their most dangerous threats, and target them in real time or systematically. Tactical and operational weapons are provided their targeting data, meteorological data and priority to engage the identified targets. Post-strike analysis and retargeting data are provided by directed reconnaissance. Resupply of munitions and missiles are conducted to newly-occupied firing sites when needed. This depiction differs from Figure 1 in that it is a proposed solution to ensure that reconnaissance strike and reconnaissance fire systems have access to the same integrated threat picture and that no critical targets are ignored due to lack of overlaps in distance reconnaissance and priorities of tactical and operational planning. Figure 1 is a depiction of the tactical reconnaissance strike system as it is currently configured. Figure 3 does not wholly address the integration of aviation and possible strategic missile targeting in the proposed RPS structure. Further, there is no discussion on who or what determines assets are not wasted by duplication in the event operational and tactical planners both decide to attack the same target in real time.

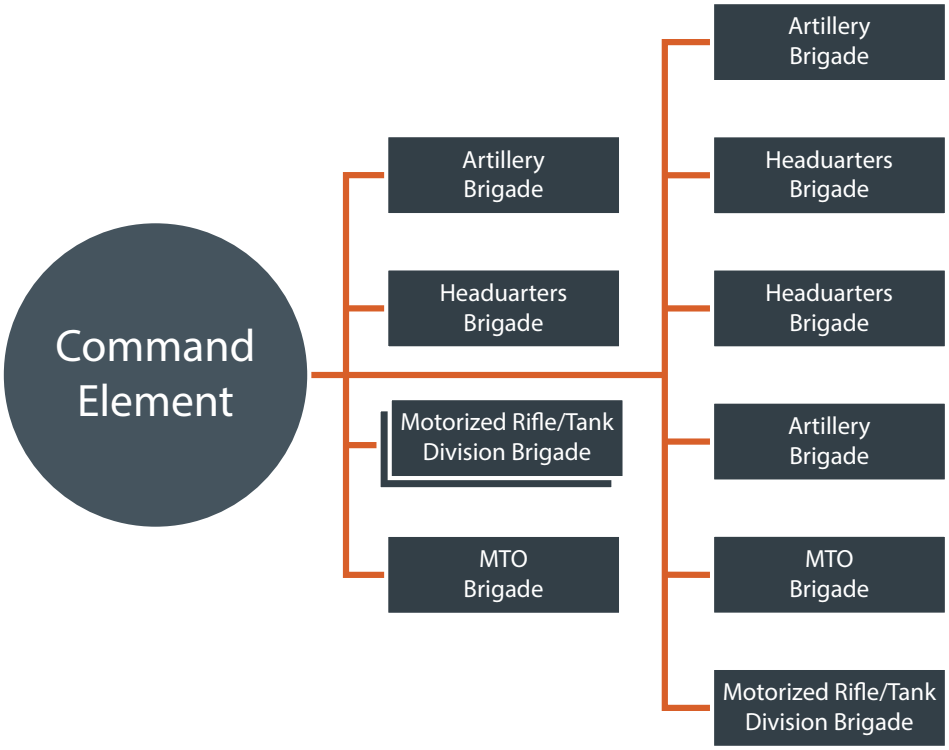


Figure 4. The Army Group Structure (Rick Paape/Courtesy information).

The main subsystem of the proposed RPS will be the ROS due to the preponderance of tactical missions and the presence of multiple, detected, immediate threats. Based on historical experience, artillery will handle 50 to 70 percent or more of the overall fire missions. In the combined arms army, the ROS includes the systems of its subordinate combined arms elements. For example, the ROS of a combined arms army, tank army, or army corps includes the ROS of its subordinate combined arms divisions and brigades. In turn, each ROS of the combined-arms division artillery includes several ROSs of the division's combined arms regiments. Structurally the ROS of the combat arm of combined-arms force elements consists of generic modules:

- ROS of Army group (combined arms army, tank army, army corps artillery) – The Army group module and several divisional, brigade, regimental, and battalion modules;
- ROS of division artillery – The divisional module and several regimental and battalion modules;
- ROS of brigade (regimental) ar-

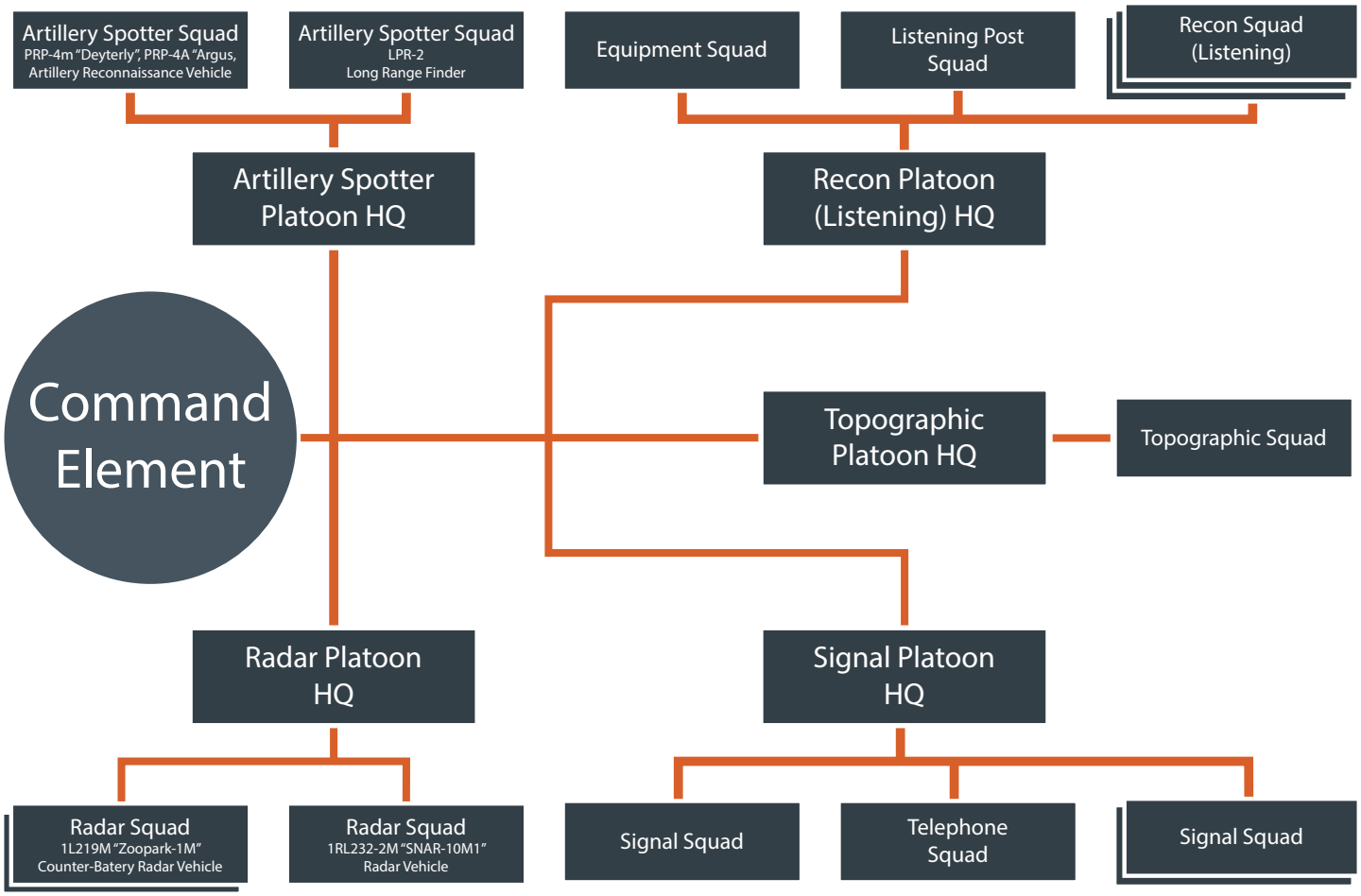


Figure 5. Division/Brigade Fire Control Battery (Rick Paape/Courtesy information).

tillery – The brigade (regimental) module and several battalion modules.

Analysis of the present-day order of battle of artillery groupings, tables of organization, and force modernization suggests that the RPS will not be fully implemented until 2020-2025. At that time, the ROS capability should be at full strength and totally integrated based on a unified KRUS. Therefore, at present, transition-period modules can be created for the ROS. Automated Control System would encompass only those artillery elements equipped with advanced and state-of-the-art armaments and automated command and control equipment systems, and this structure can function in a reconnaissance fire mode. During the initial phase, for the operational-level module, the following elements should be included in the automated command and control system: the Iskander-M missile brigades, Smerch or Tornado-S MLRS brigades and army artillery reconnaissance elements. In the future, the operational module will be able to engage enemy targets up to 500 kilometers from the line of contact with precision missiles. Therefore, in addition to artillery reconnaissance assets (reconnaissance depth up to 70 kilometers), aerial reconnaissance assets of the Aerospace Forces should function in this module (reconnaissance depth 150-500 kilometers). As new artillery and rocket systems enter the force, this process will undergo further modification and improvement.

Increasing Army group-level artillery Fires capabilities

The army group's artillery capabilities, except assets in the maneuver divisions and brigades, are contained in the Iskander-M missile brigade and artillery brigade. Typically, the artillery brigade has had no systems that could not be found in the maneuver divisions and brigades, it just merely provided more firepower. The Soviets had fielded large-caliber artillery, such as the 2S4 Tyulpan 240 mm mortar and the 2S7 Pion 203 mm howitzer, to suppress lines of communication; destroy enemy headquarters, tactical nuclear weapons, logistic areas, and other critical targets; and to destroy urban areas and field fortifications in the equivalents of their artillery brigades, but after the end of the Cold War, the Russian Federation placed most of these large caliber artillery systems into long term storage depots. At the time, this was seen as sensible because these large caliber systems were intended to deliver nuclear, as well as conventional, munitions. (The end of the Cold War meant that a long-range tactical nuclear weapon delivery was no longer needed). Furthermore, better

tube (2S19M Msta-SM) and missile (MLRS/SRBM/GLCM) systems, such as new 300 mm MLRS platforms, the Iskander-M missile system, and the 2S19M Msta-SM 152 mm howitzer, allowed Russia fulfill many of the same tasks as large-caliber artillery to varying degrees.

The Russian Federation is now taking these large caliber artillery pieces out of storage, modernizing them, and placing them into Russia's (only) 45th Heavy Artillery Brigade, and the Army groups' artillery brigades. Typically, large caliber artillery systems are organized into battalions with eight to 12 tubes (2 to 3 batteries) per battalion and use the same artillery command and control systems (such as the 1V12M Kharkov Artillery Fire Control System) that are found in standard artillery battalions. Interestingly, although there has been much discussion about the capabilities of large caliber artillery pieces, there has not been a mention of why they are being returned to service. Since there is little need for a tube-based nuclear artillery delivery system, and there are efforts to equip the systems with laser-guided munitions, it is likely that these systems are envisaged to pulverize urban areas and field fortifications, tasks which are difficult for standard Russian 122 mm and 152 mm artillery pieces.

Another possibility these systems are being reintroduced is concerns about the number of missiles in Russian depots (magazine depth). Although missile artillery systems such as the Iskander-M and new 300 mm MLRS platforms have greater ranges and may be more capable of performing specific tasks better than the 2S4 or 2S7, Russia's industrial base and financial resources to rapidly replenish sophisticated and expensive missiles at a level needed for large-scale war may be in question. (The production of 2S4 and 2S7 shells is much faster and cheaper than the production of any missile.) In short, new missile artillery systems may be better, but the 2S4 and 2S7 give Russian planners a more sustainable and economical way of conducting heavy Fires, and their use would allow the missile artillery to focus upon more specialized targets.

Brigade (division/regiment)-level artillery fire control

Maneuver division, brigades and regiments usually have a deputy commander for artillery. The brigade's fire control battery is commanded by, or reports to, this officer. As would be expected, the fire control battery contains assets for detecting, determining coordinates, and the transmission of targeting data and orders. The typical configuration for brigade-level fire control batteries includes platoons for artillery spotting (PRP-4A Argus), radars (1RL232-2M SNAR-10M1 and 1L219M Zoopark-1), listening posts, geodesy and communications.

Increasing brigade and division artillery Fires capabilities

Brigade (Division) artillery potential may soon increase. Russia has announced plans for a 'pocket' Iskander-M, a small, (likely) Ground Launched Cruise Missile (GLCM) system, known as the Precision Guided Tactical Missile System (VTRK). Just as the Army group (Combined arms army, Tank army, Army corps) commander has an Iskander-M system, brigade and division commanders will have a VTRK. The VTRK is intended to give brigade and division commanders an organic capability to conduct deeper strikes to the full extent of the tactical depth (approximately 100 km). Currently, these commanders' organic artillery assets (howitzers and 122 mm MLRS) can only hit targets out to approximately 20-60 km, depending on the equipment types and availability of extended range munitions. Unlike the Iskander-M, which is mounted on a heavy multi-axle chassis, the VTRK will be mounted on a two-axle utility vehicle similar to a U.S. Humvee. Since UAVs with 120 km range are already found at the brigade and division level, these units already can provide necessary targeting data to the VTRK, thereby creating a substantial deep strike capability. The deployment of this system to the brigade and division level demonstrates the Russian confidence in the up-down and down-up integration of the ROS and their ability to communicate in an electronic warfare and cyberwar environment.

Battalion-level artillery fire control

The Russian and Western systems for the command and control of artillery differ. In the Russian system, the artillery commanders do not sit with their artillery pieces. Instead, artillery battalion and battery commanders are typically collocated with the supported maneuver commander to relay calls for fire to the artillery; or they are on the battlefield, calling for fire on targets of opportunity. Artillery commanders have command observation post (COP) vehicles with appropriate communications, navigation, and sighting gear to fulfill this function. The battalion-level COP is typically linked with the command post of the chief of artillery of the higher headquarters (battalion, regiment or division).

Interestingly, the actual fire control for artillery units is provided not by the unit commander, but by the chief of staff for battalions and senior battery officer (the senior platoon leader) for batteries. These officers, not the commanders, are collocated with the artillery, providing them with fire direction. They staff fire direction center (FDC) vehicles to fulfill this function. The FDC vehicles are similarly equipped as the COP vehicles, but are designed to function as FDCs, and so they usually have less or no sighting equipment, more fire control equipment, and may be on a chassis more suitable to functioning as an FDC, than a COP that is conducting artillery reconnaissance on the battlefield. Russian artil-

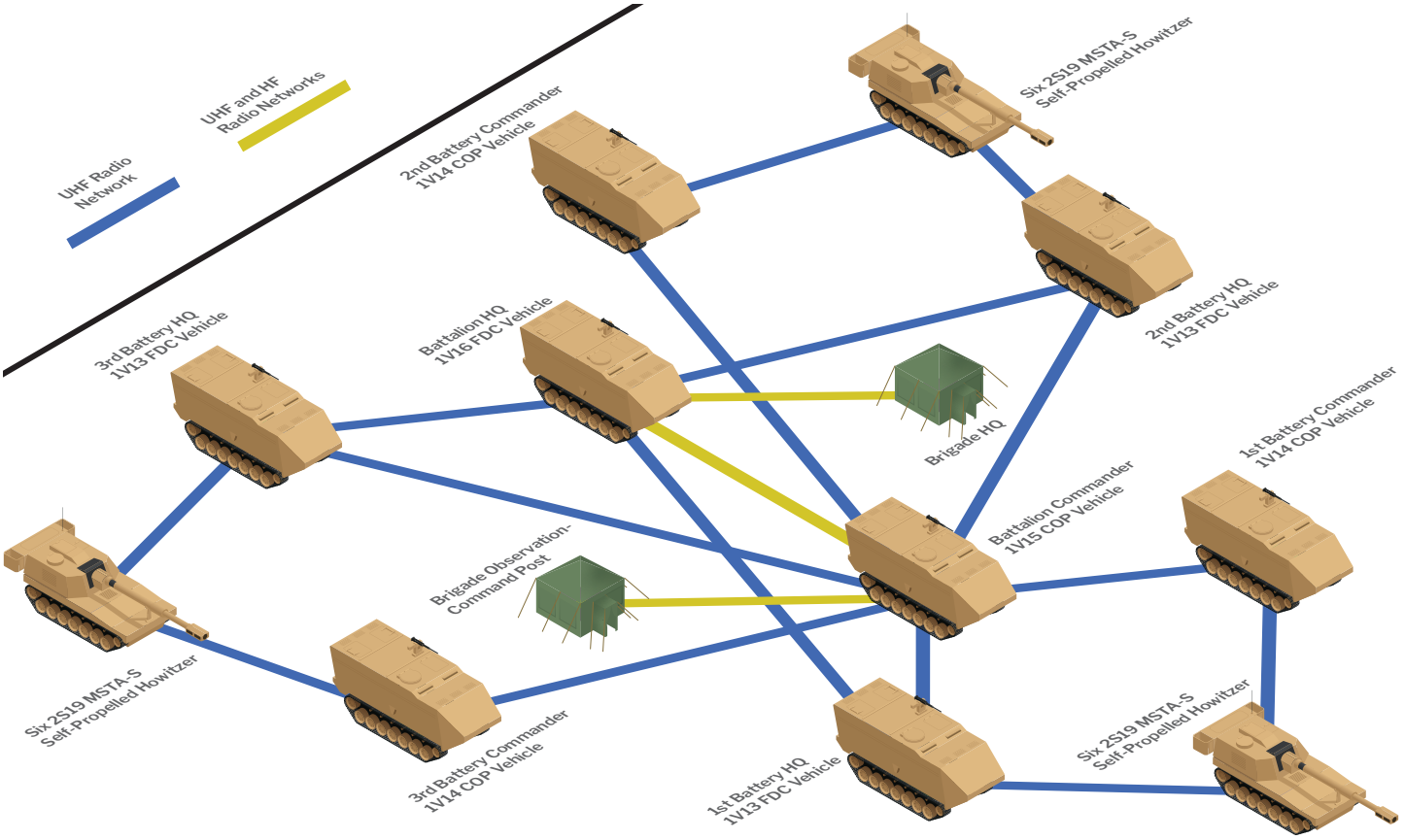


Figure 6. The 1V12 Kharkov Artillery Fire Control System (Rick Paape/Courtesy information).

lery battalions normally function as part of a DAG, RAG or BrAG, but are developing the capability of becoming a temporary ROS in support of the higher echelon. The Russians are now developing a system where artillery battalions may become temporary ROS systems when adequately equipped and linked. The Russian Armed Forces use a variety of artillery fire control systems, but they all generally follow the accompanying description of the 1V12 Kharkov Artillery Fire Control System.

1V12 Kharkov artillery fire control system

The 1V12 Kharkov Artillery Fire Control System is based upon the MT-LBu chassis and is primarily designed to service self-propelled howitzer units. A battalion level set consists of eight vehicles: three 1V13 battery FDC vehicles, three 1V14 battery COP vehicles, one 1V15 battalion COP vehicle, and one 1V16 battalion FDC vehicle. The 1V12M Faltset artillery fire control system is a modernized version of the 1V12 Kharkov, and its constituent vehicles follow the same naming convention as the 1V12 Kharkov system, except with an "M" suffix (IV13M, IV14M, IV15M, and IV16M).

The IV13 functions as the FDC for the battery are manned by the senior officer of the battery (typically the first platoon leader). It has direct radio communications with the battery COP (IV14), the battalion COP (IV15), and the battalion FDC (IV16).

The IV14 functions as the COP for the battery are typically collocated with the COP of the supported maneuver unit commander so targets can be relayed from the supported unit to the artillery, or is on the battlefield calling for fire. It has direct radio communications with the battery FDC (IV13), the battalion COP (IV15), and the battalion FDC (IV16).

The IV15 functions as the COP for the battalion are typically collocated with the COP of the supported maneuver unit commander so targets can be relayed from the supported unit to the artillery, or is on the battlefield calling for fire. It has direct radio communications with the battery FDCs (IV13), the battery COPs (IV15), and the battalion FDC (IV16).

The IV16 functions as the FDC for the battalion are manned by the battalion's chief of staff. It has direct radio communications with the battery FDCs (IV13), battery COPs (IV14), and the battalion COP (IV15).

Implementation of the Reconnaissance-Fire System

In practice, ROS is being implemented through the Strelets reconnaissance, command and control, and communications system (KRUS). The Strelets was developed in 2007 but was only fielded in large numbers beginning in 2011. It has undergone several modifications and hardware upgrades, and its use by Russian Forces in Syria is well publicized. The 'targeting' component of the Strelets is primarily used by the Ground Forces, Airborne and Naval Infantry, and GRU Spetsnaz; and consists of a small tablet

computer that can be worn on a tactical vest. The Strelets (likely based on the Linux operating system), reportedly can interface with legacy Soviet and Russian intelligence collection equipment and can interface with a variety of sensors (azimuth determination, radar, electro-optical, thermal-imaging, acoustic, target designation and sighting, et. al.), to include UAV based sensors. Russia's next generation of man-portable short-range reconnaissance radar, the 1L277 Sobolyatnik, and the 1L111 Fara-VR, appear to have been designed from the outset to integrate with it. The Strelets can also interface with other Russian Automated Command and Control Systems (ACUs) to include the Aerospace Defense Forces (VKS) Metronom strike-aviation ACU, and the Airborne Troops (VDV) Andromeda-D ACU.

The Strelets reportedly allows a service member to annotate the position of a target on digitized maps contained in the Strelets. The targets' coordinates are then transferred in real time to command posts, artillerymen, and pilots, reportedly halving the amount of time needed to lay Fires. The Strelets has several levels of accessories, the base variant is for each service members, up to squad leader. The next accessory level is intended for platoon leaders and company commanders, having a powerful computer and multifunction keyboard. The highest-level accessory package is for battalion and brigade commanders. The Strelets has an organic communications capability to communicate with other Strelets systems up to 1.5 kilometers away, and can retransmit communications from other Strelets transmitters. Presumably, it can also be integrated into existing communications networks for longer distance communications. The Strelets also has an organic GLONASS satellite receiver for navigation, and can likely use U.S. GPS signals as well, and has an inertial navigation capability that is automatically activated in satellite navigation denied or degraded environments. Perhaps one of the more interesting features is the 'friend-or-foe' recognition system, with the range depending on the specifications of the sensors to which the Strelets is interconnected. The Strelets sends a query to the unrecognized object, if the object is a 'friend' then the serviceman hears an audible notification in the earpiece. If quiet, The Strelets defines the object as 'foe.' There have also been reports of Strelets being used for medical evacuation (MEDEVAC) purposes.

Initially, the Strelets was only designed to direct artillery and aircraft Fires, but the system has reportedly been upgraded to allow the direction of naval Fires, namely the Kh-35 Zvezda (AS-20 Kayak/ SS-N-25 Switchblade/ SSC-6 Sennight), 3M-54 Kalibr (SS-N-27 Sizzler), P-800 Oniks (SS-N-26 Strobile), and presumably the forthcoming 3M22 Tsirkon (SS-N-33) hypersonic cruise missile. The real value of the Strelets is signified by much more than the fielding of a computer tablet that allows the rapid direction of Fires. The real value of Strelets is the behind-the-scenes infrastructure that creates the conditions for a network-centric C4ISR system that successfully integrates operators, reconnaissance assets, command elements, and very different Fires systems to include ground-based tube artillery and rocket artillery, ballistic and cruise missile, strike aviation, and ship and coastal naval Fires. If Strelets indeed functions as described, the Russian Armed Forces will need only one system to task Fires rapidly at all levels of battle, from front-line artillery to deep-strike aviation, through rear-area missile strikes, truly fielding a unified Reconnaissance-Fire System that facilitates Fires at both the tactical and operational depths.

Conclusion

Technological advances in the fields of computer technology and communications have finally allowed Russia to field a true Reconnaissance-Fire System (ROS) as was envisioned in Soviet times. If the ROS proves to be successfully implemented by way of the Strelets reconnaissance, command and control, and communications system (KRUS), the Russian Federation will gain a significant capability in directing Fires at both the tactical and operational levels of war. Furthermore, this architecture should significantly enhance situational awareness for Russian commanders and the resilience of Russian Fires, as most sensors are networked. In the past, if the 'eyes' and 'ears' of the artillery battalion were neutralized, the artillery battalion would be 'blind' and 'dumb,' now this artillery battalion would theoretically be able to leverage other ground forces (Army) and Aerospace Forces (Air Force) sensors to engage the enemy. In sum, although still under development, the Reconnaissance-Fire System is an emerging capability worthy of attention and further study.

Dr. Les Grau is a retired infantry officer, Russian FAO and research director of the Foreign Military Studies Office. He has published 15 books and 250 articles for professional journals. He and Chuck Bartles published The Russian Way of War: Force Structure, Tactics and Modernization of the Russian Ground Forces https://community.apan.org/wg/tradoc-2/fmso/.

Charles Bartles is a researcher and Russian linguist at the Foreign Military Studies Office. His research areas include Russian and Central Asian military force structure, modernization, tactics, and officer and enlisted professional development. Bartles is also a major, imagery and space operations officer in the Army Reserve.

