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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: *Soldiers from C Battery, 1st Battalion, 120th Field Artillery Regiment, Wisconsin Army National Guard conduct Fire Control Alignment Test to ensure the M777A2 155 mm howitzers are properly aligned to provide accurate fire mission at Camp Grayling, Mich., during joint training exercise Northern Strike 20-2/Winter Strike, Jan. 24, 2020. (MSgt Scott Thompson/U.S. Air National Guard)*

COL (P) Winston Brooks
Field Artillery School Commandant

Welcome to the 54th Commandant of the U.S. Army Field Artillery School and Chief of the Field Artillery

Colonel (P) Winston P. "Phil" Brooks

COL (P) Brooks latest assignment was as Deputy Commanding General (Maneuver) for the 1st Infantry Division. As the 54th Commandant of the U.S. Army Field Artillery School (USAFAS) and Chief of the Field Artillery (FA), he assumes responsibility of the USAFAS and FA branch as they rapidly continue to modernize and shift to fire support for large-scale ground combat operations.

COL (P) Brooks received his commission in the FA Corps from the University of Memphis in 1993. He earned a Master's Degree in Military Arts and Sciences from the Command and General Staff College at Fort Leavenworth, Kan.

COL (P) Brooks served in Baumholder, Germany, from 1994 to 1997 and deployed to Bosnia for Operation Joint Endeavor. Upon completion of the FA Captain's Career Course, he was assigned to Fort Benning, Ga., where he served as a human resources officer, fire support officer, and Commander from 1997 to 2001. He then served as an aviation brigade fire support officer, and trainer at the National Training Center in Fort Irwin, Calif., from 2001 to 2004.

COL (P) Brooks deployed to Iraq in support of Operation Iraqi Freedom three times where he served as the Executive Officer of the Commanding General, Civilian Police Assistance Training Team, Executive officer of the Commanding General, Multinational Division-Baghdad, a battalion operations officer, a brigade executive officer and as a Battalion Commander in Mosul, Iraq. He deployed to Afghanistan twice in support of Operation Enduring Freedom. He commanded battalions in both Iraq and Afghanistan. He also served as the Deputy Chief of Staff in Regional Command East in Bagram. He deployed in support of Atlantic Resolve in Eastern Europe between 2015 and 2017 as a Brigade Commander. In 2017, he served in the Pentagon as the Department of the Army's Chief of Contingency Operations and the Chief of Staff for the Army's Strategy, Plans and Policy Directorate.

While serving as the Deputy Commanding General (Maneuver) for the 1st Infantry Division, COL Brooks deployed to Eastern Europe, where he assumed the command of the 1st Infantry Division (Forward), United States Army Europe on June 3, 2019.

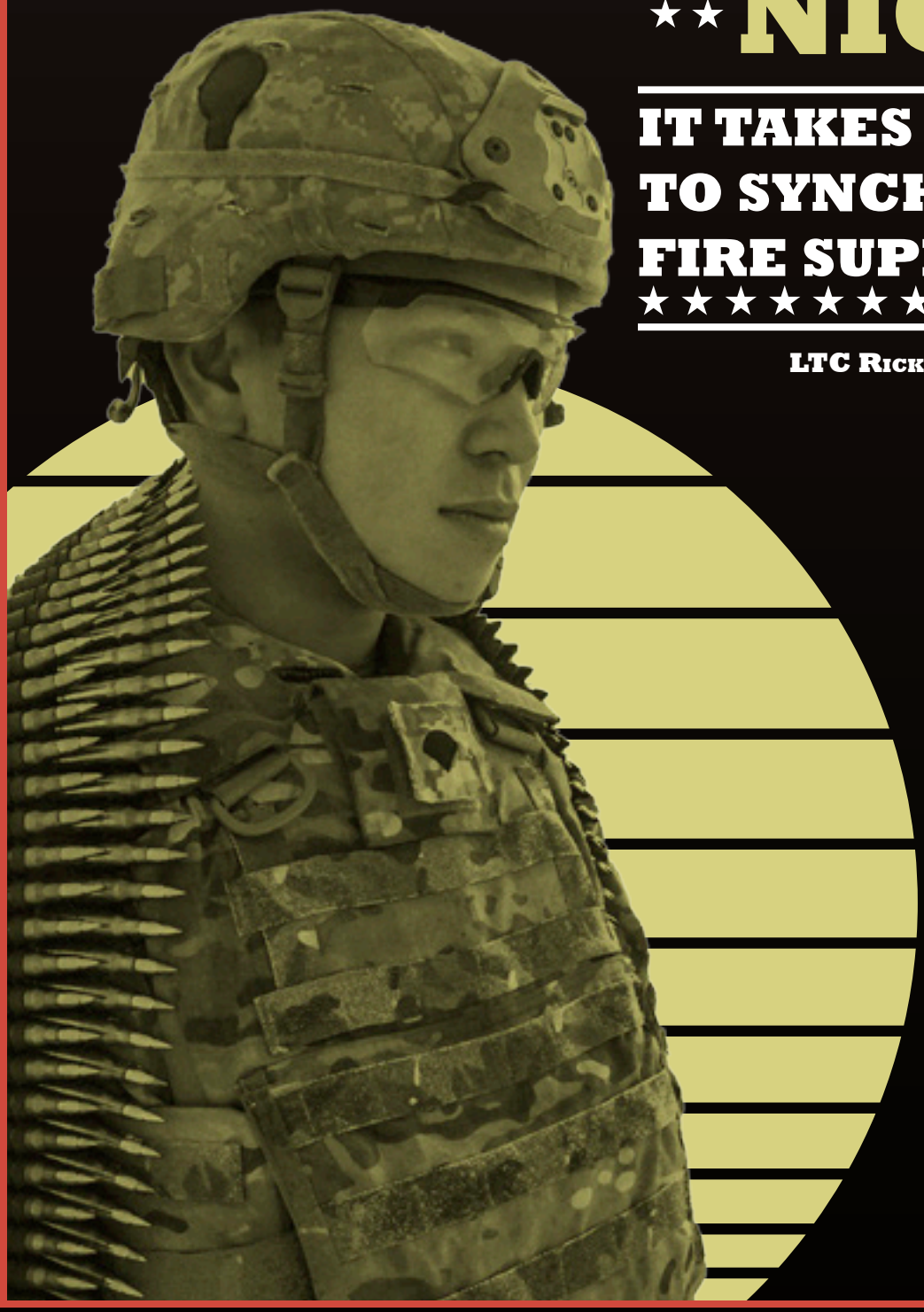
COL (P) Brooks' military schooling includes the FA Officer Basic and Advanced Courses, Airborne School, Combined Arms Services Staff College, the Senior Service College, and Joint Forces Staff College. His awards and decorations include three Legion of Merits, five Bronze Star Medals, the Defense Meritorious Service Medal, five Meritorious Service Medals, the Combat Action Badge, the Parachutist Badge, the Army Staff Identification Badge, and multiple overseas campaign and service ribbons.

COL (P) Brooks is married to Lori, of Fayetteville, Tenn.; they have two children Wes, a recent graduate of the University of Alabama, and Amelia, a sophomore at the University of Kentucky.

DON'T WAIT UNTIL FIGHT NIGHT

IT TAKES A BCT TO SYNCHRONIZE FIRE SUPPORT

LTC Rick Johnson



There are few things you can experience as an observer, coach or trainer that compares to the anticipation of a 'fight night' at JRTC. There is a palpable eagerness of the upcoming force-on-force battle with a trained infantry brigade combat team (IBCT) and the opposing force (OPFOR) in the demanding terrain of central Louisiana. Although the JRTC Operations Group carefully orchestrates the battle to optimize the IBCT's pursuit of their tailored training objectives for the rotation, no outcome is predetermined. The IBCT can win every attack or defense, and at times they do just that. But predominantly the OPFOR wins, regardless of force ratios. The OPFOR leaders over the past three years have offered the same insight into their ability to consistently defeat the latent power of a U.S. Army IBCT: the OPFOR fights as a combined arms team, whereas the IBCTs they face struggle to achieve that same synchronization in any meaningful mass. After action reviews (AARs) illustrate the salient learning points from each engagement, but they don't do much to reduce the sting of a proud, professional unit realizing the sobering fact that they endeavored greatly but lost.

Most IBCTs' Field Artillery (FA) battalions complete their tabled training at home station and arrive at JRTC with adequate technical gunnery skills. However, IBCTs struggle to mass responsive fires due to a relative lack of collective tactical training during that same progression. Rotational observations at JRTC yield three important trends regarding the underlying challenges to synchronize fire support with maneuver in the IBCT's fight. Primarily, IBCTs do not approach fire support as a holistic, organization-wide challenge; most rotational units will approach any inefficiency in the responsiveness or mass of fire missions as something for the FA battalion or the dual-hatted battalion commander/fire support coordinator (FSCOORD) to fix in relative isolation. Additionally, IBCTs rarely plan and prepare to mass fires since they have few chances to practice this during collective training events at home station. Lastly, FA battalions are generally not prepared to meet the challenges of sustainment and protection in the crucible of long-duration training at JRTC. These three challenges combine to cause unresponsive fires, with relatively low levels of battle damage inflicted upon the OPFOR.

If Artillery Tables XV (battery qualification) and XVIII (battalion qualification) are not adequately preparing our IBCTs for these challenges they encounter at JRTC, can we realistically create a different approach to training in an IBCT? Our discussion will review the existing professional discourse, and then present the current rotational observations for challenges in synchronizing fires within the IBCT. This provides relevant context to then examine each of the three aforementioned challenges in detail, identify best practices to address those challenges and finally recommend improvements to collective training progressions to reverse those trends.

A rich toolkit for the fire supporter

Collective tactical training which develops the synchronization of fire support within an IBCT is not a new challenge, nor does this challenge require the mindset of crisis management. The fire support community has a rich legacy of approaching challenges with a mixture of creative and critical thinking, as reflected both in published doctrine and professional discourse. The current effort to update FM 3-09, *Field Artillery Operations and Fire Support,* will result in a doctrine which will describe fire support and Field Artillery operations from the theater army to the BCT, but with enough specificity to be of value at each echelon. And while no fire supporter would claim that neither the current FM 3-09 nor FM 3-96, *The Brigade Combat Team*, are perfect, those two references do provide the requisite structure and common lexicon to fight as a combined arms team. The most influential publication on the effort to align artillery gunnery within a larger BCT training progression is the 2019 revision of Training Circular 3-09.8, *Fire Support and Field Artillery Certification and Qualification,* which critically establishes the guidelines to conduct and assess gunnery. Furthermore, TC 3-09.8 aligns the effort to train, certify and qualify the BCT's fire supporters and FA units as a Field Artillery gated training strategy within the larger framework of the Integrated Weapons Training Strategy (IWTS). However, the IWTS focuses on synchronizing fire support during successive maneuver collective live-fire training events, which results in a relative gap in regards to further training imperatives with the supported BCT, especially in the critical areas of planning, sustainment and protection. The IWTS has done well to sharpen IBCTs' collective training in the pursuit of lethality, as illustrated by steady improvements of platoons, companies and battalions in JRTC's live-fire exercises over the years. However, lethality alone is not sufficient to synchronize all combined arms into a fight of any meaningful duration.

Similarly, fire supporters' professional writing over the past decade expands the aperture beyond straightforward gunnery. For the unique context of fires fire support within the BCT, the Center for Army Lessons Learned (CALL) disseminated "Hunting with Fires," in 2018 which provides a great insight into one unit's approach to transitioning from an inherently restrictive environment for indirect fires to an inherently permissive and responsive environment. Within that discussion are several key concepts such as an effective BCT commander's guidance for massing fires, optimizing pre-emptive and unobserved fires, and integrating the FA battalion's

staff with the BCT targeting cycle. From the combat training centers, COL Jon Shine's widely-circulated "If I could do it over again," provides great passages regarding the rigor of Field Artillery Tables XII, XV, and XVIII from the unique perspective of the National Training Center (NTC) senior fire support trainer reviewing his challenges as a battalion commander. Recent and relevant contributions from NTC include the BCT counterfire operations section, "Setting conditions for effective counterfire," as distributed by CALL, focusing on the staff processes and command post considerations for counterfire operations within the BCT. JMRC's MAJ Kurt Knoedler recently published, "Building the confidence of maneuver commanders," which provides a detailed review of the rigor and detail required to maintain responsive fires with digital communications within a BCT. His 2020 *FA Journal* article contains the critical insight that "This is not solely a Field Artillery battalion problem, but a larger problem for the BCT." And as a confirmation that approaching the synchronization of fires from a BCT-wide perspective is not a new challenge to the force, then- LTC Janosko's "JRTC fire support observations," provides an example of similar challenges for brigades over two decades ago. While partially focused on the challenge of sustaining artillery operations within a brigade, he concluded in 1996 that, "there's still much to do – the impact of FA and other fires on the outcome of the battle and protection of the force is just too important."

