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Purpose

Originally founded as the Field Artillery Journal, the Field Artillery Professional Bulletin serves as a forum for the discussions of all U.S. Army and U.S. Marine Corps Field Artillery 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 Fires, both lethal and nonlethal; fosters Fires interdependency among the armed services, all of which contribute to the good of the Army, Joint and combined forces and our nation. The Field Artillery Professional Bulletin is pleased to grant permission to reprint; please credit Field Artillery Professional Bulletin, the author(s) and photographers.

Cover

The muzzle blast of an M777A2 155 mm "Triple-7" artillery weapon. *Photo credit: U.S. Army.*

Commandant's Forward

BG Andrew D. Preston
U.S. Army Field Artillery
School Commandant

These are exciting times within our branch and the Field Artillery school! Since I took on the responsibilities of the Chief of the Field Artillery and the 55th Commandant of the United States Army Field Artillery School, I have had the opportunity to visit with a number of students and instructors in various classes on Fort Sill and with Field Artillerymen and women across the Army. I am very encouraged by the state of our branch.

Our Field Artillery is made up of bright and enthusiastic people who have volunteered to serve their Nation; and we are lucky to have such outstanding Officers, Warrant Officers, NCOs, and Soldiers.

All Soldiers deserve great leadership, and my commitment to you is to provide multiple opportunities for leader development throughout your careers.

As our Force grows, it must also modernize, and we continue to increase lethality to ensure our Soldiers never have to fight a fair fight.

At the Field Artillery School we are evaluating what we teach, specifically how we prepare our Redlegs to fight and win during Large-Scale Combat Operations in all domains.

Starting with our Lieutenants, we provide tough and realistic training to Basic Officer Leader Course Students through execution of realistic Fire Support lanes, including a "walk and shoot" LFX, and a Culminating Training Exercise.

And for Captains, we continue to refine and improve their culminating training event known as Operation Purge in the Field Artillery Captain Career Course.

For Warrant Officers, the recruitment, development, employment, and retention of our Field Artillery Warrant Officers is critical to the success of our Targeting enterprise. We continue to select the most qualified Non-Commissioned Officers to become 131A Field Artillery Targeting Technicians.

As we invest in our People we must also modernize to maintain overmatch of our adversaries and enable MDO transformation; giving our highly skilled Redlegs the tools they need to fight and win during Large-Scale Combat Operations in all domains.

We must close all range and lethality gaps through our modernization efforts. By 2023, the U.S. Army will begin delivering a portfolio of strategic, mid-range and short-range Fires capabilities that will change the battlefield calculus against our competitors, through significant upgrades to our cannon, rocket, and missile force.

We are also modernizing our force at echelon, including significant investments at Theater, Corps and Division to transform as part of a Multi-Domain Operations (MDO) capable force.

At strategic levels, we are fielding a Theater Fires Command and Theater Fires Element in Europe and the Pacific in FY22. We are standing up Multi-Domain Task Forces to support Combatant Commanders across the globe.

In addition, in synchronization with the CSA's priorities, we will field a Long-Range Hypersonics Weapons Capability, enabling Combatant and Joint Force Commanders the ability to leverage Surface-to-Surface fires for strategic effect.

At tactical level, we will increase lethality and our ability to synchronize Fires through the creation of eight Army National guard Division Artilleries by 2028, with the first standing up this year.

At the operational level, we are developing a ground-launched, mid-range Fires capability as part of our modernization strategy known as Mid-Range Capability or MRC. MRC addresses a need identified by the FY20 Strategic Fires Study in coordination with key theaters and combatant commands. As approved by the Secretary of the Army, the Army Rapid Capabilities and Critical Technologies Office (RCCTO) is developing and we will field the initial prototype MRC operational battery in FY23.

There remains a clear need for a Field Artillery Command and Control capability at the Corps level. Currently we have no JFLCC capacity to Command and Control multiple Field Artillery Brigades. A Corps-level Operational Fires Command is needed to synchronize Joint Fires with Formal Target production capability and Command and Control multiple Field Artillery Brigades.

As we work to increase lethality and range at the tactical level, we will transition our active component 2 x 8 Rocket Battalions to 3 x 9 and our Army National Guard Echelons above Brigade 155 BNs from 3 x 4 to 3 x 6.

By FY25 we see the DIVARTYs role increasing as we begin to field Extended Range Cannons. The Extended Range Cannon Artillery will double the current M109 reach with ranges of over 65 km. Precision Strike Missiles replace the Cold War-era ATACMS, increasing the range of the Army's MLRS and HIMARS missile launchers from 300 km to around 500 km, with a future upgrade aiming for much greater distance.

What an exciting time to be a Field Artillery professional! In order to meet the challenges of the future, we must continue to prioritize leader development, modernization, and continue to enhance lethality to ensure our Soldiers never have to fight a fair fight. The state of the Field Artillery is strong.

King of Battle!

CSM Michael J. McMurdy
Command Sergeant Major
of the Field Artillery

Redlegs,

It has been a year of progress and change across the Branch, our 55th Chief and Commandant of the Field Artillery has the team laser-focused on maintaining momentum while implementing change to meet future requirements! Watching our current and future leaders navigating and professionally addressing the challenges of today and tomorrow continues to be impressive and reassuring. Based on BG Preston's priorities, here is what you should expect to see from the team and myself across leader development, Functional and Primary Military Education (PME), Self-Development, and opportunities for our Enlisted Artillery Women and Men:

-DA PAM 600-25 Update: ALL Enlisted MOS's and Grades are updated on MilSuite at https://www.milsuite.mil/book/groups/smartbook-da-pam-600-25 dated 10 Aug 21. Please take time to review these critical changes/updates to our Redleg Career Maps!

-Project Athena: We have completed our portion of the TRADOC Pilot Program in our 13 Series Senior Leaders Courses and are on glide path to incorporate Project Athena across all PME courses beginning in October 2021. We are messaging to the force to become familiar with the program, and you do not have to wait to utilize this Self Development resource just in PME. See for yourself at https://capl.army.mil/athena/#/.

-FA Master Gunner Redesign: Directorate of Training and Doctrine handed off the proposed five-week Program of Instruction to the FAMG Division for validation and edits. Upon completion, we will send it to Operational Unit leaders for comments and adjudication. Courseware, simulations, and connectivity are all on track to run the pilot program in FY23 -- assuming the Course Growth Request is approved and supported by Senior Leaders this fall for full implementation in FY24.

-FA Pre-Command Course Redesign: In preparation for the FY22 CAC mandated one-week Branch PCC, we ran our last FY21 course (26-30 July) as a pilot to allow for adjustments. Notable changes include- Incorporate Tests/Assessments- Assess students' ability to fight (technical and tactical competence), develops FA Specific IDP to correct knowledge gaps, and link assessments with leader developmental resources. CSM selects will continue to be invited to attend!

- Edition 4 of our Saint Barbara Enlisted SITREP is scheduled for release at the end of August. Previous editions can be viewed at https://sill-www.army.mil/USAFAS/stbarbenlisted/ or with this QR Code:

We are humbled to serve you and our Field Artillery community. We look forward to another year of progress, leader development, and driving change. Guns up and King of Battle!

RL7


"TODAY'S ARMY IS MUCH LESS ABOUT THE KNOWLEDGE WE HAVE, SO MUCH AS THE KNOWLEDGE WE CAN SHARE."
FKN
FIRES
KNOWLEDGE
NETWORK
FOLLOW THIS LINK TO THE BRAND NEW FIRES KNOWLEDGE NETWORK:
HTTPS://INTRANET.TRADOC.ARMY.MIL/SITES/FKN/

"Renown awaits the Commander who first restores artillery to its prime importance on the battlefield." ~ ***Winston Churchill***

Processing, Exploitation and Dissemination Enabled-Dynamic Targeting at the Division Artillery:

Adjusting the Counterfire fight for today's Large-Scale Combat Operations

By MAJ Andy Spiess, CW3 Michael D'Urbano, CW2 Josh Moore, COL Brett Forbes

Since shifting our fighting focus from counter-insurgency to Large-Scale Combat Operations (LSCO), the Army has done a tremendous job of promoting the deliberate targeting process. Considerable efforts have been expended ensuring this is a focus area for Commanders and staff at all echelons, demonstrating that it is critical to operational success in LSCO. While the force has worked hard to formalize, understand, and train the deliberate processes associated with targeting, it has continued to struggle with dynamic targeting and counterfire which comprises the majority of targets executed during operations. Echelons above Brigade (EAB) formations are largely ineffective with current processes and systems associated with dynamic targeting and counterfire. This reduces flexibility with Joint Fires, often causing missed opportunities to gain the competitive advantages required to win in LSCO against near-peer adversaries.

Commanders at echelon are challenged with incorporating the dynamic process of proactive counterfire, as defined in ATP 3-09.12, *Field Artillery Target Acquisition*, within the Division Targeting Processes. Most Commanders and Fires cells continue to employ a counterfire process similar to that used in World War II, and again during the Gulf War and Operation Iraqi Freedom, against what proved to be overmatched, mostly stationary, enemy Fires forces. Employing this process has caused the same personnel to become frustrated by only achieving moderate success against a contemporary, highly mobile Opposing Force (OPFOR) Fires structure. Observations during the last two years of Warfighter Exercises (WFXs) show Division Artillery (DIVARTY) formations were effective with the deliberate targeting process, but for dynamic targeting across the Division seemed to be serving only as a response cell for Fires vice an enabler. Analysis, air de-confliction procedures, positioning and terrain management, ammo consumption rates, and firing orders all come together to catch only the slowest of today's highly survivable OPFOR Fires Systems, demonstrating that we must adapt to the changing nature of competitive warfare. Failure to adapt to operating in this dynamic Fires environment will place Divisions in a position where they are limited in their ability to execute multiple engagement iterations, forcing subordinate units to continuously fight in unfavorable force ratio conditions, or worse, forcing culmination for the Division.

DIVARTYs must be able to provide the additional capacity needed to assist the Division in maintaining consistent pressure on the enemy through dynamic targeting efforts that ensure the flexible, effective, and timely delivery of Joint Fires. DIVARTYs are continually challenged in LSCO to shape the Division fight through counterfire against an enemy with rapid displacement times, greater range, greater quantity of munitions, and more Fires delivery systems. Even with these disadvantages, the DIVARTY is still expected to meet target decay standards, destroy identified high payoff targets, preserve our limited extended range munitions, and protect our delivery platforms. To effectively accomplish these expectations, and adapt to today's dynamic Fires environment, we must be more innovative with our processes, optimizing Fires to mitigate the challenges associated with overcoming the enemy's numerical and time-distance advantages while fighting as an economy of force.

Negating the Tyranny of Time and Distance

At the Division level, reactive counterfire, or Counter-Battery Fires, is mostly ineffective based on the sheer distances being fired, time of acquisition, time of flight for the enemy and friendly Fires, and clearance procedures (even if fully digital and automated). When these actions are added together we are already beyond an acceptable time to have rounds impacting on targets before they displace. The algebraic problem of counterfire at the Division or above level (acquisition time + processing time + air clearance + time of flight + time at the launcher ≠ effects on targets) has become increasingly challenging as the technological advances and improved survivability of enemy delivery systems have proven to be major stimuli to the changing nature of competitive warfare. OPFOR and friendly losses at this level are generally from Proactive Reconnaissance and Intelligence, Surveillance and Reconnaissance advancements rather than reactive counterfire. Ultimately, the force that more effectively operationalizes these capabilities will be superior in mitigating the effects of time and distance and be better postured to win the Fires fight, through proactive measures.

To accomplish this, the 1st Cavalry Division Artillery (1st CAV DIVARTY) sought to operationalize the Processing, Exploitation, and Dissemination (PED) of data from various information collection platforms belonging to the Expeditionary Military Intelligence Battalion (E-MIB). The theory was

that integration of PED into not only the targeting process but into the kill chain would enhance a dated counterfire process that was not producing the effects needed for the Division. The 1st CAV DIVARTY fused organic and distributed sensors to create situational awareness overmatch. This enabled the DIVARTY to defeat an OPFOR with superior range, a superior quantity of munitions, and tube overmatch- while ensuring air clearance did not hinder the process. This solution bridged the gap between the Intelligence and Fires Warfighting Functions, empowering the Counterfire Headquarters (CFHQ) to win the Fires fight. This PED-enabled dynamic targeting became a deliberate but highly responsive and flexible process that integrated an additional cell into the command post and restructured how the DIVARTY fought.

CW3 Stephen Barber published a white paper outlining and describing how the integration of PED capabilities into the DIVARTY would provide additional lethality for the Divisions they supported.[1] Based on these concepts, 1st CAV DIVARTY made the Tactical – Intelligence Ground Station (TGS) PED platoon, out of 163rd E-MIB, the centerpiece of intelligence support to the targeting process. The TGS PED Platoon (PLT) *(Figure 1)* enhanced intelligence capability and capacity to support Fires through the analysis of Geospatial Intelligence (GEOINT) and Signal Intelligence (SIGINT). This capability was then immediately fused with counterfire and Sentinel RADAR common operating pictures. This multi-intelligence discipline PED PLT construct enabled real-time tipping and cueing between SIGINT, GEOINT, and DIVARTY RADARS, ensuring greater accuracy and clarity in the depiction of enemy disposition, composition, strength, and combat effectiveness. This also allowed for better articulation and shared understanding of the battlespace between the DIVARTY, Division G2, Joint Air Ground Integration Cell (JAGIC), and other Division staff entities. The PED capabilities were physically located on the operations floor in the DIVARTY Main Command Post, adjacent to the Fire Control Element (FCE), Counterfire Element, and the Brigade Aviation Element (BAE), further expediting the improved situational awareness and subsequent actions.

Tipping, cueing, and analysis from the PED PLT, counterfire section, BAE, and the DIVARTY Targeting Section led to continuous dynamic operational planning and adjustments. Effectively employing Target Intelligence Data

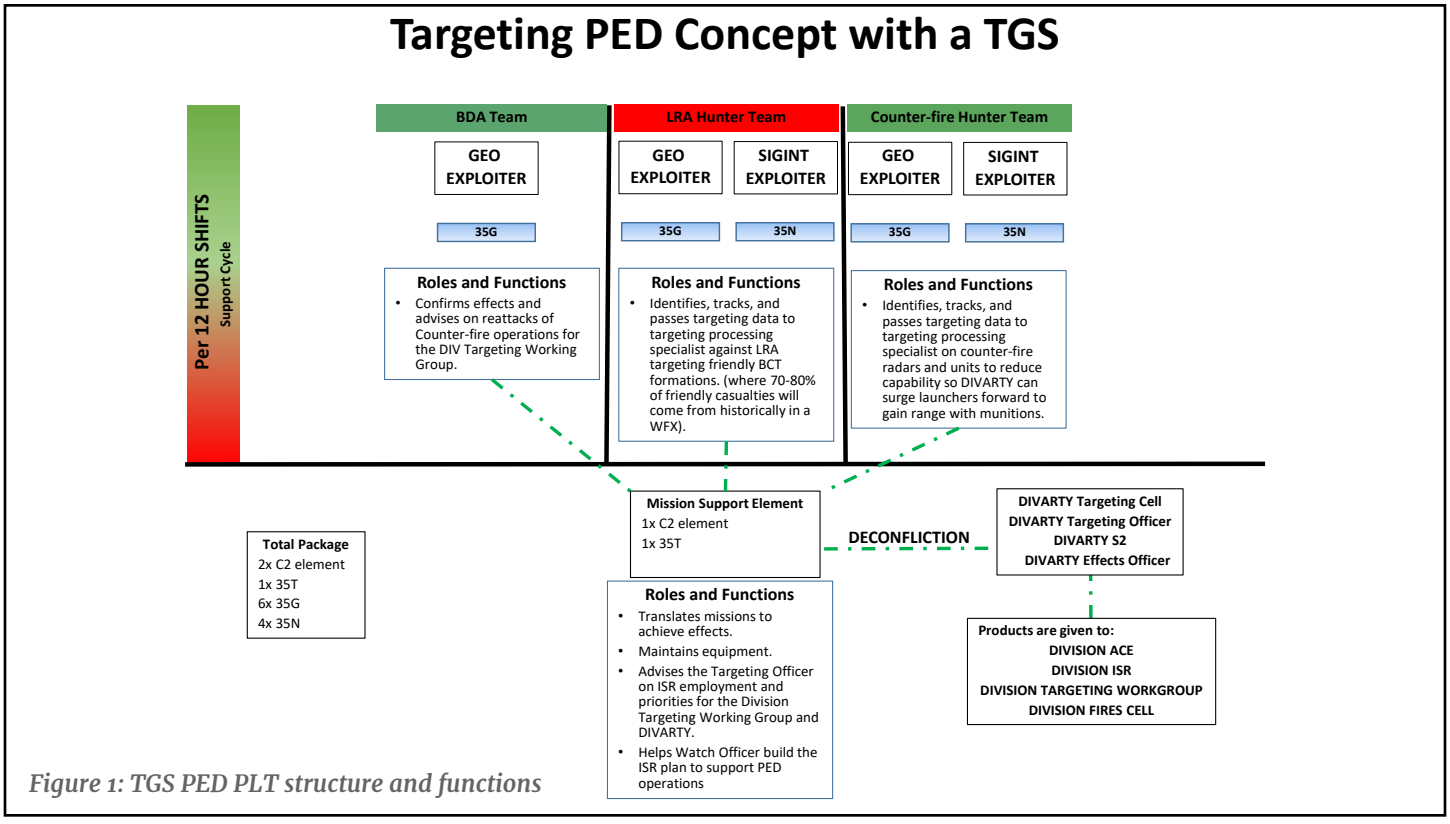


Figure 1: TGS PED PLT structure and functions

1 CW3 Stephen Barber, "Division Artillery (DIVARTY) S2 Lessons Learned and Best Practices in Large-Scale Combat Operations", *CALL Insider*, 4th QTR FY2019, pg. 2

from Distributed Common Ground System-Army (DCGS-A), allowing for timely and accurate Fires against a particular target set. Before the Division Targeting Working Group (TWG), the DIVARTY Targeting Officer would meet with Division (DIV) G2 Targeting Officer and identify what area of the battlespace DIVARTY was able to affect based on munition type, quantities, with current and future Position Areas for Artillery (PAA) locations. This process proved most effective when these Target Intelligence Data areas were close to the Coordinated Fire Lines and were tied to pre-established Air Coordination Measures developed through the dynamic targeting process.

As the DIVARTY became more proficient with utilizing the PED as an integrated part of the staff, it became apparent that the algebraic counterfire problem had been significantly mitigated. The PED-enabled process allowed the DIVARTY to be the hunter in the Fires fight instead of reacting to enemy Fires, thus providing effects (both lethal and non-lethal) on the enemy at a time and place chose by the Division. Weaponizing the PED capability ensured the DIVARTY negated the normal time-distance Fires advantage enjoyed by OPFOR. This resulted in the DIVARTY dictating the tempo of the Fires fight by mixing innovative dynamic targeting with existing counterfire capabilities to effectively employ flexible Fires in the LSCO environment.

Fighting as an Economy of Force

Prevailing thoughts and history lead most to believe that any future LSCO will occur outside of mainland United States. This will require our forces to be capable and effective when fighting as an expeditionary force. These expeditionary operations will constrict critical areas associated with targeting and Fires employment for our Divisions, making the Fires fight -- specifically counterfire and Division shaping -- an economy of force. Limitations in areas such as ammunition, personnel, and equipment necessarily become part of the operational equation during the planning and execution of Fires. To address overcoming these challenges, the 1st CAV DIVARTY established processes with the PED PLT and Division staff to ensure the effectiveness of these limited and critical Fires resources and assets. These processes included unique adaptation and use of Intelligence Preparation of the Battlefield (IPB), actions in "the Pit," and setting conditions across the Division battlespace in multiple domains.

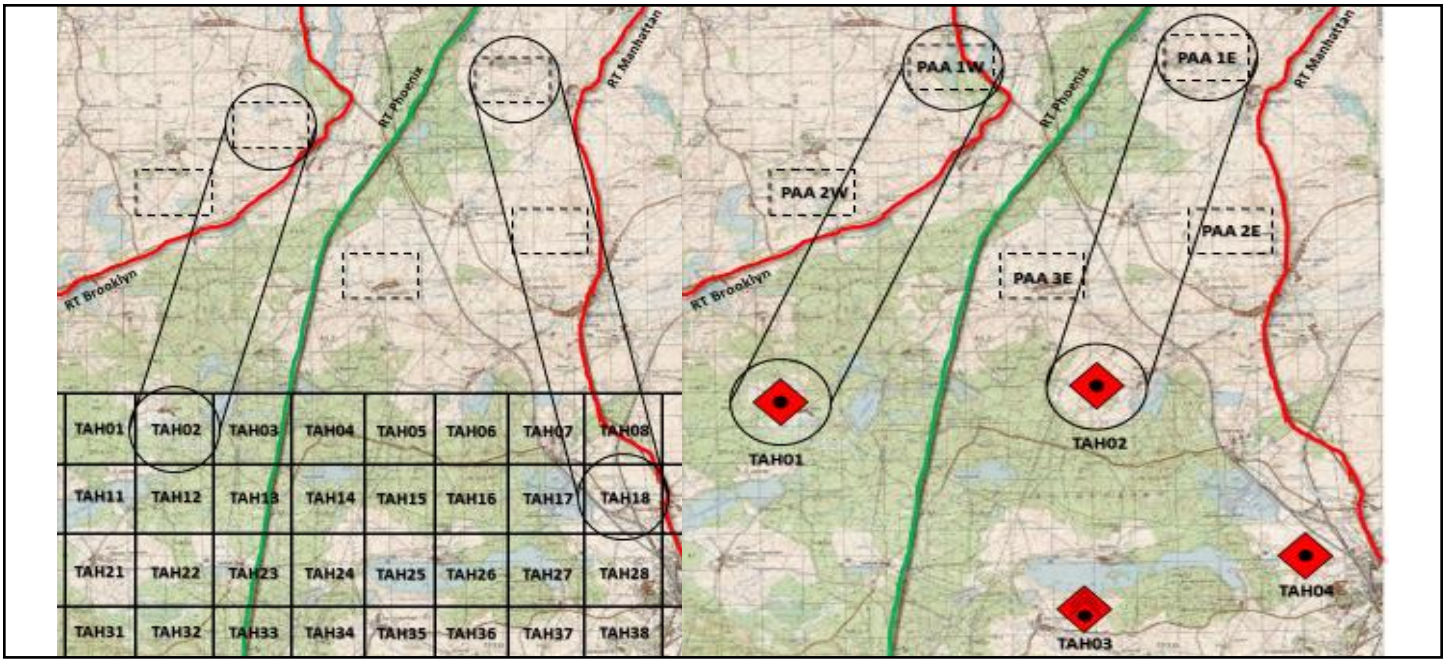
IPB Use and Integration:

MAJ Leslie A. Stanfield, the former DIVARTY S2 for 1st Armored DIV, detailed the benefit of "artillerizing" G2 products in his white paper "Artillerization of IPB in Large-Scale Operations."[2] While 1st CAV DIVARTY adopted these methods, the DIVARTY S2 targeting team differed from other formations by developing a process to transition and translate the artillerized IPB into operational action. The DIVARTY used the products from this process to assess when Target Area Hazards (TAHs) would be active. The DIVARTY S2 assessed that these TAHs may be spread across the area of operations to match potential OPFOR PAAs in restrictive terrain *(reference Figure 2, next page)*, or overlaid in a keypad system in terrain that offers more mobility *(reference Figure 3, next page)*. The 1st CAV DIVARTY IPB process was adjusted to create precleared airspace based on terrain and OPFOR course of action analysis. The DIVARTY S2 and operations section, synchronized with the PED PLT, continuously monitored the OPFOR locations and movement. They ensured Airspace Coordination Measures (ACMs) were properly activated through the Division JAGIC at the correct time to mass based on our positioning, weapons ranges and ammunition available. The process provided improvements in four key areas: use and integration of artillerized IPB, informing and enabling dynamic targeting, allowing for freedom of Fires based on better JAGIC understanding and planning for the dynamic environment, and ensuring the effective use of limited ammunition. This proved to be critical in setting conditions for the success of the DIVARTY with dynamic targeting and counterfire-related actions.