Pvt. 1st Class Troy Davis, a UH-60 Blackhawk helicopter mechanic with 3rd Assault Helicopter Battalion, 1st Aviation Regiment, 1st Combat Aviation Brigade, 1st Infantry Division, awaits instruction before take off Feb. 19, 2019 at Mihail Kogalniceanu Air Base, Romania (Sgt. Gavin Lewis/U.S. Army).

Aviation fire support in the decisive action training environment

By Capt. Karl Kunkleman

Multi-domain battle asks a lot of its force. In addition to the required skill-set each Soldier is initially trained in, this new style of fighting requires leaders to absorb and retain knowledge that makes them not only subject matter experts in their trade but also a skilled ambassador to additional specialties. Here lies a unique experience and learning opportunity that arises when you stretch your boundaries of experience and expertise, giving you the ability to broaden your horizons in a job that few of your peers will ever experience and understand. One of these jobs is an aviation fire support officer (FSO).

The FSO is an enabler to the combat aviation brigade (CAB). He is the unit's expert in not only Fires but ground-based maneuver. He must understand both what the ground force is doing and how aviation is supporting it. He must have the skill set to implement and decipher aviation routing, identify the enemy's Integrated Air Defense System (IADS), and enable freedom of maneuver for friendly aircraft on the battlefield. The FSO must be able to communicate, synchronize and incorporate fire support as well as cyber and electronic magnetic activities (CEMA) assets to provide the most essential Fires mission for the aviation brigade, suppression of enemy air defense (SEAD). A simple mission to execute but one of the most difficult missions to synchronize.

As an aviation FSO, there are three specific mission sets that you will synchronize with fire support: air assaults, deliberate attacks and hasty attacks. Each mis-

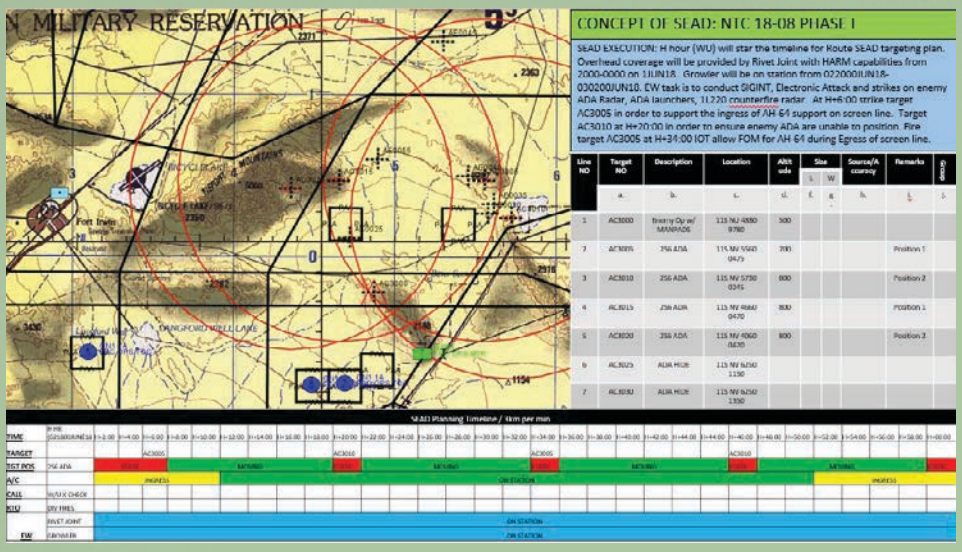


Figure 1. An example of a suppression of enemy air defense plan. (Courtesy illustration).

sion requires different types of Fires support to enable freedom of maneuver for aviation and ground forces. The main point of failure for these missions typically relies on the ability of the FSO to coordinate fire support at the significant friction points. The typical request from those outside of the Fires community is to shoot everything and anything on the battlefield to enable mission success. This broad, open-ended request is why many aviation FSO's fail. The ambiguity in leadership guidance is too broad and FSO's are afraid to go outside of their assigned area of responsibility. If you receive this type of broad guidance from your commander, try to meet his direction by creatively implementing fire support into the plan. Request everything from multiple different echelons and build you symphony of Fires on the battlefield.

Air Assaults

The National Training Center continually tests your lift capabilities by tasking a battalion or several separate company air assaults throughout the multiple battle periods. Be ready to conduct flights that accommodate multiple different aircraft types in one mission under all potential flight conditions and plan to continually support these requests from division and brigade. Having a flexible Fires plan is critical and requesting assets as early as 48 hours in advance will set you up for success. Build a relationship with the ground force to help understand how to employ aviation assets into their plan. Coordination with the ground FSO's to overlap SEAD plans is critical. A maneuver FSO that does not have their own SEAD plan for an air assault could halt or delay take off for those supporting aircraft. Understanding of this go/no go criteria must be a face-to-face or voice over IP conversation with the maneuver commander and FSO. Air assaults in the decisive action training environment (DATE) often have very tight windows for execution. Ensure that you enforce execution timelines. This was a very painful learning experience that aviators did not want to accept. Hold aviators accountable for missing their timelines and ensure they know that the allocated assets will not wait for them. When division and higher assets are required to wait for you, they are unable to support other units in a rapidly changing battlefield. Adjusting planned times does not provide last minute availability. You must be proactive and establish good commander's guidance. If you receive a "destroy everything" request, be creative. An example SEAD plan could include utilizing electronic attacks for a quiet infill and multiple strikes from rockets or fixed wing while aircraft are at the drop off location and their egress from that area. The supporting electronic attack can double as a secondary safety measure on egress. This became the standard operating procedure during our DATE rotation allowing for a quick and quiet infill and a devastating route out of the area of operation.

Deliberate Attack

Deliberate attacks, also known in the DATE as a deep attack, are special because they are typically a division-directed mission enabling the attack aviation assets to fly past the coordinated firing line (and sometimes beyond the fire support coordination line) in order to conduct disrupting attacks in the enemy's rear echelon. The main goal of this type of attack is to cause as much damage and confusion as quickly as possible before being targeted by the enemy air defense and IADS systems. It is essential in this type of mission to overlay multiple assets and mass Fires to support movement of friendly aircraft and to disrupt the enemy capabilities in their battle space. The FSO is key because he is able to support this mission in multiple ways. Asking for additional support for these missions is important. As a division mission, the aviation FSO has more authority when requesting and implementing assets to include rockets, electronic warfare, artillery and close air support (CAS). It is absolutely critical to accomplish this attack with the highest survivability to friendly aircraft in order to meet the division commander's intent.

Be sure to utilize SEAD that is cued by electronic warfare (EW) or signal collection with overlaying electronic attack to disrupt and deny IADS systems on the objective. Build targets to mass rockets in templated enemy locations identified in your targeting work group with the S2, S3 and information collection (IC) manager. The targeting working

group is essential at the battalion level when nominating targets for deep attacks. Building the analysis and IC Fires plan demonstrates to division you're shaping the environment in support of the division's mission. Manage your SEAD based on threat rings of the enemy ADA systems and Worldwide Equipment Guide (WEG) for displacement criteria. Do not forget your ingress and egress SEAD to ensure survivability of friendly aircraft. Do not rely on Hellfire rockets from Apaches as your main source of firepower in a deep fight. The Apaches have a limited supply of ammo and will not be able to resupply at a jump forward arming and refueling point (FARP) during this type of mission. These missions are quick and rely on the combat multiplier, the element of surprise. Coordination with brigade is essential even though they are not in direct support of the mission. Make sure the brigade Fires cell knows the mission and your SEAD plan, so they can add injects at the most critical points of conflict. Aerial call-for-fire relayed from your deep attack teams via satellite communication (SATCOM) or joint capabilities release/joint battle command platform (JBCP) that are coordinated with the brigade and division high payoff target list (HPTL) will be executed with proper pre-coordination. This coordination allows you to save ammunition for time sensitive targets with the Apaches.

Employing intelligence, surveillance and reconnaissance (ISR) will allow you to shape the engagement area for the deep attack prior to friendly aircraft coming on station. You will easily be allocated immediate division fire assets if you are utilizing ISR feed provided by the S2 synced with the HPTL. Focus on submitting immediate fire missions for targets on the HPTL. Remember that one rocket may not always destroy the enemy. Be creative with your engagement requests. We utilized triangle formations with time separation around towns

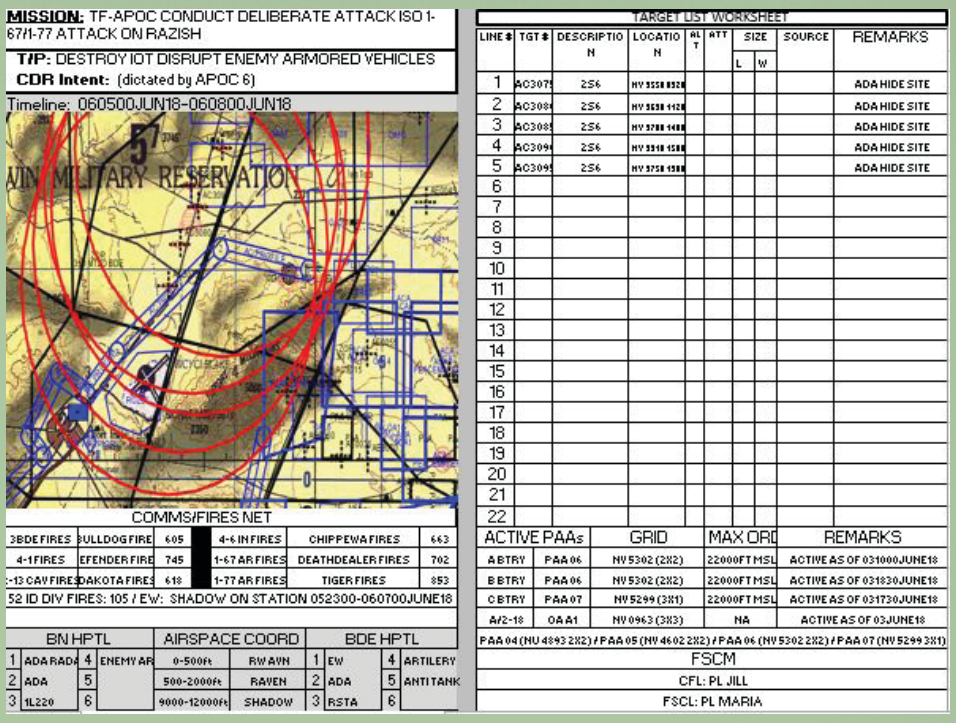


Figure 2. An example of a knee board product. (Courtesy illustration).

that had possible enemy ADA on their perimeter. This allowed multiple strikes from the same Multiple Launch Rocket System (MLRS) launcher in our sector. If ISR are not available, your aircraft have the ability to be the observers. Ballistically, friendly aircraft are safe from friendly artillery if aircraft have 1km standoff from the target, 1km standoff from friendly positionary artillery area (PAA) and are below 500 feet mean sea level (MSL). From experience, aircraft in a deep fight will not crest 150 feet MSL in order to stay hidden by terrain in their attack. De-confliction of Fires and aircraft is most easily conducted by lateral separation and will be the most efficient during a deep attack. Ensure in your SOP that, if friendly aircraft identify targets to be engaged by fire support assets, they understand their lateral de-confliction requirements.

Hasty Attack

Hasty attacks are enabled by effective flight routing. Ensure that the ground commander understands the mission requirements and that you, as the FSO, can easily translate that for the aviators. Encourage and enforce battalion FSO's to communicate in real time with supporting aircraft for situation updates, front line of troops and mortar locations. Pushing the aircrafts down to the battalion FSOs can assist in generating larger battle damage assessment and will be much easier to coordinate with the grounds maneuver scheme while on site. Typically, when conducting hasty attacks, the aircraft are constrained by restrictive corridors, this limits their superior capacity to see and impact the battlefield and make last second adjustments to win the fight. As stated earlier, the aircrafts are your best, most responsive forward observers. Let the aircraft work for you and the maneuver FSO. Permissive coordination measure importance cannot be overstated. Through our experience, heavily mandated restriction resulted in numerous missed opportunities where aircraft bypassed enemy armor that they could have easily killed.

When building your SEAD plan, or any Fires plan that supports aviation, having an official knee board product or condensed aviation plan that is distributed to pilots to sync efforts is key. This is critical when you have multiple missions going on simultane-

Crew chiefs from the 2nd Battalion, 224th Aviation Regiment, 29th Infantry Division, conduct qualifications from their UH-60 Black Hawk helicopters April 4, 2019, at Marine Corps Outlying Field Atlantic in Atlantic, N.C., (A.J. Coyne/U.S. National Guard).

ously. Knee board products will keep you organized and allow others to execute your plan if you are wounded in action or killed in action. The knee board product should include the mission, a generalized common operating picture, battalion and brigade Fires nets, fire support coordination measures, electronic warfare timelines and sectors in support of the mission, target list worksheet, PAA locations, friendly call signs and any other additional information that could benefit the pilots.

The unique attributes of an FSO in an aviation community are related to their experience and individual training background. Each FSO typically has three to five years of experience in a ground maneuver force prior to joining the aviation unit. Because of this experience, the FSO becomes a liaison. He provides knowledge in maneuver tactics, techniques and procedures making him the subject matter expert on how the Army fights on the ground. The FSO knows the best way to incorporate attack aviation into the scheme of maneuver plan and translate maneuver tactics to aviators. Since aviation has no internal fire support assets and

are considered a maneuver force, aviation units that leverage their FSO to cross-coordinate throughout the force set themselves up for success.

A common misnomer in the fire support community is that forward observers (FO) are the best observers on the battlefield. FO teams are able to visualize the battle space, move under concealment into observation points and implement Fires that can affect and shape a battle. While this is true, the reality is that the best, most reliant, most responsive and deadliest observers on the battlefield are aviation assets. Aviation has the ability to observe and cover the battlefield at a high rate of speed with the most advanced sensors available. Aviation has the capability to conduct targeting and information, reconnaissance and surveillance (ISR) with assets such as Grey Eagle and Shadow. Attack aviation uses a technique called manned unmanned targeting (MUM-T) to identify targets and shape the deep fight for the maneuver force. These assets are your best friend as a fire supporter. As the Grey Eagle and Shadow assets identify a target you are able to immediately call for fire on a known enemy location. The responsiveness of these assets gives the aviation unit and Fires community a huge advantage against any enemy threat. For example, Grey Eagle is flying forward of the Coordinated Fire Line at 20,000 feet MSL and identifies a company-size element of tanks, while simultaneously identifying an enemy air defense asset that is defending the tank company. Grey Eagle can target the air defense and strike it with an MLRS rocket or it is on board Hellfire Rocket prior to launch of the attack aviation to destroy the enemy tank company. The key to these ISR assets is its responsiveness to key targets on the battlefield, specifically those high payoff targets (HPT). A strong FSO can be considered a salesman by trade. He must be able to communicate and allocate assets from additional supporting units to assist in the aviation mission which include ISR, rockets, mortars and any other assets he can secure.

Warfighting Function (WFF) Points of Interest

The battalion FSO needs to conduct a targeting working group with the S2, S3 and lead flight planner daily to ensure that targets and information from brigade and division are properly translated. This will allow you, as the FSO, to match upcoming mission targets with your non-organic assets. Requesting additional collection assets to support your missions will be greatly enhanced with S2 input. Anticipate where you will be working and start painting the picture for the team as you move forward. This will also increase and enable assets for battle damage assessment gathering. The Intelligence WFF is the most important component to the FSO in the decisive action training environment. The FSO and S2 need to be co-located at all times of the fight to enable success on the battlefield. It is essential that these two entities

are in sync and requesting assets together. Utilizing the S2 for ISR assets in support of your Fires plan ensures that the battalion commander is updated on the situations so they can assist in building your go/no go criteria for each mission. Key to remember is that you have the fastest observers on the field. Post-mission, secure a thorough target debrief from the pilots. This will allow you to easily direct or redirect assets where they are needed and give recommendations to the aviation battalion commander. Remember, the FSO is the expert on ground maneuver in the aviation world. Support your commander by providing guidance on where the enemy is fighting, how they are fighting, how the enemy artillery will play an effect and where YOU think the enemy artillery is positioned.

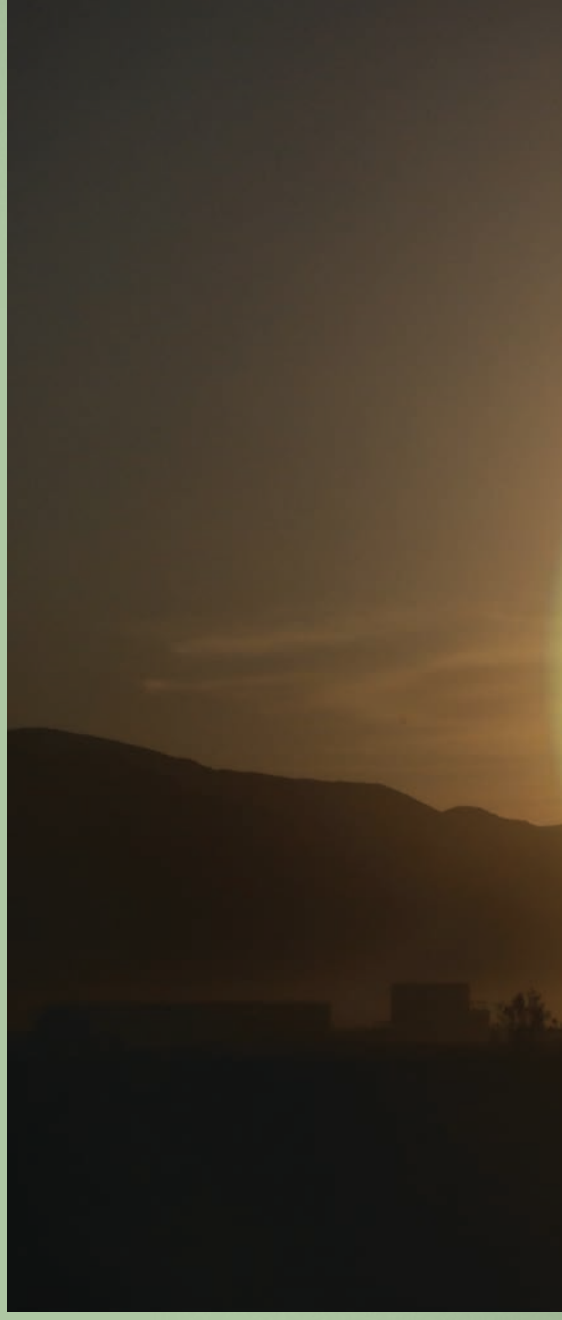
The Fires WFF can be summarized in six words Advanced Field Artillery Tactical Data System. As the smallest WFF in the aviation community you are only as good as your ability to communicate and maintain AFATDS capabilities with your adjacent units and higher headquarters. The AFATDS is your lifeline. Conducting digital sustainment training with your headquarters prior to your CTC rotation will set you up for success. Get your AFATDS up and running with everyone. The FSO team that maintains the best contact will have the most assets allocated and targets executed. Continually request information from the Fires community via AFATDS - at a minimum twice daily and at least 12 hours prior to the execution of any mission. Continually share your geometries with the brigade and supporting battalion FSO's to ensure that all parties have a common operating picture of flight routes and target locations.

Utilize SEAD ideally cued by EW or other signal collection assets. Request everything you need to accomplish the mission. Asking the simple question, "What assets are not currently being requested or templated for use from time A to time B?" can allow you to improve your plan significantly. Ensure that the BCT understands the shadow CFF capability and MUM-T (manned, unmanned team) so that your pilots can conduct hasty CFF missions for brigade and division targets on-the-fly. Don't rely on Hellfire rockets and 30 mm rounds. Use artillery when possible to increase effects on the battlefield. In addition, utilize Fires as a break contact method during hasty and deliberate attack missions to increase aircraft survivability.

Aviation FSO's rarely add to their units' defense diagrams. Requesting critical friendly zones (CFZ) over the tactical operations center and supporting company command posts is extremely beneficial. As an aviation unit you are centrally located. Requesting a division supported CFZ over your location is critical to minimize enemy indirect fire. Submit a request for radar coverage to division for CFZ support. You will initially be given a four-hour window for coverage. Conduct pattern analysis to identify when the enemy indirect fire (IDF) typically strikes your location.

Defensive targets should also be included in your defense diagram. Identify target reference points surrounding your tactical assembly area. Utilize a Blackhawk and conduct air recon of these locations and put targets on them in support of your defense. Identify avenues of approach and establish additional targets at these locations. If your unit is overrun, having these target sets ready to execute will be critical to your survivability.

In the required training gates for fire support validation, as soon as you receive IDF, make sure you conduct crater analysis in case the CFZ radar does not acquire the enemy IDF. By showing the observer/controller teams that you have conducted crater analysis to standard by doctrine they will give you the point of origin. This location can then support one of your deep attack missions later



in the exercise. For example, the Prima multiple launch rocket systems typically fire one launcher at a time from the same location. Pattern analysis will ensure you remove this enemy from the battle space.

As an aviation FSO your PACE plan is vital and will be either your greatest achievement or biggest downfall. P: AFATDS, A: Transverse, C: SATCOM, E: BFT/JBCP is one of the combinations that worked during my rotation and ensured that I could always communicate. Bring, at a minimum, one additional Fires Soldier to run the AFATDS and manage your COP/overlays. Depending on the unit you support and the jamming environment you may need

A CH-47 Chinook assigned to 1st Battalion, 501st Aviation Regiment, 1st Stryker Brigade Combat Team, 1st Armored Division, Fort Bliss, Texas, awaits orders prior to a mission during Decisive Action rotation 19-01 at the National Training Center, Fort Irwin, Calif., (Pvt. Brooke Davis, U.S. Army).

more. A minimum requirement should consist of one 13F Soldier. Kneeboard product or analog for a better term will be your friend in this contested environment.

In summary, I believe that it is essential for an aviation unit to have a dedicated FSO at the battalion and brigade levels. The necessity stems from the ability of the FSO to collectively integrate all aspects of fire support through the war fighting functions to include maneuver, aviation and Fires in a cohesive single productive unit focused on mission success.

The de-confliction requirement and necessity to "sell" Fires to all branches and echelons cannot be over emphasized. A technically and tactically proficient FSO creates an environment and atmosphere of success in a DATE rotation. The position of an aviation FSO is typically viewed as a broadening assignment for an artillery officer. The role teaches a unique capability and understanding only seen in some of the most senior and experienced FSOs. I strongly encourage those of the Fires community to seek this role and expand your appreciation of Fires role by supporting an aviation unit in a decisive action training environment.

Capt. Karl Kunkleman is the brigade aviation fire support officer and brigade Fires and Effects Officer for 1st AD CAB at Fort Bliss, Texas. He is a graduate of the Field Artillery Captains Career Course and the University of Montana with a degree in Business Finance. His previous assignments include Headquarters and Headquarters Battalion executive officer, Field Artillery Squadron, 2nd CR, B Battery, platoon leader, FA Squadron, 2nd CR and A-TRP FSO / 1st Squadron, 2nd CR.

The Soldiers of 5th Battalion, 3rd Field Artillery, 17th Field Artillery Brigade, receive instructions during a rappel training exercise (Staff Sgt. Jacob Kohrs/17th FA BDE).

Corps force Field Artillery headquarters lessons learned

By Col. Christopher Wendland

Recently, the 17th Field Artillery Brigade completed our Warfighter Exercise supporting America's First Corps in Korea. During this warfighter, the 17th FA served as the corps force field artillery headquarters (FFA HQ). In this role, the brigade was responsible for corps shaping Fires and provided mission command to another FAB HQs serving as the corps counterfire headquarters as well as two division artillery headquarters each augmented with an Multiple Launch Rocket System or high mobility artillery rocket system battalion in a general support reinforcing (GSR) role to assist with their respective division shaping or counterfire operations.

This article will showcase three field artillery brigade lessons learned from our preparations and experiences at our Warfighter:

1. Early coordination with the corps and each division staff to highlight the unique requirements of supporting corps artillery and radar assets during decisive action;
2. The additional FFA HQ staff coordination required when operating within division battlespace and when given the role of corps FFA headquarters; and
3. The value and necessity of conducting a routine FFA HQs synchronization meeting with all field artillery headquarters within the corps task organization.