The evidence

A study of JRTC's rotational counterfire trends highlight that there are some definite improvements across the force. The most positive trend deals with the IBCT's ability to clear air and ground during a counterfire drill. In August 2016, the rotational average for this task was 7:49, and today it averages 1:47. Furthermore, fire supporters and fire direction centers (FDCs) routinely demonstrate the ability to use the proper method of control to allow the FA battalion to process the fire mission concurrently so that nobody is waiting for this clearance before they proceed. However, overall rotational averages for fire missions have remained relatively stable in the 12:30 to 14:30 range since 2016.

It is also important to note that times at FDCs and on the gun line continue to improve. While rotational averages do not meet the exacting standards of TC 3-09.8, this should not come as a surprise since fire missions at JRTC oftentimes include environmental factors such as "too hot," "too wet," "too hungry," "too dark," "under fire," and at times, all five. This stands in stark contrast to the usual conditions for an Artillery Table V and VI (section certification and qualification) with well-rested and specifically prepared crews conducting a known variety of fire missions to isolate the technical aspects of the crew drill for assessment.

These rotational averages for fire mission processing are not perfect summations of the processing times at all stations. There are several reasons for this, with the two primary factors being communications and tactical fire direction. When all sensors and shooters are linked digitally, this 'slack time' between stations approaches zero. But that is rarely the case during force-on-force training at JRTC, where units revert to voice communications or a combination of both. The second factor which drives even more 'slack time' in the rotational average is poor tactical fire direction, as expressed in bad decisions regarding which firing unit should deliver fires. Out-of-traverse fire missions add considerable time, with some rotational units firing a third of their missions at JRTC after shifting the trails of their towed howitzers. Additional challenges include sending emergency fire missions ('hip shoots') to displacing units without selecting an alternate firing unit. As we will discuss later, often the challenges with tactical fire direction has its roots in the cascading effects of poor security, protection and sustainment – or the FA battalion's inability to enforce the reporting and command post practices required to overcome those issues.

In summary, the best opportunity to improve the responsiveness and synchronization of fires is to address this 'slack time.' The FA Gated Training Strategy, healthy digital sustainment training, and repetitions in crew drills provide a clear way for FA battalions to reduce approximately 4:30 worth of fire mission processing time by improving the technical aspects of fire support and howitzer operations. Rotational observations at JRTC indicate that there is about 5:30 of the aforementioned 'slack time' in fire missions due to insufficient collective tactical training. As such, we will focus on the tactical aspects of delivering responsive massed fires within the IBCT.

Fires as a BCT-wide challenge

Responsive fires are a primary measure of an IBCT's ability to plan and rehearse an operation in exacting detail. It represents the summation of an IBCT's ability to coordinate and synchronize across warfighting functions. Without harmony across multiple elements and echelons, fire support might be accurate due to technical mastery, but they will lack the requisite mass, responsiveness and relevancy due to shortcomings in the IBCT's tactical proficiency. One example to illustrate the difference in technical and tactical proficiency is to consider the trigger for a priority target in the defense. The forward observer might be able to meet all requirements for acceptable target location error, understand the specific spot on the terrain in front of them when they initiate the fire command and understand the exact fire mission

IBCT FIGHT

BCT COMMANDER'S GUIDANCE FOR FIRES

- *Does prudent risk balance risk-to-force with risk-to-mission, enabling responsive fires?*
- *Does the guidance enable detail wargaming to synchronize intelligence and fires?*

TERRAIN MANAGEMENT & BATTLEFIELD GEOMETRIES

- *Are PAAs distributed on common graphics across the BCT to prevent 'squatters?'*
- *Does the Target Working Group review and adjust the CFL, IHOL, and radar zones?*

AIRSPACE MANGEMENT

- *Does the Target Working Group review and adjust the CFL, IHOL, and radar zones?*
- *Can the BCT leverage AFATDS/AMDWS/TAIS connectivity to visualize the airspace?*

INTELLIGENCE COLLECTION PLAN

- *Does the IC Matrix include the BCT's target acquisition radars and synchronize them?*

COMMUNICATIONS

- *Do units plan a robust PACE for AFATDS and fight to get back on the primary means?*
- *Who synchronizes and validates AFATDS databases across the BCT regularly?*

ARTILLERY CL V SUSTAINMENT

- *Does the Target Working Group result in updated RSRs and resupply triggers?*
- *When demand exceeds BCT haul assets, does it coordinate for throughput distribution?*

FIRES CELLS (FIRE SUPPORT ELEMENTS, FIRE DIRECTION CENTERS, AND COUNTERFIRE CELLS)

- *Has the BCT analyzed the CF Cell's location; should it be at the BCT or the FA BN?*
- *Are the fires cells central aspects of CPs, or are they relegated to a separate tent or vehicle?*

FA BN FIGHT

FIRING UNIT MANAGEMENT

- *Do FATs balance counterfire & close supporting fires, w/ assigned BTRYs and allocations?*
- *Does the FA BN purposefully manage 'Hot' and 'Cold' firing units to mass fires?*

TACTICAL FIRE DIRECTION

- *Do the AGM & TSS enable rapid decision-making to send the fire mission to the right unit?*

TECHNICAL GUNNERY

- *Can FDCs and howitzer sections operate in FOC, degraded, and manual modes?*
- *Are fire supporters and radars qualified and capable of processing acquisitions digitally?*

RESPONSIVE MASSED FIRES ARE THE SUMMATION OF THE IBCT'S ABILITY TO COORDINATE AND SYNCHRONIZE ACROSS WARFIGHTING FUNCTIONS. WITHOUT THIS HARMONY ACROSS MULTIPLE ELEMENTS AND ECHELONS, FIRES MIGHT BE ACCURATE BUT THEY WILL LACK THE REQUISITE MASS AND RESPONSIVENESS.

Ten imperatives for responsive fires in the IBCT. (Rick Paape/Courtesy information)

processing time after an in-depth technical rehearsal earlier in the day. But the tactical employment of that fire mission is equally important; the fire mission must be synchronized within the maneuver force's engagement area development, and the enemy formation must meet the commander's engagement criteria.

One useful model to understand the relationships among tactical and technical aspects of synchronizing fires within the IBCT are 10 imperatives for responsive fires (see figure above).

The 10 imperatives for responsive fires

The most capable and savvy FSCOORDs can ensure that the IBCT addresses all 10 of these imperatives, but they only directly

influence the last four. Furthermore, the FA battalion is the exclusive action arm of only the last three. As such, it takes the collective training of an IBCT to truly develop and maintain a capability for responsive fires.

Given the limited resources and competing demands across the IBCT as it prepares for a JRTC rotation, approaching fires as a holistic IBCT training priority is perhaps the most challenging aspect. For some units, prioritizing the synchronization of fire support may require an inequitable distribution of time, physical resources, professional development sessions and collective training opportunities. Generally, rotational unit leaders report that they have one iteration in an IBCT command post-exercise, and one iteration in an IBCT field training exercise to prepare for JRTC. Conducting one of those collective training events concurrently with an Artillery Table XVIII provides a great opportunity to gain efficiency.

However, by the very nature of that arrangement, it requires a considerable amount of external support to provide the synchronized exercise control to protect the equities of both training audiences. Furthermore, it is a challenge at most installations to conduct artillery live fires required in Artillery Table XVIII while simultaneously replicating constructive fires for an IBCT's field training in adjacent areas. Absent of an opportunity to link an Artillery Table XVIII and the IBCT's culminating training event, the IBCT staff must be able to replicate a full response cell for Artillery Table XVIII and any BCT-level fire support coordination exercises. The effort for this multi-echelon training goes beyond making the FA battalion feel like there is an actual IBCT to support; the IBCT commander and their staff must understand what it takes for the IBCT (not just the FA battalion) to meet the 10 imperatives listed above.

A prudent review of any IBCT's training progression for JRTC should result in multiple opportunities to:

- Enable the IBCT and FA battalion staffs to refine their wargaming techniques as a means to synchronize intelligence collection and fires.
- Plan and adjust PAAs that are reflected on common graphics throughout the IBCT.
- Validate a PACE plan (an order of precedence list based on primary, alternate, contingency and emergency communications) for the IBCT Fires nets (voice and digital) at distance.
- Collaborate between the IBCT and FA battalion staffs to develop the complementary fire support coordination measures and airspace coordination measures required to mass joint fires.

Planning to mass fires as a BCT

Massing fires enables the IBCT to maximize effects with an economy of resources and improves the FA battalion's survivability by limiting the number of volleys required to achieve the desired effects. From the IBCT's perspective, massing fires may include the synchronization of close air support and Army attack aviation with the FA battalion's organic firepower. In large-scale combat operations, the division may require the FA battalion to periodically support other efforts in a reinforcing role, but massing the fires of the FA battalion is still a fixture in the IBCT's most effective means to concentrate all forms of combat power across the combined arms team. At JRTC, less than 10 percent of all fire missions are massed with multiple firing units during force-on-force training.

Massed fires across the IBCT have both proactive and reactive aspects. Successful IBCTs proactively plan to mass fires via the targeting process to relentlessly hunt and kill high payoff targets (HPTs), and balance that with requirements to mass close supporting fires for the maneuver force. The aforementioned "Hunting with Fires," is a good example of the detailed planning and coordination required to achieve that balance between HPTs and close supporting fires. Our observed trends and best practices during decisive action training environment rotations at JRTC indicate that successful IBCTs exhibit four common traits:

1. Utilize target pattern analysis to synchronize the limited assets in an IBCT.
2. Exhibit discipline in maintaining sensor-to-shooter pairings, most often through the use of a detailed Target Synchronization Matrix.
3. Relentlessly hunt and kill the top HPT formation until the IBCT meets destruction criteria; do not split sensors nor shooters (specifically, FA batteries) across several different HPT formations simultaneously.
4. Plan close supporting fires by purposefully allocating targets which mass the FA battalion, then disseminating bottom-up refinement to those targets.

Reactive fires provide the IBCT with an ability to mass joint fires in response to enemy HPTs as they are acquired. Our observed trends and best practices indicate a further four common traits for successful IBCTs to mass fires reactively, and thereby mass fires responsively. Although these four common traits enable reactive massed fires, they require detailed planning by the IBCT staff to:

1. Develop positioning guidance for firing units as an output of the Target Working Group.
2. Establish dedicated 'counter-fire shooters' with one of their firing units.
3. Utilize quickfire nets to reduce the 'to' in sensor-to-shooter during specified phases of the operation.
4. Centrally locate fire support elements, FDCs and coun-

terfire cells within applicable command posts.

Similar to the previous discussion regarding the ten imperatives for responsive fires, effective multi-echelon training requires representatives from across the IBCT to adequately train the proactive and reactive aspects of massing fires. In addition to validating the technical mastery required to mass the FA battalion during an Artillery Table XVIII, IBCT training progressions must also incorporate two aspects to ensure that the FA battalion can mass in support of the IBCT:

- Provide repetitions of the IBCT's targeting cycle, including the inputs from the FA battalion and dissemination of the outputs to the IBCT's current operations staff and subordinate battalion and squadron fires cells.
- Fully plan and rehearse a fire support plan for both an attack and a defense for the IBCT and each maneuver battalion or squadron.

Sustaining and protecting the FA battalion

FA battalions' challenges in security, protection and sustainment also create unfavorable conditions for responsive massed fires. Much like a cage fighter, even the most lethal combatant will not prevail if they can't protect themselves from a thinking opponent or sustain themselves for the duration of the fight. To extend this metaphor, our current tabled training methodology is resulting in fighters who can strike with more predictable accuracy and power owing to their technical skill, but it is not sufficient in and of itself to win the fight. Rotational units which train in accordance with TC 3-09.8's mandate to qualify in full operation capability, digitally degraded, and fully degraded can manage transitions between digital and degraded fires, and fight to get back to their primary means for determining and processing firing data. However, often the rotational unit finds themselves in a final AAR, realizing that their training progression through these tables did not prepare them for the additional challenges of sustainment and protection.

SUCCESSFUL ROTATIONAL UNITS UNDERSTAND THE OPPORTUNITY TO TAKE ADVANTAGE OF BOTH THE FIRING BATTERY'S HIGH DENSITY OF CREW-SERVED WEAPONS AND THE INFANTRY'S ABILITY TO EXTEND SECURITY BEYOND THE FIRST VISIBLE WOODLINE.