Establishment and Actions in 'The Pit':

The DIVARTY Targeting Cell and the PED PLT established operations in a section of the DIVARTY command post floor called 'the Pit.' This entity focused on developing, synchronizing, and actioning targets within the DIVARTY's identified targeting area to shape specific enemy formations and set conditions in the close fight. These actions allowed the Division to focus on other enemy units and associated weapon systems, deeper in the battlespace, utilizing additional lethal and non-

2 MAJ Leslie A. Stanfield, "Artillerization of IPB in Large-Scale Combat Operations", *milSuite*, https://www.milsuite.mil/book/docs/DOC-731235, 15 January 2019.



Above left, Figure 2: Keypad System for permissive terrain. Above right, Figure 3: Keypad System for a restrictive terrain. Below, Figure 4: The "Pit" utilized the Joint Dynamic Targeting Process (Find, Fix, Target, Track, Engage and Assess) nested within the Division targeting cycle to deliver effective dynamic Fires.

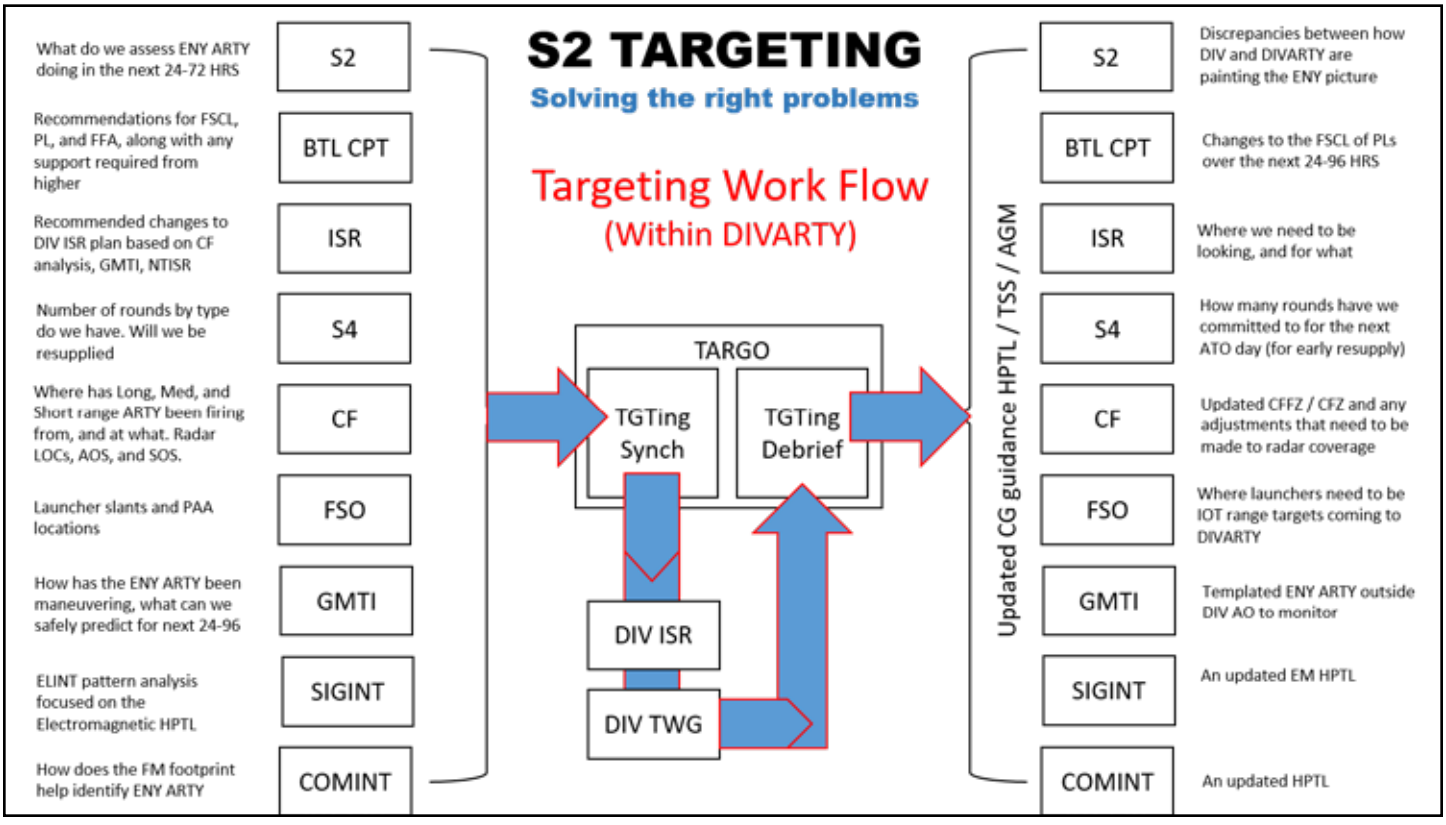
DECIDE **"What are my targets?"**	DETECT (Find, Fix, Target, Track) **"Where are my targets?"**	DELIVER (Engage) **"What am I engaging with?"**	ASSESS (Assess) **"Did we achieve our effects?"**
DIVISION	**RED TEAM**	**DIVISION** / **RED TEAM**	**DIVISION** / **RED TEAM**
TWG conducts deliberate targeting. Output products are TSM, HPTL, and AGM by ATO day that drive DIVARTY priorities.	HPTs are fixed through GEOINT/SIGINT/NTISR/DCGS (35G/35N/35F) means and functionally characterized by DIVARTY PED (35G/35N) and Targeting Analysts (35F). They relay coordinates and descriptions of targets to Target Processing Specialists (13F) co-located in the Targeting Cell and the DIVARTY FAIO (131A). Suspected targets are categorized in accordance with the HPTL, AGM, and TSS as Dynamic Targets (DIVARTY). Dynamic targets are identified by PED analysts and validated by the FAIO. Unplanned or unanticipated (Targets of Opportunity) are validated by the FAIO for synchronization. ISR confirms geo-coordinates for target location accuracy through one of several battle drills. DIVARTY Radars acquire Fires and Airborne systems to cross cue threats to validate correlation and categorization with the PED.	Validated Targets are assigned target numbers from the DIVARTY S2 Targeting Block for the FCE to process. Targets submitted for execution are IAW the 1st CAV DIV TSS, AGM and HPTL. Fire Missions are processed through JADOCS within the Targeting Cell to the AFATDS within FCE, or are routed to the JAGIC for prosecution with air or corps fires assets.	Combat Assessments are determined through post attack observations and munitions effectiveness for BDA to be sent to the DIV ACE.

lethal Fires assets. 'The Pit' distinguished these two areas of focus as the "near deep" and "far deep" battlespace. This ensured the Division and DIVARTY were able to achieve the Commander's intent by maximizing available assets without duplicating efforts. Targets found by 'the Pit' within the identified Division focus area were routed through the G2 Field Artillery Intelligence Officer (FAIO). This enabled the Division and the DIVARTY to create multiple dilemmas for the OPFOR by delivering effective dynamic Fires across the Division AOR in a simultaneous vice sequential manner (*Figure 4, previous page*).

Synchronization within 'the Pit' was critical to winning the Fires fight, bringing together all assets and processes to focus on solving the right problems. The 1st CAV DIVARTY accomplished this through two battle rhythm events -- the Targeting Synch and the Targeting Debrief. The outputs of the Targeting Synch served as DIVARTY inputs to the TWG driving the Division targeting efforts and establishing the dynamic Fires environment. At the Targeting Synch, key personnel met with the DIVARTY senior targeting officer to provide all relevant information necessary to shape actions of the Division Fires, the G2 information collection plan, and G3 aviation at the Division TWG. Once these shaping efforts were approved at the Division Targeting Decision Board, the DIVARTY senior targeting officer would conduct the targeting debrief. This critical back brief to key personnel provided the updated Division Commander's targeting guidance, DIVARTY Commander's guidance for Fires, High Payoff Target List (HPTL), focus areas for DIVARTY specific targeting, recommended changes to PAA locations (to range new targets assigned to DIVARTY), rounds committed (to assist the S4 with timely resupply), and any changes to Airspace and Fire Support Coordination Measures (*Figure 5 – Targeting Workflow*). This debrief served as the critical synchronization and operational meeting for the DIVARTY and dynamic targeting operations. The conditions setting and synchronization processes put in place with these battle rhythm events ensured a permissive Fires environment was established, facilitating the dynamic targeting in the DIVARTY and allowing 'the Pit' to focus on improving and streamlining delivery methods associated with these dynamic targeting efforts.

'The Pit' focused on improving two delivery methods -- modifying the traditional counterfire process and utilizing proactive Fires to stimulate enemy actions. The 1st CAV DIVARTY modified the counterfire process by leveraging and integrating the combined sensors available to the DIVARTY and the PED PLT to engage the enemy in hiding sites or follow-on firing points. The DIVARTY

Figure 5: Targeting Workflow



Counterfire Officer (CFO) worked closely with 'the Pit,' relying on tactical patience while hunting enemy Fires system assets. The combination of these efforts provided the greatest probability of effects and ensured limited Fires assets were effectively employed. The 1st CAV DIVARTY adjusted the counterfire drill to incorporate the integration of the PED PLT. Upon receiving a counterfire acquisition, the PED PLT would identify and follow enemy Fires assets, across the entire Fires system, through Ground Movement Target Indicators (GMTI) or Full Motion Video (FMV). The SIGINT section would identify enemy counter-battery RADARS and command nodes threatening the DIVARTY counter-battery assets and actions. Once halted, the PED PLT would notify the Targeting Section that targets were stationary, and identify any threat command nodes and sensors. The DIVARTY FAIO would then recommend targeting options based on the HPTL, Army Geospatial Enterprise, and Target Selection Standards. Targets were then pushed to either the DIVARTY FCE or the Division JAGIC for support. During assessed times of high volumes of counterfire (i.e. wet gap crossing), the CFO was provided a dedicated firing unit allowing for a streamlined sensor-to-shooter kill chain alleviating the bottleneck of missions at the DIVARTY FCE.

The second delivery method improvement was the process of using proactive Fires to stimulate the enemy during times of limited indirect Fires and activity. Based on the dynamic targeting capabilities, the DIVARTY looked for ways to maintain constant pressure on enemy high payoff targets and Fires systems, especially when enemy formations decided not to unmask through firing. Rather than waiting for confirmed targets generated by counter-battery RADARS or sensing efforts of the PED PLT, 'the Pit' developed a target list of assessed enemy locations based on the updated enemy situation template. Based on this analysis, The DIVARTY would select and fire on the most likely areas for enemy formations, utilizing a minimal number of rockets to ensure the optimization of limited Fires resources. Once fired, the PED and Targeting section observed targeted enemy locations through Electronic Intelligence, Communications Intelligence, GEOINT (FMV and GMTI), the air picture, and Q53 RADARS to confirm enemy locations and drive dynamic targeting efforts and maximize lethality with the ammunition available. A similar battle drill was used with great effects during WFX 18-05 and was improved through the addition of PED support and the processes outlined in this article during 1st CAV DIVARTY exercises in preparation for WFX 21-1. These efforts not only provided the DIVARTY more lethal capabilities as a dynamic targeting entity but allowed the DIVARTY to maximize opportunities by taking advantage of the permissive Fires environment established by the Division.

Setting Conditions for Dynamic Targeting Success:

The success of PED-enabled dynamic targeting is reliant on the full support and commitment from the Division through prioritization of Fires and supporting efforts across the Division staff. Clear messaging of requirements, risks, and capabilities from the DIVARTY to the Division staff is critical to shaping operations and ensuring conditions support the processes associated with dynamic targeting. Division operations need to prioritize movement of Fires formations early to ensure range capabilities through forward positioning, preferably directly behind, or with, reconnaissance elements. Division emphasis on the clearance of Artillery Operation Areas and defense of critical Fires assets has to be a part of initial operations. To facilitate continued lethality and the ability to gain and maintain the tempo of the Fires fight, the Division G4, and the Sustainment Brigade must prioritize the throughput and forward staging of Class V. There must also be a firm understanding across the Division of authorities associated with Fires employment and a universal trust and understanding between the Division leadership and the DIVARTY on resource allocation. These two areas will ensure proportional and effective use of munitions on the right target and the right time, and provide the Fires team the freedom to act within the Commander's intent to facilitate speed of action in today's dynamic fight. While all of these areas are needed, the G2 and the JAGIC are even more critical in setting conditions for dynamic targeting at the DIVARTY.

The success of PED-enabled dynamic targeting is reliant on the full support and commitment from the Division...

The Division G2 must prioritize collection for the DIVARTY at key portions of the fight, some of which are long in duration. During the last Command

Post Exercise (CPX) conducted, the G2 even went so far as to plan stimulation operations with its organic collection assets to enable targeting by the DIVARTY. The prioritization of DIVARTY in the Division's overall collection plan enabled the PED PLT to leverage multiple capabilities across the GEOINT and SIGINT disciplines. DIVARTY was also incorporated into any analysis and G2 internal planning for all operations serving as an extension of the Analytical Control Element. This increased integration resulted in continuous communication and enhanced sharing of data and analysis enabling the success of the dynamic targeting processes at the DIVARTY and Division.

The JAGIC has to understand and be capable of rapidly establishing or adjusting coordination measures to facilitate a permissive Fires environment across the Division battlespace. While this should be the goal all of the time, it is imperative for the success of dynamic targeting. The 1st CAV DIVARTY accomplished this by establishing a Free Fire Area (FFA) drill with the JAGIC to ensure the rapid and dynamic establishment of a permissive Fires environment. When stimulation and analysis at the DIVARTY had developed enough of a refined understanding of current enemy locations to mass effects, this drill would be executed. Through the use of an EVENT TEMPLATE, Q53 acquisitions, and the DCGS-A family of systems 'the Pit' was able to find and fix groupings of DIV HPTs. Once identified, 'the Pit' would coordinate with the JAGIC to plan periods of precleared air associated with large free fire areas. In 'the Pit', this stimulation and analysis process was continuously allowing for constant validation or adjustment of airspace coordination measures and FFAs. During the analysis process, the PED PLT and Targeting section would account for additional areas that could potentially be used by OPFOR HPTs based on time-distance analysis and possible subsequent fighting/firing locations. The JAGIC would rapidly coordinate and gain approval for adjusted airspace and dynamic coordination measures based on this analysis. This drill ensured the Division effectively shared airspace with all users while enabling freedom of surface-to-surface Fires anywhere in the FFA without hindering airspace operations. Initially, this drill took over an hour but by the last CPX was being executed in less than 30 minutes and became a routine battle drill that was conducted multiple times during each Authority to Operate period. While airspace planning continued to be a critical part of the deliberate targeting process, this drill allowed the Division and DIVARTY to be extremely flexible in adjusting airspace to account for the dynamic Fires environment with no impact on other Division assets.

The JAGIC has to understand and be capable of rapidly establishing or adjusting coordination measures to facilitate a permissive Fires environment across the Division battlespace.

Results and Takeaways

The PED PLT proved to be essential to the DIVARTY in its role as a CFHQs. By increasing the Intelligence Warfighting Function's ability to support the targeting process and Joint Fires in LSCO, PED integration enabled the DIVARTY to hunt rather than react to enemy Fires capabilities. During five CPXs, operating against free-thinking, near-peer enemy Fires formation, the 1st CAV DIVARTY achieved the destruction of the enemy Fires system within 72 hours. As the DIVARTY grew in experiential knowledge and process repetition, the effects on the enemy become greater and more rapid. In the last three exercises, 75% of all enemy firing systems and 50% of all RADAR systems were deemed ineffective within the first 36 hours. In all exercises the enemy was only capable of employing harassing Fires with remaining delivery systems, having little to no impact on friendly formations or within designated critical friendly zones. Further, the fire control and sensor network of the enemy Fires formations, including all target acquisition capabilities and IFC command and control nodes, were destroyed in their entirety within 72 hours through the integration of PED tipping and cueing through SIGINT and GEOINT.

Even when certain intelligence disciplines were disrupted or taken away, the historical data fused with other active sensors or reporting enabled the DIVARTY to have lethal effects on targets. This demonstrated that the DIVARTY was not leveraging a "one-trick pony" in the PED PLT where the use of GMTI solves all problems. The DIVARTY was moving toward a more aggressive manner to winning the Fires fight as an expeditionary force

against an enemy who thrives on culminating his foe through the use of Fires rather than Maneuver. In the last three exercises, the DIVARTY incurred no more than 10% losses from enemy surface-to-surface Fires and targeting efforts. This demonstrated that once the DIVARTY was in range for allotted munitions, and prioritized for collection, air space, and Class V, the entirety of the enemy Fires system could be defeated rapidly with minimal losses to our long-range Fires capabilities or Division Maneuver formations.

The 1st CAV DIVARTY fundamentally changed the role of the CFHQs. By weaponizing the PED PLT, the DIVARTY transitioned from a reactive response cell to a capable targeting organization that proactively hunted the enemy through an updated counterfire process. This enabled the DIVARTY to establish the tempo of the counterfire fight, rather than the enemy. The 1st CAV DIVARTY did this by successfully integrating PED PLT capabilities, DCGS-A, and RADAR capabilities into a synchronized dynamic targeting process. This dynamic targeting process operationalized artillery-focused IPB to create a permissive Fires environment and effectively countered the enemy's overmatch in surface-to-surface Fires capabilities. It further allowed the DIVARTY to move away from the antiquated counterfire process of reactive counter-battery Fires, which continues to prove ineffective in today's fight because of the tyranny of time and distance and the challenges of operating in an expeditionary, resource-constrained environment where the enemy has an artillery overmatch. PED-enabled dynamic targeting proved to be key for the DIVARTY to negate normal enemy advantages, ensure greater efficiency and lethality in the use of limited Fires resources, and successfully adapt to today's dynamic Fires environment.

The processes and capabilities highlighted in this article are in line with discussions on future functionality of the DIVARTY in the Division Fires Command concept and seem to serve as a bridging effort while the Fires community moves toward capabilities being developed as part of Project Convergence to link any sensor with the best shooter. PED-enabled dynamic targeting significantly increased the number of sensors and analytical capability of the DIVARTY, and provided the ability to adjust counterfire and kill chain processes to streamline action with all available Joint assets. The 1st Cavalry Division Fires Cell and G2 ACE adapted this concept during WFX 21-1 applying it to the "far deep" fight utilizing PED-enabled analysis to drive dynamic actions utilizing the Air Cavalry Brigade, fixed-wing assets, and non-lethal Fires. Overall, this innovative integration of an existing - and underutilized - capability improved lethality, facilitated dynamic targeting actions and regained the competitive advantage for the Division during multiple exercises. For the 1st CAV DIVARTY, this proved to be an effective way to defeat the near-peer enemy Fires threat that normal EAB counterfire operations struggle with concerning today's LSCO. Weaponizing this capability and employing it at echelon proved to be a way to further restore Fires to its important role on the battlefield for our Divisions and should serve as an option for other formations to employ as a capable solution to the challenges of today's evolving dynamic Fires environment.

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CW2 Joshua Moore serves as the Brigade Targeting Officer in the 3rd Armored Brigade Combat Team, 1st Cavalry Division. He has served as a Target Acquisition Platoon Leader, Battalion Targeting Officer, DIVARTY Counterfire Officer, and DIVARTY Lethal Effect Officer. As an enlisted Soldier, he served as an AFATDS Operator and rose in the ranks to Battalion Fire Direction NCO. He currently has a Bachelor's of Arts in Sports and Recreation Management and is currently pursuing a Master's in Early Childhood Education and Leadership.

COL Brett Forbes is currently serving as a J8 Division Chief on the Joint Staff. He has served in various positions and commands, most recently as the Commander for the 1st Cavalry Division Artillery.

Modernizing Danger Close
for 21st Century Combat

By MAJ Jordan M. Funderburk

A U.S. Army Soldier watches for artillery impacts from his observation post.
GRAFENWOEHR, Germany -- U.S. Army Paratrooper SGT Yoshimi Moreno, a Joint Fires Observer assigned to Bravo (Legion) Company, 1st Battalion, 503rd Infantry Regiment (Airborne), 173rd Airborne Brigade, watches for artillery impacts during exercise Eagle Strike on Oct. 26th, 2017. The 173rd Airborne Brigade is the U.S. Army's Contingency Response Force in Europe, providing rapidly deploying forces to the U.S. Army Europe, Africa and Central Command Areas of Responsibility within 18 hours.