Seventeenth FA Brigade (FAB) is one of the Army's four active-duty field artillery brigade headquarters. The 17th FAB commander dual-hats as the corps fire support coordinator and when the corps fights decisive action, the 17th FAB normally receives

the additional role of FFA HQs. This additional role requires the 17th FAB commander and staff to widen their aperture and look beyond their own organic formation. In some cases, the corps may choose to assign another field artillery brigade headquarters the role of counterfire headquarters, and each division task organized under the corps normally is task organized with their organic DIVARTY headquarters. Each of these subordinate artillery headquarters provide information to the Force Field Artillery headquarters to assist the FFA HQs commander/corps fire support coordinator (FSCOORD) to "see" the Fires warfighting function in a holistic sense across the entire corps formation, advise the corps commander, and quickly facilitate corps commander guidance across the entire "Fires" chain. The dual-hatted nature of the FAB commander is critical and ensures the entire Fires community remains nested with the corps commander's intent. Prior to the operation, the FAB commander participates in the corps military decision-making process (MDMP) as the corps FSCOORD and ensures "Fires" are able to shape the battlefield appropriately for the division fights and then leads their own FFA-level MDMP process with the FAB staff. During operations, the FAB commander leverages their corps deputy FSCOORD to facilitate the corps Targeting Working Group and Decision Board and also leverages their brigade DCO and brigade S3 to coordinate with each of the divisions to ensure all artillery assets and sensors (counterfire radar) are positioned appropriately to execute the mission and meet the corps commander's intent, while always operating between their corps fire support role, coordinating with all the other O6-level commanders for shared understanding, and commanding their own FAB.

Lesson Learned #1

When a field artillery brigade headquarters is assigned the role of FFA HQs, the FFA HQs staff must coordinate early with the corps staff and each task organized division staff to identify support requirements for any corps artillery or radar assets that will need to operate within the division area of operations. Liaison officers' exchange is critical to ensure a dedicated officer/NCO is able to exchange information and provide mutual support/information flow between the FFA HQs, the Corps Counterfire HQs, and each of the division artillery HQs. We identified early on, the each corps artillery unit will require support with three concerns:

1. Approved land for position areas for artillery (PAAs) and radar position areas (RPAs);
2. Security when operating in the division's area of operations, escort in/out and during operations; and
3. Sustainment support when operating in the division's area of operations to include all classes of supply and medical support.

For the initial concern, the importance of synchronizing the allocation of PAAs and RPAs within division battle space, optimal terrain may be limited, and with limited options for feasible firing positions or radar positions, without pre-coordination, the divisions may choose those same firing positions or radar positions for their own organic DIVARTY assets. Also, during operations, a corps asset may fire repeatedly from a firing position within division battlespace and then conduct a survivability move and, without proper coordination, the division may choose to move a mission command, logistics base, or one of their own organic DIVARTY artillery assets into the same PAA when it becomes available, and risk enemy counterfire onto that location. If another FAB is assigned to the corps as a Counterfire HQs, the FFA HQs should synchronize firing positions for all corps artillery assigned assets (artillery and radar) and work with the corps and division staff to include these PAAs and RPAs in the corps OPORD and ensure these locations are identified and discussed during both the corps Combined Arms Rehearsal (CAR) and the corps Fires rehearsal. Bottom line: overuse of multiple PAA/RPAs increase vulnerability. It is important that staff de-conflict in the planning process rather than during mission execution.

The next concern is the early discussion about security for these corps artillery and radar assets. In a decisive action scenario, long-range artillery and radar assets are essential tools for the corps commander to shape the battlefield for the division fight and will likely need to operate with division battlespace. The corps artillery and radar assets are high value targets to the enemy we are fighting. Corps artillery and radar assets will require protection when operating within the division battlespace from both ground and air threats. The divisions will be extremely concerned about a requirement to assign their organic combat power to protect corps assets and, for this reason, the discussion must occur early to affect division level planning. The FFA HQ staff will need to coordinate with the corps staff to ensure the corps OPORD includes a requirement for security support to corps assets operating in division battlespace and this topic must be addressed for each move to subsequent PAAs/RPAs during the corps CAR and Fires rehearsal. Since corps assets could start in one division's battlespace and then move to another division's battlespace, it is necessary to include the details for a successful handoff between assigned security elements, the escort requirements when traversing through divisional battlespace, and identifying where the authority lies to decrease or increase security requirements as the enemy threat changes. During our warfighter, we directed that the division's assign security in the corps order (this is key advantage to having the FAB commander dual-hat as the corps FSCOORD). We also

required each division to discuss the security they provided during the corps Fires rehearsal and tracked the security element for each firing unit at the FAB daily commander's update brief (it was a Commander Critical Information Requirement if a corps field artillery or radar asset was uncovered with security for any reason).

The third concern is in regards to sustainment support to the corps artillery and radar assets operating in division battlespace. These corps artillery assets require local sustainment support. The FAB has minimal organic sustainment support. Although each active duty field artillery brigade is assigned a brigade support battalion (BSB) by MTOE, the FAB BSB is only a HQs element and does not contain the subordinate units associated with a typical BSB. They do not have any of the subordinate companies (no SSA, no transportation company, no maintenance company, and no Role II medical capability). Due to the dispersed method in which corps artillery assets will operate during decisive action, the divisions Brigade Combat Team (BCT) assets (or similar) will be required to provide all sustainment support.

Lesson learned #2

A field artillery brigade staff assigned the role of FFA HQs needs to truly understand the scope of their FFA HQs mission. The staff should already have strong relationship with the corps headquarters staff and with the staff of their organic battalions. They will now need to develop a relationship with each of the division staffs supporting the corps and any field artillery brigade staffs and DIVARTY staffs that will report to the FFA HQs. Due to the positioning of the corps FA artillery and radar assets within division battlespace, the FFA HQs staff have a greatly expanded role to effectively coordinate, monitor, and hand-off the security and sustainment requirements with each movement between division battlespace. As the battle progresses, the FFA HQs S3 will need to ensure previously planned PAA/RPAs are still valid and work to identify new alternatives if those plotted locations become untenable. The FFA HQs S2 must coordinate with the corps and the respective division G2 to ensure the corps artillery asset receives local intelligence updates from the battlespace owner for each of the PAA/RPA locations. The FFA HQs S2 would not have the most relevant information for each corps artillery asset operating within the division Battlespace as multiple corps artillery/radar assets would essentially be operating in multiple brigade combat team areas of operation and the respective brigade S2 in that area of operation would have the best information on the local enemy threat. The FFA HQ S1, S4, and surgeon will need to monitor sustainment support as corps artillery or radar asset moves and must reestablish a connection their support for all classes of supply, the nearest Role II facility, or replacements. The FFA S6 must continually monitor the primary, alternative, contingency and emergency (PACE) communication plan for each of the corps artillery and radar assets to ensure they do not lose connectivity and must work with corps and each division G6 to potentially employ retrains assets (another corps asset that will require land, security, and sustainment). The FFA HQ protection chief looks at all enemy threats to artillery and radar inclusive of corps and DIVARTY (air, ground, counterfire, electronic warfare, cyber, chemical, biological, radiological and nuclear threats), looks for trends, and distributes methods to mitigate those threats across the entire FFA HQ Fires community. It is critical that the FAB staff officers are aware of their expanded role when assigned the FFA HQs mission. This expanded role requires that they establish connectivity and relationships with multiple different headquarters, develop reporting methods to keep the FFA HQ commander informed and able to advise the corps commander for the reallocation or re-prioritization of corps resources, and to ensure proper hand-offs occur for security and sustainment as corps artillery and radar units maneuver on the battlefield. Finally, the FFA HQs is likely also responsible for sourcing and monitoring fire support requirements in the rear area. This requires the FFA HQ staff to establish a non-traditional fires headquarters linkage to the corps rear area headquarters, sourcing that rear area with artillery assets from one of the BCT organic field artillery battalions or with a GS cannon unit, develop a mission command structure as well as a sensor plan, and then provide oversight of the process as part of the FFA Mission.

Lesson Learned #3

The importance of a routine FFA HQ synchronization meeting. During our Warfighter, we held a daily meeting with each field artillery brigade, each DIVARTY and the current ops corps Fires DFSCOORD. This meeting proved critical to providing the FFA HQs commander/ corps FSCOORD requisite information to advise the corps commander and ensure the entire Fires enterprise maintained shared understanding to meet the corps commander's intent for the Fires Warfighter Function. The FFA HQ synch meeting is not a replacement for any of the corps Targeting Working Groups or Boards and it is recommended that "targeting" topics are reserved only for those targeting forums. The FFA HQ synchronization meeting (see attached 7-minute drill) is a great tool for commanders (each FAB CDR and each DIVARTY commander or their representatives participated as available) to gain shared understanding on the current fight and resolve difficulties quickly. As the FFA HQs, 17th FAB exercises the forum to gain insight on any challenges requiring the short duration re-allocation of corps assets (reassigning a unit from a GS status to a GSR status as a means to assist a DIVARTY

The Soldiers of A Battery, 5th Battalion, 3rd Field Artillery, 17th Field Artillery Brigade, tactfully march toward their mission objective for the squad-maneuvering event (Staff Sgt. Jacob Kohrs,17th FA BDE).

while they were the main effort) or reassigning radar coverage to account for unexpected gaps due to either unscheduled maintenance or battle loss. For our fight, the FFA HQs had to manage all Q37 and Q53 radars in the corps area of operations through the Counterfire Headquarters (inclusive of the FAB, DIVARTY, and BCTs) since, if not centralized, the divisions would gravitate to providing coverage to only their own area of operations and the corps radar coverage plan would dissolve into a coverage area fraught with wide open gaps or extreme redundancy.

During our daily FFA synchronization meetings, we also discussed the cross-leveling of critical munitions, corps artillery assets providing temporary artillery fires short of the fire support coordination line, and the prioritization of artillery and radar replacement Class VII (due to battle loss/damage) to ensure proper radar coverage and firepower during critical time periods.

The 17th FAB served as the America's First Corps Force Field Artillery Headquarters during our Warfighter in Korea in November, 2017, and then again in Japan in December, 2017, for Yama Sakura 73. Each time, 17th FAB operated with different field artillery brigade and different DIVARTY headquarters and the previous lessons learned were critical to the effective employment of our FFA HQs. From our experiences, early communication and coordination is crucial or the initial days of the exercises will create angst and confusion across the Fires community. We recommend that the FFA HQs include their expanded FFA HQ role in the unit mission and commander's intent during MDMP, ensure division requirements for division, field artillery brigade and DIVARTY headquarters are outlined thoroughly in the corps OPORD, ensure that each of these topics are discussed at the Corps Combined Arms Rehearsal and the Fires Rehearsal, and the FFA HQ develop and disseminate clear reporting requirements for the FFA HQs and an agreed upon agenda/format for the habitual Force Field Artillery Headquarters synchronization meeting.

Overall, the 17th FA Brigade learned much about an artillery headquarters expanded role as a corps Force Field Artillery Headquarters. We offer our staff for further discussion or for requests for additional information. We hope these lessons learned will be of benefit to the entire field artillery community.

Col. Christopher Wendland is the commander of 17th Field Artillery Brigade and the fire support coordinator for America's First Corps.

Second Lt. Reed Simmons of 3rd Battalion, 43rd Air Defense Artillery, is presented with a training certificate and qualification badge for completing the Germain Air Force Air Defense training by German Brig. Gen. Michael Gschossmann (Courtesy photo).

Combined ADA training

U.S. Army officer completes training course at German Air Force Air Defense Center at Fort Bliss

By Lt. Col. Ingo Scharchmidt

The first U.S. Army officer, 2nd Lt. Reed Simmons, completed the German Patriot Fire Control Officer course at Fort Bliss, Texas, this past year. This was a milestone for the two-year-old course as U.S. officers normally complete the Air Defense Artillery Basic Officer Leadership Course (BOLC) at Fort Sill, Okla., and continue their training at their next duty assignment or national training centers.

Basic Officer Leadership Course - B in Fort Sill

German Officers have been attending the U.S. ADA BOLC-B course since 2016, before attending the German Patriot Fire Control Officer course at the German Air Force Defense Center on Fort Bliss, Texas. The U.S.-lead High to Medium Air Defense Course focuses on the Patriot weapon system's major end items, tactical simulations, and numerous classroom hours on air and missile defense (AMD) doctrine. Throughout the course students gain experience and a basic understanding of the methodology of working with allied partners. German instructors from the German Air Force Air Defense Center, and German instructors assigned to the U.S. ADA Basic Officer Leadership Course continually mentor students through this phase.

Part I achieved

Simmons and seven German Air Force officer classmates graduated from ADA BOLC-B on June 14, 2018, with no time for relaxation. Building upon their AMD fundamentals learned at Fort Sill, the instructors focused on indepth theories and duties of German fire control officers at the German Air Force Air Defense Center. Here the students are afforded the opportunity for more extensive hands-on training as well as countless hours of one-on-one training. The lion's share of the course is made up of tactical training and field/simulation exercises. Students spend many hours in the Reconfigurable Table-Top Trainer classrooms (RT-3), and up to eight fire control

Second Lt. Reed Simons and other course participants completed many hours of simulated exercises prior to demonstrating their proficiency in a live-training exercise (Courtesy photo).

crews can simultaneously train. Without the simulation facilities, it would require eight Patriot weapon systems crews to run the exercise. The simulations allow students to practice scenarios which would be difficult to implement in reality. Normally, a German Patriot scenario engaging a threat tactical ballistic missiles would only be feasible during an annual tactical shooting exercise in Crete, Greece.

Both the German Air Force Defense Center and the U.S. Army Air Defense Artillery School use simulations that focus on engagement control. However, tactical techniques and procedures are different between the U.S. Army and the German Air Force. The German Air Force focuses on NATO doctrine and tactics that are focused on the air breathing threat. "Bring the 'Air' back to 'Air and Missile Defense,'" said Brig. Gen. Chris Spillman, former 32nd AAMDC commander. This statement and evolving threats in Europe are the prime motivators for the German Training Center, and now Simmons leaves the course with a better understanding of integrating NATO air and missile defense tactics in to U.S. tactics, techniques and procedures.

The training highlight

A ten-day, end of the course exercise is the highlight of training for the officers. The individual training phases for the course are pieces to a puzzle, and the exercise reveals the complete picture. The training phases are system technology; setup and breakdown; weapon system software; and tactical options for Patriot implementation. Students are stressed during this exercise because they must demonstrate an understanding and knowledge of the overall system.

Individual tasks are changed daily, ensuring that every student performed the following task at least once: reconnaissance, fire control, setup of equipment and camouflage. Furthermore, the fire control crew (consisting of the fire control officer and tactical control assistant) assume command of all teams. This responsibility poses a unique challenge as students must demonstrate technical and tactical competence, as well as leadership abilities. Simmons had the additional challenge of being unfamiliar with German vehicles and power-generating equipment.

Mission accomplished

The eight young officers were glad when the exercise was complete, and the class graduated on Nov. 1, 2018. Brig. Gen. Michael Gschossmann congratulated the officers and highlighted the participation of a U.S. Army officer in the German Fire Control Officer course. "Current challenges can only be overcome on a multinational level. Joint training is the perfect start for successful multinational cooperation," said Gschossmann.

After the ceremony students had lunch with Gschossmann, Col. Andreas Noeske, and Lt. Col. Ingo Scharschmidt to discuss the course.

Joint training

A multitude of opportunities arises from joint training. All participants from both nations, to include the instructors, will carry these joint experiences and insights back to their units. During future operations, these officers will not only meet old acquaintances but comrades-in-arms who have one significant advantage: their joint training.

U.S. Navy Aviation Boatswain's Mate (Handling) 2nd Class Christopher Settle directs an EA-18G Growler, assigned to Electronic Attack Squadron (VAQ) 133, toward a steam-powered catapult on the flight deck of the aircraft carrier USS John C. Stennis (CVN 74) in the Red Sea, April 18, 2019 (Mass Communication Specialist 3rd Class Skyler Okerman/U.S. Navy).

Targeting in multi-domain operations

By Maj. Kyle Borne

The introduction of new doctrine is always met with skepticism and trepidation by entrenched bureaucracies. AirLand Battle had its critics. The introduction of multi-domain operations (MDO) is no different. This paper capitalizes on the experiences of four joint and coalition command post exercises (CPXs) where MDO effects were planned. The primary focus of the CPXs was to incorporate space, cyber and electronic warfare (EW) effects into the scheme of maneuver. This article focuses on the targeting experiences during those exercises and the integration of multi-domain effects.

On the surface MDO just looks like what a corps or equivalent level staff integrates every day in operations. Some of these processes are indeed similar, however it is important to recognize the differences. One of the primary differences is there is a difference between cross-domain Fires and multi-domain Fires.

Cross-domain Fires in its simplest form is just affecting one domain from another. An example would be surface-to-air missiles or using a shore-based artillery piece to attack a ship. This is what most commanders grew up understanding. Planning an air defense plan for a critical asset on the ground or requesting a Navy EA-18G to provide jamming effects are things Army staffs regularly plan and are other common examples of cross-domain Fires.

Multi-domain Fires takes those cross-domain assets and synchronizes them in time and space to create synergistic effects in windows of convergence. An example

might be creating a space-based effect which has an impact in the land or maritime domains, while an electronic warfare attack (EA) delivers a cyber effect, rendering an adversary's defensive electronic counter measures inoperable for a window of time which a Navy strike package can exploit to deliver lethal effects.

As warfare has evolved into the modern era, cross domain Fires have begun to leverage the domains of space and cyberspace. During the War on Terror the increased use of the information environment by violent extremist organizations hinged on leveraging space-based transport layers to move information over cyberspace. Joint task forces and special organizations began to target space and cyber nodes in an attempt to disrupt their command and control as well as their ideological dissemination media. All these efforts previously have been conducted isolated from each other. The Multi-Domain Task Force (MDTF) is different in that it's the first formation in the Army which brings all five domains under one command.

The novelty of the MDTF is its ability to provide effects in all five warfighting domains synchronized in time and space. As adversaries establish anti-access area-denial (A2/AD) bubbles which outrange conventional U.S. munitions, this formation provides a joint force commander (JFC) a delivery platform which can effectively shrink down those A2/AD bubbles and achieve lethal parity or overmatch, tipping the scale in their favor. In order to conduct MDO, the MDTF uses a targeting process very similar to the joint targeting cycle as described in JP 3-60 "Joint Targeting."

Joint targeting in multi-domain operations

The targeting cycle for MDO is not much different than what joint doctrine currently calls for. Give an Army targeting officer a target and a desired effect and nine times out of ten they are going to figure out how to effect that target with either artillery, close combat attack or close air support. This is

Figure 1. Target development relationships (Rick Paape/Courtesy information).

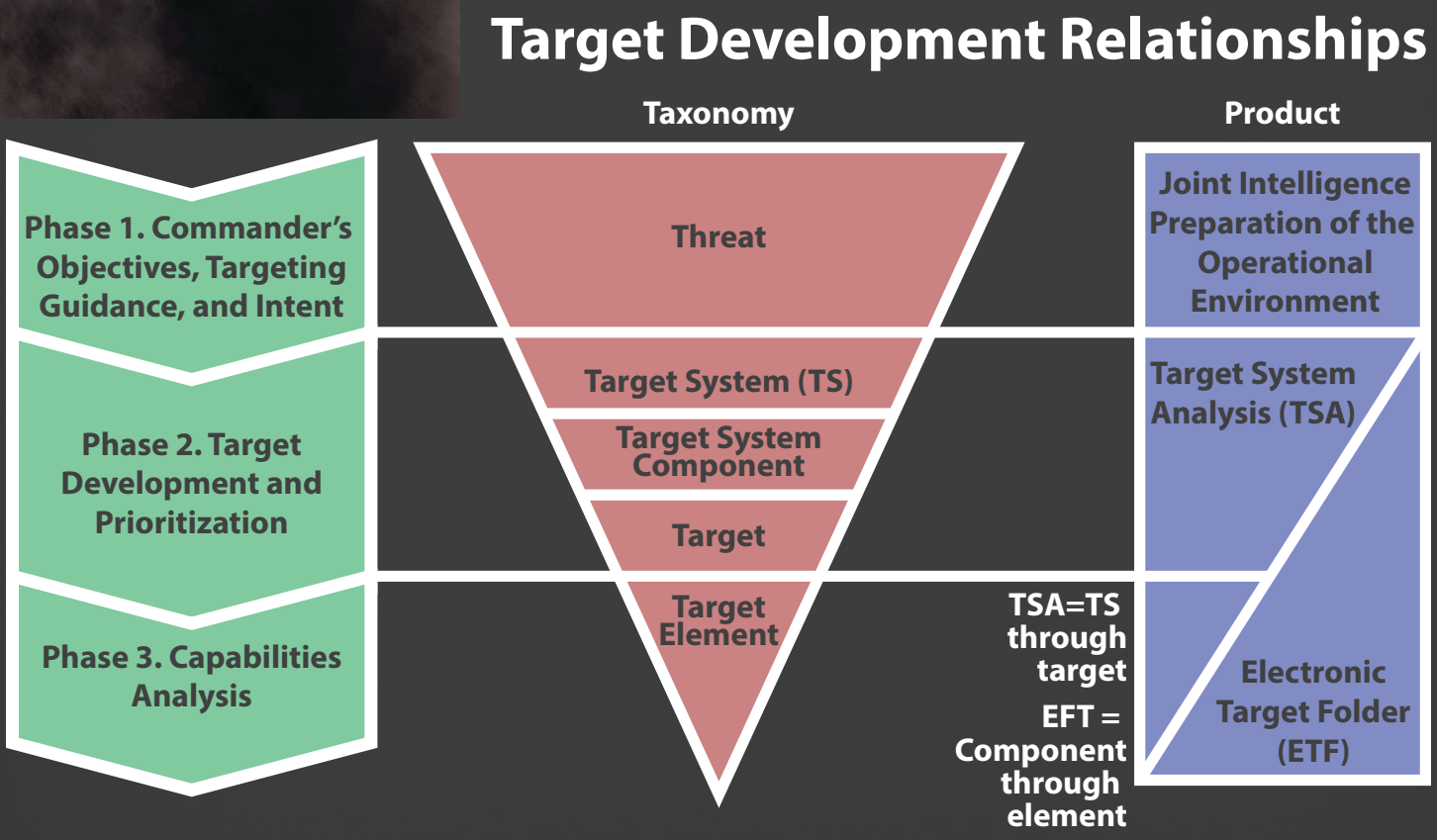


Figure 2. Joint Targeting Cycle phases (Rick Paape/Courtesy information).

because generally the Army focuses on what is within the lethal targeting distance of their longest range weapon systems and that is what the land component historically does.

Traditionally targeting occurs in a service-centric mind frame. The Army prepares and targets the enemy's land order of battle, the Navy targets the maritime domain, and the Air Force targets the air and space domains. There has always been an element of cross-domain Fires. The Army cares about air threats because they can strike ground targets. The Navy keeps an eye on the air domain as threats have evolved to be carrier-based aircraft and anti-ship cruise missiles. The Air Force has always had to be concerned with land-based anti-air artillery. A major change with peer adversaries is now space and cyberspace are contested domains and the services must factor these into their targeting calculus.

Thinking non-lethally during the joint targeting cycle

The army traditionally thinks of targets as static or linear-motion entities on the land. A commander's attack guidance matrix might prescribe firing a certain number of battery or battalion level volleys of a munition to achieve an effect on a target. This approach works fine in a traditional peer-on-peer fight or other well defined threats. The shift which needs to occur is to focus on what effect the commander wants to achieve on the threat system as a whole, not the specific piece of equipment.

The recently revised JP 3-60 does an excellent job of highlighting the difference between Army targeting and joint targeting. The Army is generally an executer of targets and focuses on the detect, decide, deliver, assess model. This level is associated with the "threat" of the joint targeting taxonomy. The MDTF needs to focus more on the lower portions of the taxonomy in order to mitigate the lethal engagement range overmatch of adversary systems. Therefore it is a fundamentally more in-depth targeting analysis which must occur, making joint targeting doctrine more applicable to MDTF missions.

JP 3-60 states "Achievement of clear, measurable and achievable objectives is essential to the successful attainment of the desired end state. The ability to generate the type and extent of effects necessary to achieve the commander's objectives distinguishes effective targeting." Instead of saying "Deny Integrated Air Defense Systems (IADS)" or "Destroy short-range ballistic missiles;" we need to shift to the system we wish to effect. A multi-domain commander's intent might look like "Deny IADS the ability to engage air targets" or "Delay IADS ability to target aircraft for two hours." This guidance provides the ability to tailor deny, delay, disrupt, de-

stroy, or manipulate (D4M) effects to meet the commander's intent. This is achieved leveraging ends, ways and means and conducted by following the joint targeting cycle.

The target working group must follow the joint targeting cycle while looking at all warfighting domains. Typically Army targeting is synchronized with an air tasking order cycle which prioritizes and allocates air and space domain capabilities against a commander's Joint Integrated Prioritized Target List (JIPTL). This is how national level assets are allocated. A key difference in the MDTF is some of those capabilities now reside at a brigade-sized Army organization which has organic assets capable of delivering effects normally found at the operational and strategic levels. Despite this, the joint targeting cycle still provides a common framework with which the Army can target and provide complimentary effects with the joint environment. Attempting to create a new targeting process has proven to just create confusion and resistance from joint partners.

Multi-domain targeting through the joint targeting cycle

The six phases of the joint targeting cycle provide a sufficient framework to analyze multi-domain targets. Phase I – commander's objectives, targeting guidance, and intent is crucial in providing clear and realistic expectations. Having a clear and concise intent within the D4M framework gives the targeting team the maximum amount of latitude to meet the commander's intent. This is essential to enable the centers of gravity (CoG) analysis and identifying the decisive points; or as described in JP 3-60, Target System Analysis (TSA) .