The first insight is that firing units will often displace and occupy multiple times in rapid succession during an Artillery Table XII, XVIII and XVIII. Multiple occupations are a great method to train and assess the unit's ability to survive by means of "shoot and move," but this frenetic pace provides an unintended challenge which is most pronounced in an IBCT owing to the longer occupation and displacement times inherent in towed artillery. If a battery has never occupied a position area for longer than eight hours during their training progression, the command team will be challenged by position improvement and expanding security after eight hours. Over time at JRTC, the OPFOR chips away at combat power via multiple forms of contact, since IBCTs struggle with the synchronization of terrain management and additional fuel required to support a constantly-moving FA battalion. Furthermore, a rotational unit untrained in battery defense will be less efficient in managing their ready platoons or howitzer sections, contributing to the aforementioned challenges for tactical fire direction.

Few IBCT staffs understand that critical assets such as the M777A2 and target acquisition radars will usually be the IBCT's priority defended assets, and they fail to develop some routine procedures to protect and secure them. While maintaining mobility and adhering to survivability move criteria are often the best means of surviving against OPFOR indirect fires, protecting these assets with prepared positions and dedicated security elements is an imperative to survive the other forms of contact. It is a supreme challenge if battery security operations are only a single page of checklists in a tactical standing operating procedure and not a practiced event. Engineer companies that have never dug in a firing battery are about as capable in rapidly planning, building and refining a firebase as firing batteries that have barely met their adjacent engineer company. The only thing more ineffective than a firing battery which has never occupied a fully developed set of howitzer parapets is the engineer company which has never received the constructive feedback to build suitable howitzer parapets. However, few IBCT training progressions make combined training with engineer assets a fixture, nor does a Field Artillery Table XV require it.

The time and combat power that firing batteries dedicate to self-securing their gun lines comes at an opportunity cost of keeping all howitzers in position and ready to fire, let alone addressing other priorities of work such as routine maintenance. Just as the FA battalion must train with engineer assets, they must also train with the infantry squads or platoons that may be tasked to

secure them periodically. The nuances of securing an artillery asset with inherent danger areas and specific hazards require close coordination, and coordinating with an adjacent unit at the battalion level is insufficient. Successful rotational units have practiced this coordination on the ground; they understand the opportunity to take advantage of both the firing battery's high density of crew-served weapons and the infantry's ability to extend security beyond the first visible woodline.

The second insight is that Field Artillery Tables XII, XV, and XVIII rarely last long enough or require enough commodities to truly stress platoon, battery and battalion sustainment. Unfortunately, if units expect to train for 72 hours in one of these qualification tables, they can deploy to the field at home station with three days of supplies on board and not require much in the way of external support. At JRTC, we see this sustainment challenge manifest itself most acutely in terms of Class V artillery munitions. The relatively low amount of high explosives, smoke and illumination rounds required to complete a table will not inherently stress the unit's ability to proactively manage combat loads. For context, most FA battalions will fire approximately 288 rounds during Artillery Table XVIII, which is only five percent of that battalion's combat load. In turn, rotational units at all echelons find themselves unfamiliar with the requirements to forecast, track and distribute the scope of replicated Class V at JRTC, where there is no such thing as a paper equivalent to facilitate training. During force-on-force training at JRTC, either you have a concrete-filled replicated round with the proper Department of Defense identification code, fuze and propellant, or you don't. An ineffective distribution of munitions serves to limit the number of available options for a fire direction officer, especially during planned operations when the FA battalion must balance the equities of multiple Field Artillery tasks.

As such, building capacity in protection and sustainment within the FA battalion requires an artful balance of field training opportunities and participation across the IBCT. As with the preceding discussion, shrewd FSCOORDs will seek opportunities to align sustainment training with existing field training for Artillery Tables XI, XV, and XVIII. "If I could do it over again" details several complementary activities to show that, "a live-fire FA Table has not been completed unless the unit has …," similarly, there is an opportunity to focus on protection and sustainment once the appropriate command team qualifies that echelon, and the training audience is still in the field.

Few rotational units arrive at JRTC understanding the critical aspects of sustaining FA battalions. Rotational units are not validating two key parts of their sustainment enterprise if they only train through short-duration gunnery tables and iteratively combined arms live fires. First, they do not understand their capacity to organize, haul and distribute combat loads. Although it leaves but a few cubic inches to spare, the first combat load to sustain a FA battalion will fit on the organic ammunition haulers and sections within the firing batteries, and the second combat load will fit on the forward support company's (FSC's) combined trains. The third combat load becomes a prudential decision for the sustainment leaders to carry with the brigade support battalion's (BSB's) limited assets or hold it in reserve to be called forward. However, this arrangement of combat loads assumes that there is full manning since firing batteries will generally fill howitzer sections first, then FDCs. In general, FA battalions and their FSCs will begin a rotation with the ability to move and distribute 25 percent to 50 percent of a single combat load, but continue to plan and shoot as if they have two combat loads available.

The second critical aspect of sustaining the FA battalion regards the effort to command and control that effort. Few FA battalions establish - let alone validate - command posts for both combat trains and field trains during their training progression for JRTC. The lack of practiced command posts to track and distribute artillery munitions is particularly evident when neither the FA battalion commander nor the BSB commander can articulate the artillery field trains' command support relationship, task organization and coordinated reporting requirements.

In some cases, training an IBCT to adequately protect and sustain their FA battalion may require additional venues to train the force. With a bit of rigor and detail, table-top exercises, tactical exercises without troops, and command post exercises all provide options for a complementary effect. When combined with a culminating training event in the field, these additional events within the IBCT's training progression should provide the IBCT opportunities to protect and sustain the FA battalion by:

- Identifying routinely prioritized defended assets within the FA battalion and allowing those tactical units to train with their protection and security elements.
- Developing a fires-protection team (firing batteries and engineer companies) through iterative digging exercises in a similar fashion to the way a maneuver-fires team develops through iterative live-fire exercises.
- Understanding the unit's carrying capacity for artillery Class V and identifying the best tactical opportunities for throughput distribution when demand exceeds the IBCT's limited haul capacity.
- Enabling the FA battalion to evaluate and standardize their prepackaged artillery Class V loads.

- Validating the FA battalion's combat trains command post and field trains command post in conjunction with BSB training.

Train as you fight: as a team

The Army's principles of training begin with the familiar exhortation to train as you fight as a realization that, "[i]n this way, units conduct training employing more than one echelon, multiple warfighting functions, and functional units in a manner that closely replicates how they will fight." Rotational unit leaders consistently cite time as the most fleeting resource during home-station training, but they do not appear to rush, circumvent, or sacrifice standards within the Field Artillery Gated Training Strategy. Fire supporters are well-versed in the commander's responsibilities and specific technical requirements within TC 3-09.8. However, the avenue of technical gunnery in TC 3-09.8 generally appears to be the only pathway that rotational units use in their quest to prepare for JRTC, with brief stops along the way to train in limited-duration scenarios with the supported IBCT and other warfighting functions.

If you're an FA battalion command team, arguably you have the first and most critical responsibility to continue the positive trends in artillery gunnery. Only you can command the effort to build and maintain a collective technical proficiency within the IBCT. Fire mission processing times must continue to improve apace. Units that remain disciplined to published attack guidance, standard fire orders and doctrinal radio transmissions are better-equipped to overcome the challenges in fire mission processing inherent in large-scale combat operations. These are aspects that FA battalions can train to a high degree of collective competency, by the means of digital sustainment training and periodic training minimums for each echelon. These are most effective when command teams (FA battalion, DIVARTY and the supported IBCT) clearly define their expectations, with an approach that the additional training complements the tabled certification and qualification requirements. But as outlined above, technical skill does not represent the largest opportunity for improvement when it comes to responsive massed fires.

The IBCT and DIVARTY commanders must ensure that those leaders in the FA battalion are not trying to solve the complex, resource-constrained challenge to synchronize fire support across the IBCT in isolation. Synchronizing fires with the other warfighting functions and among organic combat formations is demonstrably a challenge for an IBCT commander to address, with the support of the associated DIVARTY commander and their staff. Both staffs must approach this challenge together, in an acknowledgment that we are preparing FA battalions together for large-scale combat operations against a peer competitor, not tailored packages for the force-generation conveyor belt to Iraq and Afghanistan. And if you're a division commander and somehow this article makes its way into your hands (whether by some cosmic happenstance or an act of subterfuge), make your colonels and their staffs demonstrate how they will provide the IBCT with the opportunity to train as a combined arms team before JRTC, not just a team of talented sub-units which meets periodically for collective live-fire events.

Improving our tactical collective training is the first of many steps we will need to take if we want our IBCTs arriving at JRTC both willing and able to prevail against the OPFOR by synchronizing responsive massed fires. Ostensibly, it is the same approach to ensure that we are ready to answer the call for actual combat operations in the Sustainable Readiness Model. Commanders at all echelons must know how many training days it requires to get their units to an objectively trained status; we must approach this aspirational training status in terms of fighting as a combined arms team, not parallel tracks to build lethality across disparate warfighting functions. The IBCT commanders must ask themselves why (and at which echelon) they are directing the FA battalion to support live-fire exercises, owing to the inherent opportunity cost associated with each event. Fire supporters must ask themselves if the Field Artillery Gated Training Strategy precludes any realistic chance of matching the maneuver force's tempo through the training progression - lest critical aspects such as sustainment and protection are relegated to theory, and not practice across the IBCT.

The FA battalion's progression through Field Artillery Table XVIII provides a rigorous, demanding pathway to achieve lethality through technical gunnery. Properly augmented by digital sustainment training and other complementary activities, it can provide the IBCT with a dependable, accurate fire support capability. However, that is not enough in and of itself. We can no longer afford to wait until the IBCT finds itself in the unforgiving environment of a JRTC 'fight night' to learn these lessons regarding the collective tactical training required to synchronize and mass fires.

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Soldiers from C Battery, 2nd Battalion, 319th Field Artillery fire an M777 during a live-fire exercise. (Courtesy photo)

Smoke employment in the battle for Mosul

COL Daniel C. Gibson, LTC (P) Scott Pence and CPT (P) Stoney Grimes

A three-day engagement during the battle for western Mosul in 2017 demonstrated considerations for the use of artillery-delivered smoke in a dense urban environment. These best-practices in support of Iraqi Security Forces (ISF) could inform operations in future conflicts as the U.S. Army prepares for large-scale combat operations against a determined enemy in dense urban terrain. This article will describe the environment in which the operation took place, explain the risks that leadership considered during the operation, and highlight three observations from the use of artillery-delivered smoke in the urban terrain of northwest Mosul.

In 2017, Task Force (TF) Falcon, the 2nd Brigade Combat Team, 82nd Airborne Division provided support to the Iraqi Security Forces' efforts to liberate the city of Mosul from the Islamic State. The employment of fires by U.S. forces in support of the ISF provided the tactical overmatch necessary for success.

The battle for western Mosul lasted from January to July 2017. From June 2 through 4, 2017, the ISF executed an operation on the outskirts of the Jumhuri hospital complex in the Zanjili district of northwestern Mosul to rescue dozens of Iraqi civilians held hostage by ISIS fighters. In support of the operation, TF Falcon's Direct Support Artillery Battalion, 2nd Battalion, 319th Airborne Field

Artillery Regiment, provided integrated fires to assist the ISF. This article focuses specifically on two obscuration fire missions employing M825A1 improved white phosphorus smoke munitions to deny ISIS's ability to see the ISFs maneuver and gain a relative tactical advantage.

In 2017, the Zanjili district was a densely packed urban environment organized in generally geometric patterns with buildings arranged in neat blocks bounded by generally wide, straight roads. Structures varied from two to three-story residential and small business buildings to high-rise buildings more than five stories tall. The Jumhuri hospital complex east of the Zanjili district consisted of several high-rise buildings with five or more stories including the main hospital building. This main building, the Jumhuri hospital, stood more than seven stories high and dominated the surrounding terrain. It served both as the operational headquarters of ISIS in western Mosul and was used to stockpile weapons and equipment. Directly west of and adjacent to the hospital complex, ISIS occupied the Zanjili district using buildings that were formerly homes and businesses as bunkers, fighting positions and engagement areas. A four-lane thoroughfare, running from the northwest to southeast, separated the hospital complex from Zanjili. ISIS fighters positioned in the Jumhuri high- rises could easily observe ISF moving into the area and the four-lane thoroughfare made an ideal engagement area. Iraqi forces conducting the mission expected to receive indirect and heavy weapons fire from the hospital buildings before encountering ISIS fighters employing small arms, machine guns and hand grenades from positions dug into the smaller, lower buildings of Zanjili. Both Iraqi and U.S. leadership identified the need for a smokescreen to deny enemy observation and facilitate ISF maneuver into the objective area.