The Field Artillery must remain prepared to deliver close supporting Fires in future combat. The U.S. Army's development of long-range precision Fires will increase the capabilities of artillery to strike deep, but ground forces will still close with the enemy. At the front line, warfighters depend upon timely and effective Firepower to defeat their adversaries. Today, Fire missions in close proximity to friendly troops are designated "danger close" within the call for Fire. Generations of fire supporters equate danger close to a target distanced 600 meters or less from friendly troops, no matter the circumstances. However, technological advancements have made the distance of 600 meters an arbitrary line. It is time for the Field Artillery to modernize both the definition and procedures behind a danger close mission to match the realities of modern capabilities and facilitate timely and effective firepower on the front lines.

How We Got Here

The U.S. Army first used the phrase "danger close" in 1967, introduced within FM 6-40, *Field Artillery Cannon Gunnery.* Yet the story of how the term, procedures, and associated distance entered Army doctrine goes back to the American experience in World War I. In 1918, the U.S. Army published the manual *Instructions on Artillery Fire*, which instructed gunners to adjust aimpoints and reduce changes to tube elevation if the target was close to friendly troops. The manual reflected the close coordination seen in World War I between infantry advances and rolling barrages of artillery Fires just ahead of the troops. Following the war, the U.S. Army's artillery doctrine refined these tactics. The 1932 *Field Artillery Field Manual* dictated standing barrages stay

200 to 400 yards ahead of the front line. The manual also added instructions to constantly check the setting and laying of the guns when firing close to friendly troops.

World War II spurred further refinement of definitions and procedures for Fires close to friendly troops. The 1945 version of FM 6-40, *Field Artillery Gunnery*, introduced the concept of creeping adjustments and the terms "close" and "deep." The manual required observers to classify missions as close or deep for naval gunfire but left it optional for ground artillery. Close was any target within 600 yards of friendly forward elements. The naval guns had varied dispersion patterns, with ships using five and six-inch guns for targets in close support of advancing troops. Thus, the Field Artillery adopted its definition from naval gunfire practices.

It was the American experience in Vietnam that provided the final impetus to explicitly adopt danger close into Field Artillery doctrine. U.S. Army doctrine before the war saw few changes besides verbiage and updating the distance measurement from yards to meters. However, as the U.S. Army saw increasingly intense combat in Vietnam, the Field Artillery doctrine evolved to acknowledge the frequency of close supporting Fires. An article in the August 1967 magazine *Artillery Trends* claimed that the 1st Cavalry Division fired up to 50% of all their missions toward friendly troops or into an area virtually surrounded by converging forces. The 1967 version of FM 6-40, covering both gunnery and Fire support, introduced the term danger close and mandated the term's use in ground artillery Fire missions. FM 6-40 also required the Fire Direction Center (FDC) to provide the Probable Error in Range (PEr) to the observer. By the 1970s, artillery doctrine further refined the concept

A gunner makes adjustments to the Howitzer during a Fire mission.
A trooper assigned to Field Artillery Squadron, 3rd Cavalry Regiment, adjusts the measures on an M777 Howitzer during a gunners training exercise in Iraq, Nov. 11, 2018. The 3rd Cav. Regt. is deployed in support of Operation Inherent Resolve, working by, with, and through the Iraqi Security Forces and Coalition partners to defeat ISIS in areas of Iraq and Syria. (U.S. Army Photo by SPC Gyasi Thomasson)

by providing different danger close distances for mortars and naval gunfire, requiring the use of the gunner's quadrant on the gunline, necessitating creeping Fires in adjustment, and recommending delay fuzes.

Where Doctrine Stands Today

With traditions rooted in naval gunfire support and the U.S. combat experiences in Vietnam, the Field Artillery's use and definition of danger close has remained largely unchanged for the past half-century. Computerized fire missions and advanced munitions have not spurred an update to the legacy definitions and procedures. Meanwhile, call for Fire procedures have become antiquated and convoluted over time.

The term danger close has a range of definitions across Joint and Army doctrine. ATP 3-09.30, *Observed Fires,* defines it as, "the method of engagement when the target is (or rounds will impact) within 600 meters of any friendly troops for mortars and artillery, 750 meters for 5-inch naval guns and Tomahawk Land Attack Missile." Slightly different definitions appear in ATP 3-09.23 *Field Artillery Cannon Battalion,* ATP 3-09.32 *JFIRE: Multi-Service Tactics, Techniques, and Procedures for Joint Application of Firepower,* and in JP 3-09.3 *Close Air Support.*

Additional definitions for rotary and fixed-wing Fires, and related terminology such as Risk Estimate Distances (REDs) confuse the situation further. ATP 3-09.32 *JFIRE* defines danger close for air-to-surface munitions as not a common distance for all, but instead as the number of meters for 0.1 percent Probability of Incapacitation (PI) for each specific munition. In other words, these platforms define danger close by the specific munition to account for the complicated differences amongst today's munitions. Referred to as REDs, these distances are also listed for all artillery platforms and most munitions. As a familiar tool to most observers, REDs provide a more comprehensive assessment of risk in close Fires and may provide an adoptable solution.

Danger close procedures are not contained within one publication or concretely explained. ATP 3-09.30 contains two procedural requirements. The first requirement is for the requestor to announce "danger close" in the call for Fire when the target or expected round impact is within 600 meters of any friendly troops. Additionally, if the target or friendly troops move and are no longer within 600 meters, the requestor must transmit "cancel danger close." The second requirement is the requestor must adjust using the creeping Fire method. This method allows adjustments of only 100 meters or less and directs the observer to walk the rounds closer towards the target, avoiding large range corrections.

Various manuals contain additional procedures, which are not explicitly required. The first is the Fire Command, Use Gunner's Quadrant, found in TC 3-09.81, *Field Artillery Manual Cannon Gunnery.* The manual instructs the FDC to announce the command "when the FDC desires the gunner's quadrant be used to set or check quadrant elevation. This is more often used when firing danger close or precision fire missions, which require greater accuracy." The second additional procedure is found in ATP 3-09.23, *Field Artillery Cannon Battalion,* and states, "Whenever possible, the most accurate weapon system and shell, fuze, and charge combination should be used for danger close situations." Finally, ATP 3-09.30 provides an example transmission of a danger close call for fire where the observer requests a delay fuze setting. While not explained elsewhere in the publication, this suggests a technique of weaponeering specifically for danger close missions. The use of a delay fuze would slightly bury the round into the surface before detonation, thus reducing the explosive effects.

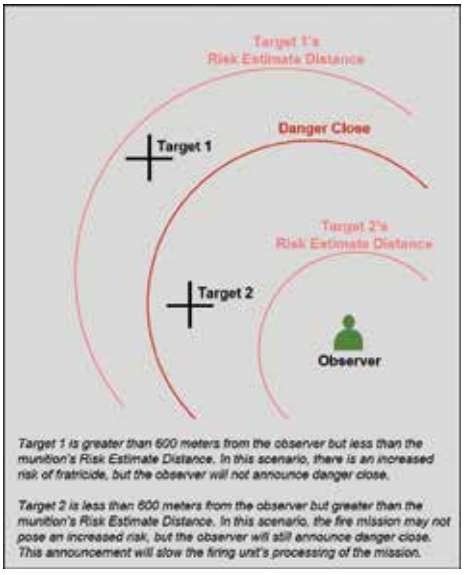
Some U.S. Allies have recognized the need for modernized danger close doctrine. Both the British and Canadian armies developed danger close definitions and procedures to more accurately assess which Fire missions pose a hazard to friendly troops. In doing so, both the observer and ground force commander have a greater understanding of the risk involved in every unique mission fired close to troops. While differing in specifics, both nations expand the concept beyond an arbitrary distance in meters. Observers or Fire Direction Centers calculate danger close based upon several factors, such as gun-target line and Angle T, PEr, PI at various percentages, range-to-target, and the degree of protection of friendly troops. Important distinctions within the methods are the balance between simplicity and shared understanding, risk

responsibility, and duties of involved personnel. Both the British and Canadian methods provide a useful guide towards updating U.S. danger close doctrine.

Today's Close Supporting Fires

The need for change is evident. While artillery Fire posed increased risk at 600 meters in 1945, then 75 years of modernization forces a reframing of the risk. When viewed from the frame of the five requirements for accurate predicted Fires, the Field Artillery has both lowered and raised the risk for fire missions within 600 meters of friendly troops. Technologies and techniques, such as global positioning systems, laser rangefinders, and meteorological modeling have increased accuracy since danger close was last defined. Still, other advancements, such as rocket-assisted projectiles, have increased risk to troops within 600 meters of the target. Are 600 meters enough to correctly warn observers and commanders of the risk to troops when firing either a rocket-assisted 155 mm round at max range or an Excalibur round?

With three calibers of artillery in the arsenal and numerous munition types, the Field Artillery must distinguish the significant differences amongst them. A broad definition of danger close would cover most munitions but unnecessarily delay fire missions for more accurate or smaller munitions. A firing unit may also experience a "boy who cried wolf" scenario where every mission becomes labeled as danger close, so cautionary procedures are gradually ignored. Consider combat in dense urban terrain, where 600 meters from the front line is the deep area. Here, all close supporting Fires would be labeled danger close, thus dulling the urgency and warning behind the term. On the other hand, a narrow definition of danger close would expedite fire missions but leave observers, commanders, and firing units unaware of the increased risk of a mission. An infantry platoon leader firing 155 mm rocket-assisted projectiles one kilometer from his position may be unaware of the risk he is assuming. Any changes to the danger close doctrine must consider the entire fire support system and the range of environmental variables.



Target 1 is greater than 600 meters from the observer but less than the munition's Risk Estimate Distance. In this scenario, there is an increased risk of fratricide, but the observer will not announce danger close.

Target 2 is less than 600 meters from the observer but greater than the munition's Risk Estimate Distance. In this scenario, the fire mission may not pose an increased risk, but the observer will still announce danger close. This announcement will slow the firing unit's processing of the mission.

Solutions

Potential updates to the danger close doctrine should consider three questions. First, is 600 meters the correct distance that artillery Fires produce increased risk? Second, do the proposed gunline and observer procedures enable a shared understanding of the risk? And third, do the current procedures decrease the risk to friendly troops? Changes to doctrine should also consider three criteria. First, simplicity – the procedures must be sensible, reasonable, and memorable for both forward observers and combat troops likely to call for fire. Second, protection – the procedures must trade any delays to fire mission times for valuable protection of the friendly force. Finally, comprehensiveness – the procedures must encompass digital and degraded capabilities, varying intensities of combat, Joint and multi-national interoperability, and factors of the operational environment such as terrain.

The concept underpinning the term danger close remains valid and should remain as a definition – danger close is a warning to friendly troops of the increased risk from particular fire missions. However, the conditions defined whereupon a fire mission produces increased risk need adjustment. Six hundred meters is not the universal line where all rounds suddenly have increased risk, and unnecessary delays in mission processing or misunderstanding of risk could have catastrophic consequences.

The first option is to change the definition from 600 meters to a different distance from friendly troops. A distance of 400 meters would reflect improvements in the Five Requirements for Accurate Predicted Fire and align closer to historic close combat engagement ranges. Unfortunately, while this answer is the simplest, no universal distance will comprehensively cover every munition available today.

The second option is to adopt

observer and FDC calculations similar to the British or Canadian methods. The definition would change from 600 meters to an "it depends." While this option is fully comprehensive and offers the most protection via shared understanding, the option is the least simple. Instead, these advanced procedures and calculations should perhaps be offered as an addendum for special situations and a shared understanding of risk.

The final option is to adopt the approach used with air-to-surface Fires and define danger close by the RED of each munition. This option presents the best balance of simplicity, protection, and comprehensiveness. Similar to the air-to-surface munitions in ATP 3-09.32, each Howitzer and rocket platform would list every munition available and the associated 0.1 percent PI, which would equate to danger close for that munition. Artillery REDs also capture a generalized accounting of PEr, since each RED is given for various ranges. In addition to specifying all munitions not currently listed in ATP 3-09.32, observers would also benefit from listing additional PI percentages.

The Field Artillery should also update procedures required during a danger close mission to protect troops and remove ambiguity. The imperative for timely and accurate Fires is high, and clear doctrine will particularly reduce risk when units fire danger close missions without a habitual relationship to the friendly troops in danger. The two current procedures should remain in doctrine – both the requirement to announce danger close in the call for fire and the creeping method of adjustment in 100-meter increments. Drawing from the 1967 FM 6-40 and allied forces techniques, today's doctrine should require FDCs to provide the PEr and the gun-target line in the Message to Observer, however if it's a precision munition, the circular error probable could be transmitted. Both of these actions will increase shared understanding between the observer and FDC, remind the observer of critical factors to consider when assessing risk, and compel the FDC to consider risk mitigations during a danger close mission. Lastly, the Field Artillery should clarify if an observer can assess and accept the risk of a danger close mission, or if the ground force Commander must approve each mission. Since the proposed definitional change draws from the air-to-surface munitions concept, which requires transmission of ground force Commander initials, confusion may increase.

The firing battery needs clear procedures for danger close missions. TC 3-09.81 should again require the gunner's quadrant to be used during degraded danger close missions instead of only mentioning the option. For digital missions, Howitzer section chiefs should also check elevation to the tenth of a mil. Finally, specific weaponeering options to reduce risk to friendly troops should be explained. ATP 3-09.23 offers a detailed explanation of considerations for danger close missions, but no manual describes technical and tactical fire direction options. Based on historical doctrine, a few techniques include: firing delay fuzes in adjustment to reduce explosive effects, firing precision fuzes or munitions, and selecting a lower charge to increase the angle of fall. Clear procedures, which are the same across all Field Artillery doctrine, will speed mission processing and increase protection to friendly troops.

Conclusion

The Field Artillery holds a proud tradition of delivering timely and accurate Fires to Soldiers in close combat. Danger close, as a concept and procedure, grew from this heritage and remains in our doctrine today. However, technological advancements have outpaced the concept's relevance. The arbitrary distance of 600 meters works for neither GPS-guided rounds nor unguided munitions fired at max range. Without fixing the doctrinal definition or procedures, future Soldiers may misunderstand the underlying risk of a fire mission, resulting in catastrophic consequences. The best answer is adopting each munition's REDs as the basis for a new danger close definition and updating the procedures for modern warfare. This option reinforces the importance of a common understanding of risk between the troops in contact and the firing unit while creating a robust doctrine to facilitate safe, timely, and effective Fires.

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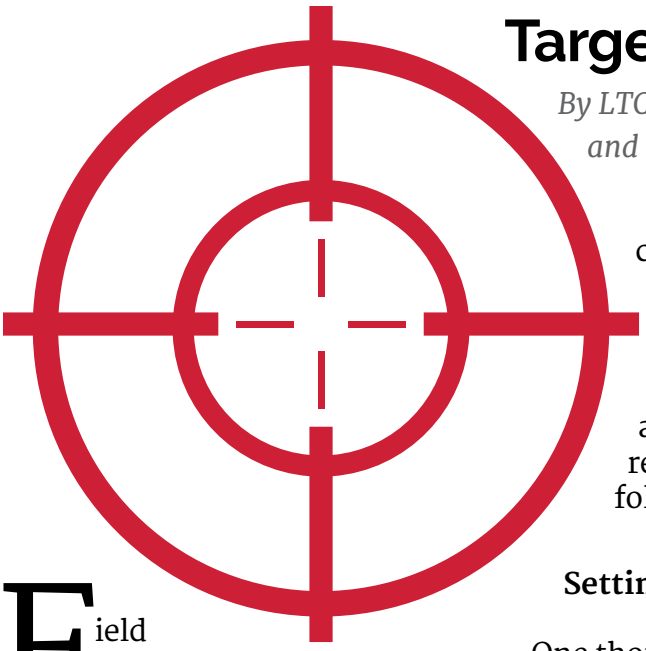
Targeting and Synchronizing Fires

By LTC Travis Robison, MAJ Joshua Hollingsworth, and CW3 Edwin VillanuevaVargas



Field Grade Officers graduating from Intermediate Level Education (ILE), and some Field Artillery Battalion and Brigade Combat Team (BCT) Commanders, often have limited knowledge or experience managing the complexities of targeting and synchronizing Fires during brigade operations. This shortcoming tends to manifest in desynchronized and ineffective Fire support at the Combat Training Centers (CTC) and, if not corrected, potentially during large-scale combat operations. The purpose of this article is to provide Brigade-level primary staff officers, particularly those serving as intelligence, operations, and Fire support officers, an overview of the requirements to effectively target and synchronize Brigade Fires. This paper attempts to bridge the gap between doctrinal expectations and realistic execution in a complex, dynamic, and time-constrained environment. We use our recent experience supporting the 2nd Infantry Brigade Combat Team, 25th Infantry Division, during a comprehensive training cycle culminating in a rotation at the Joint Readiness Training Center (JRTC) where we achieve noteworthy results that inform the following discussion.

Setting the Stage

One thousand hours, time for the Targeting Working Group (TWG) to begin. Seated at the table were the Fire Support Coordinator (FSCOORD), Brigade Executive Officer (XO) or Operations Officer (S3), Brigade Fire Support Officer (FSO), Brigade Targeting (TARGO) and Counterfire Officers, Brigade Intelligence Officer (S2), Brigade Engineer, Battalion liaisons officers, and a diverse set of enablers representing the Air Force, Special Forces, along with several other Army collection and non-lethal assets. Representatives from Brigade S1, S4, and S6 would attend as needed, and the brigade's Chief of Reconnaissance often dialed in to participate by phone. The rules of the road were rank didn't matter and that everyone came prepared with information and ideas. Efficient briefing ensured that the large group received relevant information for synchronizing brigade operations.

The briefing began with the Assessment Officer addressing the FSCOORD. "Sir, in Air Tasking Order (ATO) BB we supported the Commander's intent by focusing on enemy maneuver, reconnaissance, surveillance, target acquisition, and Fire support assets on the high-payoff target list. We destroyed seven tanks, one air defense RADAR, and two long-range artillery systems. This reduced the enemy's strength to 68%. We remain on track to achieve the Commander's intent for targeting." Following the Assessment Officer, the Air Force Staff Weather Officer briefed, "Sir, weather conditions remain favorable for us over the next three ATOs." The TARGO followed. "Sir, ATO BC remains unchanged and is currently flying. In ATO BD we recommend moving Fire support from number four on the High-Payoff Target List (HPTL) to number one based on our assessment that the enemy is increasing its Fire support capability which may disrupt or delay maneuver during our upcoming attack. In ATO BE, the enemy will be preparing to conduct a hasty defense, so we recommend moving engineers from number three to number two on the HPTL and focusing on their mine-laying capability to facilitate our freedom of maneuver. Pending any questions, we are ready to discuss ATO BF." The FSCOORD looked at the Brigade XO, FSO, and S3 to see if they had any input. Without any, the FSCOORD replied "We're ready, let's work through ATO BF. Keep in mind the Brigade Commander's intent to preserve as much combat power as

possible during the assault in order to F for the counter-attack expected during ATO BG."

The TARGO approached the analog map board with the affixed enemy, maneuver, engineer, intelligence, and Fire support overlays. He began with, "Roger Sir. In ATO BF the Fire Support Coordination Line will move to Phase Line (PL) Chargers as we complete our assault and the Coordinated Fire Line will move from PL Packers to PL Chiefs. The Division HPTL remains unchanged as they continue to focus on maneuver, Fire support, reconnaissance, and command and control in support of our assault. Pending any questions, I will be followed by an assistant operations officer (AS3)." The AS3 approached the operation map board, then moved unit icons as he briefed, "Sir, in this ATO Task Force (TF) Rattlesnakes will continue to screen north and south of Objectives (OBJ) CRIMSON and TIDE, respectively. TF Wolfhounds will complete their air assault no later than 2000 and will be prepared to execute actions on OBJ CRIMSON no later than 2200. TF Gimlets will complete their air assault no later than 1930, conduct link-up with their ground assault convoy no later than 2000, and begin movement towards OBJ TIDE no later than 2020. TF Wolfhounds and TF Gimlets will complete their assaults no later than 0200 in ATO BG. Sir, pending your questions, I will be followed by Brigade S2." The FSCOORD, BCT XO, FSO, and BCT S3 briefly discuss the air assault timeline and the conditions that must be set for success, including suppression of enemy air defense during two air assaults with multiple turns. They also discuss the potential effects of the brigade's artillery displacement on its ability to support the ground assault convoy. Once satisfied, the FSCOORD replies with, "Thank you, no questions."