In order to properly conduct a TSA the targeting team must have access to a robust repository of intelligence data. The intelligence team needs to be able to find relevant information across all warfighting domains. During the competition phase, it is vital to the targeting enterprise and essential to the joint targeting cycle to identify intelligence gaps, develop priority intelligence requirements and develop a competition phase intelligence, surveillance and reconnaissance (ISR) collection plan. Once identified, these gaps and requests for information (RFI) must be resolved before the conflict phase. These processes enable the non-lethal targeting team to fully develop a target and validate the engagement plan of adversary systems. Key outputs from phase one include clear and concise commander's guidance, an initial TSA of JIPTL items, and refined RFIs.

After the CoGs are identified the targeting team can move to Phase II – target development and prioritization . The non-lethal world is best characterized by viewing the threat as a system of systems. JP 3-60 even describes this: "Target systems are typically a broad set of interrelated, functionally associated components that generally produce a common output or have a shared mission. Target development often approaches adversary capabilities from a target systems perspective." These enabling processes are where the MDTF and specifically the Intelligence, Information, Cyberspace, Electronic Warfare Space (I2CEWS) Battalion (BN) is tailor made to address. The planning expertise found in the battalion enable operational and strategic level analysis to be completed in a tactical formation. Key outputs of this phase are the TSA with supporting intelligence and combat assessment criteria for each node.

Unique MDO targeting planning considerations in Phase II of the joint targeting cycle

A planning factor for non-lethal effects is the amount of time and effort which are required to validate a target. In order for an MDTF commander to conduct the necessary intelligence gathering in this phase they must have the required authorities to conduct national technical means ISR or cyberspace surveillance and reconnaissance (C-S&R) and ultimately to produce effects in gray or red space. For example, a national level asset may derive signals intelligence (SIGINT) which provides an exploitable access point for cyberspace to begin conducting C-S&R, requiring the formation to be legally authorized to conduct the activity.

Once this process is complete, a different set of authorities may be required to refine the TSA of that system through cyberspace ISR. Once established, a cyber-support team will have to develop a tool which meets the commander's intent for that specific system. All of this can take months to years and cost millions of dollars in asset time and man hours. This places an additional calculation on the targeting team to provide the commander a cost-benefit analysis estimation of whether using a specific tool for the mission is worth the expense. The assumption is once the tool is delivered it will not be able to be used again.

The MDTF is a hybrid organization which blends all three levels of war, especially through non-lethal targeting with the I2CEWS battalion. Non-lethal targeting at the operational and strategic levels elevates the amount of de-confliction which must take place. Intel-gain/loss has always been a calculation between SIGINT and electronic warfare (EW), however the addition of cyber extends this to the cyber domain and involves other government agencies which have a stake in the domain. This phase also raises the specter of the Law of Armed Conflict the Rules of Engagement. Cyberspace and electrons in the Electromagnetic Spectrum (EMS) aren't confined by geographical boundaries. Adversary systems often leverage this ambiguity by using dual-use systems which service both civil and military systems. As with the example above in the JP, sometimes the CoG is a dual-use system which requires even more

Soldiers of 1st Battalion, 14th Field Artillery Brigade, 75th Field Artillery Brigade, Fort Sill, Okla., prepare an M142 High Mobility Artillery Rocket System after having arrived at Fort Chaffee, Ark., by an Air Force C-130J Super Hercules for Operation Phantom Flight on April 12, 2019 (Sgt. Dustin D. Biven/75th FA BDE).

tailored effects to minimize impact on the civilian population.

Phase III of the targeting cycle, capabilities analysis, is where a clear definition of the commander's intent allows for maximum flexibility in the I2CEWS' ability to deliver effects. During TSA, targeteers determine which capabilities in which domains are required to achieve the commander's intent. Depending on which state the conflict lies defines which methods of effect delivery are suitable, feasible and acceptable. For example, during competition phase a kinetic strike is less likely to be used for the risk of triggering a shift to conflict phase, whereas C-S&R provides anonymity and reversibility to achieve an effect and may be used as a deterrent to conflict.

With the analysis and capabilities assessment completed, the MDTF commander would then inform into the fourth phase of the joint targeting cycle – commander's decision and force assignment. A novelty with the MDTF is it is a brigade-sized unit directly supporting a geographic combatant command (GCC) and acts on the same level as a joint force air component commander, which is typically commanded by a two-star general officer. Inherent in the MDTF's mission, they are a direct support unit to a GCC or a JFC if one is present. Through both competition and conflict phases the MDTF commander would be sending nominated targets to the JFC for inclusion to the JIPTL.

More than one unit may be required to service a target. The MDTF may not even be the best unit for striking a target they nominate. For example, if the MDTF discovers a CoG which lays outside the lethal effects range of their long-range artillery, an Aegis cruiser may be able to engage with a Tomahawk Land Attack Missile. The MDTF may still service a portion of the target packet by providing a cyber or space effect at the same time in order to enhance the lethality of the strike.

Just like lethal Fires, non-lethal effects need an observer to watch effects on target. For an EW mis-

sion, using a SIGINT asset provides the ability to determine if effects are achieving the desired results by monitoring the rest of the EMS in order to determine if the target is moving around in its primary, alternate, contingency and emergency plan. A cyber operator can use network monitoring tools to determine if a system administrator on the target system is taking corrective actions or if the desired change in network behavior is occurring. Key outputs of this phase may include a warning order (WARNORD) to identified units and an initial strike plan. Once the executing units are designated, phase V – mission planning and force execution begins .

Phase V, mission planning and force execution, may find the MDTF executing other unit-nominated targets and vice versa. Once the MDTF receives the WARNORD tasking to service a target, the individual units of the MDTF must begin their troop leading procedures (TLPs). Each has their own considerations, however the I2CEWS BN units are nascent in their TLP development. A space detachment will have different mission planning requirements than the CEMA teams. As with all targets, each unit has to validate the assumptions and facts used to plan the mission are still valid. For example, a cyberunit will need to verify the target is still being held at risk or that they can still gain end-point access in order to hold it at risk. Key outputs for this phase are a completed military decision-making process (MDMP) cycle and company-level operations orders (OPORDs).

The final phase, combat assessment is crucial. For the I2CEWS units whose effects exist in domains which aren't immediately visible, it is imperative during Phase II the planners included combat assessment criteria for what success looks like. Unlike kinetic effects where the damage is physically apparent by looking at an ISR feed, effects delivered in the EMS and cyberspace don't always lead to visible indicators. Often the non-lethal team is asked to achieve effects the JFC can't reach physically with lethal munitions. Thus the mission of the non-lethal team is to create a window of convergence with non-lethal effects which sufficiently provides D4M effects to minimize risk to a kinetic strike package. Timely, well thought out combat assessment criteria allows the MDTF to quickly determine if the intended effects were delivered, which may serve as a trigger for a ship or aircraft to maneuver into contested space and deliver lethal effects.

Bringing it together

The MDTF is a novel organization which cobbles together elements of the traditional Army with new units found in the I2CEWS BN. With this addition, the MDTF is able to create windows of convergence across all five warfighting domains simultaneously in order to enable joint maneuver in contested A2/AD environments. This requires commanders and staffs to change their frame of thinking from kinetic targeting as the primary method of engagement to include non-lethal means. It also requires them to think across the continuum of operations and realize targeting now must take place all of the time, not just during conflict. The means to conduct targeting are handled in the joint environment through the joint targeting cycle.

This article looked at each phase of the joint targeting cycle and highlighted key similarities and differences for MDO. After exercising the MDTF in four multi-national and joint exercises, the joint targeting cycle has proven to be an effective method. The skillsets exercised by the I2CEWS BN and MDTF targeting staffs require broadening to actively include non-lethal target systems analysis. When combined, the joint targeting cycle enables the MDTF to seamlessly integrate into joint operations. This is essential as the A2/AD fight is inherently joint in nature.

The next step in developing MDO doctrine needs to look at how joint targeting feeds into the tactical level of war. The staffing processes have been tested and with an experienced cadre of Soldiers many of the higher level processes have a strong foothold on doctrinal development. Translating these processes down to a tactical maneuver unit to begin discerning the "how" to deliver multi-domain effects needs to be tested and bottom-up refinement given to the staff to polish processes.

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Soldiers assigned to 3rd Battalion, 7th Field Artillery, 25th Infantry Division fire a 155 mm artillery round from an M777 howitzer during Operation Lightning Strike (OLS) 2019 on Pōhakuloa Training Area, Island of Hawaii, Hawaii, April 13, 2019 (Pvt. Lawrence Broadnax/U.S. Army).

Preparing for artillery operations in a GPS denied environment

By Capt. Neal MacDonald

Abstract

The Fires community is immensely dependent on the ability to determine accurate location and direction. From the laying of a howitzer, the emplacement of a counterbattery radar system, an occupation of a Patriot launcher, or to the fixing of a target grid, knowing where 'here' is becomes a vital portion of any activity. There is good reason why the first two of the Five Requirements for Accurate Fire are concerned with correctly determining position, be it friendly or enemy. Without this basis of precise location, being able to deliver indirect Fires becomes an exercise in futility. Notably, almost every piece of equipment in the artillery arsenal now relies on Global Positioning System (GPS) as the means for acquiring location, greatly improving functionality under ideal conditions but also increasing vulnerability in a contested operating environment. It therefore should be of concern to all artillerymen that potential adversaries are developing sophisticated technologies to deny, degrade, and disrupt our modern positioning, navigation and timing (PNT) capabilities. This necessitates a critical evaluation of how we train,

equip, and prepare our artillery forces to operate in a GPS-denied environment.

Overview of PNT usage

The primary mechanism for acquiring PNT is the GPS, a satellite-based radio navigation system owned by the U.S. government. The first GPS satellites went into orbit in the 1980s, with the fully-operational 24 satellite constellation being achieved in 1993. With the advent of GPS, worldwide geolocation became a simple and accessible process, requiring nothing more than line of sight to at least four of the satellites. For the U.S. Army and other services this provided a massive technological advantage, as anywhere a unit went they were able to determine their location using one of the increasingly portable GPS receivers at their disposal.

One such device is the Defense Advanced GPS Receiver (DAGR), which is distributed widely across U.S. and allied forces. It is a dual-frequency receiver, meaning that it can acquire both the L1 and L2 frequencies that the GPS constellation emits, supported by a Selective Availability Anti-Spoofing Module (SAASM) that allows the DAGR to be filled with cryptographic keys. When correctly encrypted and employed, the DAGR can provide a 95 percent horizontal Circular Error Probable of less than 6.7 meters. This high degree of accuracy drives the extensive use of the DAGR in the Fires community, not just as a manually controlled handheld device: it digitally provides location services to the M777A2 and M109A6 howitzers, the Improved Position and Azimuth Determining System-Global Positioning System, Patriot missile launcher system, and a variety of Fire Support devices. Additionally, other Fires systems utilize integrated GPS chipsets, such as the M119A3 howitzer with a Ground Based GPS Receiver Applications Module (Gb-GRAM) embedded in its hardware.

Emerging threat

Unfortunately, as we become increasingly dependent on these technological solutions to provide accurate location, the opportunity for this to be exploited against us also increases. Specifically, the reliance of United States Armed Forces upon GPS has become a major risk now that potential adversaries have identified it as a critical dependency, one that is vulnerable to attack. The threat to GPS-reliant systems is diverse: denial and deception of receivers, cyberattacks on the GPS infrastructure, and a variety of other means exist that are unambiguously designed to interrupt our ability to use and trust GPS data. The artillerymen and women of the past, however, still determined location and directional control without the crutch of modern technology, which should serve as inspiration to the current generation of Fires leaders who will be asked to adapt and overcome the challenges of the modern battlefield.

While specifics regarding the threat posed by potential adversaries quickly enter classified territory, there are several open-source examples of real-world use of GPS denial actions that can serve as vignettes. One event that is commonly used to demonstrate the impact of GPS jamming is an incident that occurred near Newark Airport several years ago. A commercial truck driver, seeking to avoid his boss monitoring his activities via his truck's GPS tracking system, purchased and employed a small GPS jammer. Over the course of two years, his usage of the jammer resulted in Newark airport experiencing harmful interference to their ground and air-based GPS systems, and when the FCC finally tracked him down he was arrested, fined $31,875, and fired by his employer. A more startling employment of GPS interference occurred in the Black Sea in 2017, when multiple ships reported their GPS receivers erroneously showed their position as being on dry land and up to 200 km away from their actual locations afloat on the water. The reports were assessed by PNT experts to be clear indications of "spoofing" activities, whereby GPS signals are deliberately manipulated to result in an inaccurate location being reported to the user. In this instance, no lasting damage was done, but this could have easily resulted in ships running aground at night or in foul weather, and highlights the real-world presence of GPS spoofing.

Planning to win

Because of this growing threat, U.S. Armed Forces must prepare to continue operations in the event that GPS becomes unavailable. Relevant to direct support artillery units located in the BCTs, much of this planning will occur at the battalion level. As part of the military decision-making

process (MDMP), planners should include decision points and commander's critical information requirements that address GPS denial. If forward-located units such as forward observers and unmanned aerial vehicles (UAVs) encounter and are able to report GPS interference, this could drive commanders' decisions to occupy different position areas for artillery (PAAs), modify survivability move criteria, or change fire orders to counteract the GPS jamming threat. This requires that staff planners be aware of both the potential enemy threat capabilities on the battlefield, as well as their friendly forces' vulnerabilities. Just a few examples of Warfighting Function impacts that occur in a GPS-denied environment are:

- *Mission Command.* Networks that rely on GPS-based timing for synchronization start to degrade, progressively falling more out of tolerance as the length of GPS denial continues.
- *Movement and Maneuver.* Use of Friendly Force Tracking devices are degraded, with unit icons becoming stale and systems inaccurately representing the current location of forces.
- *Fires.* Loss of Precision Guided Munition capabilities; Artillery pieces must be positioned and laid utilizing degraded and manual techniques.
- *Intelligence.* Collection assets such as UAVs are unable to navigate or locate targets.
- *Protection.* Increased casualties and fratricide due to lowered spatial awareness, decreased operational tempo, and inability to maintain common operating picture.
- *Sustainment.* Logistics convoys and Joint Precision Airdrop Systems are unable to reach intended destinations.

Fighting through interference

GPS-enabled methods will continue to be the primary means of occupation and other artillery operations for the foreseeable future. The speed, accuracy and all-weather availability of GPS provides a significant advantage over degraded methods. As previous articles in this journal have pointed out, the time required to emplace and fire U.S. Army howitzers is already a source of concern in a near-peer fight; incurring additional time on the firing point deriving location manually only exacerbates this issue . Therefore, while units must absolutely be prepared to execute these manual location-determining techniques, there are several techniques that may enable continued usage of GPS devices in a contested environment.

First and foremost, every military GPS receiver can and should be encrypted with crypto variable (CV) keys. The SAASM chip embedded in military receivers provides the ability for these devices, when filled properly with CV keys, to access the encrypted P(Y) code that is broadcast over the L1 and L2 bands from the GPS constellation. This not only makes the devices more accurate, but it significantly increases their ability to function in the presence of electromagnetic interference (EMI). Contrary to popular belief, the process of encrypting a SAASM-enabled GPS device does not change the classification level of the equipment. Unlike a filled radio, an encrypted DAGR remains unclassified. For these reasons and others, the DoD specifically instructs combat and combat support operations to utilize SAASM-enabled military receivers only, and will not field PNT systems that cannot be encrypted.

Second, thanks to the laws of physics, GPS jamming has many limitations which can be exploited. Like all jamming activities, it requires three elements: frequency, access and power. For GPS, the frequencies used are specific, unchangeable and publicly known: 1575.42 MHz for L1 and 1227.6 MHz for L2. There is not much that can be done to defend against this element of jamming other than avoiding unintentional interference from friendly systems, such as radars which operate in the same frequency region. Next, the power of a GPS jammer determines its range of effect; the more power, the farther its reach. This plays into the final element, in that a jammer must be located in a line-of-sight to the receiver, close enough for its power to reach it. While the finer points of wave propagation are beyond the scope of this article, the basic way to defeat GPS jamming is therefore simple: if you can place enough mass between jammer and receiver, the signal cannot reach or access, and therefore affect, the device. Terrain features, armored vehicles, or even the human body can provide this masking between jammer and receiver, and so long as the receiver is able to still see four GPS satellites it has the potential to continue to function properly. One of the easiest ways to achieve this is by digging a small hole six to 12 inches in depth and width and placing the receiver inside. This hole provides lateral protection from terrestrial-based jammers while still allowing a clear view of the sky and the GPS constellation.

The most critical element of preparing to deal with GPS interference is exactly that: preparation. We must adequately ready our Soldiers through education, doctrine and training on GPS and EMI. There are opportunities to do so beginning with initial entry training and continuing onward through venues such as professional military education courses, unit collective training events, and combat training center (CTC) rotations. As there is no substitute for the real thing, this also includes establishing realistic training environments where Soldiers can directly observe the effects of GPS interference on their equipment and operations. The complications of conducting live GPS denial jamming at home station or the CTCs are currently being addressed through coordination between agencies including SMDC, USSTRATCOM, and the FAA, with the intent being to bal-

ance the disruption to civil activities while still providing effective training to the operational force. There are also materiel solutions in development that will aid in the replication of contested space environments, as well as a variety of publications and doctrinal resources regarding GPS degraded operations training available for reference. The key is to develop Soldiers to be able to recognize, react to, and fight through GPS interference, but also to know when to revert to manual location techniques.

Manual techniques and doctrinal references

While many of the techniques and procedures to determine location and direction without GPS-aided devices are no longer in regular use, they are as or more valid today than they were in years past due to the emergence of new threats. These techniques may have fallen out of common practice, yet there are still several doctrinal references regarding their usage and employment. For example, ATP 3-09.2 Artillery Survey Operations, published February 2016, describes the planning, execution and methodology of deliberate survey operations both with and without GPS. Similarly, ATP 3-09.50 The Field Artillery Cannon Battery, published May 2016, includes hasty survey operations techniques. In addition to these general references, every piece of Army equipment is issued with some form of reference or manual. These manuals often include considerations for operating in austere or degraded environments, and some specifically address GPS-denial.

In addition to doctrinal references, the U.S. Army Field Artillery School has published a Degraded Operations White Paper, which provides guidance on preparing and training for operations in a denied or degraded GPS environment. Of note, the white paper contains an exhaustive list of references for those interested in further study on degraded operations. For a more general perspective on operations in a denied, degraded and disrupted space operating environment (D3SOE), the U.S. Army Space and Missile Command / Army Strategic Command and the Joint Navigation Warfare Center have published several guides and best practices based on information gained from training, testing and operational experiences. The Center for Army Lessons Learned has also published a comprehensive handbook regarding D3SOE. These documents serve as a fundamental resource for units and leaders looking to train and prepare for operations in a contested or D3SOE environment.

Closing remarks and recommendations

There is no question that GPS provides enormous benefits to the warfighter and has revolutionized the way we shoot, move and communicate. Yet, almost counterintuitively, it is now more important than ever to be able to self-locate without such digital means. We must therefore prepare our artillery men and women to be experts in the usage of both the modern GPS-enabled systems and the manual techniques of the past. In order to do so, I recommend the following be implemented:

1. Reinstate training on degraded means of achieving position and azimuth control. This includes hands-on training with the techniques and associated equipment, classroom education on common survey and degraded techniques and the creation of realistic training scenarios in field exercises that challenge units to fight through a GPS-denied environment. The loss of the 13T MOS removed and reassigned many of the subject matter experts on this subject; leaders should seek out former 13Ts and leverage their experience to train their organization.
2. Update and clarify doctrinal references in support of GPS-degraded survey. While some manuals do cover hasty survey operations, the material is dated and often references equipment and resources that are hard to obtain (i.e., correction nomograms and world star charts). The Degraded Operations White Paper should be a major focus of training and field exercise planning, as it provides a modern and updated perspective on the topic.
3. Equip and outfit units to properly conduct hasty survey operations. For example, the M67 GLPS is an indispensable tool even when GPS is unavailable; there is still a clear operational requirement for it at the battery level. Removing the tools to conduct degraded position and azimuth determination from the inventory creates a substantial capabilities gap, unnecessarily blunting the resiliency of the firing battery.
4. Integrate GPS interference training and D3SOE instruction across the Fires force. This could include: incorporating GPS denial jamming (or suitable replication) into unit collective training and field exercises, sending artillery Soldiers to the Army Space Cadre Basic Course, requesting home station training from SMDC G37, and including TTPs and battle drills for GPS interference in unit SOPs and Redbooks.

Regardless of the means, it is critical that we adequately prepare, outfit and enable our artillery forces to fight and win in an increasingly contested space environment.

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Training pods installed on an M142 High Mobility Artillery Rocket System (Courtesy photo).

Enhancing rocket artillery certification with the trainer pod

By Capt. Brennan Deveraux

Upon witnessing the destructive power of rocket artillery during Operation Desert Storm, British artillery battalion commander Lt. Col. Peter Williams commented "It is the decisive battle winner. We call ourselves the Grid Square Removal System because the rockets from each launcher can take out a square kilometer of the map." These systems have since evolved to incorporate guided munitions. The invention of the Guided Multiple Launch Rocket System (GMLRS) allows rocket artillery units to process missions in support of both area and precision effects. There are currently two ways for a firing battery to train rocket artillery missions: a live-fire mission with the Reduced-Range Practice Rocket (RRPR) and a simulation mission utilizing the M68 Launch Pod Assembly Trainer (Trainer Pod). Qualification of a rocket artillery section requires the crew to process fire missions utilizing the RRPR for training purposes. The Trainer Pod is incorporated into the certification process, however it is only used to rehearse the RRPR missions in preparation for qualification. The problem the artillery community faces is that the RRPR is a training tool that does not incorporate tactics, techniques and procedures (TTPs) for precision rockets. Employment of GMLRS is unique and cannot be replicated with a RRPR. To increase the readiness and lethality of rocket artillery sections, the Fires Center of Excellence must modify the certification tables that utilize the Trainer Pod to ensure all rocket artillery units are trained to employ precision munitions.

The foundation for this argument is based on my personal experience as the M142 High Mobility Artillery Rocket System (HIMARS) liaison officer for the Combined Joint Operations Center - Baghdad Strike Cell in support of Operation Inherent Resolve (OIR), and the lessons learned from the train up and execution of the battery and battalion exercise evaluations of Bravo Battery, 1st Battalion, 94th Field Artillery Regiment. These experiences have made it apparent that gaps exist between conducting rocket artillery training missions compared to the way missions are actually fired in combat. This article examines the differences between firing RRPRs and precision munitions, outlines the capabilities of the Trainer Pod, and proposes additions that must be incorporated into the certification process for rocket artillery units.

RRPR vs. precision munitions

The difference in the execution of missions between the RRPR and precision munitions goes beyond guidance systems. The RRPR is designed to simulate conventional rockets which follow ballistic principles. The accuracy of these types of rockets can be improved with the calculation

of meteorological data (MET) and require validation of safety when used in a training environment. When firing RRPRs, the fire direction center (FDC) has limited options to distinguish one mission from another outside of basic methods of control. There are no options to adjust the fuze of the RRPR or its trajectory. Conventional munitions are fired off the side of the cab forcing the launcher to occupy perpendicular to the azimuth of fire (AOF) to process the mission.

Precision munitions are both simpler and more complex than their training counterpart. These munitions utilize an inertial navigation system and are global positioning system (GPS) aided. The FDC does not need to compute MET or plan for safety; the grid input into the rocket is the grid the rocket will hit. However, these munitions force the FDC to conduct specific mission processing to ensure desired effects are achieved. The Multiple Precision-Aim Point Mission (MPAM) is a mission type in which a single launcher fires numerous rockets with each individual rocket targeting a designated grid coordinate. The rockets fire within three to five seconds of each other allowing the supported unit to determine the order in which specific aim points are hit. Beyond deadly accuracy, the FDC must worry about both the trajectory upon impact and the fuzing of each rocket. Each rocket can be selected to impact on either a nominal ballistic type trajectory or a vertical near straight down trajectory. The capabilities of the GMLRS M31A1 rocket type give the supported unit ample options for obtaining exactly what is requested. It has five distinct fuzing options with varying effects, and multiple fuzes can be selected in support of an MPAM. The launchers also fire precision munitions differently than conventional rockets. All precision munitions are fired directly over the cab, forcing the launcher to lay on the AOF. The crew must also attach a cable and validate GPS keys to allow the launcher to process precision missions. The RRPR is designed to simulate the launch of conventional non-guided rockets. To maintain proficiency in processing a precision fire mission, rocket artillery units must utilize the Trainer Pod.