The ISF depended upon U.S. forces for integrated fires to support their operation. Despite their possession of indirect fire systems, ISF could not employ them with the adequate precision and mass required to enable the operation. The 2-319th AFAR employed its organic M777A2 battery and a reinforcing M109A6 Paladin platoon from the 2nd Battalion, 82nd Field Artillery to provide the necessary close supporting fires.

At the time, the M825-series improved white phosphorous projectiles were the only U.S. smoke munitions available for 2-319th AFAR to employ in support of the operation. The 155 mm M825-series smoke projectile is superior to the U.S. Army's M116-series HC Smoke projectiles in both the time required to build the smoke screen and the amount of time the smoke lingers, affording longer duration smoke screens with fewer rounds. Because of this, the U.S. Army has gradually phased the M116 HC smoke munition out of its inventory. However, the white phosphorous wedges used in the M825 munition burn at nearly 5,000 degrees Fahrenheit causing a risk of collateral damage to structures and non-combatants. In June 2017, there were no U.S. 155 mm HC smoke projectiles in the U.S. Central Command area of responsibility.

Despite the inherent risk of white phosphorous, the command deemed the likelihood of civilian casualties exceptionally low because nearly all civilians had fled the Zanjili district as a result of the intense fighting around the Jumhuri hospital the week prior. This conclusion was supported by full-motion video feeds from intelligence, surveillance and reconnaissance aircraft that failed to detect any civilian patterns of life in the area. Additionally, many of the structures in the objective area were constructed from concrete reducing the likelihood that the structures themselves would catch fire. Thus, the command's decision to employ M825 munitions demonstrated a deliberate, necessary risk acceptance to enable the success of the Iraqi forces in their mission to rescue hostages.

The 2-319th AFAR captured three important observations that apply to the employment of artillery smoke in a dense urban environment. First, the conditions in the dense urban terrain caused variances in the meteorological conditions at surface level that changed the effectiveness of the smokescreen. This "micro-MET" at the surface could be dramatically different from what was captured in the meteorological data—the MET message—used to account for weather variations in the calculation of accurate firing data. This compounded as things caught on fire in the engagement

Soldiers from C Battery, 2nd Battalion, 319th Field Artillery fire an M777 during a live-fire exercise. (Courtesy photo)

area, causing micro high- and low-pressure systems in the urban canyons between the buildings that resulted in localized high winds that dramatically disrupted the smokescreen.

To mitigate this, the battalion executed the smokescreen as multiple, one-gun adjust-fire missions. As the conditions on the ground changed, the battalion fire direction center (FDC) adjusted the aim points and height of burst to sustain the necessary duration and thickness of the smokescreen. This enabled the battalion to continue firing with one or more guns while adjusting others to prevent a lapse in obscuration. The FDC quickly realized that if it managed the smokescreen as a single linear mission with multiple aim points, any adjustment would require the battalion to cease-firing on the entire mission. This would waste time, obscuration and ammunition as more ammunition would have to be fired to re-build the screen inputting the adjustments.

Secondly, when the battalion fired M825 at the standard height of burst of 100 m, the smoke billowed ineffectively on the tops of and behind buildings. The FDC reduced the height of burst, sometimes as low as 20 meters above the ground, to place obscuration with some modicum of precision.

Finally, the FDC realized that the propellant charge affected how the screen materialized. The buildings in the immediate objective area became intervening crests that had to be accounted for in the technical firing solution. Firing a higher charge, at a lower quadrant elevation, and with a reduced height of burst, rounds cleared the intervening crests, but often impacted long from the aim point. The FDC reduced the charge to the lowest possible to achieve the range with the highest possible angle of fall to mitigate the intervening crest and contain the M825's felt wedges to a more confined area. This increased the probability that the desired effects were achieved in the target area.

By the end of the three-day operation, 2-319th AFAR fired more than 135 M825 smoke rounds, providing nearly 90 minutes of smoke. These effects enabled Iraqi forces to rescue dozens of Iraqi civilians held hostage by ISIS fighters and escape from the ISIS-held area in western Mosul with no subsequent reports of civilian casualties caused by the smokescreen. The timeliness of the rescue and the superior positions of ISIS justified the need to accept the risks inherent to the use of M825. This engagement demonstrated that the use of white phosphorous in cities is not only possible but effective. These considerations can shape how the Army trains the fires force for the use of artillery-delivered smoke in a dense urban environment for future combat on an uncertain battlefield.

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Fire support conditions

CPT Samuel H. DeJarnett, Sr.

Fire supporters are failing to set the conditions for lethal fires. In Syria during ISIS clearance operations, thousands of artillery rounds were fired with less than lethal effects. A recent unit at the Joint Readiness Training Center (JRTC) fired 342 mortar rounds and 120 artillery rounds, in a deliberate defense, without inflicting a casualty on the opposing force. In both environments, most indirect fires (IDF) were not observed. At JRTC, communications with the observers were unreliable and target descriptions unclear. In both situations, ground force commanders struggled to understand the risk associated with each mission. Fire supporters failed in training and combat to set the conditions for IDF to be lethal. Whether at a combat training center (CTC) or in combat, achieving lethal effects with IDF requires three conditions: observation, communication and clearance.

One of the biggest lessons a fire support officer (FSO) can learn at a CTC is to stop focusing solely on planning targets and focus on planning observation. If the senior fire supporter in the fires cell does not plan observation points (OPs) chances are the junior fire supporters will not either. Most rotational training units come through focused on producing "fighting products" which exclude the detail of a doctrinal Annex D. These products are most often a target list worksheet, attack guidance matrix, high-payoff target list, fire support execution matrix, and a fire support overlay. Only two of these products, if made correctly, include any instructions for observers. However, the overlay and fire support execution matrix are often ignored by the subordinate commanders, not provided to the company FSOs, or lost when combined with the operations order and graphics. The battalion FSOs must place greater effort in communicating the importance of each OP to the subordinate fire supporters and commanders by including OPs in the task to subordinate units of the operations order. This turns the observation of targets from a recommendation of the staff to a specified task in the operations order. Company commanders rarely ignore a "Task to Subordinate Units" paragraph. After the OP is initially planned and tasked the onus is on the observers to be in the right place at the right time.

Observers must use the OACOK (observation and fields of fire, avenues of approach, key and decisive terrain, obstacles, and cover and concealment terrain assessment) as a tool and not an excuse. One of the skills the JRTC teaches a unit is how to utilize terrain. The vegetation at JRTC often limits observation to less than 100 meters. This means observers must learn to create observation at key points while at the same time utilizing the vegetation to conceal their OPs. Just as hunters create shooting lanes in the woods, observers must create observation lanes to see their targets and triggers. The National Training Center is effective at teaching the importance of dominating key terrain. The large dominant terrain features force observers to master their optics and conducting line-of-sight analysis. The best observers not only utilize their joint battle command platform (JBCP) or S6's systems planning engineering and evaluation device tool, but a map utilizing contour lines, string and a protractor to do line-of-sight analysis. At JRTC and NTC, observers rarely employ all the optics available on the modification table of equipment. The Lightweight Laser Designator Rangefinders, thermal weapon sights, binoculars and other tools are underuti-

lized resulting in poor observation when light and weather conditions deteriorate and or targets and triggers are at a great distance.

Lack of observation means that the artillery and mortars are firing blind. The risks associated with such actions range from wasted rounds to fratricide. Without ensuring observation of the target, the odds of hitting the enemy targeted are extremely low. Reliable observation also creates the opportunity to adjust fires onto a target and forgo starting a new fire mission. Many consider sending their forward observers forward to observe targets as an unacceptable risk. Is the risk to force and risk to mission higher when firing targets observed or un-observed?

A trusted colleague said that if the observers can't communicate with the higher headquarters, they are just out there camping. The communication condition has two aspects. The first is radio telephone operators (RTOs) at all levels must be able to speak clearly and concisely. This means training to use simple descriptive reports, such as the SALUTE (size, activity, location, uniform, time and equipment), calls for fire formats and identification of threat systems. When RTOs and observers are experts at these skills they can communicate clearly and concisely so triggers and targets can be easily understood. The clear and concise target description alleviates friction in both voice and digital communications.

Establishing a clear understanding of the target enables rapid tactical fire direction and contributes to processing times of one to two minutes per echelon. Without this, processing times from company through the brigade fires cells can range from five-to-10 minutes per echelon and results in confusion and target decay.

The second aspect of communication is using a validated PACE (primary, alternate, contingency, emergency) signal plan. A commonly briefed PACE plan in the Field Artillery world is: primary is FM Digital, alternate is FM Voice, contingency JBCP/joint capabilities release (JCR), emergency is a runner. This plan has serious flaws. It ignores the fact that fire support teams (FISTs) have high frequency and tactical satellite capable radios. The 1694 series, Harris 152 and 117 series radios give the FIST beyond line-of-sight capability that is rarely understood or used. The ability to use these radios to their full potential must be trained before deployment or rotation through a CTC. The PACE plan above also assumes that each company level FIST has access to a JBCP/JCR. This is most often not the case as it is a primarily mounted system in vehicles that the infantry brigade combat team's FIST does not have and is improbable for dismounts to employ. It also ignores the fact that utilizing a runner is less feasible than a preplanned visual signal. Proficient use of all systems available ensures that leaders at echelon can receive the key calls from observers on time to achieve the desired effect.

Clearance is the last condition and also the one which demands the most from the maneuver units' command posts. Graphic control measures (not just fire support control measures) can enable the proper trigger of target engagement, shifting, echelon and cut-off. Maneuver graphic control measures also enable accurate battle tracking. The awareness of where friendly units are on the battlefield is essential in assessing the risk of each mission. When combined with the clear reports, graphics make visualizing the distance between a target and a friendly unit simple and quick. Commanders must first account for friendly forces distance from the target and then assess the total risk to force and risk to mission. Risk estimate distances give commanders a guide on the risk of munitions within range, but do not take into account the current conditions of each engagement. Fire supporters must have a conversation with the ground force commander concerning other risk-mitigating factors such as weaponeering and degree of cover. Commanders must consider issues like: Are the improved conventional munitions fired close to the friendly battle position less or more dangerous than the BMP-1s attacking it? Does the risk calculation change with overhead cover, delay fuzes, or ratio of friendly to enemy forces? These are all things the maneuver commander must consider and fire supporters must have the information to inform decision.

Analyzing 116 IDF missions across three JRTC rotations only 45 missions produced lethal effects. Each of these missions had observers in place, clear communications and efficient clearance. Unfortunately, 15 of these missions were friendly forces calling IDF on their positions as they are overrun; final protective fires called after all defensive obstacles are breached; friendly forces within risk estimate distances or sheafs of their missions without understanding the risk. Eleven of these missions also produced civilian or friendly casualties. The trends at JRTC point to the fact that fire supporters are not setting conditions that will enable lethal effects in a conventional fight. Battalion fire supporters must address observation, communication and clearance in training and planning before entering their first fights.

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A rocket is fired during a live-fire training at Fort Sill, Okla. (Courtesy photo)

Transformation through rigor

Field Artillery AIT

CPT Justin L. Allen

"Rigor," is a term that has become a trademark for the Center of Initial Military Training, and carries a complexity of implications for training, educating and inspiring future Field Artillerymen and women. The "increase rigor" initiative became the launching point for refocusing the development of Soldiers on basic warrior tasks and battle drills which has driven the Army's success in near-peer operational environments (OE). As the world's conflicts change, it has become incumbent upon the U.S. Army to change with them. The Army has adapted over the last 18 years to a global strategic en-

vironment that is unpredictable, increasingly volatile[1] and extremist driven. However, our near-peer adversaries have trained and developed their military formations, and are increasingly capable of contention with the United States Armed Forces in large-scale combat operations (LSCO).

The Field Artillery (FA) recognized the need for development in Advanced Individual Training (AIT) to prepare Soldiers for the rigors of future combat. In an article, *Meeting the Challenge of Large-Scale Combat Operations Today and Tomorrow*[2] LTG Michael D. Lundy states, "Mastering the skills and experiences acquired during training, education and operations requires repetition. Sustaining and improving what we are doing now is our challenge." The 1st Battalion, 78th Field Artillery, *Teamwork Battalion* accepted that challenge.

The 1-78th FA is the home to Field Artillery AIT. Its mission is to create future Field Artillerymen and women to enter the combat force, ready to provide effective and timely fires and fire support. Field Artillery initial military training is currently transforming to match the intensity, rigor, and complexity of Multi-Domain Operations.[3] TRADOC Commander GEN Paul E. Funk II deemed the primary goal of training to be "tenacity," as the operational force recognizes its need for development. Tenacity builds the necessary resiliency in individual Soldiers to maximize readiness, and to equip Soldiers for an increasingly complex OE. Field Artillery Commandant, BG Stephen G. Smith, echoed that guidance in 2018 with a directive to increase rigor across the U.S. Army Field Artillery School by getting trainees back in the field. The Field Artillery must prepare to provide fires and fire support in degraded, denied and disrupted OEs. Technical competency is no longer the primary key to success for the Artillery, but tenacity, resiliency and readiness are the key to victory. In 2018, 1-78th FA received the directive to increase rigor in AIT and to re-enforce the need for tenacity within the Field Artillery community.