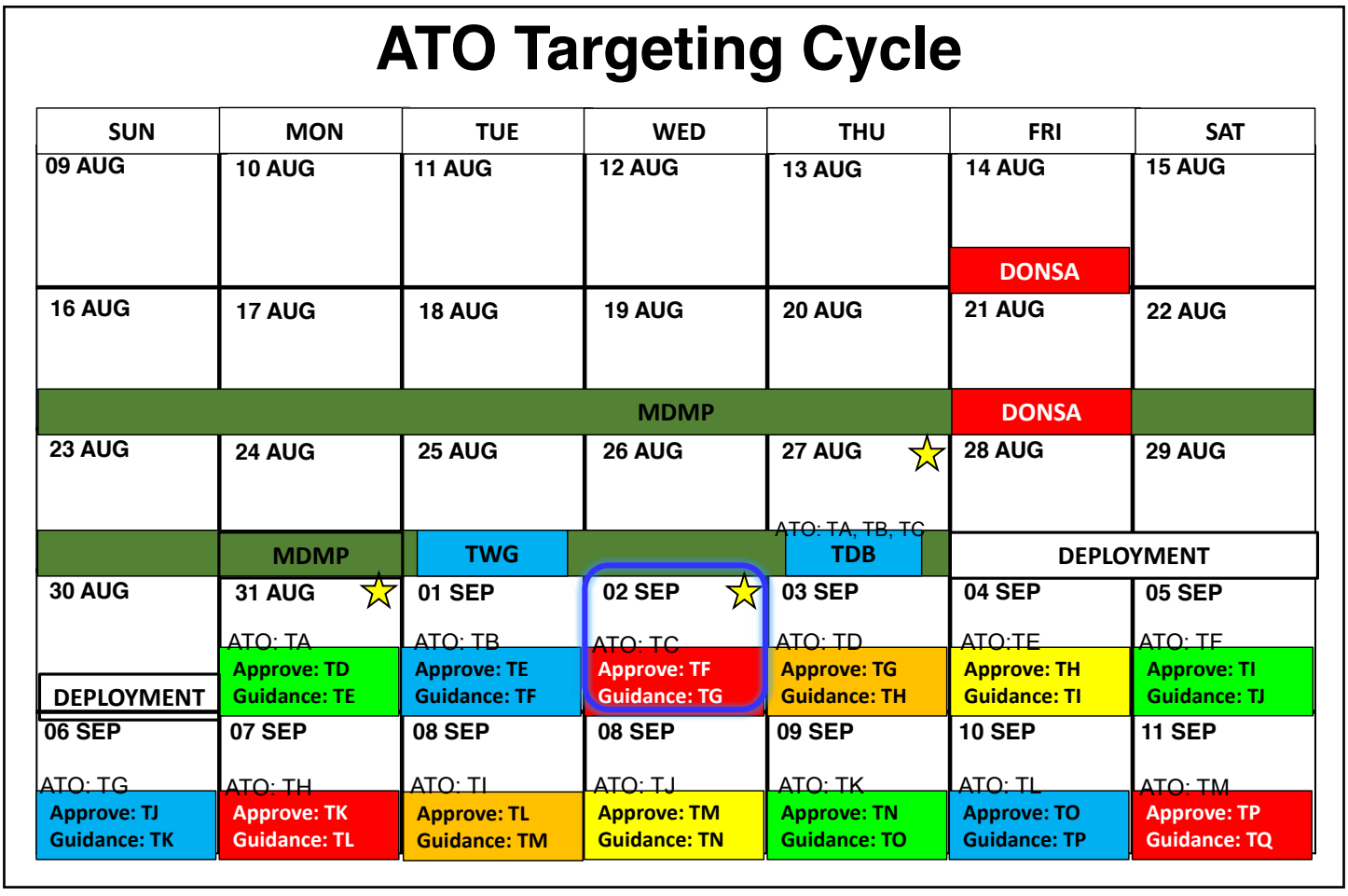
Following the AS3, the Brigade S2 approached the map board and moved enemy icons while briefing, "Sir, during ATO BF the 163rd Mechanized Infantry Brigade will be in defensive positions along with PL Chiefs at objectives CRIMSON and TIDE. We assess that by this ATO the 163rd will be at 35% strength. This means that the 163rd will have approximately two T-72 tanks and three or four BTR-80 Infantry Fighting Vehicles in prepared defensive positions on each objective. The 163rd will be supported with indirect Fires from the 175th Brigade Artillery Group (BAG) and the 17th Division Artillery Group (DAG). The BAG and the DAG are expected to be at 50% strength and capable of providing long-range Fires from BM-21 rocket launchers and close-range Fires from D-20 and D-30 Howitzers. The 163rd will use organic mortar systems to disrupt our freedom of maneuver around both objectives. Sir, pending your questions I will be followed by our Special Forces partners." The Brigade XO asked, "S2, from how many BM-21s can we expect to receive Fires during our assault on OBJ CRIMSON?" The S2 replied, "Based on their current strength, and if they decide to mass Fires on OBJ CRIMSON, I assess that we will receive anywhere from two to eight rounds per minute for 10 minutes from multiple BM-21s." The FSO responded with, "I agree, they can fire two rounds per minute per launcher system; however, based on their current strength, if they decide to mass, I think we should only expect six to eight rounds per minute." The FSCOORD then replied with, "Roger, FSO, we need to elevate this one to the Division since Fire support is number two on their HPTL. Tell them we'll need at least ten systems destroyed to set the conditions for our assault. Thank you, no further questions."

The Special Forces liaison then briefed, "Sir, we are direct support to the brigade during ATO BF. We will be located west of PL Chiefs conducting forward reconnaissance of OBJs SABAN and BRYANT to identity the enemy reserve and BAG locations. Sir, pending your questions I will be followed by the TARGO." The FSCOORD then replied with, "No questions, but the Commander is particularly concerned about the enemy reserve, so please prioritize locating that. Thanks for your support." The TARGO then stood up and briefed, "Sir, based on the friendly, enemy, and Special Forces schemes of maneuver during ATO BF, we propose the following HPTL: Maneuver, focusing on the T-72s, Fire Support focusing on the D-20 and D-30s, Command, Control, Communications, Computers and Intelligence focusing on jamming the 163rd's ability to communicate, and Reconnaissance and Target Acquisition focusing on their ability to detect our indirect Fire systems." The FSCOORD replied with, "Roger that, let's go through each one." The core of the targeting process occurred following this portion of the working group.

Targeting. We used the Army's Decide, Detect, Deliver, and Assess (D3A) methodology. Establishing the HPTL during

the process described above completed the decide portion – "what do we need to kill?" Next, we went through each high-payoff target with the S2 and Collection Manager discussing where, when, and at what strength we should expect to see systems. During this time-phase analysis, the Collection Manager highlighted which Named Areas of Interest allocated collection systems would focus on based on the S2's assessment of the enemy scheme of maneuver. Additionally, the Collection Manager discussed which collection systems would layer over each area and their cross-cueing criteria. Once satisfied with the detection plan, the team transitioned to discuss delivering effects against the targets. The FSO, Air Liaison Officer, S3, Brigade Aviation Officer, XO, and FSCOORD discussed the various lethal and non-lethal capabilities available to the brigade as well as division-level assets that required synchronization to deliver effects against each of the high-payoff targets at the specified time. This process answered the critical questions of where will the target be on the battlefield, when will it likely be there, are collection assets in the correct location to see the target, what will it look like so we know that we're attacking the right target, and are assets in place to deliver desired effects? The meeting transitioned to guidance for the following ATO after discussing each HPTL category in detail. This allowed the staff to shift focus to the following day and begin synchronizing targeting resources. The meeting then adjourned, to be followed later in the day by the Target Decision Board (TDB).

The daily TDB followed the same format as the working group except that the FSCOORD led the brief to the Brigade Commander. The Commander received an assessment of the previous ATO, focusing on whether the brigade achieved its targeting objectives. This was important to stay focused on fighting the enemy instead of the plan as often happens when managing targeting by the ATO cycle. The Commander also received an update on the current ATO and recommendations to update or change the next two ATO targeting priorities based on the assessment of the effects. The last portion was his approval or directed changes to



the recommended HPTL for the ATO 96 hours out as discussed during the TWG. Following the Commander's approval, he provided guidance for the following ATO and the meeting adjourned. At this point, the Battle Captain received the targeting board for the next ATO to post on the command post floor. This effectively completed the Future Operations to Current Operations (CUOPs) battle hand-over.

The TDB must occur daily as it provides the staff with guidance and priorities directly from the Commander three days in advance of execution. Our TDBs occurred in the brigade's Main Command Post, its' Tactical Command Post, under poncho or on a HUMMWV hood while conducting a move, and desk-side with the Commander when key players or time weren't available. The bottom line is that the TWG and TDB must occur daily regardless of circumstances because they enable synchronized targeting focused on killing the enemy. The *Warrior Brigade's* targeting process was synchronized, successful, and highly efficient. This begs the question, how do you get your brigade to perform similarly or even better? The answer lies within a gated training strategy using the crawl, walk, run methodology.

Training the Team

The *Warrior Brigade* started with an untrained staff who was willing to learn, a highly knowledgeable FSCOORD, and a Brigade Commander who fully supported the targeting process. What followed was a five-month training plan based on an objective, standards-based approach aligned with the brigade's upcoming JRTC rotation. During the crawl phase, we emphasized training each targeting task. During the walk phase, we focused on training each task to an objective standard. During the run phase, we conducted iterative, multi-echelon collective training to achieve and sustain proficiency at the full targeting process. Each of these phases began with leader professional development sessions focused on developing foundational, rehearsal, and execution knowledge across the staff.

During the Foundational (crawl) phase, we conducted training in a classroom environment. Members of the Brigade Fires Cell and any staff member who might be part of the process learned the fundamentals of targeting and the D3A methodology. This included required inputs and outputs from each Warfighting Function (WfF) and the responsibilities of each section within the targeting process. In the Rehearsal (walk) phase, training centered on the TWG, including conducting mock working groups with the FSCOORD who used these sessions to coach, teach, and mentor participants. This phase culminated with familiarization with the TDB and involved discussing issues, concerns, guidelines, responsibilities, and recommendations for operations. The training focused on efficient preparation, consolidation, and deliberation during the TDB. During the Execution (run) phase we conducted the TWG and TDB during the Military Decision Making Process for the brigade's culminating training event. This exercise provided the staff opportunities to conduct the TWG and TDB daily and under simulated wartime conditions. The staff experienced first-hand that they must come prepared for the TWG by conducting the necessary WfF analysis ahead of the meeting and to be ready to discuss solutions for complex targeting problems. This event and our subsequent Leadership Training Program course at Fort Polk resulted in the staff becoming highly proficient at the targeting process. The final step was ensuring that the work transitioned from planning to execution – the Future Operations to CUOP hand-over. Our biggest question was how?

Organizing for Success

The *Warrior Brigade* discovered that the answer was two-fold. The first centered on the overall layout of the brigade's main command post. Our main command post was originally organized to house (i.e., fit) all of the elements of the staff and attached enabling partners. It was organized, but it was unenergetic and generally unproductive because the layout reduced cross-talk and situational awareness across enablers and key warfighting functions. This became the first thing to change. We restructured, focusing on the efficiency of interactions within the command post. The Brigade Commander authorized the creation of a "Kill Table," similar to the Joint Air to Ground Integration Centers found within Division main command posts. Applying the JAGIC concept facilitated our synchronization of Joint Fires and the de-confliction of the airspace across the brigade's area of operation. The Kill Table became the focal point for all operations. The Brigade FSO ran the table which had all

of the brigade enablers facing each other. This immediately and measurably increased our command post capabilities and effectiveness, in large part because it helped create shared understanding across the warfighting functions. Moreover, the Brigade FSO was tied into the targeting process and understood the Commander's intent, so he could orchestrate shaping and destructive effects to achieve the Command's intent.

Our second answer focused on information sharing. As previously mentioned, we changed the targeting board each day after the TDB to ensure CUOPs fought the correct ATO. The ATO board hung directly in the center of the CUOPs floor and we briefed it during battle handover, seven-minute drills, and as assets checked onto the station. We taught the Battle Captains how to read the board and where to look when assets checked onto the station or when targets of opportunities presented themselves. It highlighted the time (decide), the place (detect), and the assets the Commander authorized (deliver) for use against each of the HPTL categories. It provided guidance and ensured the work during the targeting process remained consistent during execution. In short, it focused and synchronized CUOPs even during those periods when the Brigade FSO and XO left the floor to work on other brigade priorities. The board ensured that the approved HPTL created shared understanding and focused action at decisive points.

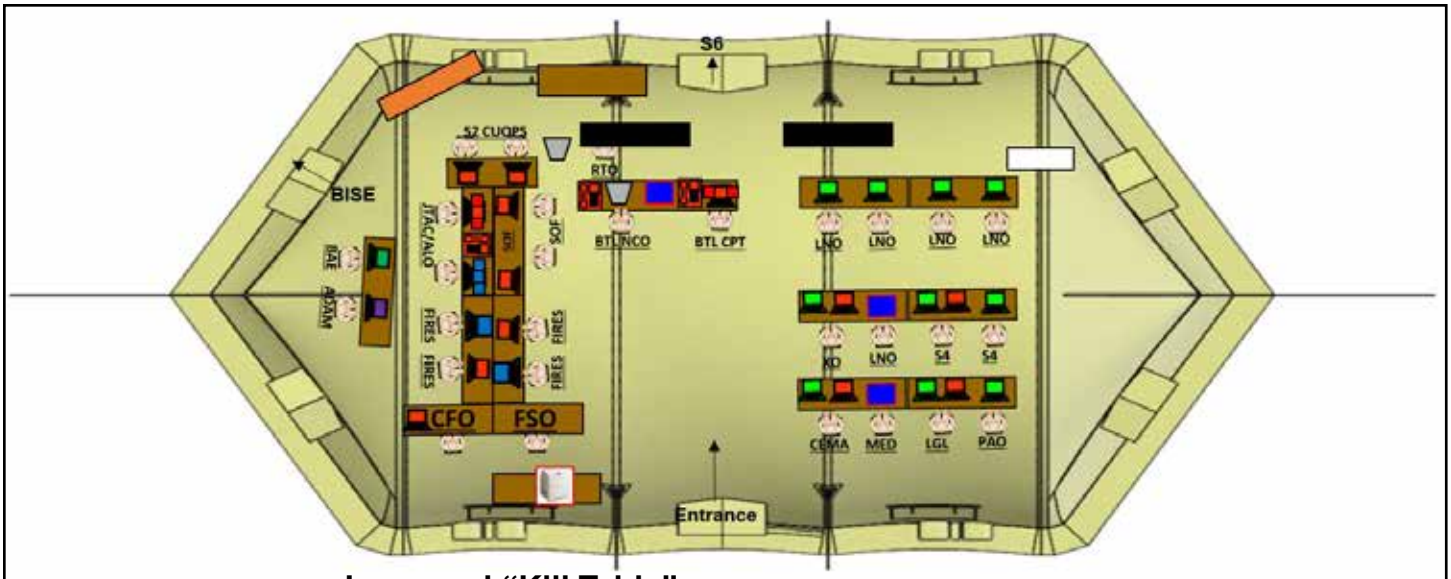
Final Takeaways

Our targeting process efficiently established an HPTL synchronized with detection and delivery assets. However, our earlier targeting efforts were often ineffective despite being developed within the context of the enemy and friendly schemes of maneuver. We focused on identifying what was killing us but failed to fully understand or identify when a target would present itself on the battlefield to be killed. This resulted in our using collection assets in the wrong place or requesting delivery assets at the wrong time. Moreover, the JRTC team was unable to visualize how targeting fit within the scheme of maneuver. This resulted in the misapplication of delivery assets against lower priority targets.

Battle Rhythm

Main CP Battle Rhythm V4.1 CAO: 13 1000 AUG 20

Time	Event	Location	PACE	Attendees
0000	Orders Published	Plans Tent	CPOF / ShareDrive	
0100				
0200				
0300				
0400	S2 Sync	BISE	CPOF/ SVOIP/ FM	BN S2s, IC Managers, FAIO, CA, SOF LNOs
0500				
0600	Battle Handover Brief	CUOPS Tent	In-person/ SVOIP	All
0700	BUB	Plans Tent	In-person/ SVOIP	BCT CMD Team, BN CMD Teams, BCT and BN Staff Primaries
0800	AWG/ BN Inputs/ Running Estimates	Plans Tent	In-person/ SVOIP	CHOPS, BTL CPT, S2, S4, CF/FAIO, LNOs, ADAM/BAE, Non-Lethal, CM
0900				
1000	TWG	Plans Tent	In-person/ SVOIP	XO, S3, FSO, S2, S4, S6,TARGO, FAIO, CFO, SJA ,BAO, ADAM/BAE, CM, ALO/TACP, CEMA, ENG, PAO, CA, PSYOPS, SOF LNO, CUOPS, LNOs, MNVR Planner(s)
1100	LOGSYNC	S4 Tent	CPOF/ SVOIP/ FM	S4, BN S4, FSC CDRs (XO), SPO, BAE
1200	IC Sync	BISE	CPOF/ SVOIP/ FM	BN S2s, IC Managers, CEMA, FAIO, CA, BAO, SOF LNOs, SIGINT, HUMINT
1300	RDSP	Plans Tent	In-person/ SVOIP	All
1400	Plans Update to W6	Plans Tent	In-person/ SVOIP	S3, MNVR Planner(s)
1500	TDB	BISE	CPOF/ SVOIP/ FM	XO, S3, FSO, S2, S4, S6,TARGO, FAIO, CFO, SJA ,BAO, ADAM/BAE, CM, ALO/TACP, CEMA, ENG, PAO, CA, PSYOPS, SOF LNO, CUOPS, LNOs, MNVR Planner(s)
1600	S2 Sync	Plans Tent	In-person/ SVOIP	BN S2s, IC Managers, FAIO, CA, SOF LNOs
1700	CSV/ Requests	CUOPS Tent	CPOF/ SVOIP/ FM	BN CMD Teams, Staff Primaries
1800	Fires Sync; Battle Handover Brief	CUOPS Tent	CPOF/ SVOIP/ FM	BCT FSO, BN FSOs
1900	DIV CUB	CUOPS Tent	CPOF/ SVOIP/ FM	BCT CMD Team, S3, XO
2000				
2100	OPSYNC	Plans Tent	CPOF/ SVOIP/ FM	S3, BN S3s, MNVR Planner(s)
2200				
2300				



Improved "Kill Table"

Through coaching, we learned the importance of establishing targeting priorities within an ATO, based on a detailed time-phased analysis of enemy and friendly schemes of maneuver. We retained the HPTL, but synchronized detection and delivery assets to focus on periods when the assets on the list would likely appear in the zone and how they would present themselves. Establishing these targeting priorities focused assets when and where we expected to see high-payoff targets and mitigated our tendency to spread assets across the battlespace. It also facilitated the CUOPs team's understanding of when and where we needed to kill targets to facilitate our desired scheme of maneuver. We immediately noted significant improvement in targeting effectiveness against targets on the HPTL, and ultimately, as noted by the Fox Observers, Coaches, or Trainers achieving the best targeting process JRTC has seen in years.

These noteworthy results informed the previous discussion in hopes that Field Grade Officers graduating from ILE, as well as new Field Artillery Battalion and BCT Commanders, can bridge the gap between doctrinal expectations and realistic targeting in a complex, dynamic, and time-constrained environment. Desynchronized and ineffective Fire support at the CTC or, worse, during large-scale combat operations will hinder success. Worse yet, they will force our Soldiers to pay for in blood what we should be using steel to buy. We owe it to them to master and apply an effective targeting process.

LTC Travis Robison was commissioned in 1999 as a Field Artillery second lieutenant upon graduation from the University of Colorado as an Army ROTC Distinguished Military Graduate. His education includes a Bachelor's of Arts in Political Science from the University of Colorado, a Master's of Public Administration from the University of Montana, a Master's of Operational Art and Science from the Air Command and Staff College, a Master's of Arts and Doctor of Philosophy in Political Science from the University of Pennsylvania. Before assuming command of 2-11th Field Artillery, 25th Division Artillery, LTC Robison served as an Advanced Strategic Planning and Policy Program fellow. He is moving on to become the Special Assistant to the TRADOC Commander.

MAJ Joshua Hollingsworth graduated and was commissioned in December of 2008 from the University of Alabama. He holds a Bachelor's of Arts in Criminal Justice from the University of Alabama and a Master's Degree in Defense and Strategic Studies from the Naval War College. His previous assignments include Battery Commander within the 1-320th Field Artillery Regiment, 101st Airborne Division Artillery, Senior Field Artillery Assignment Officer at Human Resources Command; Brigade Fire Support Officer and Battalion Executive Officer in 2-11th Field Artillery supporting 2nd Brigade Combat Team within the 25th Infantry Division and he is currently serving as the Brigade Operations Officer for the 25th Infantry Division DIVARTY.

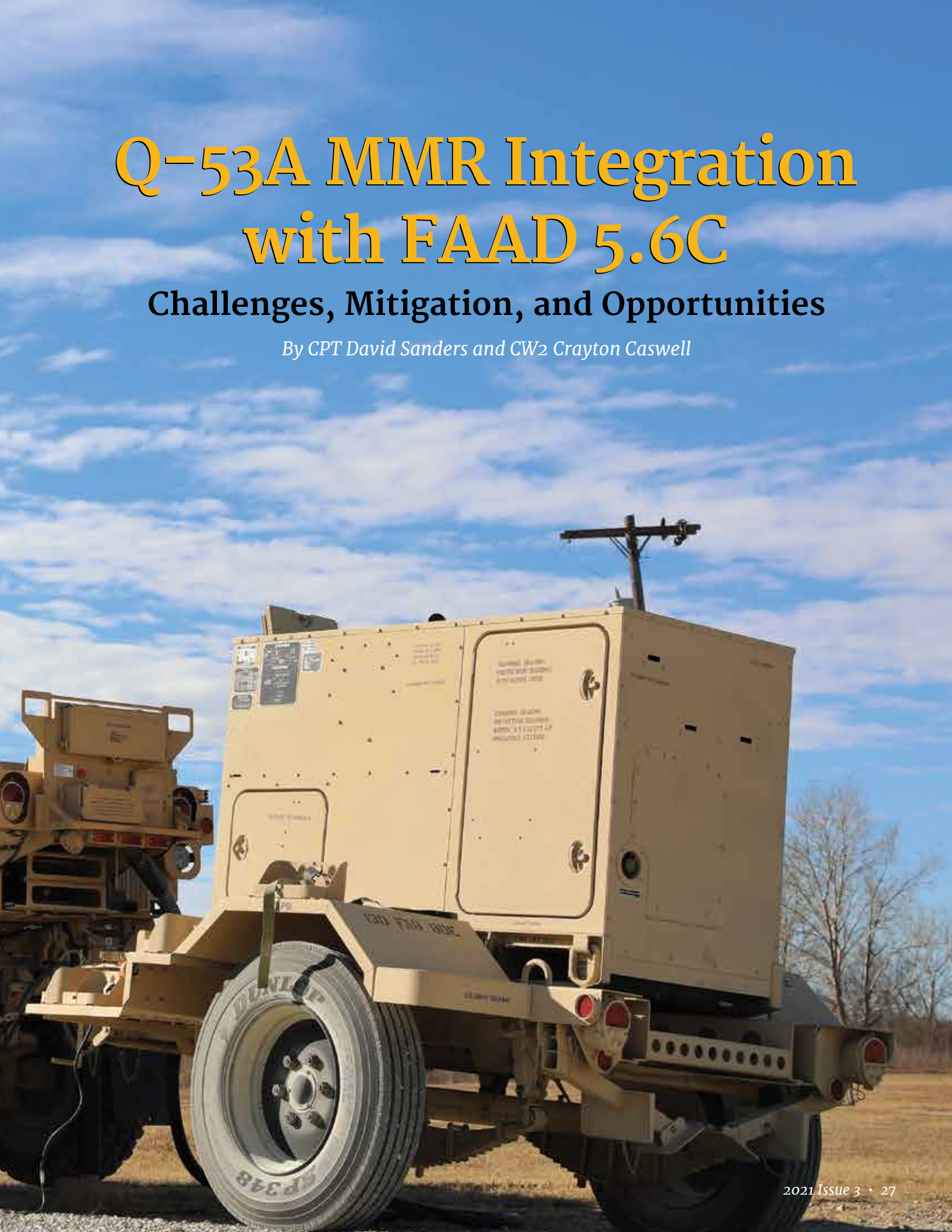
CW3 Edwin VillanuevaVargas is the 2nd Brigade Combat Team's Targeting Officer. He has served in the Active Army for over 20 years and has been deployed on numerous occasions in support of OEF, OIF, and OIR. He earned a Bachelor's of Science in Sports and Health Sciences from the American Military University. Prior to this assignment, during his career, CW3 VillanuevaVargas has served as the counter-fire officer and target acquisition platoon leader for 4th Brigade Combat Team, 82nd Airborne Division; Targeting Officer for 3rd Brigade Combat Team, 82nd Airborne Division; and as the Fires, Cyber, Space Planner for the 782nd Military Intelligence Battalion.