Launch Pod Assembly Trainer: The Trainer Pod

The Trainer Pod is unique to rocket artillery. It is not a simulation center where Soldiers go to train, but an addition to the launchers themselves. Crews have the ability to load the Trainer Pod on the launcher, as if it was live ammunition, and train with it in the field. With the correct programming, it can simulate a multitude of scenarios to facilitate numerous training objectives. The Army Training Publication for rocket artillery, ATP 3-09.60, states that the Trainer Pod "...assists in providing realistic training to the MLRS/HIMARS crewmen. The training tasks include fire mission execution, reaction to munitions malfunctions and reload operations." The Trainer Pod offers units an opportunity to tailor training to specific mission sets and ensure that the launchers and FDC element are ready for any task required in combat.

The Trainer Pod is capable of simulating precision missions. "It is about as close as we can get to practicing for missions requiring GMLRS..." said Sgt. Patrick Feeney, a HIMARS launcher chief who deployed to Iraq with 1-94th FAR. While discussing pre-deployment training he went on to say that the Trainer Pod "...is capable of helping us train for all situations. With the proper code configured in the pod, we can shoot regular fire missions, or codes can be set to force a hang-fire, misfire or weapon malfunction to occur." The Trainer Pod allows units to effectively focus training on real-world missions and issues artillerymen will see in combat, including both fuzing variations and MPAMs.

The financial requirements of training a modern military force are daunting. Training events can range from thousands to millions of dollars depending on the scale of the exercise, and the type of unit. Creating additions to the certification tables utilizing the Trainer Pod does not require an increase in allocated munitions and would have no increase in the financial costs of training rocket artillery units. There is also no burden of fielding new equipment, as the Trainer Pod is already with every launcher. Every rocket artillery unit has the ability to incorporate the Trainer Pod into unit training beyond just rehearsing RRPR missions for certification. This is done through weekly digital sustainment training (DST), sergeant's time training (STT), and the execution of fire plans in support of a field training exercise. If the Army expects these units to deploy and be proficient in the TTPs of precision munitions, then additions must be made to the certification tables utilizing the Trainer Pod.

The tables

Many things can be added to artillery certification tables to enhance the quality of readiness for artillery units. However, none of these additions are as vital as adding tables which stress the uniqueness of precision rocket artillery. Cannon units are not required to work through all mission sets as part of qualification, but training opportunities with fire supporters and brigade combined arms live-fire exercises ensure that cannon units are able to execute these missions with live rounds. Examples of this include coordinated illumination and immediate smoke, both of which are part of fire support qualification tables. On the other hand, rocket artillery units almost exclusively fire RPRRs, with many Soldiers going their entire career without firing a GMLRS or an Army Tactical Missile System (ATACMS). When discussing certification tables, Staff Sgt. Evan Fowler, a fire direction NCO in B/1-94th FAR, said, "I believe MLRS qualifica-

tion tables are missing key elements to how we would deploy and process fire missions in a real-life combat environment. They are overly focused on constructing a safety-T and incorporating MET. I would like to see us add to our tables to incorporate more realistic fire mission processing procedures." For most Soldiers, the first time these munitions are fired live is going to be in combat. To ensure unit proficiency, the certification tables using the Trainer Pod must focus on three things: 1. ATACMS fire missions, 2. multi-fuze MPAMs and 3. misfire procedures.

ATACMS are the strategic arm of the artillery. Planners at all levels incorporate ATACMS when the asset is available. The range of the missile makes it a common munition for echelon above brigade exercises such as Warfighters and multi-national exercises such as Yama Sakura and Ulchi Freedom Guardian. There is no requirement for Soldiers to train on processing ATACMS. The incorporation of ATACMS in the certification process forces FDC Soldiers to gain an appreciation of the extended range of the missile, as well as the dramatic disparity between the variations. A M39 variant has a maximum range of around 165 kilometers and drops hundreds of bomblets, while a M57 type can range nearly 300 kilometers as a unitary warhead. Similar to GMLRS, there are small adjustments that have to be made by launcher crews to support ATACMS missions. Adding the ATACMS certification table utilizing the Trainer Pod will greatly increase the readiness of rocket artillery units to support deep shaping Fires.

Thousands of GMLRS have been fired since 2014 in support of OIR and most targets shared a common theme, missions were processed as MPAMs, allowing planners and supported units to control exactly where each rocket would impact. This is not something built into any certification process, and many units faced similar challenges as they began executing these types of missions in combat. When discussing pre-deployment training which would have better prepared them for their mission in Iraq, Staff Sgt. Derrick Dasalla, a HIMARS launcher chief in 1-94th FAR, said, "One of the greatest struggles through the beginning of this deployment has been troubleshooting how the FDC and HIMARS systems work together with regard to MPAMs."

Urban missions supported with GMLRS often require MPAMs to utilize numerous fuze types to minimize collateral damage and exploit the effects of the first impact. The RRPR does not offer any fuzing options, so FDC personnel are not forced to train on fuzes.

Fowler noted that "Different types of fire missions require a more detailed process that includes numerous fuze types, using GPS keys, and inputting target description. My Soldiers do not train on this enough and it is probably what they will be doing for a real-world mission." Creating a multi-fuze MPAM certification table with the Trainer Pod prepares rocket artillery units to support special operations and urban warfare with precision rockets. This also forces FDC Soldiers to become familiar with the diverse fuzing capability of the GMLRS.

Soldiers in cannon artillery units will be provided an opportunity to work through misfire procedures whether they want to or not. Tubes will be punched and primers will not work. Rocket artillerymen do not naturally face most misfire procedures with live munitions until lives are on the line. Although they will never have to "punch the tube," rockets are prone to issues that require immediate action. First Sgt. Christopher Castignanie, the B/1-94th FAR 1st Sgt. and a field artillery master gunner, explained that "The unavailability of munitions other than RRPRs for training, and the multiple years the rocket artillery community has deployed in non-conventional roles, has created a population of artillerymen that lack the real-world experience needed to address misfires or troubleshoot problems with precision missions."

A misfire mission as part of the certification tables with the Trainer Pod increases knowledge of troubleshooting procedures across the Army, and makes launcher crews more responsive to maneuver forces.

Conclusion

The Trainer Pod simulates numerous mission types better than live firing RRPRs. Rocket artillery is growing, and not just with an increase in the number of launchers that are fielded. Technological advances in munitions are rapidly affecting how rockets are employed. Rockets are a combat multiplier capable of supporting any mission set. To stay relevant on the battlefield requires more than just launchers and munitions; it takes training and competency. It is imperative that Soldiers are prepared to do their job in combat. To ensure this, training must replicate combat operations. Relying on individual unit DST or STT programs to ensure artillery, as a community, is combat ready is a recipe for failure. The Fires Center of Excellence must modify rocket artillery section certification to encompass the Trainer Pod so that sections can be proficient on complex precision fire missions they will be expected to process in combat.

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Returning SHORAD to Europe, part I

Establishing the foundation

Lt. Col. Todd Daniels, Maj. Christopher Couch and Maj. Rory McGovern

Introduction

We live and work in a complex and rapidly evolving operating environment. Rapid technological change and a number of other important developments across the full breadth of the diplomatic, information, military and economic spheres have led to a general consensus that the character of war has changed. But the future is inherently uncertain, and it is impossible to accurately predict the full arc of change with any degree of precision. Military professionals are, as they always have been, struggling to recognize the next major conflict's location, what or who is coming over the next hill, and prepare accordingly to counter these unknowns. Quite understandably, then, today's military journals are replete with articles unveiling the latest weapons systems, new technological advances, and emerging concepts designed to maximize and sustain a comparative and competitive advantage now and in the foreseeable future.

Critically important to achieving that goal, and somewhat underrepresented in much of the professional dialogue so far, is how the force "recaptures" and reapplies combat capabilities divested in our recent past. The demands of grueling counterinsurgency and counter-terror operations pushed the Army to eliminate or marginalize viable weapon systems, especially in Short Range Air Defense (SHORAD). Now, however, as the Army returns its focus to large scale operations against peer or near-peer adversaries and acknowledges that the proliferation of Unmanned Aerial Systems (UAS) has given both national militaries and violent extremist groups credible air threats, SHORAD in direct support of maneuver units is once again critical to preserving the force and freedom of maneuver on the battlefield.

Lt. Col. Todd Daniels and Command Sgt. Maj. George Palmer unfurl the 5th Battalion, 4th Air Defense Artillery Regiment colors during the battalion's activation ceremony on Nov. 28, 2018 (Sgt. 1st Class Jason Epperson/U.S. Army).

Recently activated during the first quarter of this fiscal year in Ansbach, Germany, 5th Battalion, 4th Air Defense Artillery Regiment (Avenger) is at the forefront of the growth and expansion of the broader Fires enterprise as the Army adapts to better posture against the threats of today and tomorrow. Air and Missile Defense growth and modernization is one of six priorities identified in 2017 by Gen. Mark A. Milley, Chief of Staff of the Army. The 5-4th ADA's experience will prove relevant to other SHORAD battalions scheduled to activate in the near future. Sharing lessons learned and best practices can and will significantly assist as leaders of future SHORAD formations encounter similar conditions and circumstances. This article is the first in a series covering 5-4th ADA as it builds combat power, and is intended to focus on the early efforts to establish a strong foundation needed to activate, man, train, and equip the Army's newest active duty SHORAD battalion.

The problem

With a restructuring directive in the early 2000s, the U.S. Army began to inactivate SHORAD battalions, leaving intact only those batteries in composite formations (battalions comprised of three Patriot batteries and one Avenger battery) under Air Defense brigades. As the Army's focus shifted to the counterinsurgency (COIN) fight over the next decade, the total divestiture of SHORAD battalions from the active duty force occurred, including the only two in Germany. SHORAD was not

dead; but with the Army's shift to COIN, SHORAD capacity in the active component dwindled to only two battalions supporting ongoing operations in Iraq and Afghanistan with a Counter-Rocket, Artillery, and Mortar (CRAM) capability using the Ground Based Phalanx Weapons System. Likewise, many of the seven SHORAD battalions in the Army National Guard were tethered to Homeland Defense missions, not supporting maneuver forces in the field.

As a result, knowledge and experience in tactical SHORAD atrophied throughout the force. There are many Air Defense Artillery Soldiers and leaders who have not touched an Avenger or Stinger weapon since initial entry training. Furthermore, most Soldiers and leaders in today's maneuver forces have not operated with direct support SHORAD at any point in their careers. The Air Defense community in general, and newly-activating SHORAD units specifically, must therefore overcome a generational problem defined by a daunting array of related knowledge and experiential gaps at the individual, organizational and institutional levels. But as we have found, such issues cannot be addressed without first laying a deeper foundation upon which any SHORAD battalion's ability affect individual, organizational, and institutional problems depends.

Setting the foundation

In September 2017, 10th Army Air and Missile Defense Command (AAMDC) began mission analysis and conducted initial site visits to Ansbach in order to set conditions for the activation of 5-4th ADA slightly more than one year later. To minimize friction while restoring SHORAD capability in direct support of USAREUR formations, 10th AAMDC partnered with United States Army Garrison-Ansbach (USAG-A) representatives to ready facilities, network architecture, automations, and Soldier and Family Services. Routine engagements and dialogue with Human Resources Command (HRC) early and often enabled a manageable personnel surge to occur over time, based on pre-determined manning priorities focused on incrementally building combat power. The 10th AAMDC also reached out to 21st Theater Support Command (TSC), Letterkenny, Cruise Missile Defense Systems (CMDS), and 2nd Signal Brigade to proactively and collaboratively set conditions to activate, man, and equip 5-4th ADA as rapidly as possible. The relationships forged during this time synchronized efforts at echelon and addressed many challenges before the Army officially announced plans for the unit's activation and stationing in Germany.

During the planning process, 10th AAMDC identified 13 critical billets to fill initially, selecting personnel from the 10th AAMDC HQ, 5-7th ADA, and 21st TSC in order to build the core leadership team at Ansbach four months before the first Soldiers' arrival. The 10th AAMDC designed this "Tier-1" group to establish as many mission command, sustainment, and communications systems as possible prior to the unit's activation. Immediately upon arrival, this team worked with garrison leaders and agencies to establish the reception, staging, onward movement and integration (RSOI) process for Soldiers and families. This group proved to be a tremendous asset that facilitated progress on establishing 5-4th ADA even before the Army identified its battalion command team.

As part of the Overseas Force Structure Change (OFSC) process, Shipton Kaserne in Ansbach, Germany, became home to 5-4th ADA. The selection of this installation is symbolic to the ADA branch for several reasons. It is named after the famed ADA founding father Brig. Gen. James A. Shipton, and was previously occupied by 6-52nd ADA, a Patriot battalion. The facilities are more than adequate to support a SHORAD battalion. Additionally, refurbishing buildings offered a more rapidly available and less costly basing solution. The primary lesson gleaned from reclaiming older buildings lies in the state of readiness beyond the traditional contracted patch, paint and plumbing efforts. Barracks spaces were "move-in" ready with new appliances and furniture prior to the arrival of 5-4th ADA Soldiers. However, other areas such as the battery operating facilities, battalion headquarters, staff offices and the motor pool required intensive user involvement to complete on time.

With the Tier-1 team in position and operating early, critical coordination between 5-4th ADA, 678th ADA Brigade Mission Command Element, contracting representatives, contractors and technical subject matter experts dramatically accelerated renovation timelines from projected completion dates as late as spring 2019 to an actual completion date of Nov. 15, 2018. The main issues encountered involved outdated network architectures which required modernization before accepting digital communications packages needed by today's Army. Contracts written without fully understanding end-user requirements regarding network capacity was the main issue causing the delay. In a resource-constrained environment, it is highly likely that the Army will continue to rely on reclaiming and rehabilitating older buildings on various installations selected to garrison new units. Organizations supporting new unit activation should strive to capture requirements as early as possible, and write them into scopes of work to alleviate confusion in the final months of multi-year contracts.

With the initial group focusing almost entirely on plans and infrastructure, the leadership of 5-4th ADA, 174th ADA Brigade Mission Command Element (having replaced 678th ADA as the rotational ADA brigade headquarters in Europe), and 10th AAMDC organized 5-4th ADA's second

tranche of inbound personnel—comprised predominantly of junior noncommissioned officers (NCOs)—to prioritize the human dimension of activating a new unit. This decision proved especially critical after the first gains report indicated that new Advanced Individual Training graduates fresh out of Fort Sill would make up the vast majority of 5-4th ADA's first significant personnel surge. The Enlisted Personnel Management Directorate (EPMD) and ADA Branch at HRC, began discussions with 10th AAMDC and donor units to identify these Tier-2 leaders, thus enabling NCOs advance notice of their assignment orders prior to their publication. This was especially helpful in allowing these NCOs to prepare for this assignment, as delays in the host nation notification (HNN) process prevented the timely distribution of orders to affected personnel. In this case, Soldiers and leaders received notification of their selection for 5-4th ADA, allowing them to prepare ahead of the HNN. Fifth-4th ADA leaders conducted sponsorship video teleconferences with this group to streamline sponsorship efforts, answer questions and manage expectations of the Soldiers and the unit in a condensed timeline. After HNN, HRC placed those Soldiers and leaders on assignment, with many arriving within 30 days of receiving orders.

With infrastructure and initial personnel in place, 5-4th ADA was able to focus its attention on planning and coordinating its approach to activation. From the beginning, USAREUR leaders emphasized the importance of activating smartly instead of rapidly. Guidance to the battalion leadership was consistent and clear: activate methodically and resist outside influences to "rush to failure." To that end, 5-4th ADA developed an activation strategy that presented a phased approach to building combat power based on criteria determined by the battalion leadership.

Using Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) as a framework, the battalion leadership identified conditions necessary for calling forward equipment from staging areas at Army depots in Europe, ensuring nothing would move without the proper personnel to account for, maintain and sustain the equipment. Analysis identified 11 critical positions and a total of 33 personnel required to call forward the first set of combat equipment, which consisted of 12 Avengers and eight Sentinel Radars with associated maintenance vehicles and equipment. This initial fielding has become the tactical backbone for Battery A, 5-4th ADA's main effort in building combat power at this early stage. Working with HRC and 10th AAMDC G1, the Tier 1 personnel were able to pinpoint the time to request this equipment based on projected personnel gains and begin initial planning with civilian support agencies for fielding and New Equipment Training (NET) at Ansbach.

Moving out

With a foundation in place, 5-4th ADA activated in first quarter, FY19. Soldiers are eager and await the opportunity to hone individual, crew, and platoon skills, reintroducing direct support SHORAD to USAREUR's maneuver forces. In setting that foundation, two important lessons are worth noting. First, the initial planning and coordination that 10th AAMDC conducted with partner units, agencies and directorates across USAREUR, the Fires Center of Excellence (FCOE) and HRC—carried on, once in place by 5-4th ADA's core leadership team—was crucial to setting conditions for a relatively smooth and deliberate activation process. As a result, 5-4th ADA had the right leaders and processes in place to receive its first Soldiers and equipment sets. Second, developing a collective plan and using a deliberate approach tailored to the unique conditions facing each newly activating unit will prevent missteps and delays. A rush to failure will do nothing to help the enterprise address the individual, organizational and institutional problems that must be overcome to regenerate and rebuild SHORAD in direct support of maneuver forces on the dynamic and demanding battlefields of today and tomorrow.

Observations and lessons learned will follow in parts II and III, in an effort to share information to the entire enterprise. Returning SHORAD to Europe is a complex mission requiring concerted and collective effort from all ADA echelons in theater—5-4th ADA, 678th and 174th ADA Brigades, and 10th AAMDC. We hope that our experience may inform and assist the broader ADA enterprise as we collectively strive to enhance the branch, regenerate direct support SHORAD capability and re-educate the force on SHORAD support to maneuver forces in the current and emerging operating environments.

Lt. Col. Todd Daniels commands 5-4th ADA. He has served at multiple echelons and unit types including Short Range Air Defense platoon and battery; Patriot battery, battalion, and brigade; an armored division headquarters; and was on the Counter-Rocket, Artillery, Mortar fielding team. He deployed twice to Iraq and once to Kuwait.

Maj. Chris Couch is currently the executive officer of 5-4th ADA. He has served in air defense assignments from battery commander up to the Army Air and Missile Defense Command in addition to an assignment as the Army Readiness Coordinator, Human Resources Command, G3. He has deployed multiple times in support of Operation Enduring Freedom.

Maj. Rory McGovern is an Army strategist currently serving as the Deputy G-5 of 10th AAMDC. His past service includes field artillery assignments at all echelons from company fire support team up to division headquarters, a tour as an assistant professor in the United States Military Academy Department of History and two deployments to Iraq.

Airspace clearance of Fires using "ghost guns" geometries

By Nick Niewadomski

The intent of writing this document was to capture current airspace clearance processes and procedures for engaging division (DIV) targets of opportunity (TOO) with surface-to-surface Fires. These tactics, techniques and procedures (TTP) worked for units which participated in Joint Air Ground Integration Center (JAGIC) focused training with the Army Joint Support Team (AJST). The TTP detailed here was designed to give other JAGICs an understanding of the specific procedures that were successfully used during a DIV TOO battle drill. By following the steps outlined below, the DIV JAGIC will increase their lethality by fully utilizing their Army Battle Command Systems (ABCS) and minimizing the time it takes to achieve air clearance of surface-to-surface Fires.

The following article contains technical information. It is important to understand that it was not written from a "never done this before" perspective. This is not a checklist. It is the author's expectation that anyone utilizing the procedures outlined in this document is or has a trained Advanced Field Artillery Tactical Data System (AFATDS) operator (13J) that has a thorough understanding of fire direction and relevant experience. The ghost gun procedures described here are not designed to be done on a Fires cell (FC) AFATDS, but from the fire direction center (FDC) AFATDS they send their fire missions to; most likely the Division Artillery (DIVARTY) FDC.

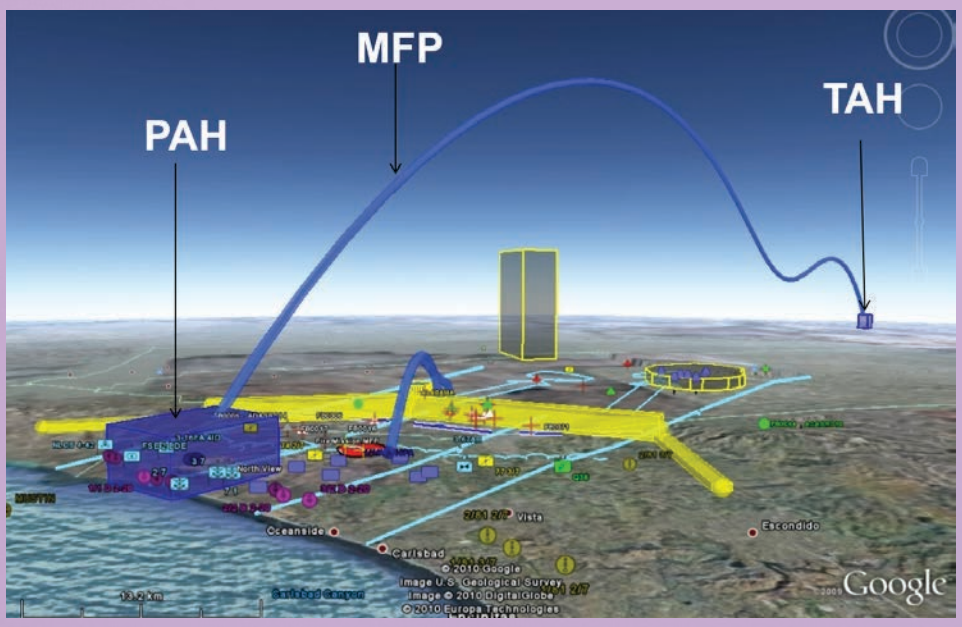
Ghost guns and technical fire direction

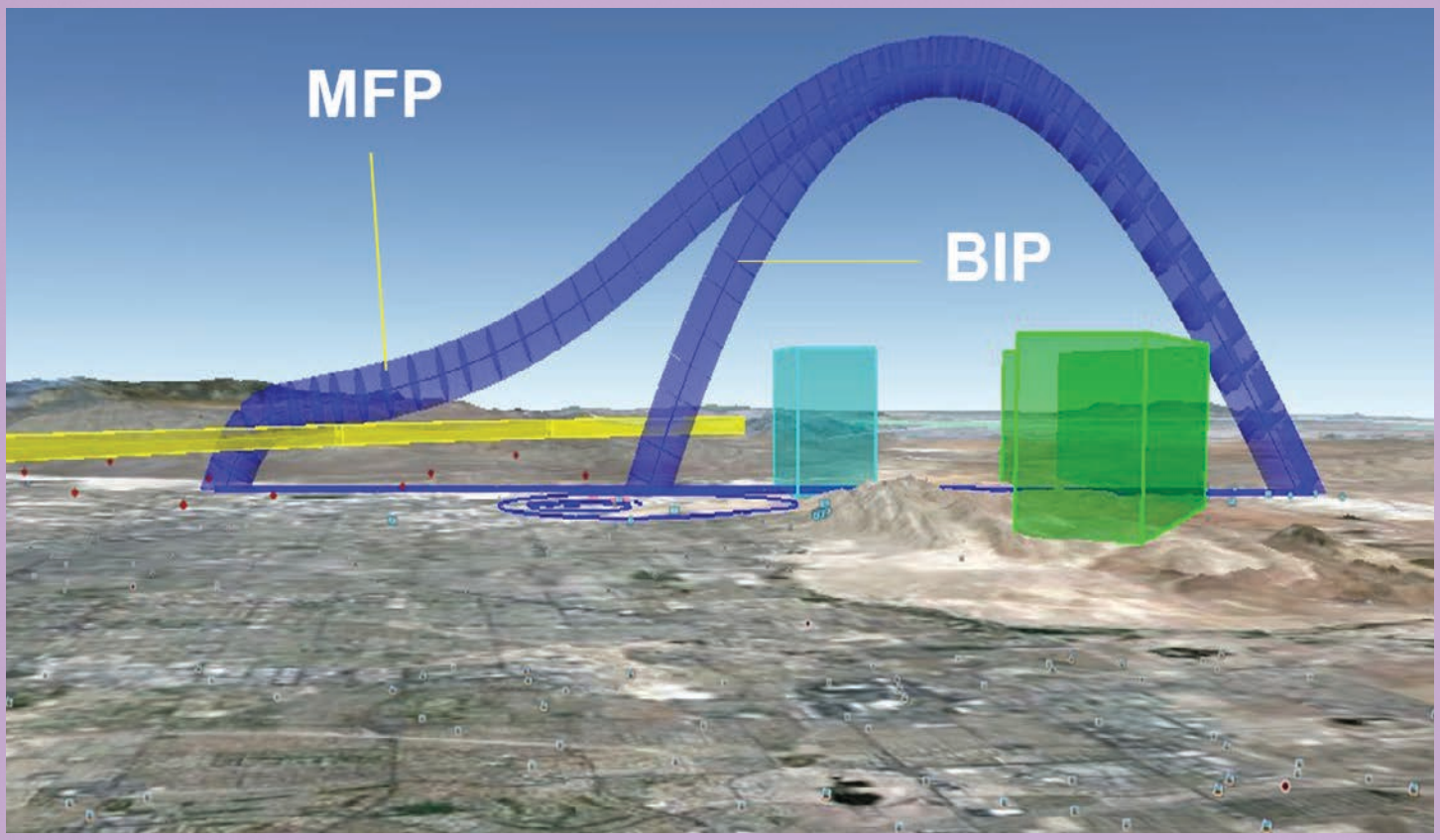
The term "Ghost Gun" refers to an artillery piece that does not actually exist; a gun which was created in the AFATDS by a platoon or battery FDC and used to produce technical firing data for other guns. The ghost gun was given the average Muzzle Velocity Variance (MVV) and elevation of all the guns being fired for a given munition/charge and placed at the center of battery (COB). Firing data was calculated for this single ghost gun and announced to the platoon/battery. Each gun chief would add their gun's terrain gun position corrections (TGPCs) to the FDC announced deflection, quadrant elevation and time (for a time fuzed munition). This method wasn't as accurate as sending individual piece data because the TGPCs had been determined on one distance for a particular charge, but it was effective enough for area Fires and saved time by allowing the FDC to check firing data against a single gun that was placed at COB on a chart (rather than checking data against each piece).