The 1-78th FA pushed forward in FY19 to increase rigor in AIT by introducing a culminating training exercise into every 13 series MOS training schedule, adding academic rigor through a reconstruction of the program of instruction (POI), and refocusing on degraded operations.

To initiate transformation, 1-78th FA introduced a four-day, three-night field training exercise for all 13 series AITs, called the culminating training exercise (CTE). The CTEs placed increased attention on the rigors of near-peer combat through the implementation of foot marches, artillery skill proficiency tests (ASPT), an engagement skills trainer (EST), a combat obstacle course, terrain navigation, and live-fire operations. The new CTE added a significant amount of rigor in contrast to the limited field time in AIT before November 2018.

Cannon Crewmember (13B) AIT incorporated training on firing point occupation, survivability drills and defensive operations to develop 13Bs with combat functionality. Foot marches to and from firing points in conjunction with this training added rigor that simulated the intensity of combat. The 13Bs were no longer merely pulling the lanyard, but there was now a revitalized effort to create Cannoneers capable of conducting mission command at the lowest level. The 13Bs were able to shoot, move and communicate to support maneuver elements in combat aggressively.

Joint Fire Support Specialist (13F) AIT introduced a CTE that physically challenged students to meet the requirements of intense ground combat. This CTE required a more intensive focus on the fundamentals of combat: basic Soldier tasks and battle drills, foot marches, basic rifle marksmanship, observation post (OP) selection and occupation, and land navigation with an M2 compass. The 13F schoolhouse matched the increased rigor of the CTE with an intensified train-up before the field exercise that would prepare Soldiers for quality training. The 13F POI expanded to include High Physical Demands Tests (HPDT) consisting of a 12-mile foot march with OP occupation, a hand grenade course, land navigation testing, and a live graded call-for-fire exercise. These training objectives accurately tested 13F students' ability to endure rigorous physical, mental and emotional challenges. The future fight will likely demand "FISTERS" who can move tactically and efficiently, and provide fire support under rigorous conditions.

Fire Control Specialists (13Js) shifted from a classroom-based focus on the Advanced Field Artillery Tactical Data System (AFATDS) to training that placed students in a field environment conducting skill level 10 tasks, degraded operations, foot marches, and fire direction center (FDC) occupation drills. These radical shifts successfully added rigor and created 13Js who could effectively control and deliver fires in contested domains.

M270 Multiple Launch Rocket System/High Mobility Artillery Rocket System [MLRS/HIMARS] Crewmember (13M) and Firefinder Radar Operator (13R) AITs introduced rigor within CTEs by introducing foot marches, marksmanship training, ASPTs, basic warrior tasks and battle drills, and dismounted land navigation. The launching of rockets during MLRS and HIMARS live-fire has also provided the opportunity for students to witness the technical proficiency required to safely deliver and observe live rockets.

The 1-78th FA challenged schoolhouses to integrate training

1 Meeting the Challenge of Large-Scale Combat Operations Today and Tomorrow
2 Ibid
3 TRADOC Pamphlet 525-3-1 (The U.S. Army in Multi-Domain Operations 2028)

across MOSs, to maximize training value in the field. The Field Artillery is comprised of multiple skillsets all geared toward one joint mission; to destroy, neutralize or suppress the enemy by cannon, rocket and missile fire and to help integrate all fire support assets into combined arms operations.[4] The battalion integrated training by allowing 13Js to conduct fire direction, while 13Rs and 13Fs observe during 13M MLRS and HIMARS live-fire operations. The 13J students have the opportunity to operate the AFATDS with close supervision and gain practical experience. During Howitzer live-fire operations, 13F students conduct call-for-fire operations, establish communications with 13J students operating in the FDC, and observe live rounds from 13Bs on the gunline. Through the integration of CTEs, students witness the complex coordination required to accurately deliver fires in near-peer combat.

The second line of effort to increase rigor was to restructure POI across the battalion to maximize academic rigor. Limited contingency operations[5] over the last 17 years allowed the FA to focus on technological advancement, improvement of intelligence, reconnaissance and surveillance capabilities, and close-range counter-fire operations. This focus geared FA AIT toward creating technically proficient trainees, ready to provide fires and fire support for counter-insurgency operations while enjoying the luxuries of multi-domain superiority. Now our near-peer adversaries have worked to match our capabilities. Necessarily, the FA mindset is shifting to a focus on LSCO. Such combat requires FA Soldiers to be proficient in the basic skills that they are trusted to employ. The 1-78th FA has restructured POI to increase technical proficiency in AIT graduates and prepare them for near-peer combat.

To do this, POI became less focused on automated systems, and more focused on basic Soldier tasks. Schoolhouses adjusted POI to create technical competence within the classroom by training on all level 10 ASPTs in conjunction with technical MOS training. The skill level 10 ASPT tasks are specific to each MOS and are essential for building combat-ready Field Artillerymen and women. All 13 series MOSs partially covered these tasks before the reconstruction, but with a heightened demand for proficiency, FA AITs added all ASPT tasks to the POI.

The 13M schoolhouse added dismounted navigation with the Defense Advanced GPS Receiver (DAGR) and operation of the AN/VRC-104 HARRIS radio to the POI. The 13R schoolhouse added OE-254 set-up, M2A2 Aiming Circle training and map reading. Although the modifications to the 13M and 13R POIs seemed minimal; the reconstruction of lesson plans, resources and instructor certification proved to be both challenging and progressive.

The 13B AIT added POI that would serve to add both physical and academic rigor. The 13B HPDTs grew to include a hand grenade throw, sled drag, sandbag carry and an M107, 155 mm projectile ammunition carrier load test. The ammunition load test proved to be the most critical evaluation point for students by setting a new standard for 13B combat readiness. These changes in the 13B POI served to challenge the physical ability of the students and added practical combat-focused rigor.

The 13F AIT adjusted POI to match the need for proficiency in the fundamentals of joint fire support. Combat against a near-peer adversary requires an intensive understanding of basic fire support concepts such as special munitions employment, foreign enemy vehicle identification and OP selection and occupation. The 13F students are now required to complete all of these tasks in conjunction with the graded call-for-fire, as a graduation requirement. In addition to the new required tasks, 13F AIT expanded POI to include graded land navigation, Laser Designator Range Finder set-up and operation, and operation of the RT-1523 SINCGAR and AN/VRC-117G HARRIS radio. The 13F POI updates serve as the starting point to produce fire supporters capable of flexible fire support in a contested OE.

All of the 1-78th FA POI updates were challenging, but necessary for adding rigor and effecting change. POI updates have continued as training is implemented, evaluated and refined. Leaders in the battalion are constantly gathering data to determine where modifications to POI would best add rigor and maximize training value for AIT students.

In a final effort to add rigor, 1-78th FA placed an increased emphasis on the importance of degraded operations to prepare for the certainty of disrupted operations in contested domains. While the technological capabilities of the FA are vast, operational success has been overly reliant upon domain superiority across multiple domains; namely, air, space, cyberspace and the electromagnetic spectrum (ES).[6] The U.S. Army and the Field Artillery can no longer assume domain superiority against near-peer adversaries[7]; therefore, artillery systems must maintain the capability to operate degraded. All members of the "Kill Chain," from the 13F to the 13B, must be prepared to fight and win in degraded, disrupted and denied operations.

The 13J fire control specialist training was focused on gaining expertise and competence on automated gunnery systems before the rigor initiative; namely, the AFATDS. The 13J POI focused heavily on operating the AFATDS

4 FM 6-20 Chapter 2 FIELD ARTILLERY RESPONSIBILITIES
5 Meeting the Challenge of Large-Scale Combat Operations today and tomorrow
6 TRADOC Pamphlet 525-3-1 (The U.S. Army in Multi-Domain Operations 2028)
7 Ibid.

A student of the Field Artillery School's Advanced Individual Training course observes an impact area. (Courtesy photo)

to minimize reaction time while enjoying domain superiority in cyberspace and the ES. In the future, technological degradation will demand 13Js who are highly proficient in the fundamentals of manual gunnery. The increase of manual gunnery was the largest attempt at academic reconstruction within the 13J schoolhouse. Delta Battery executed a mass purchase of graphical site tables (GST) and graphical firing tables (GFT) in 2019. GST and GFT are used for manual computation of firing data for Howitzer systems. Additionally, the training emphasized firing chart proficiency, which is commonly referred to as "charts and darts."

The 13F AIT refocused on light infantry-style training by eliminating M7 Bradley Fire Support Vehicle utilization, and increasing focus on dismounted fire support. The 13F land navigation training was GPS aided with a DAGR, before the increase rigor modifications. Now unaided land navigation with an M2 compass is a graduation requirement for every 13F AIT student. Graded foot-marches, graded live call-for-fire, and degraded call-for-fire with special munitions have all aided the simulation of disrupted operations. In a future OE with disrupted air, ground and sea domains, these skills must be trained, refined and perfected.

The 13Bs added Howitzer emplacement evaluations and degraded mission processing as graduation requirements for cannon crewmember students. While students continue to train Howitzer operations with the Digital Fire Control System; there is an increased focus on ensuring proficiency while operating the M109A6, M119A3 and M777A2 Howitzers in a degraded environment.

To conclude, the developments made in 13 series AIT have initiated the push for cultural change within the Field Artillery community. The 1-78th FA pushed to increase the rigors of AIT by introducing a CTE across all MOSs, increasing academic rigor through POI updates, and refocusing on degraded operations. All of these implementations serve the primary purpose of increasing rigor and preparing Soldiers for combat. These developments are the beginning stages for creating Field Artillery Soldiers ready and eager to join our formations. While the Field Artillery continues to adapt, and doctrinal updates emerge, the 1st Battalion, 78th Field Artillery Battalion will continue to educate, train and inspire Field Artillery trainees.

CPT Justin L. Allen received his commission upon graduation from the United States Military Academy at West Point in May 2013. CPT Allen served as an AS3, battery fire direction officer and firing platoon leader. As an AS3, CPT Allen served as a battle captain during Operation Combined Resolve II in Grafenwoehr and Hohenfels, Germany. Allen completed Air Assault School and transitioned to Fort Sill, Okla., to attend FACCC, which he completed in October 2017. CPT Allen was then selected to serve as a fire support instructor for FA BOLC-B, with Bravo Battery, 1-30th Field Artillery. Upon completion of his time as a fire support instructor CPT Allen took command of Alpha Battery, 1st Battalion, 78th Field Artillery.

CPT Allen holds a Bachelor of Science degree in American Legal Studies from the U.S. Military Academy.

2019 Knox, Gruber & Hamilton Winners

Henry A. Knox Award

Congratulations to Headquarters and Headquarters Battery of the First Infantry Division Artillery, Fort Riley, Kan.

The 1ID DIVARTY Fort Riley, Kan., took full advantage of every training opportunity in fiscal year 2019 and executed its missions with distinction. The train-up and execution of the Multi-National Warfighter Exercise 19-04 and support to Operation Atlantic Resolve through the 1ID Forward Deployed Mission Command Element in Europe, propelled the battery towards realizing its full potential as the senior element responsible for every aspect of the fires warfighting function within the 1ID.

The Henry A. Knox Award is named after the first Chief of the Field Artillery, and first Secretary of War, Major General Henry A. Knox. The award recognizes the most outstanding active component battery. Originally called the Knox Trophy and Medal, the awards were established in 1924 by the Chief of the Field Artillery and presented annually. The trophy recognized the best Field Artillery battery and the medal recognized the best enlisted Field Artillery Soldier. Before World War II, the awards were not presented. In 2002, the Knox Trophy was reinstated and the medal was replaced with the Gruber Award to recognize individual Soldiers.

2019 Knox, Gruber & Hamilton Winners

Alexander Hamilton Award

Congratulations to Charlie Battery, 1st Battalion, 161st Field Artillery, Kansas Army National Guard.

Charlie Battery's mission is to destroy, neutralize or suppress the enemy by cannon fire, to help integrate all fire support assets to dominate large-scale combat operations and on order to conduct Civil Support Operations in support of Defense Support to Civil Authorities (DSCA). The battery executed their assigned mission in an exemplary manner by participating in multi-national partnerships in support of Operation Spartan Shield, and security force missions in support of Operation Inherent Resolve as assigned. Charlie Battery participated in Table XVIII gunnery qualification while in country.