The AN/TPQ-53 RADAR staged for pre-mobilization training at the Regional Training Center in Salina, Kansas.

Q-53A MMR Integration with FAAD 5.6C

Challenges, Mitigation, and Opportunities

By CPT David Sanders and CW2 Crayton Caswell



The Q-53A Multi-Mission RADAR (MMR) is the latest version of the Q-53 Field Artillery RADAR, developed to track not only indirect fire but the growing threat of Unmanned Aerial Systems (UAS) as well. With this new system, both indirect fire and UAS can be tracked with a single platform, an obvious logistical advantage. The MMR was deployed to the Central Command (CENTCOM) Area of Responsibility (AOR) to begin operations and refine its capabilities before the system was approved for broad adoption.

Air Defense Artillery (ADA) RADARS, not Field Artillery, typically fill the role of maintaining the Air Defense picture, including UAS detection and mitigation. The new MMR – only found in the CENTCOM AOR, and coming from a different branch – was not integrated into this broader Air Defense picture. The MMR operated locally, in a separate world, delivering UAS warnings through voice communications. The operators performed well and showed good judgment, but the MMR and the ADA RADAR needed to integrate into a common virtual air picture.

The 130th Field Artillery Brigade (FAB), currently the CENTCOM Force Field Artillery Headquarters (FFAHQ), has developed the methodology for integrating these two air pictures into one. Shortly after they arrived in the CENTCOM AOR, personnel in the 130th FAB began to experiment with organic equipment to find a connection that would bring the MMR air picture to the Air Defense picture and the Brigade network, to be shared across the theater. Brigade personnel solved their connection problems by using an organic Forward Area Air Defense Command and Control (FAAD C2) to operate as a command and control device to each MMR system. The link of the FAAD C2 allowed the Brigade's Air Defense Airspace Management Cell/Brigade Aviation Element (ADAM/BAE) to bring in the UAS picture from the MMR. That process, the how, and the why is the topic of this article.

This article describes the successful integration of the MMR with the FAAD C2 system architecture, including troubleshooting issues and the realized benefit for the counter-UAS effort. Perspectives on the way forward and conclusions from the 130th staff are included. The purpose of this information is to:

- Assist future FFAHQ and adjacent units with maximizing the effects of their software and established operating systems, including the highest "bang-for-your-buck" in mitigating UAS and clarifying the air picture.
- Inform and provide options for Brigade and Senior Theater Command Leadership, with a useful depth and solutions that address the operational gaps identified by the classified Operational Needs Support Memorandum (ONS Memo 21-36132) generated by the 130th FA BDE.
- Synchronize the Brigade ADAM Cell's actions in the mission command and protection Warfighting Functions for the record to future FFAHQ units supporting Operation Spartan Shield and Operation Inherent Resolve.
- Enable the effective use of powerful new counter-UAS (C-UAS) tools and information that enable base defenses across the region.

A local physical connection between the Q-53A MMR and the FAAD C2 is simplicity itself: the RADAR connects by plugging in at a local switch in the Q-53A's cab, which feeds data directly to the



Left: CPT David Sanders and CW2 Richard Machina of the 130th Field Artillery Brigade, Task Force Spartan, conduct ADAM/BAE operations in the Brigade Combined Operations Information Center. Center: CPT David Sanders and CW2 Anthony Calanni of the 130th Field Artillery Brigade, Task Force Spartan, outside an AN/TPQ-53 command and control shelter. Right: CPT David Sanders and CW2 Anthony Calanni of the 130th Field Artillery Brigade, Task Force Spartan, look into the regulations outside an AN/TPQ-53 command and control shelter.

FAAD C2 through the Electric Remote Computer Terminal. Because of this, local connectivity is not an issue.

The problem was getting the FAAD to connect and communicate with the ADAM Cell's Air Defense System Integrator via Link 16. The ADAM Cell's current air picture is theater-wide and shared with Task Force Spartan, the Battlefield Coordination Detachment, and the CENTCOM ADA Brigade. This nearly real-time data originates from the Communications Reporting Center in theatre, and 130th FAB focused on bringing the MMR data into that picture, sending it to higher echelons and other interested units across a broad battlespace.

The network architecture operates on two separate network systems in the CENTCOM AOR: the South West Asia strategic network and the traditional tactical network. Both must be connected to bring together dispersed nodes, ensure network resiliency, and give Commanders the most up-to-date common operating picture. The process of making the connection between a known tactical system, like the ASDI or FAAD, required over 25 days of work before the link was established.

Part of the problem in establishing this link was policy. Integration of the FAAD to the broader system architecture required firewall exceptions, as the network administrators and managers were unfamiliar with FAAD integration and the MMR data. Gateways between the different protocols existed, but needed approvals to work. At first, Firewall Exception Requests (FER) did not work because there was no central coordination point based on network node and routing. Eventually, the establishment of a central coordination point for FER's proved critical to the long-term success of integrating systems for theater-wide use. Clearing these obstacles took much time and required significant coordination between 130th FAB personnel and theater system administrators.

With these obstacles cleared, the 130th personnel found that the Q53A MMR using software version 7.90.02 could integrate with this air picture provided the FAAD C2 used the recent 5.6c software version. This connection allowed the 130th FAB Target Acquisition Platoon to contribute actionable C-UAS data across the network, using the MMR in an integrated role for the first time.

As a result, the ASDI integration of the FAAD C2 and MMR created an enhanced multi-domain operating picture for the USCENTCOM Commander to use in the C-UAS effort. This enhancement came with no degradation of the Q53's indirect fire mission. C-UAS tracking and Counter-Target Acquisition (CTA) could take place simultaneously.

The FAAD C2's three-dimensional display of the RADAR search area provides better situational awareness to ground force Commanders and superior vision for base defense. The FAAD C2 filters the data source to provide low-altitude air tracks. This allows ground force Commanders to see UAS activity tracked by the MMR, on the same screen as the tracks provided by ADA RADAR. The FAAD C2 system connection with the Q-53 MMRs allows for ground Commanders to assess UAS threats probing the Area of Operations for surveillance, reconnaissance, or attack against the United States or Coalition Forces.

Many questions remain about the strengths and weaknesses of the integrated system, and evaluation procedures are strongly recommended. From a digital perspective, the network architecture and infrastructure in theater now process more data in a new way, and while the system gives every indication of resiliency, these changes add complexity to critical data, and analysis is needed.

Local force protection cells and Brigade personnel on the ground have been synchronized so all sensor nodes are interoperable with the protection plans and rehearsed into Tactics, Techniques and Procedures/Standard Operating Procedure development for base defense design. This allows the ground force Commander to prioritize key critical assets in the immediate Area of Operations for protection and provide passive air defense through early warning detection of the C-UAS system. The MMR might benefit from site locations that emphasize connectivity between C2 nodes and host servers, with the future movement of sensors bearing system integrity in mind.

From a technical perspective, ADAM Cells do not have assigned sensors or shooters; however, the major equipment items are C2 related. The ADAM Cell C2 Systems Integrator (140A Military Occupational Specialty) took on the responsibility to provide linkage between the MMR and FAAD

system, and in coordination with the Brigade S6, identified the appropriate data pathways, gateway protocols, information exchange points, and routing over various networks. All are now documented for follow-on Brigade ADAM Cells, held for reference at a higher classification.

Future FFAHQ ADAM Cells will need to update to the 5.6c FAAD software before arrival in theater to ensure they will retain this capability. Future FFAHQ RADAR units will need to coordinate with Project Management RADAR, appropriate vendors, and Field Service Representatives for the newest version of Q53A software, currently 7.90.02. These updated software versions and their capabilities for sensor and C2 assets should be identified and incorporated into DOTMLPF-P at the schoolhouse, which would negate the need for Necessary Equipment Training/Fielding and improve future unit readiness. Leaders should also share current version software during unit site surveys for future unit rotations, providing incoming units with ample time to execute the updates.

There is a known gap in communications that this integration helps to fill, bringing a command integration system into play when more sensors and more shooters are placed in a Joint coalition kill chain. The concept is "any sensor to the right shooter," where a sensor detects, transmits target information to a C2 node through flexible routing, and an engagement decision is routed to the best shooter available. The ideal is complete modularity of sensors and shooters through a C2 node that encompasses all response options.

Until this kill chain is achieved Machine to Machine (M2M), the implied task for Brigade and below remains bridging their known capability gaps and to piece together Joint kill chains which span multiple services and all levels of war.

The current network infrastructure, divided by specialties and sections, would likely benefit from a shift toward a Joint mission network with cloud technology and well-schemed C2 routing. In order to achieve a decisive advantage over near-peer threats in the region, a sustainable and resilient network like this would be a great improvement. A Joint kill chain can be achieved so long as the network architecture and infrastructure are sustainable and resilient, with a varied set of authorities and permissions, along with appropriate messaging formats and authorities. This would enhance an M2M kill chain through Hardware in the Loop and Man on the Loop; as long as gateway protocols and translation services exist. The establishment of these networks is under discussion among the senior levels of Department of Defense leadership on the Joint All-Domain Command and Control (JADC2) Cross-Functional Teams along with known capability gaps for the Joint Concept of Command and Control. In a multi-domain fight with unconventional threats like

The 130th Field Artillery Brigade ADAM Cell assigned to Task Force Spartan (Left to Right) CPT David Sanders, CW2 Richard Machina, CW2 Anthony Calanni, SPC Bryce Manker, SPC Christopher Dame, SSG Chase Weber, and SSG Johnathan Bustamante.

C-UAS certain to continue, these changes are critical to saving lives and winning the fight.

The 130th FAB proved the concept of the FAAD C2/MMR integration with the assistance of Task Force Spartan and Combined Air Operations Center. Several conclusions are evident:

- FAAD C2/MMR integrated system provides useful strategic and tactical value for Commanders, at both the low-level and theater air picture
- FAAD C2/MMR integrated system provides a greater footprint to detect, track, and locate C-UAS
- FAAD C2/MMR provides detection of low-level air tracks at a higher confidence level
- Local Q53 Air Picture deemed usable by the 32nd Army Air & Missile Defense Command (AAMDC)
- Forward-deployed MMRs provide local force protection, contributing to the C-UAS mission, while simultaneously providing effective FFAHQ CTA coverage
- Future units will require the same routing methods, IP schemes, and data pathways identified by the 130th FAB

Several members of the 130th FAB's Target Acquisition Platoon gave relevant insights on UAS activity in austere environments, and the 130th FAB ADAM Cell collected data and recommendations for evolving C-UAS efforts and base defense throughout the AOR. Because of the sensitive nature of the topic, a classified version of this article is published with these specifics.

The Q53A MMR's ability to detect, track, identify, and locate UAS targets in testing is well-proven. Thanks to these efforts by the 130th FAB, those capabilities provide Air Component Command, Combined Joint Task Force and Task Force Tiger with greater awareness, better ground unit support, and another step forward in the process of creating the ideal targeting system.

CPT David Sanders enlisted in the South Carolina Army National Guard (SCARNG) in 2012. He was commissioned as an officer in 2016 from Furman University ROTC, branched ADA. Sanders has worked as a high school teacher and football coach for 3 years before being hired as an Air Defense Subject Matter Analyst to the Joint Staff J6 Joint Assessment Division, formerly known as the Joint Deployable Analysis Team. He has mobilized twice as an Active Army Air Defender and once as a Defense Contractor. Upon commissioning, Sanders served on battalion staff as an assistant tactical operations officer. From 2017-2018, he mobilized in support of Operation Noble Eagle as an Air Defense Artillery Fires Control Officer serving in the Joint Air Defense Operations Center as a part of the National Capital Region Integrated Air Defense System mission. Sanders then served as a platoon leader and as a Current Operations staff member of the 263rd AAMDC G3 staff. He served on the CJTF Integrated Air and Missile Defense with USARCENT supporting Exercise Eager Lion in 2019. Also in 2019, he deployed with the JDAT as a field analyst and data collector for the OCONUS Counter Unmanned Aerial Systems Assessment. Sanders has supported various exercises as a defense contractor spanning from CUAS Demonstrations, JADC2 events, and Exercise Bold Quest. As a "green suiter" Sanders has been activated with the SCARNG supporting various disaster relief, humanitarian, and civil support operations. Currently, he is deployed as an attached ADA Officer to the 130th Field Artillery Brigade, KSARNG, where he serves as the Air Defense and Airspace Management (ADAM) Air-Ground Integration Cell OIC.

CW2 Crayton Caswell joined in 2004 as a 13F, Fire Support Specialist. He gained combat experience while deployed to Iraq on convoy security. Since becoming a warrant officer in 2018, he has served as an assistant targeting officer and counter- fire officer. He currently serves as the Combined Joint Task Force - Operation Inherent Resolve sensor manager and liaison for the Headquarters and Headquarters Battery, 130th Field Artillery Brigade. On the civilian side, Chief Caswell is an entrepreneur and lives in Kansas City.

Members of the Target Acquisition Platoon, 130th Field Artillery Brigade, Task Force Spartan, conduct maintenance on the AN/TPQ-53 RADAR in the CENTCOM area of operation.

Members of the Target Acquisition Platoon, 130th Field Artillery Brigade, Task Force Spartan, discuss maintenance on the AN/TPQ-53 RADAR in the CENTCOM area of operation.

Operation Marauder:

Developing flexible response and deterrence options through multi-national airborne assault and multi-national team Fires

By LTC Mike Tumlin, CPTs Everett Heiney and Samantha Straskulic, CW2 Alex Sumner, and 1SG Chuck Lee

M119A3 Howitzer Section conducts live-fire following Airborne Assault in Drawsko Pomorskie Training Area, Poland.

Emerging threats in the European theater necessitated increased interoperability with North Atlantic Treaty Organization (NATO) Allies and Multi-national Partners. The 4-319th Airborne Field Artillery Regiment (AFAR) serving as the direct support Field Artillery Battalion assigned to the 173rd Airborne Brigade (ABN), recently conducted a combined training exercise, Operation Marauder, with the 6th ABN Polish (POL). This exercise functioned to enhance Allied interoperability, prove NATO Intermediate Staging Base (ISB) and power projection capabilities, and further refine techniques for multi-national Team Fires during an airborne assault and follow-on operations.

In late February 2021, 4-319th AFAR deployed from Grafenwohr, Germany, to the 6th ABN POL headquarters in Krakow, Poland, to conduct planning, rehearsals, and heavy equipment rigging, then executed a combined airborne assault to deliver live indirect Fires at Drawsko Pomorskie Training Area (DPTA). Operation Marauder exercised NATO power projection capabilities and execution of multi-national fire support at the tactical level. Task Force (TF) King, composed of 4-319th AFAR, with an attached 6th ABN POL mortar platoon, executed an airborne assault to establish firing capability inside the airhead line and deliver combined live Fires in support of U.S. and POL observers. During this exercise, *King of the Herd* artillerymen and Polish mortarmen exchanged and validated Tactics, Techniques, and Procedures (TTPs) to increase interoperability in defense of NATO.

The 2018 National Defense Strategy outlines three major areas of focus: build a more lethal force, strengthen the alliance and attract new partners, and boost performance and affordability. Operation Marauder signifies growth in all three areas. By utilizing 6th ABN POL rigging facilities and Krakow airbase, U.S. Airborne Forces and Allies now have another platform to rapidly project combat power across the European Theater. The 6th ABN POL and the 173rd Infantry Brigade Combat Team ABN demonstrated capability to provide rapidly deployable, integrated indirect Fires, which increases the lethal deterrent options against a near-peer threat in Large-Scale Combat Operations.

Krakow as a NATO Power Projection Platform

Since 2014, the 173rd IBCT ABN historically conducts ISB operations from Aviano Air Base (Italy), Ramstein Air Base (Germany), or Papa Air Base (Hungary). This exercise validated another location from which U.S. combat power can rapidly project forces. Geographically, Krakow provides a unique option for onward deployment. Krakow "shortens" the legs for intra-theater air movements to the Baltics and Eastern Europe, yet remains outside of threat air defense capabilities.

Two M119A3 Howitzers are rigged for an airdrop in 6th ABN Logistics Battalion Rigging Facility. Heavy Drop loads are transported to the Departure Airfield using a Jelcz 862 with mounted Hiab Crane Loader.

The truck transfers the Howitzers to a Polish Military K-Loader, which loads both platforms onto one C-130J.

TF King conducted an out-load from the departure airfield at Krakow-Balice Aviation Base, a short distance from the 6th Airborne Headquarters and rigging facility, with ample personnel and equipment holding areas while awaiting load time. The 6th ABN's state-of-the-art facilities, ample life support, and proximity to a military airfield proved to meet all 4-319th AFAR requirements while conducting ISB operations. Operation Marauder highlights the potential for Krakow as an ISB for airborne operations enabling NATO Commanders greater flexibility to rapidly respond to threats in the Baltics or Eastern Europe.

Multi-national Team Fires Airborne Assault

The 173rd Sky Soldiers and 6th Airborne Paratroopers await to board a USAF C-130J.

During Operation Marauder, TF King task-organized for purpose into a multi-national Team Fires that planned, prepared, and rehearsed prior to infiltration. Team Fires is a proven TTP used for an airborne assault that consolidates mortars under the tactical control of the Field Artillery Battalion to facilitate the clearance of Fires, assist in local security of fire support assets and simplify fire support nets to ensure response Fires. The Team Fires TTP was first described in the March-April 2001 edition of the *Field Artillery Bulletin* by then LTC John Uberti and CPT John Herrman in an article titled, "Team Fires: Taking Responsibility for TF Mortars."

TF King further refined this technique to establish TTPs for integrating NATO allies and multi-national partner indirect fire capabilities to achieve the same end state: responsive Fires to support Maneuver in ground combat. Key lessons learned include the development of a Combined Battalion Fire Direction Center (BN FDC), investment in liaisons in and out, as well as deliberate tactical and technical rehearsals prior to execution.

During Marauder, 4-319th AFAR and 6th ABN POL did not have common Communications Security Keys. As a result, TF King relied on Polish and U.S. observers to route secure Calls for Fire over respective nets, which were then tactically processed in the Combined BN FDC. The battalion fire direction officer then directed which systems would engage the Call For Fire based on target selection standards, attack guidance, weapons positioning, and target

De-rigging an M119A3 following heavy drop and parachute assault.

location. The fire missions were then routed from the BN FDC to the firing units using respective secure communication means and further processed for execution.

The battalion placed the Headquarters and Headquarters Battery XO with the Polish Mortar Platoon to serve as liaison (LNO) with the intent to provide a redundant means of communication to enhance situational awareness. Likewise, the Polish Mortar Platoon Leader co-located with the Battalion FDC and Tactical Air Control to provide the same capabilities. TF King greatly benefited from the enhanced situational awareness provided by these LNOs and strongly recommends selecting the right trooper for the mission.

Leaders develop TTPs for multi-national Team Fires fire mission requests and processing.

Most importantly, the first time TF King executed this TTP was not on the Drop Zone in DPTA – the battalion conducted a series of tactical and technical rehearsals while in the ISB to identify friction points, develop solutions, and then validate procedures ahead of execution. The focus in preparation enabled TF King to rapidly establish firing capability on the drop zone and deliver Fires in support of our observers.

Execution

TF King conducted the airborne assault into Piaskowy Brod Drop Zone in DPTA, heavy dropping two M119A3 Howitzers, then personnel to establish firing capability within 25 minutes (P+:25). At the time of execution, a rigging solution for an airdrop of the Polish 98 mm mortars was not yet approved and as a result, four 98 mm mortars were pre-positioned on the drop zone and quickly integrated into the fight as Paratroopers landed. TF King, organized itself using the multi-national Team Fires TTP described, delivered 36 rounds of 105 mm and 60 of 98 mm high explosive rounds in support of U.S. and Polish observers with great effects on the target.

Training exercises like Operation Marauder highlight the importance of continuing to train to refine existing TTPs with strategically relevant partners, further identify options for

Combined Battalion FDC receives and processes both U.S. and POL Calls for Fire then routes to U.S. artillery and POL mortars.

Operation Marauder leaders huddle.

Training with strategic partners.

NATO Commanders to project combat power, as well as signify a strong alliance in the defense of Europe.

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LTC Mike Tumlin is the Battalion Commander for 4th Battalion, 4th Security Forces Assistance Brigade, and the former Battalion Commander for 4-319th Airborne Field Artillery Regiment, 173rd ABN. LTC Tumlin has served from the Platoon to Division level in the 82nd Airborne Division, as well as in the Asymmetric Warfare Group and Joint Special Operations Command.

Applying Multi-Domain Effects to Operation Inherent Resolve

By MAJ Benjamin Murphy (UK) and COL G. Damon Wells

"Out of intense complexities, intense simplicities emerge."
Sir Winston Churchill

Churchill WLS. *The World Crisis, Volume III: 1916–1918*, London: 1927

Multi-Domain Operations (MDO) are the U.S. Department of Defense's most recent solution to the complex, multifaceted problem of state actors subverting Westphalian conventions[1]. At its heart, MDO evolved from the natural and inevitable fusion of accelerated improvements in technology, the complexity of modern competition, and the need for rapid battlefield decisions at echelon. The concept of simultaneously employing ways and means across multiple domains to achieve a specific end is not new. This employment technique historically provided Commanders options for executing simultaneous and sequential operations by integrating capabilities across domains. When applied appropriately, these operations present multiple dilemmas to an adversary, achieve friendly physical and psychological advantages, and maximize influence and control over the operational environment[2]. This is as true for the Combined Joint Task Force (CJTF) in Phase IV of Operation Inherent Resolve (OIR) as it is for the doctrinal MDO problem set of Anti-Access and Area Denial (A2/AD) systems.