Ghost guns have also been used when AFATDS was unable to calculate a two-gun firing solution for a smoke mission. The AFATDS would require three guns for the solution, but the platoon FDC only had two guns to shoot. In this instance, the ghost gun was given the exact same location, elevation, munitions, MVVs and all other pertinent data that was required to duplicate one of the real guns. The data produced by AFATDS for the ghost gun was then announced to the real gun that had been copied. This allowed FDCs to fire a three-gun smoke mission with two guns.

The ghost gun technique can be applied to rocket launchers for the purpose of planning and clearing airspace. Although AFATDS does not produce technical firing data for launchers, it does produce platoon area of hazard (PAH), target area of hazard (TAH), and munitions flight path (MFP) geometries for rockets and missiles. It is important to understand how this process works in order to best utilize this feature for clearance of Fires and planning

The munitions flight path for the Army Tactical Missile System displayed in the Advanced Field Artillery Tactical Data System (Courtesy photo).





The munitions flight path for Excalibur munitions displayed in the Advanced Field Artillery Tactical Data System (Courtesy photo).

for airspace. The PAH/TAH/MFP is produced by the last AFATDS in the fire mission chain of communications. When the fire mission data is sent from the platoon operations center (POC) AFATDS to the launcher, the POC AFATDS creates the geometries needed to assist in the clearance of airspace. These geometries (PAH/TAH/MFP) are sent to the AFATDS that initiated the request for fire. (Note: The geometries are created by the AFATDS at the POC, not by the launcher. These geometries can be created by AFATDS at any echelon when using this TTP.)

Ghost gun TTP used by 3ID JAGIC and DIVARTY FDC while training with AJST

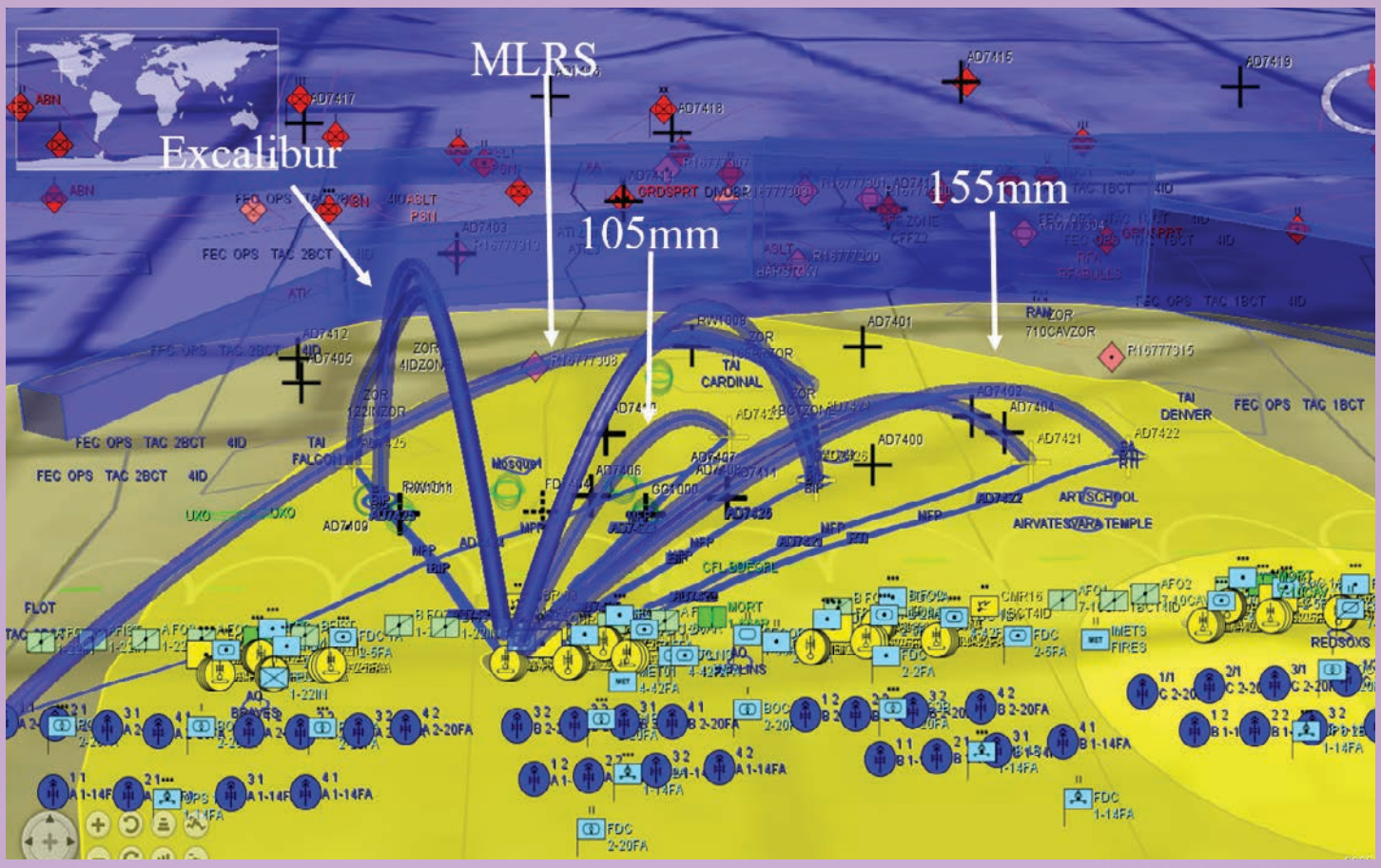
In a DIV command post (CP) utilizing a JAGIC, the current ops AFATDS (also called JAGIC AFATDS) in the DIV FC initiates fire missions on targets of opportunity for the JAGIC. The DIVARTY FDC AFATDS will receive these fire missions and is expected to provide the DIV FC with launcher location, Maximum Ordinate (MAX ORD), and gun-target line. Instead of sending the fire mission with a method of control of "At My Command" (AMC) down through all the lower echelons to the POC, the DIVARTY FDC AFATDS can produce the geometries locally by building a ghost gun. When the DIVARTY FDC sends the fire mission to the ghost gun, they will receive a medium-level alert notifying the operator that transmission of the fire order has failed, but the AFATDS will still produce the PAH/TAH/MFP geometries and automatically transmit them back to the JAGIC AFATDS in the DIV FC. The DIV FC AFATDS operator can open the MFP geometry in the Geometry Workspace and view the MAX ORD and Time of Flight by selecting the "Details" tab (MAX ORD is expressed as maximum elevation of munition in feet plus elevation above mean sea level of the launcher).

In a DIV TOO battle drill, the accepted process is to simultaneously work surface-to-surface and aircraft solutions. The JAGIC chief will make the call on whether surface-to-surface Fires are to be used or to engage with joint air assets after they have received the PAH/TAH/MFP geometries and consulted with their Air Support Operations Center (ASOC) on available air missions. The benefits of using the ghost gun are three-fold. First, the time from receipt of mission to producing the required data is greatly reduced. Second, the real launcher is not tied up with the mission in AMC status while the decision to engage with air or surface to surface fires is still being made. Finally, airspace requirements are communicated digitally to the Tactical Airspace Integration System (TAIS) operator and the ASOC air space manager.

AFATDS configuration tips

There are some system configuration requirements and additional steps necessary that AFATDS operators need to be aware of to ensure success when using the ghost gun method. They are:

1. The AFATDS controlling the



Munitions flight paths displayed in the Advanced Field Artillery Tactical Data System (Courtesy photo).

ghost guns must be set to conduct "Detailed" level fire mission analysis (AFATDS current bar > System > Preferences > Attack Analysis > Mission Processing).

2. Deleting the alerts received relating to transmission of fire order failures to the ghost gun(s) will end the mission. Ending the mission will also delete the geometries that have been produced.
3. The ghost gun controlling FDC (DIVARTY FDC in the scenario described) must concurrently initiate a fire mission on the same target that was sent to them from the JAGIC AFATDS in preparation for a surface-to-surface fire mission decision by the JAGIC chief.
   a. Create a new target list on AFATDS (AFATDS current bar > Target Workspace > double click "Current" > List > New Target List).
   b. Within the target workspace, double click "Current Active Targets" to display active fire missions.
   c. Drag the current target into the new target list on the left.
   d. Open new target list, right click desired target, choose initiate fire mission.
   e. After clicking on the Intervention Point (IP) and opening the IP window, select "Recalculate All."
   f. In the Initiate Fire Mission (IFM) window that opens, select the real launcher that corresponds to the ghost gun as the unit to fire (More Msn Data tab > Rocket/Missile Unit > Use drop down box to select unit to fire > Select Analyze Target).
   g. The AFATDS will produce red gumballs due to target duplication. If the JAGIC chief decides to engage with surface-to-surface Fires, end the ghost gun mission, recalculate all (Do Not Change Firing Unit that was set in Previous Step), and process.
   h. The JAGIC AFATDS will not receive MTO, PAH/TAH/MFP or any other data digitally since the original mission was sent to the ghost gun and the actual mission to be fired was initiated at the DIVARTY FDC. Rounds complete will need to be sent via chat.
   i. The steps outlined above can also be used for Excalibur and standard munitions (AFATDS will produce the MFP for both low-angle and high-angle cannon Fires. PAH/TAH are rocket and missile only).

Note: AFATDS DOES NOT produce PAH/TAH/MFP for rocket munitions M26 and M26A1/A2 (see table at end of document). Tabular Firing Tables (TFTs) will need to be used to derive MAX ORD without sending the fire mission to the launcher.

Ghost guns and preplanned Fires

Ghost guns enhance the ability

of a FC to plan Fires. By understanding the capability of the AFATDS to produce the PAH/TAH/MFP without needing to send data to a gun or launcher, FCs can work with their supporting FDC to produce these geometries prior to an exercise or operation. During planning, the preplanned fire missions can have their associated MFPs digitally sent to their local TAIS where they are then added to the unit airspace plan (UAP). Lower echelon UAPs are merged into one UAP at each echelon and sent to higher; the merged UAPs will eventually be submitted to Theater Battle Management Core System (TBMCS) by the Battlefield Coordination Detachment (BCD) TAIS and added to the airspace control order (ACO). This will guarantee that airspace is formally planned and approved for your preplanned Fires.

Even though a DIV JAGIC is the target audience for the above TTP, it can be used at other echelons. The steps developed here reduce the time needed to produce geometries used for airspace clearance of Fires. These same steps can also be used for battalion, brigade and corps Fires.

Nick Niewadomski is a Joint Fires/AFATDS instructor currently teaching ABCS classes for the Joint Air Operations Command and Control Course for the 505th Command and Control Wing Field Training Unit which AJST supports; Hands-on AFATDS lab training for Air Operations Center Initial Qualification Training for Soldiers assigned to a BCD and AFATDS lab training supporting the AJST Echelons Above Brigade Airspace Course (EABAC) and our JAGIC focused training for divisions training for their upcoming WFXs.

Geometry production for munitions within the Advanced Field Artillery Tactical Data System (Rick Paape/Courtesy information).

155 mm (M109A6, M777A2)	MFP	PAH	TAH	EA
ADAM Long				
ADAM Short				
APICM				
Copperhead				
DPICM				
GPS Guided HE				
HE				
HE RAP				
Illum IR				
Illum VL				
RAAM Long				
RAMM Short				
SADARM				
Smoke				
Training				
WP				
WP2				

105 mm (M119A3)	MFP	PAH	TAH	EA
APICM				
HE				
HE BB				
HE RAP				
Illum IR				
Illum VL				
Smoke				
WP				

M270A1	MFP	PAH	TAH
MLRS SADARM			
MLRS DPICM			
MLRS DPICM Guided			
MLRS HE Guided			
MLRS Smoke			
MLRS AW			
ATACMS APAM			
ATACMS HE			
ATACMS BAT			
TGW			
Mine			
Practice Round			

M142	MFP	PAH	TAH
MLRS SAFARM			
MLRS DPICM			
MLRS DPICM Guided			
MLRS HE Guided			
MLRS Smoke			
MLRS AW			
ATACMS APAM			
ATACMS HE			
ATACMS BATT			
TGW			
Mine			
Practice Round			

Munitions flight path (MFP), platoon area of hazard (PAH), target area of hazard (TAH), engagement area (EA).

AFATDS will produce geometry for munitions **AFATDS will not produce geometry for munitions**

Responsive Fires in the deep fight

By Lt. Col. Jeremey Davis

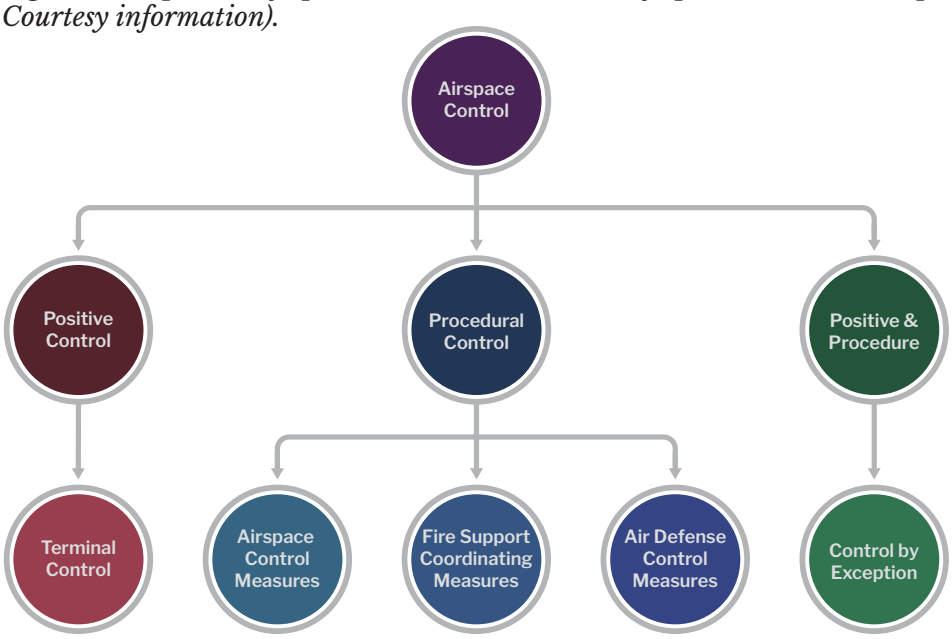
Fire supporters at the division and corps level must become experts at airspace coordination in order to enable maneuver commanders to dominate in Unified Land Operations against near-peer adversaries. For over the past decade, we have lived in an environment where maneuver forces operated outside the range of friendly artillery, precision Fires were more valuable than massed Fires, and complete air supremacy meant friendly aircraft were on station all the time. As we return our focus to facing a near-peer adversary, the Fires community must relearn skills reminiscent of Air-Land Battle: linear combat against a numerically superior enemy where local air superiority is hoped for but not guaranteed. Things have progressed since the time of Air-Land Battle doctrine, and fire supporters have a broad array of tools to integrate in time and space. In order to integrate all fire support assets, Fires planners must develop airspace coordination measures that support the maneuver plan and produce attack guidance that matches the right weapon to the right target at the right place on the battlefield.

Insufficient or inadequate planning before the battle leads to 1) unresponsive Fires 2) engaging with munitions that may not be the most effective 3) expending scarce resources where they could be best used elsewhere. Planning must generate Fires products throughout the military decision-making process, such as the attack guidance matrix and the target list worksheet. Targets short of the intelligence handover line and coordinated fire line go to the brigade's organic Fires assets in the close fight. At the division and corps level, one could base the attack guidance matrix on the relative location in the battlespace rather than the phase of the operation in order to facilitate shaping Fires. This product could provide guidance that while fixed-wing aircraft can hit anything on the battlefield, artillery cannot strike strategic deep targets and therefore should be prioritized in the close fight, thereby saving sorties for deep targets.

When aircraft are considered the primary fire support asset and have priority in all areas of the battlefield, field artillery is rendered unresponsive and thus ineffective. With unresponsive artillery, units expend their limited number of aircraft sorties in the close fight. Conversely, due to the planning required for the air tasking order cycle, units find it expedient to place calls for fire requesting Army Tactical Missile Systems (ATACMS) to engage dynamic deep targets. Unfortunately, ATACMS are a limited resource and candidly carry a smaller payload than a fixed-wing attack aircraft. As a result cannon and rocket Fires are underutilized, inadequate shaping Fires fail to attrit enemy maneuver forces, and friendly forces pay the price in the close fight.

Airspace coordination is essential to providing responsive Fires. As a general rule, surface-to-surface Fires should have priority short of the fire support coordination line (FSCL) and air-to-surface Fires should have priority beyond the FSCL. This neither prevents airstrikes short of the FSCL nor prohibits launching ATACMS beyond the FSCL. Rather, airspace coordination measures (such as blue and purple kill boxes) should be established short of the FSCL permitting aircraft to conduct operations, and beyond the FSCL to allow for missile fire. Whether in the Joint Air Ground Integration Cell at division or the Fires cell at brigade, Fires officers need to engage with all other airspace users during the airspace management meeting to develop ACMs. These ACMs can be permanent, of limited duration or on-call. Even an on-call ACM can provide benefits versus live de-confliction due to the ability to disseminate and rehearse the measures beforehand. Ideally, the FSCL should be calculated based on how far the field artillery can fire without breaching the coordinating altitude. Lessons learned from Combined Joint Task Force – Operation Inherent Resolve have found that responsive indirect fire support requires at least a 10,000-foot coordinating altitude (Redleg Update 04/17). How-

Figure 1. Corps area of operations within a theater of operations (Rick Paape/ Courtesy information).



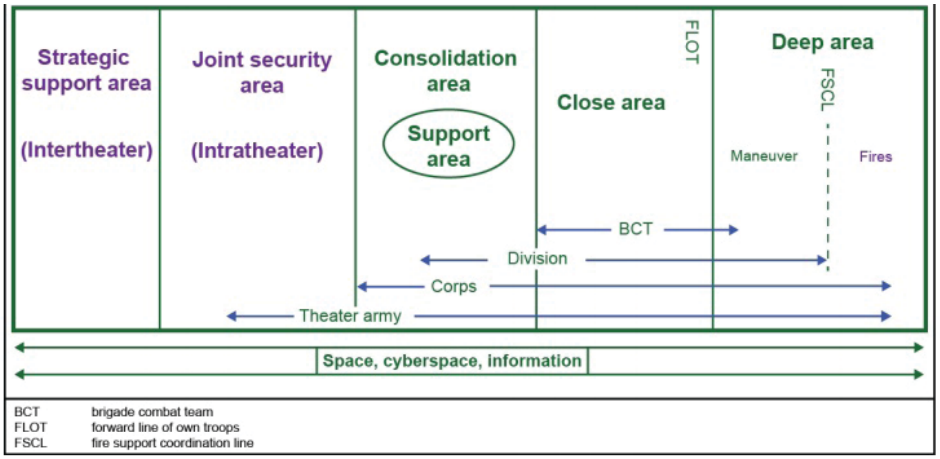


Figure 2. Airspace control methods (Courtesy illustration).

ever, 20,000 feet allows for most 105 mm Fires and 30,000 feet facilitates most 155 mm Fires. The commander's decision on FSCL and control access comes down to a question of just how responsive he wants his surface-to-surface Fires to be. Placing the FSCL too far out runs the risk of creating a gap where field artillery systems cannot range targets, yet aircraft must request clearance to engage. To address the difficulty of coordinating an FSCL move during offensive operations, one technique is to establish an airspace coordination area (ACA) short of the FSCL. This effectively allows aircraft to cover the gap beyond the range of the field artillery and then, once the field artillery is in position, turn off the ACA to allow Fires up to the FSCL.

"We don't plan targets because we don't know exactly where the enemy will be." This statement overheard in a warfighter Fires cell, along with the opposite extreme of plotting a target on every grid square "just in case," exemplify common misunderstandings of why we plan targets in the first place. Planned targets provide a specific focal point for coordinating assets when the maneuver commander declares what he wants dead, when and where. A sufficiently detailed target will specify a target number, trigger, location, observer and delivery system. This ensures we can have a primary and alternate observer on station and a delivery system in range at the right time during the battle. Once position areas for artillery are selected and aviation attack by fire positions are plotted, each of the respective branches can compare notes and start de-conflicting gun-target lines with air mobility corridors. Air Force planners can select ingress and egress routes that do not intersect planned rocket flight paths, while Artillerymen establish on-call restricted operating zones over their firing points. It all starts with target development combined with military specialists working in tandem to minimize risk and maximize joint effects.

Joint Publication (JP) 3-52 describes positive control as a method of airspace control that relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein. Procedural control is a method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures according to JP 3-52.

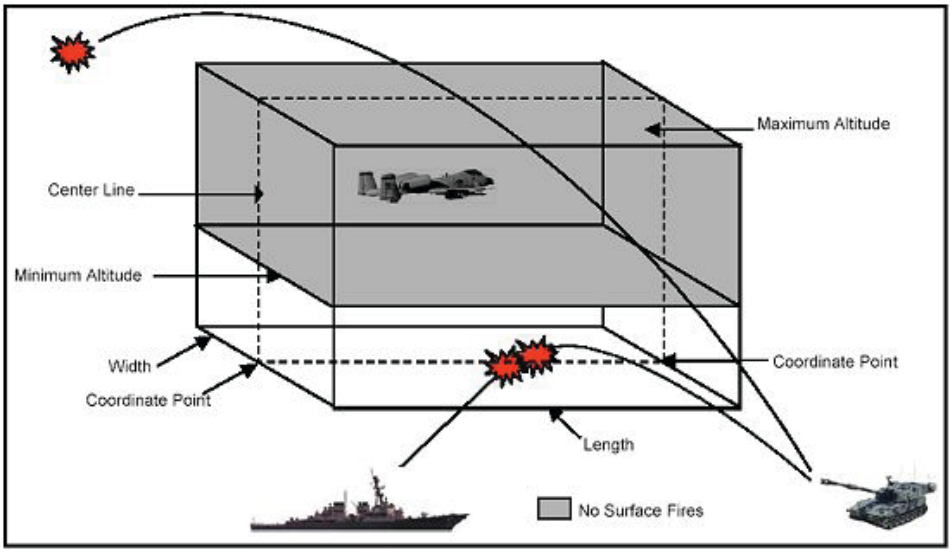
TAIS, with a real-time friendly feed and integrated with AFATDS, provides the tracking, while the air support operations cell provides the authorities to facilitate rapid de-confliction of deep Fires in the JAGIC via positive control. This assumes digital systems have not been degraded or tampered with by a near-peer adversary. Ultimately it is up to the commander what risk he is willing to accept. Positive or procedural control can only reduce risk; it cannot eliminate it.

A key part of the joint targeting cycle is capabilities analysis or weaponeering; determining how we want to engage a target in order to achieve the desired effects. In doing so we must consider the capabilities of our weapons and delivery systems verses the properties of the specific target. Given an abundance of planning time, each individual target can be analyzed to generate an engagement solution tailored to the properties of that specific target. However, an Attack Guidance Matrix (AGM) provides a general starting point for weaponeering pre-planned targets, and expedites the tactical fire direction required to engage dynamic targets. Three variables to consider when creating an AGM are the target's survivability, mobility and relative location on the battlefield.

- Is the target unarmored, armored or hardened structure?
- Is the target mobile or static?
- Is the target generally found in the close, deep maneuver or operational deep area?