Additionally, the unit achieved numerous significant readiness milestones including: a 100 percent duty MOS qualification, meeting 119 percent of their re-enlistment mission, 100 percent Army Physical Fitness Test (APFT) take rate, 88 percent APFT pass rate, and 100 percent qualification on personal weapons. The unit led the battalion in the Noncommissioned Officer Education System with an overall 100 percent completion and also ranked among the highest within the state with a 100 percent assigned strength, and an exceptional 100 percent duty MOS qualification, all contributing to the unit's overall success. Charlie Battery rear detachment Soldiers also excelled at mission execution by supporting DSCA activities during multiple periods of state active duty. Charlie Battery participated in ceremonial salutes, wildland firefighting efforts as well as supported stranded motorist assistance and recovery teams during winter inclement weather.

The Alexander Hamilton Award recognizes the best Army National Guard Battery. It was created in 2002 and is named after American Statesman and Continental Army Artilleryman Alexander Hamilton. Alexander Hamilton was an outstanding artillery battery commander and a skilled cohort of General George Washington during the Revolutionary War. Hamilton helped frame the U.S. Constitution and served as the nation's first Secretary of the Treasury.

2019 Knox, Gruber & Hamilton Winners

Edmund L. Gruber Award

Congratulations to CW3 Christopher Ludwick with Headquarters and Headquarters Battery, 3rd Battalion, 320th Field Artillery Regiment, 101st Airborne Division Artillery, 101st Airborne Division (Air Assault), Fort Campbell, Ky.

Throughout his career, CW3 Ludwick has demonstrated incomparable leadership and dedication to the Field Artillery as both an enlisted NCO and warrant officer. While serving in the 3rd Brigade Combat Team, 101st Airborne Division (Air Assault) as the brigade targeting officer, CW3 Ludwick significantly enhanced the lethality and capability of the brigade. He created, and masterfully implemented, a revised targeting process, providing more lethal and non-lethal options to the brigade commander. This targeting process acutely serves air assault and airborne forces, in support of large-scale combat operations, and is primed to be adopted throughout the division and beyond. An output of the targeting process resulted in the creation of non-doctrinal targeting products and facilitated more effective synchronization within the brigade operations process. His creativity led to recognition by the Joint Readiness Training Center leadership in March 2019 as a best practice as well as a feature in the quarterly Center for Army Lessons Learned Insider newsletter.

The Edmund L. Gruber Award is named after Brigadier General Edmund L. Gruber, a noted Field Artillery officer, who as a first lieutenant in 1908 composed the "Caisson Song," which the Army adapted as "The Army Song" (The Army Goes Rolling Along) in 1952. The Gruber Award was established in 2002 to recognize individual Field Artillery Soldiers for innovations that resulted in significant contributions to enhance the Field Artillery's war fighting capabilities, morale, readiness and maintenance.

Airspace prioritization

A methodology for airspace planning in large-scale combat operations

MAJ Ryan Johnson

"Weapons and units work more effectively when they operate together. No single action, weapon, branch or warfighting function generates sufficient power by itself to achieve the effects required to prevail."[1] This statement comes to us from ADP 3-90, *Offense and Defense* and it captures the essence of how we fight. Our joint and U.S. Army doctrine is built around fighting as a team. Our effectiveness, efficiency and lethality increase when all of our branches and all of our capabilities work in concert with one another. To fight and win against a near-peer adversary we truly must be the 'Musicians of Mars' that GEN George S. Patton described in his famous quote. A major component of this combined arms mindset is air-ground integration. Unfortunately, as evidenced in every "key observations" report that the Mission Command Training Program (MCTP) produced from present back to FY15, we tend to struggle with effectively integrating air and ground assets to mass effects on the enemy. This article will delve into why we tend to struggle in this area and offer a potential solution in the form of an airspace planning methodology.

The greatest symptom that manifests itself from our challenges in air-ground integration is ineffective surface-to-surface fires as a result of slow and cumbersome airspace clearance procedures. I witnessed this as an observer, coach or trainer with MCTP, I lived it as a division fire support officer and Joint Air-Ground Integration Cell chief, and the MCTP annual "key observations" reports validate it. The root problem, however, is several layers deeper.

Airspace clearance is overly cumbersome and slow because, more often than not, our unit airspace plans (UAPs) are poorly thought out and not maintained to stay relevant in a dynamic fight. Our UAPs are essentially our framework for how we are going to integrate all airspace users, and they are comprised of individual airspace coordination measures (ACMs). The doctrinal basis for this is in FM 3-52 *Airspace Control* which states that "Army com-

1 ADP 3-90 Offense and Defense, July 2019, para 2-47.

1. Build the team
2. Prioritize airspace usage
3. Plan for the surface fires fight
   a. Template the enemy
   b. Build CFFZs
   c. Template pre-planned deliberate fires
   d. Position friendly artillery
   e. Build surface fires AMCs
4. Integrate rotary wing assets
5. Integrate joint assets
6. Plan for UAS
7. Brief and rehearse UAP

Figure 1. Steps in the unit airspace planning process. (Courtesy information)

manders use airspace coordinating measures to facilitate the efficient use of airspace and simultaneously provide safeguards for friendly forces."[2] Now, to look more deeply at the problem, we must ask ourselves, why do we tend to struggle so much with developing useful UAPs?

There are ample reasons our UAPs tend to be inadequate: lack of detail, infeasible, do not account for all airspace users and not complete. The biggest cause, however, is that we fail to appropriately prioritize airspace usage based on the nature of the current fight we are in. Prioritizing airspace usage is the foundation of our UAPs, and like any structure, it cannot stand if we don't build it correctly from the ground up.

Airspace usage prioritization is crucial because, like all prioritization we do in the military, it guides our planning efforts, resources and focus. Unfortunately, we seem to consistently skip over this critical step. We are all victims of our own recent experiences and we tend to automatically prioritize fixed-wing assets as the primary airspace users. This mindset is derived from two places. First, our experience over the past 15 years fighting counterinsurgency where fixed and rotary wing assets were clearly, and rightfully so, the primary airspace users. And, second, we also tend to drag priorities from one phase of the fight into another even though the nature of the fight has changed. In the joint phasing model Phase III and Phase IV ("seize the initiative" and "dominate" respectively) are the arenas where warfighter exercises take place and largely consist of large-scale ground combat operations. There is a portion of the fight where the "… joint force commander seeks to degrade enemy capabilities …"[3] that is typically characterized by significant deep shaping operations, most of which are conducted by fixed-wing assets with very few long-range surface fires in support. During this portion, the initial shaping effort, it is logical that we would build our airspace plans around our fixed-wing assets. As we transition to ground combat, however, the fight changes and we see a significant increase in surface fires utilization. Even though the nature of the fight has changed, and therefore airspace usage has changed, we oftentimes do not readdress our airspace usage prioritization accordingly. In large-scale ground combat operations, from what we have learned from simulating a peer/near-peer fight in warfighter exercises over the past decade, it is a fires fight and surface fires occupy the airspace for a preponderance of the battle.

The price of not accurately prioritizing airspace usage in support of large-scale ground combat operations is slow and ineffective surface-to-surface fires. So, how can we correct this? The following methodology describes how to build a UAP that will enable rapid surface fires and full integration of all air users. Of note, this example is written through the lens of a division planning effort, but it is applicable at any echelon.

Step 1 Build the Team

Building a UAP is a team effort, to be successful you have to have the right people involved. The team should include at a minimum all of the personnel listed in the Figure 2. It is also critical to know when to bring this team together. If we want true integration of our air-ground assets we need to build our airspace plan simultaneously with our maneuver and fires plans. This means that we need to be discussing airspace as soon as we start the military decision-making process (MDMP). The "airspace team" should come together frequently throughout MDMP with the bulk of the conceptual work being done during the course of action development (COA DEV)

2 FM 3-52 Airspace Control, October 2016, para B-1.
3 JP 3-0, Joint Operations, 17 January 2017, page V-10 para 3.

Division Staff		DIVARTY Staff	CAB Staff
DFSCOORD/FSO	G3 (rep)	S3	S3
Targeting Officer	G5 (rep)	S2	S2
FAIO	G2 (rep)	FCO	TACOPs
ALO	Collection Manager	Targeting Officer	Senior Pilot
CM+D Officer	G3 Air	Counterfire Officer	ISR
AMD	Airspace Manger		

Figure 2. The minimum required personnel and positions to establish a UAP team. (Courtesy information)

process and the detailed work being done somewhere around COA approval. Like all of our planning efforts, we must plan for airspace continuously.

Step 2 Prioritize airspace usage

The basis for this planning methodology is that we will first prioritize airspace usage based on the nature of the fight, and subsequently build our UAP around that usage. Our repeated simulations during warfighter exercises of a peer/near-peer fight show that surface fires are the primary airspace user. Therefore, in this methodology, we will begin sculpting our airspace plan for surface fires first, specifically our counterfires.

Step 3 Plan airspace for the surface fires fight

This includes both pre-planned deliberate fires as well as counterfires. The following sub-steps break this process down.

Step 3A Template the enemy

This does not have to show the entire event template, simply focus on high payoff targets. Of critical importance here is the marriage of the Division Artillery (DIVARTY) S2 and division G2 sections (ie. fusion, collection, targeting). It cannot be overstated how important it is for the two organizations to collaborate to develop the best possible and most detailed assessment for how the enemy is going to employ his artillery assets and where they will be located on the battlefield.

Step 3B Build call-for-fire zones (CFFZs) over enemy long-range artillery (LRA)

Once we have templated the enemy LRA it is time for our DIVARTY counterfire officer to build CFFZs. Since templating the enemy is not an exact science, these CFFZs should be large enough to encompass error in our enemy template, dispersed enemy artillery formations and the survivability moves that the enemy will inevitably conduct. It is a balance however, as we do not want to unnecessarily consume space that other airspace users could utilize.

Step 3C Template pre-planned deliberate fires

These are commonly fires that support the preparation of objectives or other relatively known or fixed locations. Plot them on the map to visually show them just like we did with the CFFZs in step 3B.

Step 3D Position friendly artillery

Now that we know where we are shooting, we can appropriately place our friendly artillery. Presumably, the DIVARTY has already created a position area for artillery (PAA) overlay based on terrain analysis that will help narrow down our options. This is a collaborative effort between the DIVARTY staff and the G3 and G5 to ensure that we place our artillery in positions where we can maximize the effectiveness of our munitions ranges while balancing terrain management and risk to the force.

Step 3E Build surface fires ACMs

Once we know where we are shooting to and from, we can build ACMs to "pre-clear" the airspace for the surface fires fight. The goal is to account for all of the airspace needed to shoot anywhere inside the CFFZ or target areas without being overly restrictive to other airspace users. The best technique to accomplish this is to utilize "SSMS" geometries. A Surface-to-Surface Missile System (SSMS) is a combined geometry that consists of the position airspace hazard (PAH), target airspace hazard (TAH), and missile flight path (MFP). Leveraging advanced Field Artillery tactical data system and target areas of interest (TAIS) you can gain the technical firing solutions by running digital dry fire missions from the center of your PAAs to the lower-left corner of the CFFZ and the upper right corner of the CFFZ (or target area for planned fires). The resulting geometries provide you the data (PAH, TAH, MFP, and maximum ordinate) to submit into your UAP to create a pre-cleared zone of airspace for surface fires that you can turn on and off as needed. This is similar in concept to

how artillerymen build their safety T's. This technique is preferred because it is the least restrictive and allows the Air Force master air attack plan planners the most flexibility.

Step 4 Build a network to integrate rotary wing assets

Rotary wing assets are relatively simple to integrate. The coordination level ensures vertical deconfliction from other airspace users, our only concern then is lateral deconfliction from our artillery assets. Our goal here is to create some sort of a simple network or framework that will keep our assets from flying directly over our PAAs and target areas and will serve as a common graphic to quickly move assets across the battlefield as necessary. You can accomplish this with a series of checkpoints, establishing zones, or overlaying a grid system. This effort is spearheaded by the combat aviation brigade staff, in coordination with the DIVARTY staff.

Step 5 Integrate joint assets

The next step is to integrate our joint assets. Again, vertical deconfliction is relatively simple. The primary focus of this effort is lateral deconfliction and building the specific ACMs necessary to move fixed-wing assets into and across division airspace without moving through any pre-planned artillery missile flight paths. The division air liaison officer is the proponent for this piece of the plan. This includes building kill boxes, air corridors, close air support holding areas, minimum risk routes, etc. Our measure of success is generating a plan that will allow all airspace users the ability to operate simultaneously, in concert with one another, to bring the maximum amount of destruction to the enemy.