Although MDO shares common traits with concepts like Airland Battle there are important differences. Airland Battle doctrine focused on the three-dimensional and technological impacts of modern warfare that prescribed rapid, integrated air and ground maneuvers and viewed a battlefield extended in both the dimensions of geography and time[3]. This informed NATO's deep battle warfighting concept to combat against a potential Soviet attack in Europe. In comparison, MDO focuses on the competition continuum and the requirement for parity of effort throughout. It incorporates the fundamental changes in the character of warfare and acknowledges that constant competition between nations with sporadic escalation to conflict is the new normal. While not a direct translation of MDO doctrine into the application, Operation Inherent Resolve's current activities fit the model in practice. At the lower echelons, organizational structure, resource availability, and competition spectrum specifics may not truly match the MDO model. However, it can be scaled to function in varying environments through the understanding

1 Hartley DS & Jobson KO. *Cognitive Superiority: Information to Power*, Zurich: 2021
2 Lundy MD. *Meeting the Challenge of Large-Scale Combat Operations Today and Tomorrow*. Military Review, 98(5), 111. Washington DC: 2018
3 King S & Boykin DB. *Distinctly Different Doctrine: Why Multi-Domain Operations Isn't Airland Battle 2.0* Washington DC: 2019

and deliberate application of the U.S. Army's principles[4]. CJTF-OIR created the Multi-Domain Effects Directorate (MDED) as a functional bridge to enable a typical CJTF structured headquarters to leverage the advantages created through a multi-domain approach.

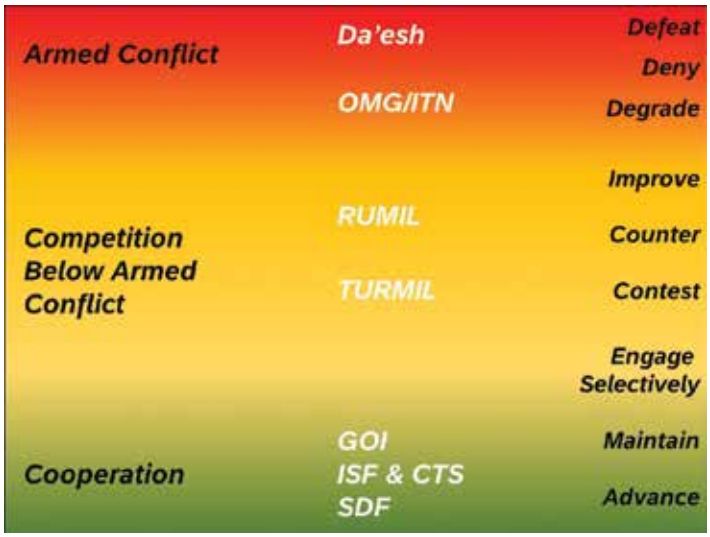
Conceptually, U.S. forces seek to execute MDO in several stages. Initially, the main effort is the penetration of enemy A2/AD systems[5] to enable strategic and operational Maneuver. The next step is the disintegration of the aforementioned A2/AD system to enable operational and tactical Maneuver for U.S. forces and partners. Exploiting the resulting freedom of Maneuver achieves operational and strategic objectives which defeat enemy forces across the domains. The final stage is re-entering normal competition and consolidating gains before forces return to competition on favorable terms to the United States and allies[6].

CJTF-OIR's initial analysis of restructuring into an MDO approach was a function of environmental complexity and change from Phase III to Phase IV. CJTF's primary mission is the defeat of Daesh across designated regions of Iraq and Syria. The design of the campaign enables whole-of-government actions to increase regional stability and is currently in its fourth and final phase. During the first three phases of the campaign, which ran from 2014 through mid-2020, the Coalition trained and equipped partner forces in Iraq and Syria, advised and accompanied those forces during operations, provided intelligence, and conducted airstrikes to enable the territorial defeat of Daesh. As a result, Daesh lost its territorial hold in Iraq in December 2017 and Syria in March 2019 but has continued to operate as a low-level insurgency in both countries. In the summer of 2020, OIR transitioned to Phase IV of the campaign. In this phase, the Coalition largely shifted from hands-on training, developing, and assisting partner forces in both Iraq and Syria to advising and enabling them, mainly remotely, from consolidated bases during operations against Daesh. Training of partner forces continues in Syria, while in Iraq Coalition efforts focus on reforming and professionalizing Iraqi security institutions and combating corruption to ensure the enduring defeat of Daesh.

In both Iraq and Syria, OIR's most significant security threats come not just from Daesh but other forces working against Coalition interests in each country. In Iraq, several Iranian-Aligned Militia Groups (IAMG), including some incorporated into the Popular Mobilization Forces, remain hostile toward the U.S. troop presence[7]. IAMG violence against Coalition interests in Iraq increased ahead of the first anniversary of the U.S. strike on the Iranian Revolutionary Guards Corps' Quds Force Commander, General Qassem Soleimani, and again with the advent of Ramadan. In Syria, Coalition forces continue to operate in a complex security environment in close proximity to Russian, Iranian aligned, the Syrian regime, and pro-regime forces. These actors moved into the areas of northeastern Syria U.S. troops vacated when Turkey launched an incursion into northern Syria in October 2019[8]. The Defense Intelligence Agency reported that malign actors, including Daesh and forces associated with Iran and the Syrian regime, pose the most significant threat to the Coalition and its mission[9]. Moreover, the U.S. must embrace the complexities of a Joint Coalition headquarters, and relationships with the Government of Iraq, the Iraqi Security Forces (ISF), and Counter-Terrorism Service forces, as well as Coalition Aligned Syrian Forces (CASF). Plotted graphically, the complexity of actors in the CJTF area of operations represent points on nearly every section of the cooperation/conflict continuum.

Daesh remains the primary adversary and they demonstrate a willingness to try to retake territory in Iraq, displaying the makings of a growing and dangerous insurgency. While technically defeated, they maintain the capability to conduct limited actions against the local populace and Coalition

4 U.S. Army. *TP 525-3-1: The U.S. Army in Multi-Domain Operations in 2028*. Washington DC: 2021
5 A2/AD is commonly accepted as layered and integrated; long-range precision-strike systems, littoral anti-ship capabilities, air defenses, and long-range artillery and rocket systems.
6 Chief of Staff of the Army. *U.S. Army Multi-Domain Transformation – Ready to Win in Competition and Conflict,* Washington DC: 2021
7 U.S Government. *Lead Inspector General for OIR's Q4 2020 Report to the U.S. Congress*. Washington DC: 2021
8 Van Veen E, Yüksel E, & Tekine H. *Waiting for blowback: The Kurdish question and Turkey's new regional militarism*. Den Haag: 2020
9 U.S Government. *Lead Inspector General for OIR's Q4 2020 Report to the U.S. Congress*. Washington DC: 2021



Actors in the CJTF-OIR Operational Area span the competition continuum from cooperation to armed conflict.

forces in Iraq and Syria, thus efforts to prevent their resurgence cannot be underemphasized. As part of the natural progression of conflict, the kinetic tools and methods previously employed in Phase III (Defeat-Daesh) operations are no longer appropriate and relevant to Phase IV (Normalize). Non-kinetic means and non-lethal effects now have primacy while the Coalition achieves the gradual and deliberate transition of operations to the host nation forces.

During Phase III operations, the CJTF-OIR staff structure included a Fires Cell (CJ34) and an Information Operations (IO) Cell (CJ39). Fires had limited assets with a sole focus on kinetic strikes and consisted of HIMARS, M777A2, and air assets. In contrast, IO focused on longer-term planning and consisted of multiple Information Related Capabilities including; Cyber and Electro-Magnetic Activities, Psychological Operations, Special Technical Operations, Special Activities, and Space (specifically Space Force). This is not atypical for a standard military (especially U.S.) HQ staff. Indeed, there was some overlap in the functions of Fires and IO, as might be found in a typical U.S. JTF or Division-level headquarters. However, integration and interaction were not the default. This organizational construct created particular disadvantages. First, there were limited interactions between the Fires and IO cells. With a focus on purely kinetic strikes, the Fires Cell had minimal deliberate interactions with the non-kinetic IO cell. Additionally, increasing levels of classification for IO capabilities up to U.S. Top Secret / Alternative or Compensatory Control Measures / No Foreign Nationals mean those particular functions became stovepipes. Often there was such separation from the remainder of the HQ that they planned and conducted their tasks in isolation from other sections and sometimes independently of other capabilities within CJ39. On occasion, this even resulted in divergence from the campaign's priorities and objectives which had the potential to degrade the efficiency of the capabilities themselves and the HQ as a whole. Predictably, the lack of the function of a truly integrated effect created a substantial gap in the ineffectiveness during Phase IV planning and execution.

To adapt to the changing operational environment, CJTF-OIR undertook a structural review in January 2021, creating the MDED. The intent was to scale down from the pure MDO model (Multi-Domain Task Force[10]) to meet the requirements of the CJTF-OIR Phase IV environment. Additionally, this new staff section would establish itself and function as a microcosm of the wider staff. The MDED organization draws from appropriately qualified and experienced pan-service Five Eyes personnel[11] within CJTF-OIR. Accordingly, the design of the organization was not from the ground up, with a requirements model and an understanding of the exact nature of operational effectiveness.

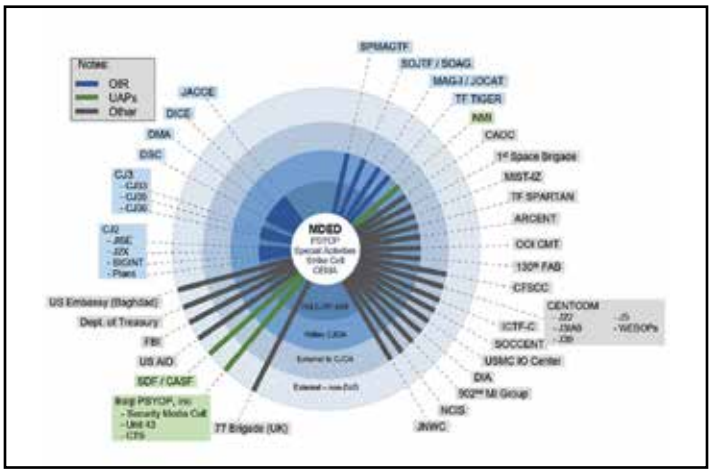
In simple terms, the creation of the CJTF-OIR MDED consolidated the CJ34 and CJ39 sections; a fusion of kinetic and non-kinetic Fires to provide integrated delivery of lethal and non-lethal effects by design. This model has proven efficacious and conditional recommendations are only slight modifications, each depends on the exact requirements of the operational environment. The conditions to successfully operate in Phase IV primarily emphasize non-lethal effects and environmental influence while reducing the employment of lethal Fires. CJTF-OIR's Line of Effort 2 is '*Enhance Partner Force Capabilities*' so MDED's primary planning focus was to ensure that the ISF, Counter Terrorism Service, Syrian Democratic Forces,

10 U.S. Army. *First Multi-Domain Task Force plans to be centerpiece of Army modernization*. Washington DC: 2021
11 CJTF-OIR's MDED includes personnel from all five services (USA, USN, USMC, USAF, and USSF) as well as the UK (Army and RAF), Canada (Army), and Australia (Army).

and other CASF conducted kinetic operations while Coalition efforts focused on the ability to shape the environment so that the kinetic effects were optimized. Consequently, MDED's primary charter is the convergence of partner operations and Coalition non-lethal effects. The MDED, while not strictly adhering to MDO as outlined by U.S. Army TP 525-3-1, adopted Multi-Domain thinking and an MDO approach to the CJTF-OIR mission. Through the creation of the MDED, CJTF-OIR created a scaled-down MDO hub within the larger headquarters.

The ultimate benefit of changing CJTF-OIR's HQ structure to an MDED concept versus the standard Joint Effects concept may be subtle, but it is real. An important point of clarity is that MDO is not just combined arms with some space and cyber capabilities mixed in but a fundamentally new way of thinking about warfare across both the competition and conflict phases of war; to either make conflict unpalatable or victory decisive. Integration of all effects substantially increases effectiveness and the MDED achieves this by serving as CJTF-OIR's integration cell for multi-domain operations and effects. This requires an intimate understanding of the environment, campaign objectives, intermediate military objectives, and operational effects while ensuring that all assets and organizations align optimally to achieve these effects with the requisite synergy and convergence.

Conceptually, instead of a pan-staff MDO approach, the MDED naturally became CJTF-OIR's nexus by serving as its primary integrator, with a reach extending into the various other staff sections and importantly, into subordinate and external units, and other governmental agencies. This integrative capacity is the root of MDO in practice. Consequently, the MDED's influence is broad and it has become a significant contributor to CJTF-OIR's operational effectiveness; it is exponentially more effective than the sum of CJ34 and CJ39.



A hub and spoke diagram outlining MDED's stakeholder relationships.

By ensuring the inculcation of a multi-domain approach, MDED planners in each functional area are better equipped to employ their effects in conjunction with other capabilities to enhance operational effectiveness. This is a learning process, so it was not immediately apparent, but the leaders quickly understood the benefit and actively supported the process. Additionally, with more emphasis on the MDO team, versus individual assets, the senior capability representatives were able to step up and away from their stovepipes and more efficiently lend their experience to shaping multiple plans across the HQ. Finally, with more senior capability representatives engaged in the process, there was enough functional overlap that the team created an increased capacity for planning and cross-domain influence throughout the current and future operations staff sections as well as to Commanders. In practice, only a moderate amount of time and effort determines which domain was relevant or how many domains to leverage for the sake of multi-domain adherence. Instead, the MDED solved problems using all the available assets, organic or externally requested, including the doctrinal air/land/sea/cyber/space, and also interagency, special operations forces, human, informational, and any other 'domain' available. Thus, regardless of how one defines a domain, MDED leveraged it. There was less concern about which domains to employ and more focus on maximizing the use of resources to achieve the desired effect on targets.

Physical structural changes enabled and accelerated this cohesion. The creation of bigger, open workspaces, ensured previously disparate teams were now in close proximity. While obvious to the point of cliché, and frequently downplayed as a merely superficial technique, it created an immediate dividend for the CJTF-OIR MDED team. Previously, the split of CJ34 and CJ39 across three distinct office spaces and two Sensitive Compartmented Information Facilities

(SCIFs) exacerbated the functional stovepiping. By creating a large, open planning room, a large conference room, and one executive area, it nested team members together and they became more collaborative which enabled the creation of novel solutions against tactical and operational issues. To mitigate against segregated SCIF areas there were several weekly touchpoints introduced to ensure the SCIF workers had regular interactions with the remainder of the team. These centered around two weekly MDED meetings conducted each Saturday; the first was a morning huddle, in which every team member, agnostic of rank, briefed their current projects for no longer than five minutes. The second meeting was an afternoon leadership seminar, which provided an informal touchpoint and encouraged lateral thinking and problem solving within the group. These seminars were unique and beneficial as the topics were independent of current problem sets. Finally, daily touchpoints each morning quickly covered priorities, changes in the environment, progress on tasks, or other topics.

The primary manifestation of these changes was the noticeably enhanced team cohesion and increased unity of effort across the MDED. A more integrated team enabled mutual understanding and de-confliction of capabilities while simultaneously promoting diversity of thought. This led to increased effectiveness of planning and problem solving by introducing novel solutions to traditionally stovepiped problems, which achieved the desired effects. A microcosm of this increased efficiency was the MDED plans team's approach to CJTF-OIR planning groups. Planners in the MDED are both lethal and non-lethal Subject Matter Experts (SMEs) so they continually look for opportunities to leverage assets and effects across domains to create a convergence of effects, as well as spatial or temporal advantages and opportunities to defeat competitors' short term niche environmental supremacy. The CJ39 personnel's full integration into the larger staff created the most dramatic effect, facilitating a noticeable depth of environmental awareness and response time.

MDED planners operate in both the current and future operations sphere, so have awareness of operational impacts as they happen, insight into how current conditions affect future operations, and the ability to anticipate changes in the operational and information environment. This was a marked change for former CJ39 personnel, who moved from relatively isolated planning teams to quickly become adaptable and responsive to environmental changes. By

MDED relationships

evolving to a multi-domain approach, their wide spectrum of non-lethal assets provided immediate applicability and relevance to the HQ. Having broader awareness has created a better ability to plan and operate under the umbrella of campaign priorities, this ensures the organization is deliberately driving toward the correct effects and desired endstates or conditions. As a result, the MDED achieves a better understanding of desired effects across the HQ and highlights opportunities to leverage multiple assets for convergence, which creates a temporal or spatial advantage. Placing the relevant capability SME into the planning event at the right time enables efficient planning. More efficient use of SME time provides an ability to focus on relevant problem sets, improve synchronization and then effectively employ the available assets.

A secondary benefit was the inculcation of an execution-focused mentality into the information-related capabilities. By being better linked to the Strike Cell and the Tactical Forward HQ these previously long lead capabilities' SMEs were exposed to the benefits of maintaining awareness of the current tactical dilemmas. They could now have pre-authorized response options and Concept of Operations to use in real-time situations which empowered Commanders with the ability to leverage a wide range of lethal and non-lethal effects. This gave them the ability to create multiple dilemmas' for our adversaries. In turn, this generated flexibility in decision making at the operational level and mitigated CJTF-OIR's inability to ensure supremacy across a wide combined Joint operational area by guaranteed provision of localized superiority at the Commander's time and place of choosing.

Instead of agonizing about the difference between Joint and multi-domain, consider multi-domain as the natural extension of Joint. Joint is a step up from past operations, which were fairly service/domain-centric. The Joint concept focused on the integration of services and took the military's ability to synchronize and coordinate to the 'next level.' Multi-Domain Operations are the natural extension of Joint, it is the new 'next level.' Where previously conducting Joint operations was a pivotal milestone, it should now be the baseline. When you shift your baseline, you must conceptualize what your next step up must be. Multi-domain improves Joint operations. We have enough practice and experience with Joint operations to refine, improve, and introduce further complexity. Also, consider that when creating the Joint concept the threat was markedly different to the current and future threat environments. Joint simply isn't good enough anymore. MDO enables us to simplify the conduct of operations with partner force and ground forces, coalition, cyber, space, and technical effects, to ensure success at a specific point in the tactical battlefield. MDO is not just a concept applicable to great power competition in the Pacific. The CJTF-OIR MDED experience proves that it can and should be modified to fit the environment then applied wherever and whenever U.S forces operate.

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COL Damon Wells is a Field Artillery officer and is currently the 4th Infantry Division Artillery Commander. His previous assignments include Combined Joint Task Force – Operation Inherent Resolve Fire Support Coordinator and Director of Multi-Domain Effects, Director of the Commander's Planning Group at the Fires Center of Excellence, and Commander of 2nd Battalion, 20th Field Artillery.

Photo: XM1299 ERCA, picture taken from Army.mil (credit to U.S. Army)

XM1299 Extended Range Cannon Artillery at the National Training Center 20-10

By CPT Samuel Sutton and MAJ Jeffery Wollenman

In September of 2020, the 1st Infantry Division (1ID) rotated through the National Training Center (NTC) 20-10. It was the first time a Division rotated through as well as a proof of concept was tested regarding the Reinforced Cavalry Squadron (RCS) model. The 1st Division Artillery (DIVARTY) deployed to support 1ID as the Force Field Artillery Headquarters. In addition to their organic Paladin Battalions, 1ID controlled a guest Battalion of M270 Multiple Launch Rocket Systems (MLRS), simulated M777A2 Howitzers, and simulated Extended Range Cannon Artillery (ERCA). Given the physical restrictions on maneuverable space, only one Paladin and one MLRS battalion were present at the NTC, whereas the other Artillery Battalions were simulated from response cells at Fort Irwin Cantonment Area and Fort Riley, Kansas. While this rotation validated Divisional operations in a contested environment, the RCS, and the employment of DIVARTY, the rotation illuminated the effectiveness of a new weapons platform: the ERCA. It demonstrated the profound impact of the ERCA to the Division fight and the promise of renewed supremacy in land-based warfare.

Background On Erca

The XM1299 ERCA is the next artillery platform for the United States Army. Designed by BAE Systems, the ERCA is the next step in modernizing the nation's Field Artillery capabilities against peer adversaries. Still in the prototype stage, the ERCA boasts a longer tube, improved breech, and an autoloader, mounted on

the existing M109A7 chassis.[1] The ERCA has demonstrated its ability to fire a round over 65 km to within one meter of a target.[2] This outclasses the M209A7 and M777A2 Howitzers by more than twice their range. The autoloader is templated to fire 10 rounds a minute sustained, once again eclipsing any cannon artillery in the arsenal. With its improved range and rate-of-fire, the ERCA shows exceptional potential on paper. However, it is a revolutionary platform of which no current unit or Soldier has experience.

Train-Up to NTC, Employment in DG II & III

During its training trajectory for the NTC 20-10, 1ID conducted three Command Post Exercises (CPXs) called Danger Gauntlet (DG) IV. DG IV was the culminating training event executed at NTC 20-10. The majority of the DIVARTY staff which attended NTC 20-10 executed DGs II and III, which incorporated ERCA into the DIVARTY's task organization. DGs II and III also had similar troop lists as DG IV, including the ERCA, MLRS, Paladin, and M777A2 units. Each of these units was represented by a work cell and executed without realistic constraints and friction such as maintenance or communication. The Paladin and M777A2 Battalions spent much of their time as direct support to the RCS or their organic Brigades, and therefore received positioning guidance and answered Calls for Fire primarily from their parent organization in support of the Division close fight. The ERCA and MLRS Battalions were General Support (GS) to 1ID, therefore they received their positioning guidance from DIVARTY and supported the deep fight: shaping in between the Coordinated Firing Line and the Fire Support Coordination Line.