ATP 3-94-2 Deep Operations gives us the following guidance regarding Army assets:

> *Artillery strikes are very effective for engaging well-defended, high-payoff targets, day or night, in all weather conditions. They can conduct short-notice strikes without aviation support against targets in heavily defended areas where the probability of the loss of aircraft is too high. Artillery strikes are typically employed against soft, stationary targets such as unhardened surface-to-surface missile sites, emplaced artillery batteries, air defense sites, logistics sites and command and control facilities. Appropriate target areas include chokepoints along mobility corridors and areas through which hostile weapon systems and equipment must pass.*



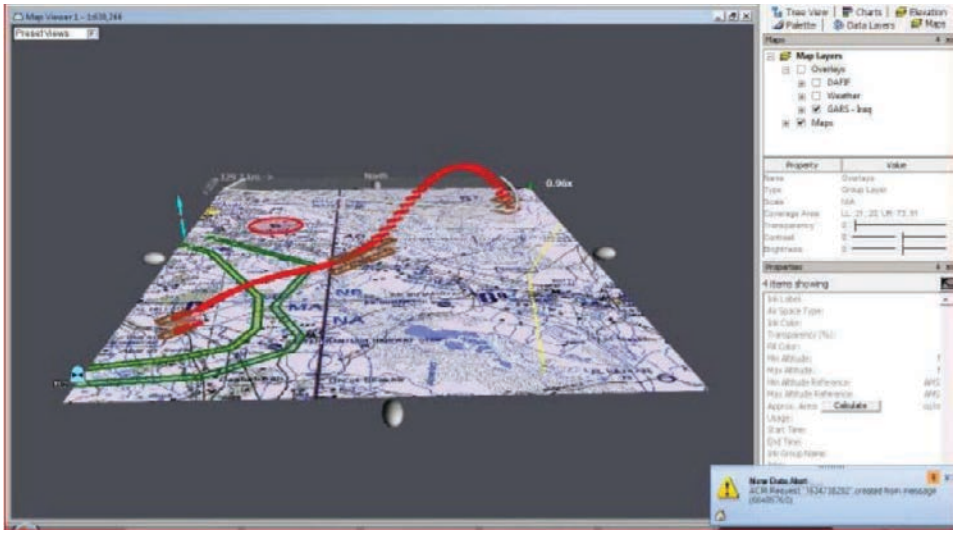


Figure 3 (top). Formal airspace coordination area (Courtesy illustration).
Figure 4 (bottom). Munitions flight paths in TAIS (Courtesy illustration).

Aviation attacks are effective at executing precision engagements against moving enemy forces, armored forces, hardened targets (such as bunkers), or targets located in terrain that restricts, prohibits or degrades artillery strike accuracy and effectiveness.

The wide variety of ordinance and aircraft available to the United States Air Force, combined with the ability to operate throughout the depth of the battlefield, make air power effective against most assets. When building the AGM, the question is not "Can aircraft effectively engage this target?" but rather "Do I have other assets that could engage this target?" Artillery ammunition is typically more plentiful than available sorties, and is effective against fewer targets. It should be prioritized against the targets it can best influence in order to free up aircraft for deeper targets. Additionally, when aircraft are grounded by weather, artillery continues to provide support for the close fight while also providing some ability to engage deep high-payoff targets. Lastly, we can expect a near-peer adversary to have a robust combination of fighter aircraft and air defense artillery. In these cases, aircraft require support from electronic warfare assets, air superiority fighters, and artillery suppression of enemy air defenses missions to create windows in which to deliver their ordinance and come back alive. In summary, artillery is best against static soft targets in the close or deep maneuver area, aviation is best against mobile armored units in the close fight, and aircraft are versatile against many targets, but are limited by availability, weather and the balance of air power.

Shaping Fires in the deep fight attrit enemy forces, divert or disrupt their scheme of maneuver and deprive them of key capabilities by striking high payoff and high-value targets, ensuring maneuver commanders have a decisive advantage once they make contact with the enemy. Fires are often the "action" part of "actionable" intelligence gathered by the division's reconnaissance assets. The effectiveness of shaping Fires depends on a combination of tactical weaponeering and technical responsiveness. In weaponeering, fire supporters engage in a deadly game of rock, paper scissors to employee the most effective asset against its most vulnerable counterpart as distilled into the AGM. For Fires to be responsive, we need to use the appropriate delivery asset at the right point in the battlespace. To do so requires prior planning, in the form of position areas for artillery, targets, fire support coordination measures and airspace control measures. It is through this combination of tactical and technical proficiency that we can most effectively destroy, defeat or disrupt the enemy with joint integrated Fires.

Lt. Col. Jeremey M. Davis is currently the commander of the 3rd Battalion, 116th Field Artillery Regiment (HIMARS). In his 20-year career, he has participated in several Warfighter-equivalent exercises and has fire support experience at all levels from company to corps, including recent experience in the Joint Air Ground Integration Cell for the 3rd Division (UK) and the Fires Cell for the VII Corps (ROK). Davis is a graduate of Command and General Staff College ILE Advanced Operations Course, the Field Artillery Advanced Course and Joint Operational Fires and Effects Course.

U.S. Marines and Soldiers man an anti-aircraft weapon during World War I (2nd ID).

US Artillery in WWI: Part 2 of 3

By 1st Sgt. (ret.) Scott Cortese

Following Russia's capitulation after the internal turmoil caused by the Bolshevik Revolution, German Maj. Gen. Erich Ludendorff re-allocated his forces from the eastern to the western front and mounted a massive attack whose objective was to capture Paris, believing that it would force the Allies to surrender. Ignoring the intelligence gathered from a couple of German prisoners that "an important German offensive was in course of preparation between the Oise and the Reims," the French and British were caught completely unprepared for the violence that the Germans unleashed upon them on May 27. As the Germans advanced very rapidly under a well-coordinated combination of infantry, armor, artillery and poison gas, the shocked British and French commanders could only watch in horror as their lines disintegrated. The Germans moved over 12 miles that day and any French reinforcements sent in to counterattack "evaporated immediately like drops of rain on a white-hot iron." By June 3 the French were in full retreat from the Germans.

The American Expeditionary Force (AEF), comprised of both U.S. Army Soldiers and Marines, took up various defensive positions directly in front of the German advance. Passing through the Marine's lines, a retreating French major suggested to them that they too follow suit. Upon learning of the major's suggestion, Marine Capt. Lloyd Williams loudly replied, "Retreat, hell! We just got here!" For the next two days the Germans relentlessly attacked the Marines' defenses and each time were thrown back. The German commanders were forced to have their units dig in and prepare defensive positions. Going on the offensive, the Allies ordered the AEF to attack near Bois de Belleau or Belleau Wood.

Led by Marine Brig. Gen. James Harbord, the task to attack Belleau Wood fell upon the 4th Brigade of the 2nd U.S. Division. The battle plan consisted of a two-phase operation kicking off on the afternoon of June 6. The first phase given to the Marines consisted of taking the woods and the second phase was to take the town of Bouresches and the surrounding high ground west of the woods. French intelligence indicated that German resistance was light and they had entrenched themselves in only a small area across the northeast corner. How-

ever, contradictory reports made by various observers suggested that the woods were heavily defended. One French pilot flying over the woods noted that, "Fire is heavy enough southeast of the Bois de Belleau…I am under the impression that they are occupied by the Boche." Planned as a surprise attack, the AEF would make a bloody mistake: There would be no substantial use of artillery fire before the advance.

When the light artillery barrage completed, the Marines emerged from their positions and marched across open ground towards the woods. It turned out that the "unoccupied" woods actually consisted of numerous, interlocking German machine gun positions. Making their presence known, the Germans swept their machine guns back and forth mercilessly, tearing into the Marines and pinning them down in the open. "Come on, you sons of bitches! Do you want to live forever!?" shouted Marine Gunnery Sgt. Dan Daly as he attempted to motivate his platoon forward. Many of the Marines did not make it to the woods and many who were wounded were killed trying to seek cover. Marine Lt. Graves B. Erskine related that, "We jumped off after about 10 minutes of very light artillery concentration in and around the area of Bouresches and were met with murderous fire, mainly automatic weapons, some artillery and some mortar. My platoon consisted of 58 men in addition to myself when we jumped off. About 40 minutes later, five of us were left." Because so few Marines had lived to even make it to the woods, they were unable to hold their positions against a German counterattack that night. In the middle of the night the Marines fell back to the original positions they had assumed only 12 hours before and were instructed to make no other attacks until further ordered.

Seemingly unfazed by the underlying cause for the high casualties that they had sustained, another attack, also characterized by a low level of artillery support, was ordered on the woods. AEF mortar fire proved to be ineffective on the German positions and as soon as the Marines broke cover on the morning of June 8, the German machine guns mowed them down. Marine Maj. Berton Sibley reported back to Harbord that, "They are too strong for us. Soon as we take one machine gun, another opens…All of the officers of the 82nd Company wounded or missing and it is necessary to reform before we can advance." Harbord ordered his officers to, "Get cover for your men in the ravine at the south end of woods. Let your men rest. I will have artillery play on the wood" with a massive bombardment set to begin on the morning of June 10.

At 3:30 a.m. that morning the 2nd Field Artillery Brigade unleashed hell. For the next hour they fired approximately 28,000 shells from their 75 mm guns and approximately 12,000 rounds from their 155 mm howitzers into Belleau Wood. The Marines once again stepped off and followed the rolling artillery barrage close enough for it to provide cover. This artillery-centered method, scoffed at by subscribers to the infantry-centered concept, appeared to have worked. Reports from the battle came back to Harbord stating that, "Artillery barrage working beautifully," "Action in woods deemed finished," "The line advanced obtaining objective without opposition" and "Everything going nicely. No losses coming across…there is practically no firing. Artillery has blown the Bois de Belleau to mincemeat." Harbord reported back to his division headquarters that the objective had been reached shortly after 5 a.m. with eight men killed and 24 wounded. Over the next two days the Marines continued to fight in the woods making reasonable progress. Although their casualties were higher during those two days than on June 10, the distinction between the two tactics was glaringly apparent. As Marine Gen. James Lejeune noted, "Strikingly obvious is the great need for artillery in the attack, when one contrasts the little progress made without it and the advances of the last two days." Unfortunately for his men, Harbord apparently did not let these hard-learned lessons over the past several days sink in well enough.

On the night of June 17, Harbord ordered the 7th Infantry Regiment of the Army's 3rd Infantry Division to relieve his battle-weary Marines. Instructed to clear out the remaining Germans from Belleau Wood, the Soldiers fell far short of their goal. Twice they assaulted the German positions without any significant pre-planned artillery support and each instance ended in a predictable outcome. Harbord felt that these failures were due "from the inefficiency of the officers of the 7th Infantry" and ordered his Marines back in to finish the job. The burden to complete this task fell upon Marine Maj. Maurice Shearer.

Harbord informed Shearer that "it is not practicable to withdraw again and give further artillery preparation." Amazingly, Harbord added that, "It is believed that by the judicious use of sharpshooting snipers you can reduce the German positions without much expenditure of men." Shearer was given until 10 p.m. on June 23 to finish the job. The attack kicked off promptly at 7 p.m. that day and once again the results were foreseeable.

By 8 p.m. Shearer reported that his progress was slow but the Marines were stopped cold shortly thereafter. In less than three hours, they had sustained over 130 casualties and were pinned down by German machine guns in several places. The wounded bled to death in the woods as nobody could reach them without themselves also becoming a casualty. By 11 p.m. Shearer informed Harbord that the attack was going to be stopped for the night and would continue in the morning. Marine Capt. Robert Yowell reiterated what his superiors should

Soldiers from the B Battery, 1st Anti-Aircraft, 2nd Infantry Division use various instruments to locate enemy planes in Montreuil, France, June 15, 1918 (2nd ID).

have learned: "I know of no other way of attacking these positions with chance of success than one attempted and am of opinion that infantry alone cannot dislodge enemy guns."

Finally on June 24 Brig. Gen. W. Chamberlaine, commander of the 2nd Field Artillery Brigade, developed a rather elaborate artillery plan to assist the Marines. During the early morning hours of June 25 the combined French and AEF artillery fired a massive barrage which lasted well into the afternoon. Army Capt. George Wahl, a commander whose battery was involved in this barrage, recalled that, "the artillery was given full permission to play on the evacuated part of the woods to its heart's content. It did. During the early afternoon every gun that could shoot was turned on the place. By dusk it was practically kindling." Precisely at 4 p.m. the barrage increased in intensity and rolled back so that Shearer's Marines could follow closely behind. Shortly before 6 p.m. Shearer reported that he had sustained many casualties but more importantly, the German machine guns which had caused murderous casualties in the past were practically silenced. With their defenses crumbling under this attack, the German commander, Capt. Alexander Von Kaulbars, ordered his units to retreat from the woods that evening. Reaching their objective in the northern part of the woods, the Marines had noted with awe the deadly accuracy and devastation that their artillery had caused. At 7 a.m. that morning Shearer proudly sent Harbord a message proclaiming that, "Belleau Woods now U.S. Marine Corps entirely."

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ROK-US alliance set for deterrence of provocation

By Capt. Galen Meador

Soldiers fire a High Mobility Artillery Rocket System at Daecheon, Republic of Korea (Sgt. Ashley Marble/U.S. Army).

The Republic of Korea (ROK) and the United States military members stationed on the Korean Peninsula have a saying; 'Kapchi Kapshida' or 'We Go Together'. United States Soldiers, Airmen, Marines and Seamen have been stationed in Korea for over half a century and the requirement has never been greater for a strong alliance. The Korean Peninsula is of strategic importance for the United States. With tensions rising on the peninsula, the continued strength of the Republic of Korea and the United States is paramount to the mission of the Combined Forces Command and U.S. Pacific Command (PACOM). The ROK-U.S. alliance is strong and the forces on the Korean Peninsula are ready to "Fight Tonight," even though the main mission of the United Nations Command is to maintain the armistice. The basis for maintaining the armistice comes in the form of deterrence. ROK-U.S. deterrence of North Korean provocation is the cornerstone of the strategic framework for the alliance.

The ROK-U.S. alliance has two distinct capabilities that are critical to the deterrence of North Korean provocation; Rapid Force Projection and Rapid Response. This article discusses both capabilities in the context of Korea and reviews examples from recent events. Korean and U.S. equipment and actions are reviewed in order to provide the scope of effort focused on deterrence. The capabilities of Rapid Force Projection and Rapid Response are crucial to maintaining the armistice agreement between the Democratic People's Republic of Korea (DPRK or North Korea) and the United Nations Command. Through these capabilities, the strength of the ROK-U.S. alliance is clear and commitment to deterrence is clear.

The Department of Defense defines deterrence as: the prevention of action by the existence of a credible threat of unacceptable counteraction and/or belief that the cost of action outweighs the perceived benefits (JP 3-0). Rapid Force Projection and Rapid Response are two methods of deterrence on the Korean Peninsula as well as the use of a strategic message. Together these three capabilities provide the framework for deterrence in the region. Successful, enduring deterrence is predicated on two factors. First is maintaining a high degree of military readiness. The second is communicating that readiness level throughout the region. In this example Rapid Force Projection and Rapid Response provide the tangible military readiness while the strategic message of deterrence is the medium for communicating to allies and adversaries.

The first capability inside the deterrence framework is Rapid Force Projection. This is the ability of the ROK-U.S. alliance to quickly project forces to the peninsula in order to deter North Korean provocation and reinforce the armistice. As seen in Cobra Gold 2014, and other PACOM multi and bi-lateral training events, the alliance can exercise their readiness to support deterrence by rapidly changing postures with the employment of airborne forces and aerial delivery of combat power. A specific example occurred during the month of September, 2017, when the U.S. Army conducted a live-fire exercise using High Mobility Artillery Rocket System flown to the Korean Peninsula by C-17 aircraft from the continental U.S. The ability to rapidly posture forces is a key deterrent tool for the alliance that reinforces the Republic of Korea's faith in their U.S. partners resolve to support them with additional assets to deter North Korean provocation. However, Rapid Power Projection is not the only critical capability.

The second capability is Rapid Response: the ability to rapidly respond to North Korean provocation. It is crucial to the maintenance of the armistice that the ROK-U.S. alliance can quickly react to dissuade provocation. The ability of the alliance to respond efficiently with precision deep strike capability is imperative to

U.S. Army Soldiers prepare to load High Mobility Artillery Rocket Systems (HIMARS) on to a U.S. Air Force C-17 Globemaster during a HIMARS rapid infiltration exercise (Staff Sgt. Laurel Richards/U.S. Air Force).

effective deterrence as a response option. On July 5, 2017, military personnel from the U.S. Army and Republic of Korea conducted a combined precision deep strike show of force following the North Korea intercontinental ballistic missile test. Utilizing the ROK Hyunmu-II Missile and the Army Tactical Missile System (ATACMS), alliance forces fired into the territorial waters off the East Coast of South Korea. The intent was to reaffirm the ability of the ROK-U.S. alliance to rapidly respond with deep strike capability anywhere, anytime, and anyplace. In addition to land-based Ballistic Missile Defense (BMD) systems, the U.S. Navy has BMD capable ships in the region. The ROK maintains three destroyers called KDX-III (Korean Destroyer eXperimental), with radar system comparable to the version used by U.S. Navy ships. Alliance discussion of ROK purchasing Standard Missile-3 interceptor missiles from the U.S. contributes to the outward message of deterrence. This would provide ROK destroyers to engage ballistic missiles and contribute to the ballistic missile defense of the peninsula. However, the commitment on the Korean Peninsula to Rapid Response and its effects on deterrence goes farther than deep strike capabilities.

The recent deployment of the Terminal High Altitude Area Defense system to the peninsula highlights the importance of deterrence through readiness and the capability to respond rapidly. The system provides a layered missile defense capability capable of ballistic missile intercept and destruction from projectiles inside or outside the atmosphere. Recognizing the importance of Rapid Response capabilities to successfully deterring provocation, the ROK recently began ballistic missile defense modernization. When completed, ROK Patriot ballistic missile defense forces will have the increased range and greater lethality against theater ballistic missiles. Additionally, this modernization works in conjunction with layered system approach of the overall Rapid Response framework. This layered approach enhances the battle space for ballistic missile defense and provides another deterrence capability. These capabilities alone do not accomplish the desired endstate. But must work in conjunction with a greater strategic message in order to be effective. The message is simple and resounding: "the alliance can strike anywhere, anytime, and anyplace without hesitation." This strategic message not only informs our allies in the international community of the alliance's stance but when working in conjunction with deliberate actions based on the capabilities of Rapid Force Projection and Rapid Response, they may influence the North Korean decision cycle.

Deterrence and its framework capabilities are inherently combined. As the ROK Army modernizes it reaffirms the strategic message of "anywhere, anytime and

A Terminal High-Altitude Air Defense system stands ready to launch at Seongju, Republic of Korea (Staff Sgt. Laurel Richards/U.S. Air Force).

anyplace without hesitation." The ROKA has recently developed the Korean Smart Top-Attack Munition which is a fire and forget, top attack anti-tank munition with an effective operating range of 2-8 km. This extended range and ballistic trajectory allow the vehicle to remain concealed behind cover while firing successive rounds toward the known locations of enemy to provide effective indirect fire support against targets hidden behind obstacles and structures. The ROKA has a robust artillery capability made up from a mix of some older and more modern systems. They have most recently upgraded with self-propelled 155 mm K9, much like the US M109A6 Paladin which can displace and fire quickly and possess increased range and accuracy. The ROK and U.S. alliance's commitment to deterrence can take many forms but function best when used in tandem.

These efforts, equipment and messages directly increase the Combined Forces Command's ability to influence the Korean Peninsula to deter aggression. The integration and synchronization of combined and joint Fires assets further enhances the Combined Forces Command's ability to rapidly project power and rapidly responds to North Korean provocation. Tangible displays of commitment to that cause working in tandem with a consistent, strategic message allow the alliance to speak to the international community, and most importantly North Korea. Modernizing equipment and transparency of goals reinforce this narrative. What this amounts to is a simple lesson; in order to deter North Korea aggression layers of capabilities, messages and actions are necessary.

Only when taken in totality can the scope of the ROK-U.S. alliances efforts to deter North Korean aggression be appreciated. Rapid Force Projection from sea, land and air reinforce the strategic message that: "the alliance can strike anywhere, anytime, and anyplace without hesitation." Rapid Response capabilities define the methods of engagement and strengthen the messages further. With the notion of anywhere, anytime and anyplace already understood, all changes to capabilities must be viewed through that lens. This echoes the commitment to deterrence by the alliance and provides context for allies and adversaries. The ROK-U.S. alliance is truly combined and ready to "Fight Tonight." Together the three fingers of Rapid Force Projection, Rapid Response and Strategic Messaging form a resolute fist that not only deters North Korea provocation but informs the international community of the unyielding will of the ROK-U.S. alliance. Deterrence shapes actions on the Korean Peninsula and provides the framework for the ROK-U.S. alliance to influence the Korean Peninsula.

Ballistic missile defense security in the Middle East through foreign military sales; the key to develop a robust combined air missile defense strategy

By Maj. Angel Rios-Pelati

The ballistic missile activity in the Middle East has almost doubled in the last two years, prompting countries within the Gulf Cooperation Council (GCC) to develop strategies to defeat potential missile threats. From early warning radars to ballistic missile defense platforms, GCC countries often resort to the United States via Foreign Military Sales (FMS) to fill the air and missile defense operational gap.

However, the military threats in the Middle East are not a new phenomenon. In 1981, GCC was formed to promote the interests of the Gulf States and protect them from the threats posed by the Iraq-Iran War. The war presented a security threat to the states due to the possible proliferation of missiles from either of the two nations. After the war, another danger occurred through the invasion of Kuwait by Iraq. It is during the Iraq-Kuwait that the U.S. deployed Patriot batteries with the aim of protecting their bases in Saudi Arabia and Kuwait. After the Iraq-Kuwait war, the emergence of terror groups mixed with battles in Syria and Yemen (between the government and rebels) has exposed the region to a new layer of missiles threats. It is worth noting that most of these countries do not have stable governments as they are struggling to recover after the Arab spring led to collapse of their governments.

The U.S. military concerns in the Middle East has been focusing on Iran's advances in nuclear program and the possibilities of the nuclear proliferation and its potential harm in the region and the globe. As result, ballistic missile defense is gaining momentum in the gulf region with countries like Saudi Arabia, Kuwait and the United Arab Emirates; procuring cutting-edge air and missile multi-level defense structure, attributed to the immense support these countries received from the U.S. via FMS. Other nations are also showing interest to venture in the ballistic missile defense in the future due to Iran already advancing their ballistic missile defense (BMD) technologies. The growing demand for the BMD technologies in the gulf region is attributed particularly to China, Russia and the U.S. as they are the main players as collaborator, suppliers and advocators of the Integrated Missile Defense (IMD) infrastructure in the GCC region.

FMS refers to the program by the Arms Export Control Act (AECA) under the Department of Foreign Policy. Section three of the Arms Export Control Act provides the President of the United States with an opportunity to approve the sales of arms to any foreign countries if it will help in strengthening the security of the U.S. FMS are products of government-government agreement that allows the U.S. to offer military support to their allies. The military supports include both the technical and the physical Army wares. The technical aspect involves the military training. The government-to-government agreement is referred to as the Letter of Offer and Acceptance (LOA).

There are several cases of FMS that has helped improve the security across the Middle East which is the core responsibility of the U.S. as a superpower. Some of the cases include the sale of air defense platforms to GCC countries. FMS presents a significant advantage to both the U.S. and the client as it creates a win-win situation for both countries. The U.S. wins by getting a market for their military hardware and promoting interoperability whereas the receiving nation gets the equipment and support to maintain their security and stability.

Developing an effective air defense strategy, especially in complex terrains like the gulf region, requires a combination of interoperable platforms, field experience and technical skills. A multilateral framework is the best way to develop interoperable and integrated regional air and missile defense. Nations are stronger-not weaker but stronger when they work together. The GCC can greatly benefit from integrated missile defense framework to provide a robust capability to respond to potential crisis; offset and deter potential threats and lead to a more stable and secure region.

When a country procures a platform via FMS, it creates an interoperable architecture that maximizes the possibility for combining resources and increases overall capability. Integrated missile defense is accomplished by synchronizing sensors and linking the equipment that passes data to weapons systems between the U.S. and the GCC country so that we can respond effectively and efficiently. However, an effective command and control will be necessary to bring this altogether.

Countering the ballistic missile defense and cruise missile threat will require dedicated and determined knowledgeable professionals throughout the GCC and U.S. force. To be successful countering missile threats is critical to achieve unity of effort. Achieving a multilateral effort will create a synergy of combined integrated

The Army test fires a Patriot missile in a recent test. The Patriot missile system is a ground-based, mobile missile defense interceptor deployed by the United States to detect, track and engage unmanned aerial vehicles, cruise missiles, and short-range and tactical ballistic missiles. Patriot, along with other missile defense systems, are included in the Army Air and Missile Defense 2028, which provides the Army's overarching vision for the AMD force, describes how the AMD force is postured to support the Army and joint forces, and articulates what must be accomplished to achieve the 2028 desired end state of preventing and defeating adversary air and missile attacks through a combination of deterrence, active and passive defense, and support to attack operations (U.S. Army photo).

efforts that will allow the GCC to successfully defend and prevail against an attack.

AMD FMS cases provide a focus for integrated air and missile defense cooperation within the customer and the U.S. which allows them to define individual national defense requirements, priorities, and policies while establishing clear expectation for augmentation of the current air and missile defense in the Middle East.