Step 6 Plan for unmanned aerial systems

Although they are unmanned we still have to account for their presence in the airspace. Key areas to focus on are their launch and recovery zones and the space they need to climb to their assigned operating altitude. Once they are at altitude and we have achieved vertical deconfliction, we can plan routes to get these assets to and from the named areas of interest and TAIs they are collecting in. The collection manager and ISR reps at echelon lead this part of the discussion with input from all other airspace users.

Step 7 Brief UAP at the combined arms and fires/intelligence rehearsals

This ensures all airspace users understand the initial plan and that the plan is complete. It also generates an appropriate level of pressure and commander involvement.

This simple planning methodology will serve as a handrail to help personnel develop thoughtful and complete UAPs that address the challenging problem set of airspace planning. There are, however, a few additional points to address. First, our discussion during the airspace planning working group mirrors the typical targeting process agenda and provides the division targeting officers a golden opportunity to build or validate all of their initial targeting products. Second, just like the targeting officers, the collection manager can use this planning effort to build or validate their initial collection plan. Third, this is only the initial plan. We first address it during MDMP and it is realistic to build it out to 96 or 120 hours. We then need to maintain and update our plan as the fight unfolds. Since white space in a division battle rhythm is hard to come by, a possible solution is to include the airspace discussion in the targeting working group or conduct a separate airspace working group immediately after. Simply asking "what ACMs do we need to build to ensure our shaping fires are permissive?" is a great segue from the targeting to airspace management discussions. Whenever we choose to do it, we must ensure we have enough time to submit our new ACMs or refinements before the Air Force conducts their master air attack planning.

On the eve of D-Day, General Dwight D. Eisenhower described the enemy the allies were about to face. His characterization of the enemy rings true to the near-peer opponent we are training to fight today. To succeed we must find harmony in battle with all weapons, branches and warfighting functions complemen-ting one another. Achieving complementary effects in the deep fight requires successful air-ground integration. Appropriately prioritizing airspace usage based on the nature of the fight we are currently in is the foundation for building a solid division UAP that will stand the test of battle. Any infantryman would relish the opportunity to build the terrain they are going to fight on; we need to take the opportunity we have to build the terrain our airspace users will fight on so that it works for us, rather than against us.

MAJ Ryan Johnson is a graduate of the Command and General Staff College. MAJ Johnson was assigned to the 25th Infantry Division at Schofield Barracks, Hawaii. While in the 25th ID he served as the division fire support officer, the battalion executive officer for 3-7th Field Artillery, and the brigade fire support officer for 3rd Brigade. In 2019, he was assigned to Fort Leavenworth, Kan., to serve in the Mission Command Training Program again as a fires OC/T with Operations Group Delta.

A High Mobility Artillery Rocket System live-fire demonstration is performed during Exercise Talisman Sabre, July 8, 2019. (Senior Airman Ashley Maldonado/U.S. Air Force)

King of Battle, your counsel is calling

MAJ Katherine L. DePaul

With the rise of near-peer competition and a re-focus on large-scale combat operations (LSCO), the U.S. military cannot afford to have the King of Battle on the sidelines. This paper provides the Field Artillery with a discussion of the importance of legitimacy in modern conflicts, a refresher on the basic principles of the Law of Armed Conflict (LOAC), and discusses how these principles are incorporated within U.S. military doctrine and woven into our targeting methodologies. It concludes with examples of how to apply the LOAC in Field Artillery specific operations. By employing fires in accordance with the LOAC, the Field Artillery can maintain its position as the King of Battle and ensure long-range precision fires (LRPF) are the most attractive option for commanders tasked with winning our nation's wars.

The LOAC is not an external, academic layer to be applied on top of military operations. Moreover, its principles have been part of the U.S. Army since its earliest con-

flicts and should be very familiar to the Field Artillery community already.[1] Although international in origin, the LOAC's basic principles of military necessity, distinction, proportionality, humanity and honor have been incorporated into U.S. domestic law and woven into U.S. military doctrine. The Department of Defense Law of War Manual; Field Manual 6-27, *The Commander's Handbook on the Law of Land Warfare*; Army Regulation (AR) 350-1, *Army Training and Leader Development* (i.e., Table F-2, "The Soldier's Rules"); and AR 27-23, *Legal Review of Legality of Weapons under International Law*, are just a few examples. The LOAC has also been baked into our targeting processes.

Recall the process of decide, detect, deliver and assess (D3A).[2] The "decide" phase considers the principles of military necessity and distinction because only valid military objects are selected as targets. The "detect" phase relates to the principle of distinction because surveillance of the target should include an examination of the surrounding area for civilian and non-combatant personnel and objects. The "deliver" phase considers the principle of proportionality because weaponeering is employed to minimize collateral damage. Finally, the "assess" phase includes determining whether the strike resulted in any unexpected collateral damage and, if so, how such effects can be avoided or mitigated in future operations, both of which are proportionality considerations. Similarly, each of the five questions asked in the collateral damage estimation (CDE) methodology also relates to one or more LOAC principles.[3] Consequently, understanding the LOAC - both what it requires and what it does not require - will help the Field Artillery correctly apply the D3A and CDE methodologies which, in turn, will enhance legitimacy in operations where fires are employed.

Legitimacy as a principle of war

"Legitimacy," which joint doctrine recognizes as a principle of war, refers to the ability to "maintain legal and moral authority during operations."[4] Further, along with the unity of command and objective, legitimacy is recognized as being important in all operations.[5] The importance of maintaining legitimacy in the conduct of operations can be seen with the current conflict with Iran. By using proxy forces to accomplish military objectives or using its forces but denying their involvement, Iran has succeeded in, at a minimum, delaying and potentially preventing attribution for many of its actions. For example, following the attacks on oil tankers near Fujairah, United Arab Emirates on May 12, 2019,[6] and in the Gulf of Oman on June 13, 2019,[7] the U.S. government and the international community were forced into a "tactical pause" as the world tried to determine who was responsible. Unless Iran or its proxies could be tied to the attacks, any use of force against Iran would likely have been be viewed as illegitimate.

The issue of legitimacy again surfaced when Iran attacked an unmanned U.S. drone. Although Iran admitted responsibility for the attack, it claimed the drone was operating inside its territorial borders.[8] The United States disputed that claim, arguing the drone was operating in international airspace.[9] The battle for legitimacy over the initial attack and potential response waged without either side winning clear victory. These incidents highlight just a few of the many ways in which the principle of legitimacy is being employed in the current environment where Field Artillery units operate.[10]

The Law of Armed Combat

Because lawfulness confers legitimacy, adhering to the LOAC will enable commanders to maintain legitimacy during operations.

1 General Orders No. 100: The Lieber Code, Instructions for the Government of Armies of the United States in the Field, https://avalon.law.yale.edu/19th_century/lieber.asp (e.g., Art. 37 provides, "The United States acknowledge and protect, in hostile countries occupied by them, religion and morality; strictly private property; the persons of the inhabitants, especially those of women: and the sacredness of domestic relations. Offenses to the contrary shall be rigorously punished.").

2 Army Training Publication (ATP) 3-60, TARGETING, May 2015, Chapter 2.

3 First, has positive identification of the target been established (military necessity/distinction)? Second, are there collateral objects, including noncombatant personnel, CBR plume hazards, or significant environmental concerns within the effects range of the weapon selected to attack the target (distinction)? Third, can damage to those collateral objects be mitigated by engaging the target with a different weapon or method of employment, yet still accomplish the mission (proportionality)? Fourth, if not, how many civilian and noncombatant casualties will the attack be expected to cause (proportionality)? Fifth, would the collateral effects exceed the commander's guidance, requiring elevation of the strike decision (proportionality)? Overall, the methodology is designed to ensure our forces attack only lawful military objects and to avoid or minimize collateral damage while still accomplishing the mission.

4 Joint Publication 3-0, JOINT OPERATIONS, Appendix A, A-4 (17 January 2017, Incorporating Change 1, 22 October 2018). The twelve principles of war are objective, offensive, mass, maneuver, economy of force, unity of command, security, surprise, simplicity, restraint, perseverance, and legitimacy. Id. at ix.

5 Id. at A-1.

6 Vivian Yee, Claim of Attacks on 4 Oil Vessels Raises Tensions in the Middle East, THE NEW YORK TIMES (May 2019), https://www.nytimes.com/2019/05/13/world/middleeast/saudi-arabia-oil-tanker-sabotage.html.

7 John Bacon, Pompeo: Iran Responsible for Attack on Oil Tankers in Gulf of Oman, USA TODAY (June 2019), https://www.usatoday.com/story/news/world/2019/06/13/oil-tankers-attacked-gulf-oman-off-iran-us-navy-responding/1441787001/.

8 Michael D. Sheer, et. al., Strikes on Iran Approved by Trump, then Abruptly Pulled Back, THE NEW YORK TIMES (June 2019), https://www.nytimes.com/2019/06/20/world/middleeast/iran-us-drone.html.

9 Id.

10 An additional example is both the United States' and Iran's repeated public statements that each seeks to avoid war, but will defend its interests if threatened by the other. Moreover, both blame the other as the reason for heightened tensions. Associated Press, The Latest: Top Officials Say US Doesn't Want War With Iran, US NEWS (May 2019), https://www.usnews.com/news/world/articles/2019-05-21/the-latest-trumps-iran-policy-focus-of-hill-briefings (Secretary of State, Michael Pompeo, has said, "We fundamentally do not seek war with Iran" while adding, "We have also made clear to the Iranians that if American interest are attacked, we will most certainly respond in an appropriate fashion); Steve Inskeep and Bobby Allyn, NATIONAL PUBLIC RADIO (June 2019), https://www.npr.org/2019/06/21/734605683/irans-u-n-ambassador-u-s-escalating-hostilities-like-a-knife-under-your-throat (Iran's ambassador to the United Nations sent letters to the U.N. Security Council claiming it acted in lawful self-defense by attacking the U.S. drone, reiterating it "does not seek war.").

The basic principles of the LOAC are a military necessity, distinction, proportionality, humanity and honor. The LOAC should not be confused with rules of engagement (ROE) which are a commander's rules for the use of force based on operational, political and legal considerations. Unlike the basic principles of the LOAC, which do not change regardless of the operating environment, ROE is theater-specific and can change as operational, political and legal considerations change. As professional warfighters, Field Artillery planners must be familiar with and accurately apply the LOAC concepts, not only because they are legally obliged to do so, but to ensure partner nations and U.S. citizens view their operations as legitimate.

Unfortunately, some mistakenly believe following the LOAC is akin to "fighting with one hand tied behind your back." This thinking shows a fundamental misunderstanding of the LOAC for three reasons. First, the LOAC is primarily aimed at protecting civilian and noncombatant personnel and objects who, by their very definition, are not directly participating in hostilities or contributing to the enemy's warfighting functions. Thus, attacking such persons or objects wastes valuable and often limited resources without accomplishing the mission. Second, civilians and noncombatant personnel or objects who directly participate in hostilities lose their protected status and can be attacked. Finally, the incidental death or destruction of civilian and noncombatant persons or objects during an armed conflict is not a per se LOAC violation; as noted below, such actions are only prohibited if the resulting collateral damage was excessive in relation to the concrete and direct military advantage gained by the attack.

When applied correctly, adhering to the LOAC enhances the targeting process by placing fires and effects upon valid military targets. Failure to do so, however, risks the Field Artillery being sidelined in future battles as commanders pursue other options that can meet mission requirements while also maintaining legitimacy.

The principles of the Law of Armed Conflict

First, military necessity is defined as the principle that justifies the use of all measures needed to defeat the enemy as quickly and efficiently as possible that are not prohibited by the LOAC.[11] Military necessity does not require the use of minimum force necessary to accomplish the mission; such an erroneous interpretation would prolong conflicts and increase suffering.[12]

Second, the principle of distinction obligates parties to a conflict to distinguish between military objects and civilian and noncombatant personnel[13] and objects. A "military object" is an object by which its nature, location, purpose or use makes an effective contribution to military action and whose total or partial destruction, capture or neutralization, under the circumstances at the time, offers a definite military advantage.[14] Examples of military objects include enemy radars and integrated air defense systems (IADS), both typical targets of artillery fires.

The third principle, proportionality, requires commanders to refrain from attacks in which incidental harm to civilian and noncombatant personnel and objects would be "excessive" in relation to the concrete and direct military advantage expected to be gained.[15] This principle also requires commanders to take "feasible precautions" in planning and conducting attacks to reduce the risk of harm to civilian and noncombatant per-

11 DEPARTMENT OF DEFENSE LAW OF WAR MANUAL [Hereinafter DOD LOWM], para. 2.2, June 2015 (Updated December 2016).
12 Field Manual 6-27, THE COMMANDER'S HANDBOOK ON THE LAW OF LAND WARFARE, 07 August 2019, para. 1-24.
13 "Noncombatant personnel" include military medical and religious personnel. See DOD LOWM para. 2.5.1.
14 Id. at para. 2.5.
15 Id. at para. 5.10.