The 1ID DIVARTY Commander's guidance for planning and fighting his artillery was to "Fight Fires Forward," or employ the GS artillery as far forward as possible to maximize range and then destroy the enemy with large volleys. This translated to the GS Field Artillery Battalions moving rapidly forward just behind the Brigade Combat Teams (BCTs) main elements or the initial screen line during the counter reconnaissance fight while the BCTs were uncoiling from their Target Audience Analysis. Positioning these Battalions forward ostensibly makes more of the enemy available to shoot. Saturating the enemy artillery and air defense in indirect Fire is a must to ensure the enemies' total annihilation. This clear and simple guidance drove the planning cycles for each of the Danger Gauntlet CPXs and framed the schemes of Fires and Field Artillery Support Plans (FASP) the DIVARTY developed. The DIVARTY staff planned 3x3 km Position Areas for Artillery (PAA) over ground the DIVARTY S2 analyzed as sufficient for cannon cant tolerance. These PAAs covered nearly all the unrestricted terrain in the area of operations, as the staff planned to move frequently. Due to the unfamiliarity with both the ERCA and MLRS platforms and the lack of available doctrine on ERCA, the DIVARTY staff planned both the MLRS and ERCA to use these PAAs interchangeably. Since the guidance was to saturate the enemy in Fires, both Battalions were consolidated in one PAA each and expected to fire significant volumes of Fire. Due to the limitations of the simulation employed in the CPX, ammunition resupply was not well-rehearsed and the resupplies were unbridled by terrain or enemy. This created an unrealistic expectation of ammunition expenditures unconstrained by a controlled supply rate and near-instantaneous Class V resupply. Once the DIVARTY staff received the Fragmentary Order (FRAGORD) stating a realistic Controlled Supply Rate, an updated Maneuver plan, and an enemy long-range artillery threat, they realized their old procedures for fighting deep-shaping battalions was insufficient.

Concept of ERCA Employment in Planning

The DIVARTY staff deployed directly into Forward Operating Base Santa Fe at Fort Irwin with a scheme ready to execute. Upon synchronizing with the MLRS operations team in person for the first time due to COVID-19 and receiving a FRAGORD from 1ID, the staff quickly executed Rapid Decision-Making Process to refine their current concept of Fires. The MLRS' bottom-up refinement on how to best utilize their formation in terms of munitions capabilities and

1 Todd South," The Army is 'making artillery great again,'" *Army Times*, March 11, 2020, https://www.armytimes.com/news/your-army/2020/03/11/the-army-is-making-artillery-great-again/
2 Jared Keller, "Watch the Army's new supergun nail a target from 40 miles away," *Task&Purpose*, March 10, 2020, https://taskandpurpose.com/military-tech/army-extended-range-cannon-artillery-video

Extended Range Cannon Artillery, or ERCA, will be an improvement to the latest version of the Paladin self-propelled howitzer that provides indirect fires for the brigade combat team and division-level fight. Building on mobility upgrades, ERCA will increase the lethality of self-propelled howitzers. ERCA provides a "10x" capability through a combination of an increased range, increased rate of fire, increased lethality, increased reliability and a greater survivability. Photo by Edward Lopez, June 12, 2018

operations area requirements necessitated another look at their employment. Additionally, the tempo of the Division's fight was elevated, requiring more aggressive posturing of GS units forward, which fits the tenet underlined by ATP 3-09.60[3] *Multiple Launch Rocket System (MLRS) Operations and HIMARS Operations*. Therefore, the DIVARTY staff reworked the FASP and published a new scheme of Fires.

The new concept for the GS Battalions included redefined roles for each platform. Due to the limitations on ammo received for the rockets, the DIVARTY staff reserved them for planned missions on soft or stationary targets such as air defense or command posts. The traditional combat load for MLRS supporting Corps includes a great number of Army Tactical Missile Systems. Since our Guest Battalion was acting as a Division asset and not a Corps shaping unit, they received the Guided Multiple Launch Rocket System only. The ERCA would serve as the workhorse- prosecuting both counterfire and dynamic targets that required rapid execution. Due to the simulated theatre and situation, VII Corps was the main effort of the United States Army in Europe and therefore received the coveted Bonus MK II Round. While enemy armored forces enjoyed relative safety from indirect Fires in the past, the Bonus MK II Round penetrates armor with a roughly one-for-one round per tank ratio. Simultaneous with these changes, the staff reallocated land for PAAs so that each PAA would be a 4x4 km area. Each of our guest MLRS' two batteries would receive their Operation Area (OP AREA) and the ERCA would receive one PAA. Though the ATP 3-09.60 maintains a 4x4 km operational area for each platoon, we were unable to provide such a large amount of land.[4] The scheme retained the aggressive "Fires Forward" mentality, however, since the MLRS battalion was truly on-ground and not simulated, they were relegated to on-post land only.

Begin ERCA Employment Actual DG IV

Once the force-on-force portion of NTC 20-10 began, the DIVARTY staff confronted several challenges with the ERCA. First was the initial volume of Fires requested from 1ID was significantly greater than anticipated. Instead of firing around fifty missions a day as in DG II and III, the ERCA was firing over a hundred missions a day split between counterfire, deliberate, dynamic, and Suppression of Enemy Air Defense (SEAD) Fires. Because of this, the DIVARTY and ERCA response cell split the battalion into three PAAs to maximize the space in which each battery could conduct survivability moves. Unfortunately, splitting the ERCA battalion into three separate PAAs greatly diminished

3 ATP 3-09.60, 3-1.
4 ATP 3-09.60, 4-12

responsiveness for battalion massing since the Division Joint Air-Ground Integration Cell had to clear three distinct locations. Therefore, ERCA transitioned from firing Battalion volleys to primarily firing Battery volleys. The DIVARTY reserved massing the ERCA Battalion for enemy Battalion- and Brigade-sized formations which were stationary and justified longer Target Selection Standards. As force-on-force progressed, the great preponderance of Fire missions was sent to the ERCA to service due to its flexibility and responsiveness. The 1ID's Battalions fought a tough close-fight with enemy indirect Fire systems with significant counterfire. The Division's GS Battalions, however, fired with little to no fear of repercussions.

The second challenge effect of the volume of Fires on how each ERCA battery conducted survivability moves, managed ammunition and maintained equipment. ERCA's initial survivability criterion was to conduct a survivability move within their PAA after every Fire mission. Due to the volume of Fires, this became untenable with multiple Fire missions queued for each firing battery. Therefore, DIVARTY refined the survivability criteria to conduct survivability moves within their PAA after three to four Fire missions or during any lull in the firing. The Battalion Fire Direction Center (FDC) then managed those moves and reported when they needed to conduct survivability moves. Ammo resupply with the volume of Fires required a daily resupply with forecasting out to 96 hours. We exercised "just in time inventory" at the beginning of the rotation as we adjusted our consumption tables to account for the higher volume of Fires. This was critical to ensuring continuous Fires and was personally managed by the DIVARTY Executive Officer in a daily staff synch. Additionally, maintenance became an issue with the volume of firing for the ERCA. The tube life for the XM 907 is currently templated at 700 rounds with the supercharge propellant firing at max range. [5]Additionally, if the tube temperature reached 350 degrees, then the tube required a mandatory 24 hour period to cool down. The ERCA response cell simulated these constraints by rotating firing batteries and managing their Battalion Fire orders. Despite this management, there were times ERCA sections were down for maintenance for 24 hours to account for tube wear and temperature.

A third challenge was the change in command-support relationships with the ERCA. During one of the lulls in the fighting, our Paladin battalion requested the ERCA provide GS Fires to the RCS to allow the Paladins to reconsolidate, conduct Battalion resupply, and refit operations and then reposition to better support the RCS next zone reconnaissance the following morning. The ERCA BN was able to provide these GS Fires without having to reposition its forces and with no degradation to its deep shaping Fires. The extraordinary range capabilities of the XM1299 allow for the Battalion to fire into the far northern corridor in the area of operations and shape the deep fight in the central and southern Maneuver corridors of the area of operations simultaneously.

A fourth challenge was the assistance to the Combat Aviation Brigade's (CAB) deep attacks in the form of SEAD. The CAB conducted a period of darkness deep attack nearly every night and consequently submitted a robust request for SEAD every day. The ERCA battalion consistently provided suppression of enemy air defense for these missions. ERCA's munition flexibility allowed for specific rounds per target type as well as last-minute "audible" changes to targets. Having the capability to range up to 70 km to suppress or destroy air defense enabled the CAB to not only expand its attack distance but expand its target SEAD targets to allow for a more comprehensive suppression. Though the DIVARTY staff does not recommend it due to ammunition and planning requirements, the ERCA regularly suppressed or destroyed over a dozen targets for SEAD near simultaneously.

The last challenge of the ERCA was in its fight against the enemy's armor. Of course, the Bonus MK II Round was the key to this challenge, which arguably provided the greatest advantage of the ERCA. While the Bonus MK II Round was reputed to be a revolution, 1ID had yet to utilize this round; simulation or otherwise. This combination of extended range up to 50 km and anti-tank munitions changed the course of the battle. As 1ID moved west and occupied the initial objectives, the enemy received a mechanized brigade

5 JWA_Inc2_LRPF_CFT_Capability Baseball Card

of reinforcements and launched a devastating counterattack. The counterattack caused the Division to halt and the GS Battalions to retrograde to more secure PAAs and OP AREAS. This was in anticipation of the roughly 200 (T-90) MS Main Battle Tanks consolidating to attack through the southern mobility corridor. The 1ID quickly identified the force and its supporting air defense assets. Then, the 1ID cleared all air in the south and sent DIVARTY a single Fire mission targeting this enemy Brigade Tactical Group. The DIVARTY Fire Control Officer directed the ERCA to fire twelve battalion volleys of the Bonus MK II Round. The ensuing Fire mission destroyed 135 T-90s in minutes thus effectively ending the enemy's counterattack and ensuring the initiative remained with 1ID. The ERCA would subsequently destroy the remainder of the T-90s in piecemeal Fire missions using that munition.

Of note was the pairing of the AN/TPQ-Q53 RADAR and the ERCA, which could fire out to the RADAR's maximum sensing range. The enemy medium and light indirect Fires were focused on the close fight with the BCTs and RCS and chose to prioritize those formations over the GS Battalions. Therefore, the DIVARTY's Counterfire became a game of "whack-a-mole," trying to destroy the dispersed medium artillery as quickly as possible to support the BCTs in the close fight. The medium artillery was lower on priority on the High Payoff Target List, but VII Corps shaping effects had been effective at destroying the enemy long-range artillery. Therefore, the ERCA Battalion received minimal counter Battery at its formations and could fire with near impunity in the counter firefight.

Summary and Future Considerations

The ERCA response cell consisted of an FDC, with one AFATDS box operator sending to the simulation operators. This system was not entirely realistic, however, it created enough links in the mission chain to somewhat simulate realistic FDC processing times. Since the platform will come equipped with an autoloader, the unrealistic mission times could be near accurate. Therefore, the value of the experiences and knowledge learned from the ERCA during the rotation shouldn't be discounted completely due to simulations.

The XM1299 ERCA dominated the battlefield during NTC Rotation 20-10. Positioned just behind Maneuver forces to fire forward, the ERCA had ample range in which to Fire missions, providing extraordinary responsiveness when Division acquired targets. The very nature of cannon artillery enables munition flexibility, as the round only needs to be on hand and not pre-loaded. This platform destroyed tanks, artillery, electronic warfare assets, and air defense with lethal efficiency. Furthermore, the ERCA can easily assist in the close fight for GS relationships when needed; the platform will not need to relocate to range. The fundamentals of the cannon propellant allow for flexibility on short or longer ranges.

The ERCA is capable of firing roughly 70 km, but that would ostensibly require a full load of supercharges. The wear from such a propellant load will rapidly degrade a tube if combined with the ability to shoot far and with an autoloader. ERCA units will need to be able to rapidly replace tubes due to excessive wear. They may need to even have the Forward Support Companies (FSC) carry them to switch out as quickly as possible, which would need to be a priority training objective for those FSC Commanders.

The extended tube and range of the ERCA does raise a few concerns. Is the XM1299 ERCA capable of direct Fire on encroaching enemies? Though it is preferable to avoid the situation, direct Fire has saved countless Artillerymen. If it is still possible, then Battery Commanders should ensure sufficient space between sections to enable direct Fire when applicable.

Communications are the other main concern. The ERCA can fire at such long ranges that traditional FM communications are potentially insufficient. The ERCA command posts were regularly located in mountainous areas 30 km or more from our nearest command post during NTC Rotation 20-10. ERCA Battery and Battalion FDCs should come equipped with both high-frequency radio and Warfighter Information Network-Tactical (WIN-T). The ERCAs must also have sufficient Joint Battle Command Platform coverage throughout the formation. While high-frequency has a slight lag time for transmission, WIN-T requires adequate satellite coverage. Both options, however, are preferable to setting up an OE-254/GRC Antenna Group at each occupation.

The XM1299 ERCA is the future King of Battle. The platform's flexibility, adaptability, range, and lethality ensure its dominance in the indirect Fires domain. Developing clear and effective targeting in conjunction with flexible air and ground clearance procedures for ERCA will result in devastating effects on the battlefield. Doctrine should be unique and carefully crafted through numerous large-scale exercises for the ERCA. Simultaneously, the Army must maintain the MK2 Bonus round or an equivalent to enable dominance against armored threats. In near-peer or peer adversaries, air superiority is not guaranteed. Allowing the ERCA space and time to work will repay all investment with interest, and victory.

CPT Sutton was the Fire Control Officer for 1ID DIVARTY during the NTC Rotation 20-10 and was in the position for five months at the time. Currently, he serves as the Battery Commander for Delta, 1-5th FA "Hamilton's Own."

MAJ Jeffery A. Wollenman was the 1ID DIVARTY Brigade Operations Officer during its recent deployment to NTC 20-10 and WFX 21-3. MAJ Wollenman is currently serving as the executive officer for the 1st Battalion, 7th Field Artillery Regiment in 2nd Brigade, 1st Infantry Division.

Current Weapons *of the* U.S. Army Field Artillery

Left Column:

M119A3 ***105 mm light towed howitzer***

M777A2 (Triple-7) ***155 mm medium towed howitzer***

M109A7 (Paladin) ***155 mm self-propelled howitzer***

Right Column:

M142 (HIMARS) ***High Mobility Rocket Artillery System***

M270A1 (MLRS) ***Multiple Launch Rocket System***

Photo credits: U.S. Army

Destroying Armor *in the* Deep Fight:

Observations from the First BONUS MK II Live Fire

By LTC Mike Tumlin and CPT Aaron Stout

In the spring of 2021, Battery C (Chaos), 4th Battalion, 319th Airborne Field Artillery Regiment, 173rd Airborne Brigade (C/4-319th AFAR, 173rd IBCT{A}), deployed from Grafenwohr, Germany, to Camp Canjuers, France, for Operation Bonus Strike with the 93éme Régimente d'Artillerie du Montagne (93eRAM) to live Fire and evaluate the 155 mm BONUS MK II Round. Operation Bonus Strike 21 marks the first operational live fire of the BONUS MK II Round outside of testing by a U.S. Army Field Artillery unit.

The BONUS MK II Round is an armor defeating munition newly acquired across the U.S. Army and provides a critical capability to Maneuver Commanders in Large-Scale Combat Operations. The purpose of this article is to provide observations and lessons learned during 4-319th AFAR's operational live fire of the BONUS MK II Round to enable effective employment of the capability across the force.

BONUS MKII Round Overview

The BONUS MK II Round is a 155 mm cannon-launched, top-attack, anti-armor shell containing two sensor-fuzed, armor-detecting submunitions. When the munition is fired and reaches the target area, a time fuze activates, causing a small ejector rocket to detach from the shell. This ejector pulls out the two submunitions which then begin scanning a 200-meter area for heat signatures. Upon detecting a target vehicle by its heat signature, the submunition detonates its explosive payload by creating an explosively formed projectile that strikes through the target's top armor. These submunitions are designed to penetrate the vehicle's hull to destroy the target and personnel inside. The BONUS MK II can only be employed using M232 Hotel Charges and the M762A1 Electronic Time Fuze.

When employing the BONUS MK II Round during operations, Commanders must be aware of the explosively formed projectile hazard area. The hazard area is a 5,000-meter radius added to the perimeter of the dispersion area to account for the potential of the munition to detonate on the ground. The BONUS MK II Round is currently not authorized for overhead Fires due to the low probability of early fuze-function resulting in the submunitions searching for targets short of the target area.

When employed effectively, the BONUS MK II Round provides Maneuver Commanders the ability to destroy threat armor well beyond the range of direct Fire weapon systems. During Saber Junction 19 and 20, two Multi-National Combat Training Center rotations at the Joint Multi-national Training Center, the 173rd IBCT(A)

Above: Battery C (Chaos), 4th Battalion, 319th Airborne Field Artillery Regiment, 173rd Airborne Brigade live Fires the BONUS MK II Round in Camp Canjuers, France) Next page: BONUS Rounds uncrated at the Firing Point.


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effectively planned for BONUS MK II employment during the targeting cycle to identify targets and associated triggers to destroy enemy capabilities in the brigade's Deep Fight.

Firing Line Observations and Considerations

BONUS MK II Rounds are palletized with two plastic containers stacked vertically. Each container stores three rounds and weighs 337 pounds, for a total of six rounds per pallet. The total weight of the pallet is 720 pounds and requires a forklift to move in this configuration. For safe transport, a round cannot be transported in the Loose Projectile Restraint System (LPRS). BONUS MK II Rounds can only be stacked horizontally, not to exceed a height of two stacked containers, and must remain in the containers until a valid Fire mission is processed. We estimate one M10883A1 FMTV is capable of hauling 36 BONUS MK II Rounds and an MTOE-equipped M777 Towed Howitzer Battery has the potential to haul 360 BONUS Rounds, propellants, and fuzes, if not carrying other munitions and no LPRS is installed.

LHS ammo showing crate storage compared against M795s in LPRS

The packaging, weight, and handling requirements create a logistical challenge as the rounds require additional equipment to move when conducting refuel, rearm, and resupply operations. When using the FMTV to conduct resupply operations, 4-319th AFAR is not equipped with the cranes for the vehicle and must disassemble the packaging outside and then reassemble the packaging inside the vehicles. This increases the amount of time to conduct these rearm operations and creates a risk to the force as ammunition sections and the distribution platoon's exposure to potential enemy observation and engagement increases.

At the Howitzer section level, storage and handling requirements for the BONUS MK II Round prevents rapid employment. It is recommended that BONUS MK II Rounds are stored in the three-pack plastic containers until a Fire mission is processed. This creates additional time to unpack and prepare the rounds for firing which Commanders must consider. During 4-319th AFAR's live Fire, storage and handling procedures added 15 seconds to remove the round out of the transport case then fuze before verification by the section chief. This increased time could be mitigated by following standard section ammunition pit-procedures and pre-fuzing rounds for planned targets. For on-call targets, the Howitzer section must work through procedures to fuze the rounds after receiving the mission adding additional time to the Fire mission before the shot.

A final consideration when firing the BONUS MK II Round is the security and survivability of the firing element. During the round's flight, the BONUS MK II Round produces a white trail as it reaches the apogee of the flight path. Our observers have positioned over 16 km from the firing unit and identified distinct trails produced by the round from the observation post, which enabled the observers to identify the firing unit's location. This signature presents a security concern for firing batteries when operating in a contested environment and should be accounted for in Commander's survivability move criteria.

Fire Direction Observations and Considerations

During the 4-319th AFAR BONUS MK II Round live Fire, there were no changes in current procedures required from the Brigade and Battalion level to process the mission to the firing unit's Fire Direction Center. Using the Howitzers in ready status, the AFATDS and the Howitzers were able to conduct their independent safety checks and verify the Fire commands prior to firing.

When computing firing data for the BONUS MK II Round, 4-319th AFAR observed that we were required to add 125 meters to the target altitude to account for activation of the munition and search area for the submunitions. During

our live Fire, observers provided accurate target location using the Lightweight Laser Designator Rangefinder 2H and requested Fire on static tank hulks prepared with boilerplates to provide a sufficient and realistic heat signature. The initial round impacted approximately 300 meters long on gun-target line and functioned at approximately 25 meters height-of-burst above the impact area. Observers corrected to adjust the impact of the next round to target, however, the correction only slightly moved the round closer to the target with a similar height-of-burst observed.

In a subsequent Fire mission, the Fire Direction Center applied 125 meters to target altitude which allowed the round to function over the target area, and then identify and destroy the target. This adjustment was based on the recommendation of 93eRAM Fire Direction personnel from experience gained over ten years firing the BONUS MK I annually. The BONUS MK I round is ballistically similar to the MK II, and functions in the same manner described above; the difference being the thermal sensors on the MK II submunitions have higher fidelity to acquire the highest heat signature on the target.

A key area of focus to further enhance the capability gained for the Maneuver Commander by the BONUS round is the ability to fire the round during degraded operations. Current computational procedures only allow for the BONUS round to be fired digitally from the AFATDS with Howitzers in 'ready status.' Therefore, the Fire Direction Center was required to use two AFATDS in Hot Box / Cold Box configuration to verify computational data safe. This may present challenges to batteries fighting decentralized platoons due to terrain or mission requirements should they lose digital capability. A proposed fix is to create a manual computational solution building off of the M864 Dual-Purpose Improved Conventional Munition firing tables to enable firing in a degraded status. Until an approved firing table is developed, U.S. Army Field Artillery units will only be able to fire the BONUS MK II Round digitally.

Fire Support Procedures and Observations

Fire supporters from across 173rd Infantry Brigade Combat Team (Airborne) provided observation during the 4-319th AFAR BONUS live-Fire exercise. Calls for Fires were routed by voice to the Brigade Fire Support Element before routing digitally to the Battalion Fire Direction Center.

Currently, digital Fire support software with the capability to select the BONUS MK II Round is not fielded to the force. To request BONUS, forward observers must include the shell selection in the call for Fire request. This creates a delay in the time to modify the Fire mission before it can enter into the digital chain from sensor to shooter. Planned updates to the software will remove this concern and streamline the process along the digital Fires chain in the future.

Alternatively, BONUS MK II employment should be intentionally planned for during the Brigade's targeting process and further managed through Target Selection Standards and Attack Guidance to ensure the Maneuver Commander can fully leverage the capability of the round. The 173rd BDE Targeting Officer noted BONUS round employment must be deliberately planned and accounted for as pre-planned targets. Based on the transportation and handling requirements, as well as the firing procedures described above, Commanders and staff must thoroughly develop triggers to allow sufficient time to initiate the Fire mission and allow Howitzer sections to prepare rounds for use – especially for moving targets.