The FMS process greatly enhances partner nations interoperability opportunities to improve regional integrated air and missile defense (IAMD) capabilities and by constructing common standard operating procedures at the strategic, operational and tactical level for effective command and control of IAMD operations between the country and the U.S. The FMS provides an interoperable opportunity for the U.S. and the country the opportunity to execute air and missile defense as an integrated team; armed with a common air and missile defense understanding and enhanced interoperability effort across the Arabian Gulf area of operation.

In conclusion, FMS plays a critical role in developing new strategies in the combined air missile defense in the GCC. Some of the successful cases include the procurement of the Patriot and THAAD systems which were the result of collaboration between GCC countries and the U.S. government.

The FMS is critical in this process as it enhances cooperation between the U.S. government and the potential buyer country. The FMS process involves the client asking for equipment that can perform specific tasks within a particular environment. The incorporation of the expertise of the U.S. forces with experience of the ground Soldiers of the GCC countries provides the best opportunity to not only design and implement effective equipment but also come up with the best air and missile defense strategy against security threats in the vast gulf region.

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The end of static defense

Air Defense Artillery in large-scale combat operations today

By Maj. Joshua J. Withington

> ***'A defender aggressively seeks ways of attriting and weakening attacking enemy forces before close combat begins. A defender maneuvers to place an enemy in a position of disadvantage and attacks that enemy at every opportunity.'***
>
> *–Field Manual (FM) 3-0, Operations*

"Air Defense doesn't speak maneuver." I've heard statements like these many times over the past couple of years. For me, they are parallel to saying, "Air Defense doesn't speak Army." Maneuver is the Army, and the Fires function exists to enable said maneuver. Further, we discuss speaking maneuver in the context of the reintroduction of Maneuver - Short Range Air Defense Systems (M-SHORAD), adding an M for emphasis to isolate the system specifically from the greater air and missile defense (AMD) force. Statements like these serve only to bifurcate AMD culture and Soldiers. Reintroduction of an archaic partition preserves an element of the air defense officer corps dissociated from maneuver. This simply cannot happen again. Air defense support to large-scale combat operations today requires comprehensive coverage of mobile air defense systems in direct support to maneuver at all echelons. M-SHORAD cannot solve the maneuver support problem alone.

This article intends to answer the question, "If we had to fight near-peer large-scale combat operations (LSCO) tomorrow, how do we fight as an air defense force in support of maneuver with what we have in the Army right now?" Most presented solutions to our problem as an air defense branch supporting LSCO include material acquisition and force growth. However, new billet authorizations and weapons systems can take years to arrive on battery command rosters and property books. Beyond the approved M-SHORAD battalion force growth, air defense has historically struggled to field new combat systems. Administrations change, funding priorities shift, and the enemy always gets a vote. Thus, to answer the primary question, this article seeks to analyze similar periods of architype shift in the past. It will present some conclusions and lessons learned using the Meuse-Argonne campaign and the Yom Kippur War as LSCO case-studies for analysis. To assist in framing the following material for quick synthesis, I offer the following lessons learned from the Meuse-Argonne and Yom Kippur for ADA in near-peer LSCO upfront:

1. Maneuver must advance at a rate dictated by air defense coverage or be forced to underwrite considerable risk. Air Defense Artillery's range and speed preserve maneuver operational reach and tempo, granting unfettered access to the land domain when the air domain is in contest.
2. Air defense units directly supporting maneuver must develop an intricate understanding of phasing and associated decision support matrices (DSMs) for the ground tactical plan. This preserves the maneuver commander's freedom to expeditiously transition between branches and sequels due to enemy action or overwhelming success.
3. High mobility is required of all air and missile defense systems to directly support maneuver units in near-peer LSCO, not just SHORAD systems.
4. Enabling air defense Fires authority through existing jointly-manned, Army Fires networks to the lowest echelon possible facilitates simultaneity across all domains for the maneuver commander.

The following case studies represent different epochs, varied in technology and politics. At first glance, it is easy to assume that the operational doctrine which led to an American victory in 1918 or the Egyptian defeat in 1973 do not intersect. Both instances represent a historical period of warfare theory in transition. Additionally, both case studies include an attacker operating without air superiority. The experiences of WWI catalyzed American doctrine reform prior to WWII (trench warfare to combined arms). The observations of Yom Kippur did the same for an Army reorienting from Vietnam to Desert Storm (counter-guerilla to Air-Land Battle). The Army is faced with a similar situation today. In the Meuse-Argonne during WWI and again in the Yom Kippur War, a combined arms breach of a "stabilized front" preceded rapid exploitation with differing degrees of success. Anti-Access Area Denial (A2AD) presents a comparable problem-set to the one first encountered on the western front of WWI. Attacks are likely to be overwhelmingly contested across all domains, stifling maneuver akin to the fields of Belgium and France. Massing at the right time and place to achieve penetration of A2AD systems without sophisticated combined arms may prove prohibitively costly, as it did during WWI in 1918 and on the Sinai in 1973.

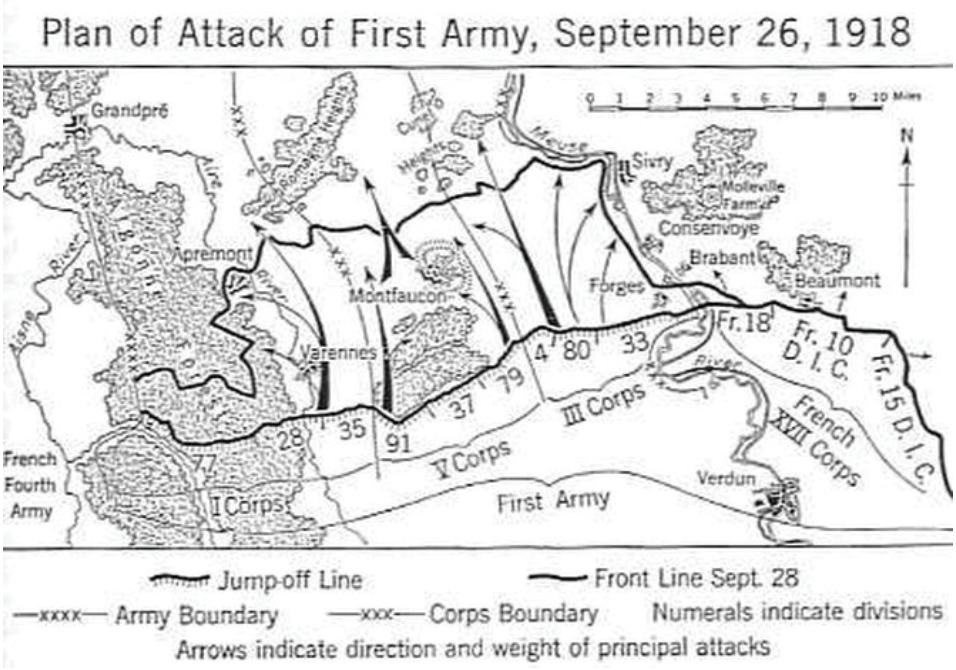


Figure 1. Plan of Attack of First Army, Sept. 26, 1918 (Courtesy illustration).

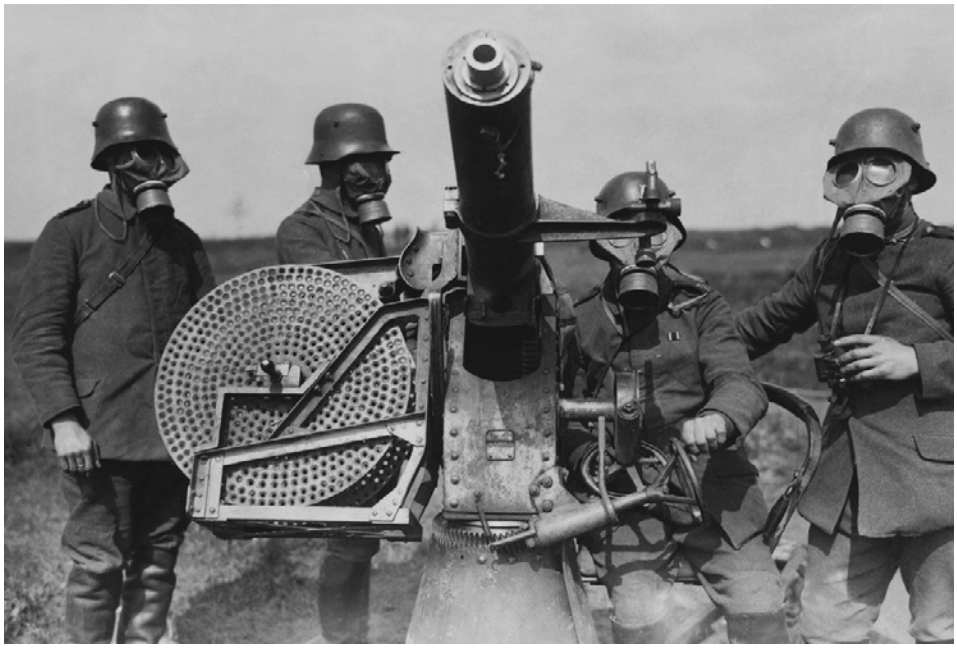
Meuse-Argonne Campaign

The evolution of theory and doctrine in the interwar years from 1919-1940 was founded on an understanding of a battlefield framework derived from the experiences of the American Expeditionary Force (AEF). Most important was determining how to break-through the stalemate created in the trenches of France and Belgium from 1914-1918. The failure of the Schlieffen Plan and the resulting deadlock following the "Race to the Sea" dethroned the infantry as the primary military arm. Artillery fire produced upwards of 75 percent of casualties in major campaigns with aircraft supplying a third battlefield dimension. Adding to the complexity, Army formations had become so large that managing the necessary firepower and maneuvering forces necessitated professionalized multi-tiered staffs. Acutely shaping for the officer corps at the time was the experience of the Meuse-Argonne Campaign and the stemming astronomic casualty rate. Warfare theory generated from this campaign would support the Army in creating several manuals for large-scale combat up until the mobilization for World War II. Each of them centered on the re-establishment of battlefield mobility by breaking through the enemy "stabilized front" using concentrated combined-arms firepower. The genesis of these theories derived from an Army ill-equipped to execute during World War I and from an officer corps dedicated to not repeating large-scale operational mistakes.

The start of the Meuse-Argonne called for successive attacks with three corps abreast across three German defensive lines. The German army had occupied the territory since 1914 and spent the four years preparing their defense in depth. The Hindenburg Line, as it became known, was a hardened network of trenches, bunkers, wire obstacles, machine gun nests, and forward observation positions. Field artillery, anti-aircraft artillery and reconnaissance aircraft supported the hardened trench-lines. Preparation of the battlefield began on Sept. 26, 1918, when, the combined 3,980 guns of the French and American forces fired over 250,000 rounds on the sophisticated German defense. Nine divisions of the First, Third, and Fifth Corps attacked northwest under a rolling artillery bombardment. Most important among the divisions of the first phase was the 79th Division of Fifth Corps, tasked with seizing the high terrain of Montfaucon. By seizing Montfaucon, the AEF plan would achieve a positional advantage, allowing maneuver to maintain the initiative and sever the German-held rail supply lines.

As the three corps of First Army advanced, thick fog in the region lead to the separation of ground

German soldiers man a 37 mm Maxim Flak M14 anti-aircraft gun during the First World War (Courtesy photo).



An SA-6 (front) stands with an SA-3 (left) and an SA-2 (right) in Egypt, 1972 (Courtesy photo).

forces and difficulty in spotting German positions to direct the artillery. Superior German anti-aircraft artillery and aviation interdicted the limited American aircraft and destroyed observation balloons. AEF artillery continued firing blindly into the well-prepared depth of defenses. American infantryman continued to press north until they outran the range of the supporting 75 mm guns. Without the support of artillery or the capacity to contest the skies, Americans were mowed-down by German machine gun and artillery fire directed by reconnaissance aircraft relaying the AEF positions.

As American commanders continued to feed the line forward, the inexperienced 35th Division of First Corps' east flank was nearly destroyed. It had to be withdrawn and replaced by the 1st Division. On the First Corps' west flank, the 77th became so disorganized an entire battalion advanced too quickly and was cut-off, becoming the storied "lost battalion" of the Meuse-Argonne. In the center of the First Army line, the 79th Division of Fifth Corps disrupted the tempo of the AEF attack by overextending its lines and failing to seize Montfaucon. The failure delayed the operation in its entirety. Only after allowing AEF Fires assets to catch-up with the attacking force was the 79th able to seize Montfaucon. By outrunning the coverage of Fires assets, and without the ability to neutralize German aircraft, the division incurred 6,000 casualties. The 3rd Division replaced the 79th for the remainder of the Meuse-Argonne, adapting its tactics to ensure the preservation of tempo and reach through preplanned sequencing of Fires.

Yom Kippur

Years later in the Sanai, the Egyptians were confronted with a similar problem. The Israeli Bar-Lev line constructed along the eastern shore of the Suez Canal following its capture during the Six Day War of 1967 was formidable. Egyptian armor was handily defeated by modern Israeli air power and tanks during the previous conflict, resulting in the Israeli occupation of the Sinai. Much as the Hindenburg line of WWI or the A2AD structures of today, multiple lines of defense in depth creatively used terrain, artillery and aviation to amplify its effect. Internal evaluations determined the Egyptian Air Force to be a minimum of 10 years from establishing parity with the Israeli Air Force. During the planning phase, the Egyptians aimed to exploit weaknesses in Israel's three-pillar doctrine that emphasized the role of intelligence, armor and an overdependence on air power. To accomplish this, Egyptian modernization efforts since 1967 included purchasing countless anti-tank guided missiles and 150 SA-6 air defense batteries from the Soviet Union.

The Egyptian general command planned a three-phase operation to seize key crossing points on the canal, breach the Bar-Lev line, and establish a defensible beachhead on its eastern shore. Operation Badr called for a simultaneous attack of two armies with five infantry divisions across the Suez Canal to establish bridgeheads 12 to 15 kilometers in depth; this included overcoming the Israeli defenses in the Bar-Lev line. The second phase called for a hasty transition to defense to repel expected Israeli counterattacks. Egyptian president Anwar Sadat anticipated competing global super powers would intervene and mediate a cease-fire once the beachhead was secured. The base plan included a third phase to mitigate the risk of an Egyptian army pinned against the canal to their rear after completing the breach. Known as "Granite 2," the third phase was a continuation of the attack to secure the Gidi and Mitla Passes 40 kilometers east. The idea was to defeat an Israeli counterattack and prevent reinforcement through the passes. The drawback to Granite 2 was it required Egyptian armored forces to attack beyond the planned coverage areas of SA-6 batteries guarding the crossing sites. Due to a low assessed probability of execution as well as officer disagreement, the branch was incomplete.

On Oct. 6, 1973, the 2nd and 3rd Egyptian Armies attacked east into the Sinai Peninsula. The network of 62 SA-6 air defense batteries directly supporting ma-

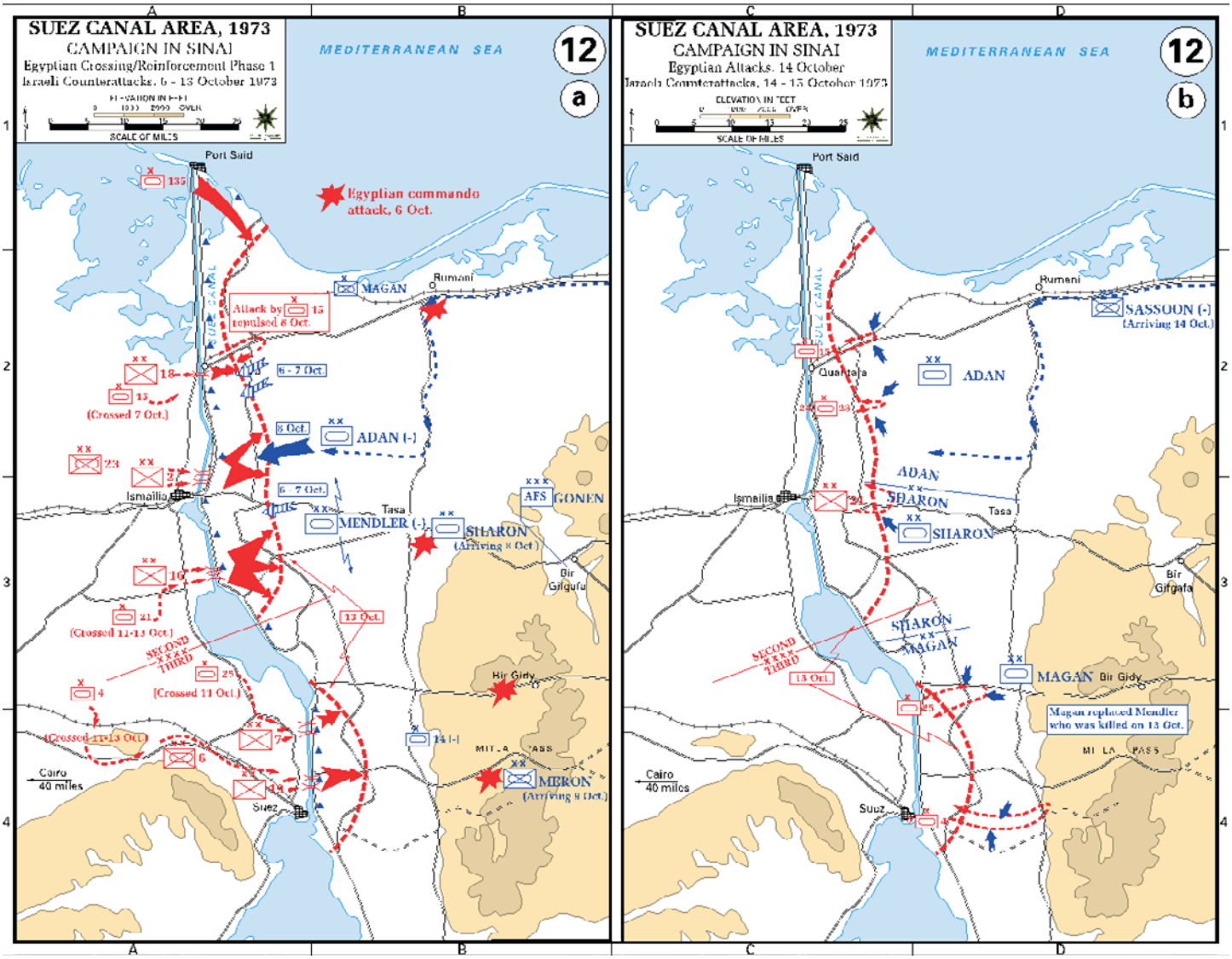


Figure 2. The Execution of Operation Badr Map, Oct. 6-15, 1973 (Courtesy illustration).

neuver elements on the attack neutralized the Israeli air force attempting to halt the advance. Using a creative solution to the Israeli obstacle belt, the Egyptians used water-cannons to blast holes in the sand berms blocking the way for armor and infantry Soldiers. In just 24 hours, they were able to surge almost 100,000 Soldiers and 1,000 tanks to the eastern side while inflicting tremendous casualties on the Israeli armored division securing the Bar-Lev line. The Israelis mobilized their reserves and scrambled sorties but were ineffective, losing at least 40 aircraft to air defense fire. The Egyptians took advantage of the weak Israeli front. From Oct. 8-14, they were able to consolidate gains and defeat enemy counterattacks under the coverage of SA-6 surface-to-air fire.

On Oct. 14, however, despite opposition from his senior officers, Sadat ordered the execution of Granite 2. Israel was imposing intense pressure on Egypt's Syrian ally in the Golan Heights. Sadat hoped to distract the Israeli Army long enough to allow Syria to regain the initiative. Egypt attacked east without SA-6 coverage. Attempts to move some of the batteries to support the attack were frustrated due to a lack of mobility training and planning. As a result, Egyptian organic Man-Portable Air-Defense Systems (MANPADS) and anti-aircraft machine guns supported the armored attack alone. Israeli fighters immediately began to destroy the exposed tank formations as Israeli armor counterattacked the disintegrating organization. Following the defeat of the Egyptian Granite 2 advance, Israeli armor exploited the gap created in the line along the Suez Canal. Israeli tanks destroyed SA-6 batteries emplaced near the crossing sites, opening the skies to the air force. Fully enabled in all domains, the Israeli Defense Force enveloped the Egyptian Third Army claiming victory.

Assessment

In the Meuse-Argonne, the AEF's hard success came only after Fires systems were positioned to enable maneuver. Simple in concept, field and anti-aircraft mobility proved difficult in execution. Subsequent battle positions

had to be planned, and movements timed to keep up the coverage of the maneuver force. Divisions that outran Fires coverage were destroyed during the early days of the Meuse-Argonne. Fires dictated reach and tempo, while detailed phasing preserved the force by mitigating lapses in support as far forward as feasible. In the Sanai, Egypt initially met with overwhelming success, backed by the defense of newly acquired air defense systems. Exploitation of successful penetration was not adequately planned. Air defense systems were not effectively integrated into the sequel plan. Egyptian maneuver forces outran their coverage and were routed by the Israeli Air Force.

Success in large-scale combat operations in a near-peer fight requires mobile, forward-area air defense enabling freedom of maneuver at the front. Static defense of anti-personnel obstacle breaching system and SPODs will remain a critical requirement. However, as it currently remains the only system with adequate range, Patriot forces, in addition to emergent M-SHORAD, will need to directly support maneuver to provide adequate operational reach. In doing so, due to electromagnetic risk, batteries and sections may be required to fight decentralized from battalion headquarters, clearing Fires through a jointly-manned, Army chain of command. This concept presents a shift in mentality and doctrine for the Air Defense Branch.

The application of cross-domain Fires within the construct of LSCO is complex, requiring unity of command to prosecute targets across multiple domains simultaneously. To do this effectively, the command must possess adequate engagement authority for each domain Fires are to be employed within or through to establish and maintain windows of dominance. This applies to all Fires be they surface-to-surface or air, physical-to-virtual, electromagnetic, or otherwise. The structure for the establishment of such a kill-chain already exists in our brigades, divisions, and corps in the form of the Fires cells, tactical air control parties, Area Denial Artillery Munition ADAM/Brigade Aviation Element (BAE), Joint Air Ground Integration Center (JAGIC), and Air Support Operations Centers (ASOC). By leveraging intelligently designed procedural fire control measures where available and processing further engagements through supported battlespace owner Fires networks, we can preserve tempo. Operational reach is extended forward by phasing air defense firing unit movements in advance, based on maneuver plan DSM conditions developing in the fight.

Conclusion

This article is in no way a statement that I have discovered the AMD "golden ratio" or that I have all the answers. Rather it is an attempt to relay the many discussions Air Defenders are having about the reintroduction of not only SHORAD but Air Defense Artillery to the Army. LSCO and MDO as doctrine and theory present the force with a solid foundation upon which to design and plan operations with shared understanding. When confronted with the near-peer A2AD problem and a finite set of resources to achieve simultaneous multi-domain dominance, solutions become more challenging. As Air Defenders in LSCO and future MDO, it is our job to fully understand the multi-domain environment and the ground tactical plan for both ourselves and the enemy. Air defense officers must provide the maneuver commander with a support plan that not only enables a position of advantage but maintains said position while preserving branch plan options. Windows of dominance will be achieved by a simultaneous contest of all domains to preserve maneuver combat power and initiative in an environment without comprehensive air superiority.

What I have found in discussing AMD support to LSCO is there are many like-minded Air Defenders out there who have never abandoned worship at the altar of the rifleman. A more accurate assessment of the air defense officer corps might be: there exists a cultural divide between those who have LSCO "buy-in" and those who are consciously opting-out of the LSCO educational mindset. For the latter, LSCO and MDO represent an uncomfortable change, disrupting an understanding of how and where air defense operates. The value in detailed planning of air defense support to corps, divisions and brigade combat teams is cast-off as "low probability" to resume routine certifications and rotations to the Central Command area of responsibility. Despite cultural resistance, the last 15 years of static defense are coming to a close, ready or not.

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In the next issue of Fires

July-August 2019, Adaptable Fires for multi-domain operations. How is the Fires force operating as part of the joint dynamic to penetrate and disintegrate enemy anti-access and area denial systems; exploit the resulting freedom of maneuver to defeat enemy systems, formations and objectives and to achieve strategic objectives; and consolidate gains to force a return to competition on terms more favorable to the U.S., allies and partners? This issue will also discuss the Army Multi Domain Targeting Center's mission and Fires force modernization to be effective in multi-domain operations.

The deadline for submissions is June. 1, 2019. Send your submissions to usarmy.sill.fcoe.mbx.fires-bulletin-mailbox@mail.mil or call (580) 442-5121 for more information.

Capt. Colby S. Miller, Phenix City, Alabama native, infantry officer, 2nd Infantry Division/ROK-U.S. Combined Division, negotiates an obstacle course, March 22, in preparation for the 2019 Best Ranger Competition taking place at Fort Benning, Ga., April 12-14. Miller and Capt. Jonathan J. Kaminski, Atlanta, Ga., native, field artillery officer, 2nd Combat Aviation Brigade, will compete as a two-person team against more than 50 other Ranger teams (Sgt. Raquel Villalona/2nd ID).