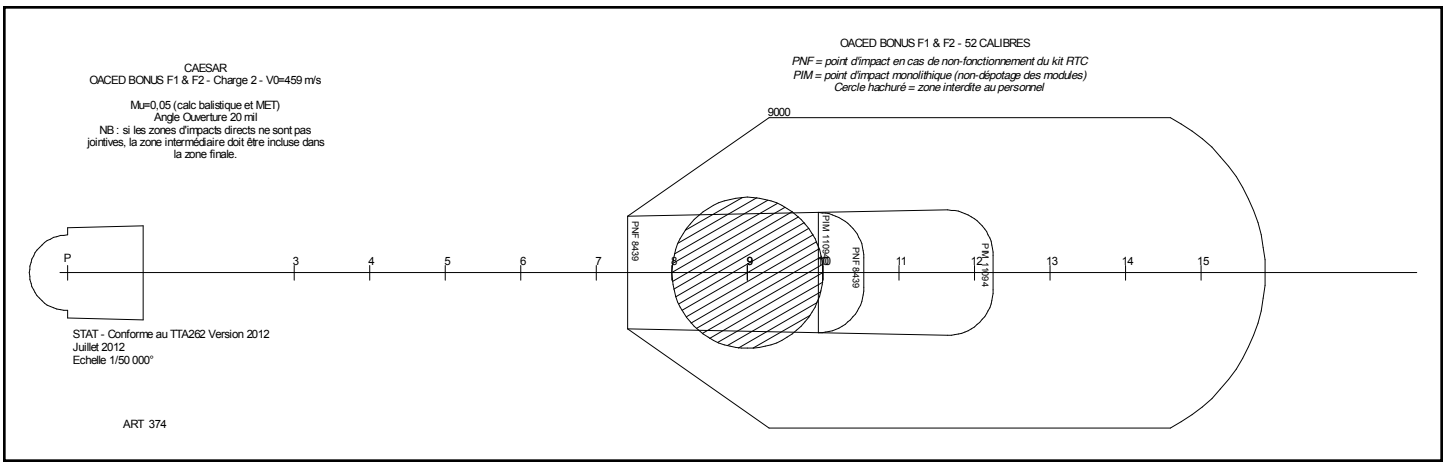
BN FDC with French ATLUS

French Bonus Observations

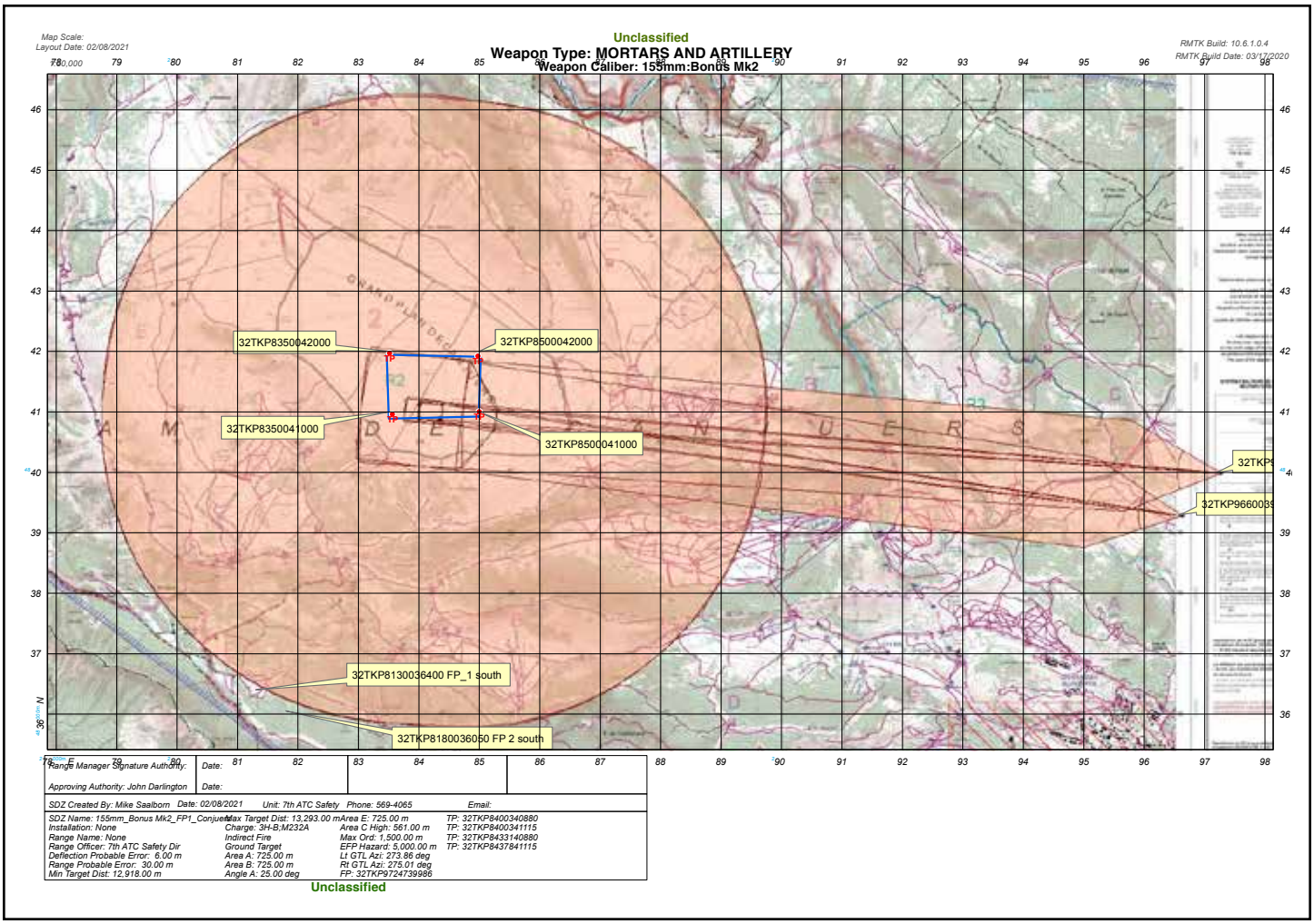
While the battery conducted training at Camp Canjuers, subject matter experts from the 93eRAM provided lessons learned from their experience shooting the round. The 93eRAM openly shared

their observer, Fire direction, and gun-line experience and proved invaluable to the success of 4-319th AFAR. We found French artillerymen's experience pivotal to our employment and successful engagement of the BONUS MK II Round. While training alongside a key NATO ally, 4-319th AFAR observed several differences in the manner in which we deliver Fires, most notably differences in the Surface Danger Zones (SDZ) for this round.

Standing safety messages for live firing the BONUS MK II Round requires a 5,000-meter hazard area from the target, while the French use a 7,000-meter extension to Danger Area B of their computed SDZ. French artillerymen clarified that there is a greater hazard from the BONUS round



Comparison of French (Above) SDZ versus U.S. (Below) SDZ.



BONUS Effects

at increased distances as opposed to a premature activation for the submunitions. While the French incorporate a larger Danger Area A, they do not include a hazard area as part of their calculations and requirements for firing artillery rounds.

Throughout Operation BONUS STRIKE, the 93eRAM Operations Officer discussed his unit's observed trends when employing the BONUS MK I. Per his experience over ten years of operational use, the BONUS MK I round tends to fire long of the target area. This trend is consistent with our initial rounds fired, observed long on the gun-target line. The solution the French Army has now adopted is to plot BONUS round impact approximately 100 meters short of the intended target. This technique reduces the quadrant required to minimize the probability of the round activating past the target area. Another option is to add 125 m to the target altitude as highlighted earlier in this article to allow the submunitions the maximum opportunity to identify the target within the 200-meter search area. The 4-319th AFAR's observations are limited to live firing four rounds and we recommend further operational testing and live-Fire of the BONUS MK II Round to determine accurate computational procedures.

Conclusion

Operation BONUS STRIKE 21 enabled 4-319th AFAR to evaluate and further learn procedures to effectively employ the BONUS MK II Round from our French counterparts. The BONUS MK II Round provides Maneuver Commanders an all-weather capability to defeat threat armor in the deep fight. Importantly, this opportunity highlighted a strong NATO alliance and demonstrated our combined ability to destroy adversary armor in the European theater.

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A Look in the Mirror:
Fire Support as a Partnered Force

By MAJ Trevor Williams

Our American military has grown accustomed to having the resources, authorities, and planning priorities to bring our world-class assets to bear at the time and place of our choosing. However, we must train to fight without the luxury of a myriad of resources seemingly on call when preparing for future conflict. To defeat a near-peer adversary, the U.S. will surely do so as part of a larger force, applying and merging the 2018 National Defense Strategy pillars of increased lethality through strong alliances and partnerships.[1] This article will highlight methods in which the Fires community can improve aggregate operational lethality through efforts to incorporate international partners into our tactical processes. We must endeavor to build comprehensive force capability through combined targeting efforts, delivery synchronization, and dynamic coordination to fully leverage multi-national contributions.

During the 1-2nd Stryker Brigade Combat Team's (SBCT) "Ghost" Joint Readiness Training Center (JRTC) rotation in November of 2020, the Brigade played the role of a foreign nation's Army in support of 5th Security Force Assistance Brigade's (SFAB)

1-2nd SBCT and 5th SFAB leaders finalize coordination for combined operations at JRTC rotation 21-02 at Fort Polk, Louisiana.

1 DoD, *Summary of 2018 National Defense Strategy of the U.S.A,* 2018, 5-8 (Washington, D.C.).

training from the competition through conflict. SFAB training objectives specific to Fires included efforts to "plan and synchronize Fires through a Brigade-level targeting process" and "synchronize timely and accurate Fires."[2] This presented the BCT's Fire Support Element (FSE) with a unique opportunity to conduct targeting and Fire support from an unfamiliar perspective of planning and fighting without all of our common collection and delivery assets. Further, the experience illuminated Fire support procedures that allowed us to better understand how we might fight in future Large-Scale Combat Operations as part of a collective force. Through transition into conflict with a near-peer adversary, BCT level targeting, detection, delivery of Fires, and assessments must embrace combined force capabilities.

The operating environment of this JRTC scenario was fascinating because it condensed the competition timeline to approximately one week, then transitioned directly into the conflict. At the outset, the BCT and SFAB teams faced threats from a Northern conventional military poised on the border, with Islamic and communist insurgencies in the Area of Operations. Then, the invasion from the Northern border instigated force-on-force operations against a near-peer adversary. Unlike other Combat Training Center rotations, this scenario offered both the SFAB and the BCT the opportunity to set conditions for combined operations through relationship building and synchronization.

The 1-2nd SBCT entered the rotation at a higher readiness level than many of the future military partners the SFAB might encounter. Accordingly, during the competition phase of the rotation, the BCT and SFAB conducted separate targeting cycles because the units had different objectives. Playing the role of a host nation forces in competition with an insurgency, the BCT focused non-lethal targeting on building relations with regional security forces, growing rapport with the spheres of influence, and understanding the human dynamic of the operating environment. Meanwhile, the SFAB targeted systems and individuals to best support host nation activities to undermine conventional threat actions. In this phase, our organizations worked to develop processes to build synchronization in the form of a shared set of targeting priorities.

Combined targeting

When competition transitioned to conflict, both organizations quickly concluded that parallel targeting was ineffective. Working through two different decision cycles with varied asset priorities creates unnecessary friction with partnered forces. The targeting cycles required complimentary priorities to ensure both forces worked towards the same end state of defeating conventional enemy forces while maximizing the effectiveness of finite resources. Through united targeting working groups, our teams established targeting guidance and priorities, synchronized the Intelligence Collection (IC) plan, and determined the best means of delivery from our respective organic and Echelons above Brigade (EAB) assets.

Next, the BCT and SFAB arranged both battle rhythms to ensure both Commanders were available for nightly target decision boards to make informed decisions according to each nation's operations over the next 72 hours. As part of a larger fighting force, the targeting battle rhythms should avoid nesting or parallel planning; they should be unified and comprehensive beginning in competition. This lesson learned could be extraordinarily valuable in future operations because it produced transparency across both teams that seemingly increased our lethal efficiency. Merging targeting cycles seems like a fairly easy accomplishment, but it does not come without friction.

Developing partnered nation capacity comes with the burden of foreign disclosure and operational security concerns that create risk for Commanders. We must consider this challenge while providing actionable intelligence without over-classifying information due to risk aversion. Intelligence, operations, and asset allocation must be fully synchronized within any good targeting cycle. As a trained and lethal American formation, the BCT is familiar with owning the collection and delivery platforms within a 72-hour cycle. However, in this scenario, the 1-2nd SBCT intelligence and Fires warfighting functions experienced the challenge our

2 *5th SFAB training objectives for JRTC rotation 21-02*

partners and allies often face: making recommendations and decisions based on requests to utilize another nation's resources according to an incomplete intelligence picture.

BCT and SFAB formations operating with partnered militaries must identify Foreign Disclosure Representatives (FDR) to limit concerns of untimely and incomplete intelligence pictures that inhibit friendly forces' ability to act. Further, these FDRs must have streamlined access to Foreign Disclosure Officers that can rapidly process requests to provide the right information at the speed of relevance. In this JRTC scenario, operations and Fires relied on shared workspaces to conduct targeting with matching digital systems classifications. SFAB classified intelligence production occurred in a separate location as a protective security measure. Nevertheless, this gap created a level of uncertainty because of the lack of complete information available.

The BCT FSE and IC teams accounted for the information gaps with refined processes to ensure we requested capabilities and effects rather than specific systems to best advocate for resources. We found more success in requesting support from the SFAB through specific tasks and purposes with flexible timing due to our lower resourcing priority. The impact on Fire support came in the form of almost strictly conditions-based triggers vice timed triggers because we controlled neither the timing nor the fulfillment of our asset requests. This required the IC and Fires teams to coordinate layered plans dependent first on our organic mortars and M777A2 Howitzer with the ability to upgrade our lethality through high-end SFAB resourced collection platforms and long-range delivery assets such as General Support (GS) HIMARS and air interdiction sorties. For example, during their counterattack, the BCT requested armed Intelligence, Surveillance, Reconnaissance (ISR) in the deep area.

5th SFAB and 1-2nd SBCT IC/Fires teams build combined collection and delivery plan for upcoming operations.

Unfortunately, due to other priorities, the ISR we received was unarmed and the BCT had to shift to other organic delivery systems to take advantage of the SFAB's available IC platform. Thus, future Brigade-level partnered operations must be very specific about the assets available during targeting working groups to limit the risk of unrealistic expectations.

Delivery synchronization

The SFAB and BCT conducted parallel Joint Fires planning early in the rotation, which did not lend itself to quality synchronization during execution. Future SFAB and BCT operations in a combined operational environment must commit early to unified planning efforts. The separation of defined organizational target responsibility became critical to efficient target prosecution. Once the rotation moved from competition to conflict, the BCT and SFAB identified the need to fight off of one mutual High Payoff Target List (HPTL) vice separate targeting priorities that would de-synchronize dynamic activity between both nations' Fire support elements.

The lethal arm to this agreement came in the form of a deliberately agreed-upon Attack Guidance Matrix (AGM). While non-standard, our combined AGM went a step further than identifying specific delivery weapon systems paired with defined HPTL targets; we outlined distinct delivery responsibility according to each nation's system capabilities. Specifically, both the BCT and SFAB agreed that the SFAB would target Air Defense Artillery and conventional long-range artillery targets in the deep area, with the BCT engaging target categories such as command and control and maneuver in the close area. This extra level of detail produced efficiency in dynamic Fire mission processing; our organic BCT cannons and mortars were unable to prosecute deeper targets that defaulted directly to SFAB resourced GS HIMARS. Our united efforts to streamline information flow capitalized on matching Named Areas of Interest and High-Value Target code names that we lacked during the counterinsurgency-focused competition phase of the rotation. Synchronized and complimentary target detection and prosecution generated confidence in the SFAB and BCT partnership. This effort can drive teamwork within future multi-national operations.

Both organizations agreed upon graphic control and Fire support coordination measures to synchronize operations and avoid international fratricide. As part of typical BCT operations, we built the framework of battlefield geometries to ensure permissive Fires while simultaneously protecting our forces with Critical Friendly Zones and No Fire Areas. Additionally, the use of Common Sensor Boundaries expedited the delivery of counter-Fire from host and partner nations. Once the FSE completed target list worksheets, the BCT shared these "fighting products" with our SFAB counterparts before and after our technical rehearsals. After reflecting on the rotation, it would have been more effective to include SFAB advisors in the technical rehearsals to gain an understanding of the effects our organic indirect Fires would achieve.

Working with another military organization requires a constant push and pull of information to ensure all products, coordination measures, and graphics are accurate at any given time. This thought lends itself to a significant point for the success of future Fires integration with partnered forces: Liaison Officers (LNO) with the right tools, authorities and communications platforms are essential in both forces' operations centers. As our Brigade Fire Support Element and the SFAB accumulated lethality, we worked through various options of a combined Tactical Operations Center (TOC), LNOs in companion TOCs, and a hybrid of separate TOCs and a shared fusion cell.

This rotation proved that the most effective and efficient manner to create desired Fires effects on the battlefield came in the form of a combined fusion cell. As our rotation moved from a deliberate defense to a counter-attack, the teams jumped TOC locations to best control operations. To synchronize processes, including IC and Fire support, the SFAB and 1-2nd SBCT both operated separate TOCs with SFAB advisors embedded in the BCT TOC to act as LNOs and communicate with collection and delivery assets. Our teams constructed a small fusion cell to provide an additional synchronization node. As we prepare to leverage Fire support with future partnered militaries, U.S. forces must carefully consider the use of a fusion cell as well as choosing the right leaders to serve in the LNO package. This two to a four-person team must have the operational knowledge and interpersonal skills to advocate for their Commander's equities within a diverse staff. Using the BCT/SFAB operational framework, the LNO package should include a Fires or intelligence leader who can speak to asset availability and articulate capability. They must also possess the digital systems and requisite skills to provide 24-hour intelligence and resourcing feedback.

Dynamic coordination

Brigade-level dynamic Fire mission execution coordinated with the SFAB drove lethal effects in support of maneuver elements during the JRTC rotation. The requirements for a combined Common Operations Picture (COP) and secure communications medium became essential components to dynamic coordination between our partnered forces. Battle tracking is one of the most important jobs of a Fire supporter; this task became quite complicated in this scenario construct because our BCT FSE conducted air and ground clearance with forces outside of our organization and typical communications architecture.

At the outset of our rotation, SFAB rotary-wing movement through the battlespace congested gun-target lines due to the BCT's lack of direct communications with pilots due to the scenario of multi-national operations. Joint airspace management typically creates confusion and risk due to a lack of real-time situational awareness. To remedy this gap, the SFAB and BCT aviation elements coordinated air corridors and communications at multiple echelons to ensure both organizations had an understanding of rotary-wing locations. The SFAB retained positive control of rotary-wing assets and the BCT controlled organic ISR. Additionally, we leveraged both the previously discussed fusion cell, LNOs, and a combined COP to overcome this friction.

Creating a real-time combined COP seems simple enough. However, we must put ourselves in the shoes of future partners and allies that do not have access to U.S. military high-end digital resources that feed our COP. In this scenario, 1-2nd SBCT did not have direct access to the Air Tasking Order, Airspace Coordination Order, or Special Instructions for each day and relied on our advisors to keep our TOC informed of changes to the airspace COP. On the ground, our teams worked to merge feeds that conjointly

displayed the collective force in real-time. To that end, the use of a combined analog COP coupled with a digital COP on a shared medium such as Command Post of the Future became vital to our ability to dynamically re-task collection and delivery assets. Additionally, working through a shared communications architecture reinforced responsiveness to support operations. Our work with the SFAB proved that partnered forces must build and rehearse the ability to flex assets in space and time according to agreed-upon priorities.

Lastly, as a partnered force without the common sensors, decision space, and access to EAB assets, the BCT relied on the belief that our SFAB advisors provided the most accurate and responsive intelligence and Fire support. During this rotation, the BCT depend on SFAB resourced deep area collection, GS Fires, and air support. The BCT FSE consistently requested more information from our SFAB advisors to confirm the prosecution of targets according to reliable intelligence and rules of engagement. Brigade leadership had to trust the SFAB owned intelligence or risk missing the opportunity to strike enemy targets. SFAB work to foster productive relationships in the competition phase laid the foundation of trust for dynamic prosecution of targets in the conflict phase. Thus, U.S. Fire supporters must build professional relations with international intelligence officers and Fire supporters to eliminate barriers of trust due to operational security, language differences, and foreign disclosure constraints.

The SFAB worked diligently to develop a layer of confidence that became increasingly significant to Fires delivery as the Area of Operations grew in kinetic activity. Relying on our combined AGM, JRTC injects forced timely engagement decisions such as cross-boundary counter Fire, while the partnered organization quickly responded to Calls for Fire in support of troops in contact. Deliberate and combined IC/Fires rehearsals shaped battle drills that led to our shared proficiency to process Fire missions for both targets simultaneously. Future multi-national operations must leverage these lessons to share, rehearse, and communicate to best bring all forces' capabilities to bear against a shared enemy. Only then can we become an unbeatable combined force capable of defeating a near-peer threat.

Application for Fires readiness

After nearly two decades of fighting counterinsurgencies as the biggest kid on the block with all of the toys, we must learn to share our Fire support systems and intelligence with partners or risk increased friction and a lack of synchronization. Using the lessons learned from this combined BCT and SFAB rotation, future Fire supporters can improve lethality through combined targeting cycles, delivery synchronization, airspace deconfliction, and dynamic coordination. When we can seamlessly integrate with another nation's operations, Fire support, and intelligence teams, we can prepare our combined forces to defeat future well-resourced and highly trained adversaries.

1-37th FA fires their M777 in support of combined operations at JRTC 21-02 at Fort Polk, Louisiana in November 2020 (courtesy of JRTC photography).

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Watch the 2021 Fires Conference.

Archived at livestream.com/firescenter/events/9789427

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Soldiers preparing for a Fire mission inside a Paladin M109A7 155 mm Artillery System.
Photo credit: U.S. Army

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