Soldiers from the 2nd Battalion, 300th Field Artillery Regiment, Wyoming Army National Guard, fire a High Mobility Artillery Rocket System June 23, 2020, at Camp Guernsey Joint Training Center. (1LT Andrew Wagnon/Wyoming Army National Guard)

sons and objects.[16] Proportionality does not impose obligations intended to reduce the risk of harm to enemy personnel or objects. Instead, protecting civilian and noncombatant personnel and objects is its primary focus. In making proportionality assessments, commanders are expected to act reasonably based on the information known at the time.

Critically, the principle of proportionality under the LOAC should not be confused with the principle of proportionality in self-defense. While the principle of proportionality under the LOAC seeks to reduce the risk of harm to civilians and noncombatant personnel and objects, the principle of proportionality under self-defense restricts the use of force applied to a military object to that which in nature, duration and scope is necessary to respond decisively. The distinction between proportionality under the LOAC and proportionality in self-defense is highlighted in the practical application section.

The fourth principle, humanity, prohibits the intentional infliction of unnecessary violence against the enemy.[17] Of course, violence is often necessary during war. This principle only precludes gratuitous violence which is not needed for mission accomplishment and is specifically intended to cause unnecessary suffering. For example, white phosphorous is a lawful weapon. However, like any other lawful weapon, it must not be used in a manner intended to cause unnecessary suffering such as burning enemy personnel for the purpose of causing maximum suffering when other equally effective weapons were available for employment.

Honor is also a foundational principle of the LOAC and an Army Value. Honor requires a certain amount of fairness and mutual respect between opposing forces. In keeping with the concept of honor, the Department of Defense (DoD) Law of War Manual requires members of the DoD to comply with the LOAC during all armed conflicts, however such conflicts are characterized and in all other military operations.[18] Further, honor also requires adherence to the LOAC regardless of the enemy's level of compliance.

Practical application

Position Artillery Area (PAA) selection – feasible precautions

Following Iran's strike on the U.S. drone, suppose a High Mobility Artillery Rocket System (HIMARS) crew had been ordered to a PAA to employ LRPF against the Iranian radars and IADS used in the attack. What LOAC considerations should be applied to PAAs? When determining PAAs, commanders and staff should consider their obligations to take "feasible precautions" to distinguish themselves from and avoid harm to civilian and noncombatant personnel and objects. For example, artillery crews are subject to attack by counter-fire. Accordingly, PAAs should not be placed near populated areas, cultural sites or other civilian and noncombatant structures if such placement would subject those persons or objects to enemy counter-fire. Once PAAs are established, commanders and staff must assess the PAAs to verify whether any protected persons or objects have moved into the area. If so, the staff should analyze whether the PAA could be moved without unacceptable risk to the mission or the force, a determination which ultimately will be made by the commander. It is important to remember that "feasible precautions" do not require that everything possible is done to avoid harm to civilian or noncombatant personnel or objects. Moreover, commanders must always consider the operational risk and risk of harm to the force of employing such precautions.

Cluster munitions - distinction

Arrival at the PAA with a known target is only part of processing a firing mission; selection of an appropriate munition is critical. What LOAC considerations are there in munition selection? The U.S. is not a party to the Convention on cluster munitions. However, the DoD Policy on cluster munitions has restricted the employment of cluster munitions with an unexploded ordinance (UXO) greater than one percent to the combatant commander.[19] The concern with unexploded ordinance is the principle of distinction – a UXO cannot distinguish between civilian and noncombatant personnel and objects. Artillery units in a deployed environment must consider whether the target set, in this scenario radars and IADS, requires the employment of cluster munitions with a UXO producing rate greater than one percent or whether the target set can be serviced with an alternative munition that will achieve the desired effect. If planners cannot articulate why this type of cluster munition should be employed despite the concerns about distinction or find a satisfactory alternative that can meet mission requirements, cluster munitions, and the artillery that delivers them, will not be an attractive option.

Weaponeering – proportionality

Following Iran's attack on the U.S. drone, the president tweeted that he would have responded with force, however, the option he was provided would have resulted in the death of 150 people.[20] The president concluded a strike that

16 Id. at para. 5.10.1.
17 Id. at para. 6.6.1.
18 Id. at para. 3.1.1.2.
19 DoD Policy on Cluster Munitions (2017) available at http://dod.defense.gov/Portals/1/Documents/pubs/DOD-POLICY-ON-CLUSTER-MUNITIONS-OSD071415-17.pdf.
20 Lolita C. Baldor and Deb Reichman, Trump Says He Decided Retaliation Attack on Iran Not Proportional, LAS VEGAS REVIEW-JOURNAL (June 2019), https://www.reviewjournal.com/news/politics-and-government/trump-says-he-decided-retaliation-attack-on-iran-not-proportional-1692117/.

Soldiers from 1st Battalion, 182nd Field Artillery, Michigan Army National Guard, fire a rocket from a High Mobility Artillery System during the Northern Strike exercise at Camp Grayling, Mich. (CPT Joe Legros/Michigan Army National Guard)

would kill 150 people was "not proportionate to shooting down an unmanned drone."[21] Consequently, the president decided against a kinetic strike against Iranian radars and IADS, instead opting for a non-lethal cyber-attack that targeted Iranian missile launch systems.[22] It is not clear from the news reporting whether any of the 150 people were civilians and/or noncombatants. Assuming for illustration purposes that the 150 people were civilians and/or noncombatants, the president may have determined their deaths would have been excessive in relation to the concrete and direct military advantage to be gained, and thus, disproportionate under the LOAC. Alternatively, assuming for illustration purposes that the 150 people were Iranian military members who participated in the attack, the president could have determined their deaths were not necessary to respond decisively to the downed drone and thus, a violation of the principle of proportionality under self-defense. Regardless of whether the strike failed proportionality under the LOAC or proportionality under self-defense, kinetic options, of which LRPF may have been available, were ruled out because the commander-in-chief was not presented with a course of action he assessed as legitimate. As shown by this example, fires planners must be able to provide commanders with options that will accomplish the mission with the least amount of collateral damage. Otherwise, commanders are obligated to look elsewhere.

Conclusion

Fighting lawfully enhances legitimacy, a principle of war that is increasingly important in modern conflicts. As the multi-domain battlefield becomes more complex and other nations improve their capabilities, accurate delivery of LRPF will be critical to winning LSCO against near-peer competitors. By employing fires in accordance with the LOAC, which is already baked into our targeting methodologies, the Field Artillery community can maintain its position as the King of Battle and ensure LRPF is the most attractive option for the commanders. Because of their expertise in military law, judge advocates are uniquely positioned to enable commanders to achieve legitimacy through timely, accurate and principled counsel on the application of the LOAC to Field Artillery operations. So Redlegs, if confronted with a complex question involving the LOAC, call your counsel before you call for fire![23]

MAJ Katherine L. DePaul served as the brigade judge advocate for the 18th Field Artillery Brigade located at Fort Bragg, N.C. from 2018 through 2020. During this time, MAJ DePaul deployed with the brigade to Camp Redleg. She previously, served as a legal assistance attorney, trial counsel, administrative law attorney and defense appellate attorney. Her next assignment is as a student at the U.S. Army Command and General Staff College at Fort Leavenworth., Kan. She attended law school at Temple University, the Beasley School of Law in Philadelphia, Pa.

21 Id.

22 Julian E. Barnes and Thomas Gibbons-Neff, U.S. Carried Out Cyberattacks on Iran, THE NEW YORK TIMES (JUNE 2019), https://www.nytimes.com/2019/06/22/us/politics/us-iran-cyber-attacks.html

23 This is not to suggest that commanders must consult with an attorney prior to making every decision. Such a practice is not necessary, nor is it desirable. However, judge advocates, like any other staff member, have a valuable role in the commander's decision making process, particularly with respect to application of the LOAC.

Timely effective Fires

CW4 Jimmy Mannings

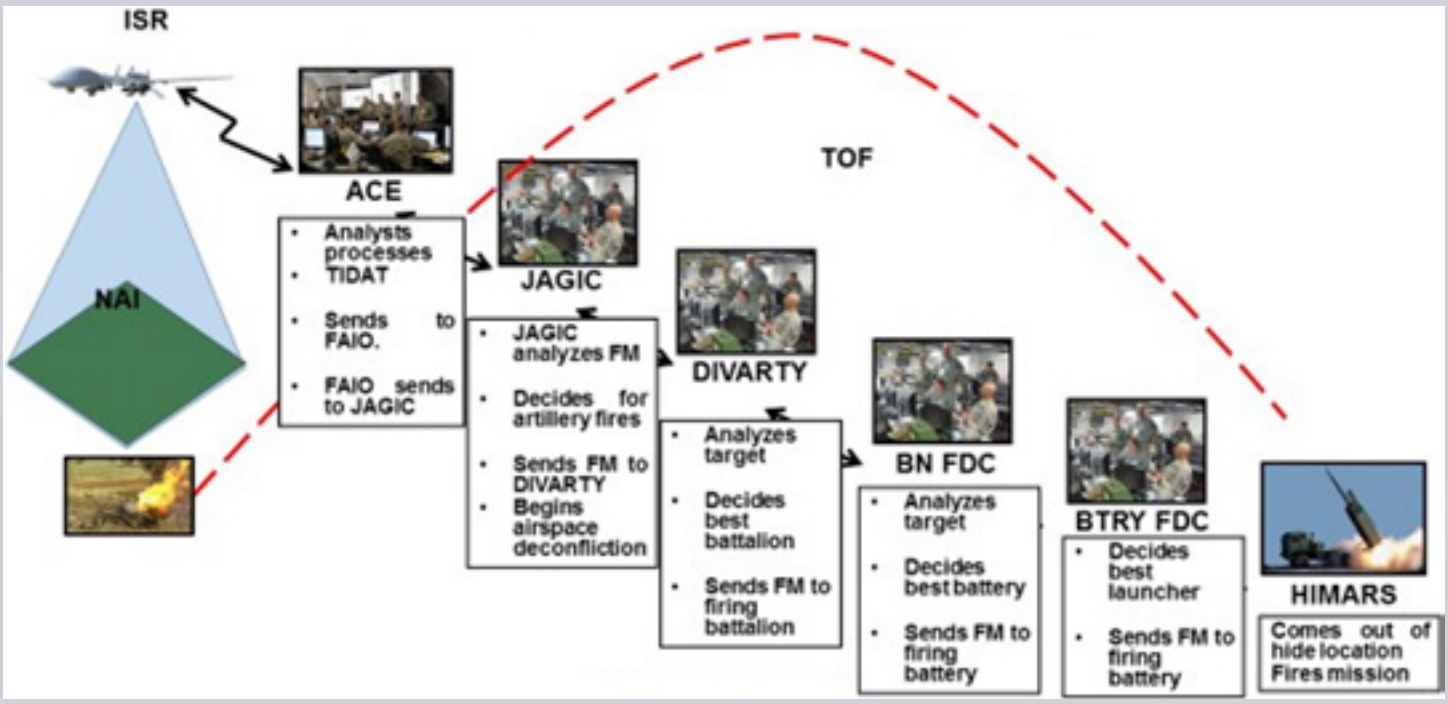
During fiscal year 2018 warfighter exercises, Division Artillery (DIVARTY) and Field Artillery brigades struggled to deliver timely and effective fires which led to an overall ineffectiveness in artillery fires. The ineffectiveness of general support rocket artillery increased the burden on direct support cannon artillery battalions and it was a significant factor in the heavy losses sustained in brigade combat teams. Many underlying factors can be related to the effectiveness, or lack thereof, of artillery fires – ranging from the accuracy of the sensor to the accuracy and efficiency of the crews. In a warfighter training event however, there is a direct correlation between timing and effectiveness. On average, fire missions with the shortest sensor-to-shooter time were most effective. In other words, to increase the effectiveness of rocket artillery fires, the unit must reduce the time it takes to put rounds on target.

Establishing fast effective sensor-to-shooter links is not a new procedure. This was a very common procedure within the fires community in the 80's and 90's doctrine. Often, the fire direction communicated directly with the observers. However, in the last couple of decades, the leadership lost confidence in these links because the Army adopted a risk-averse attitude that revolved around counterinsurgency operations. Therefore, every fire mission had to be centrally planned and centrally executed with multiple echelons involved in the process. This process significantly increases the fire mission processing time. Re-learning to establish quick and effective sensor-to-shooter links will require a fundamental change in the current processes in fire mission execution. It will also require detailed-level planning to set the conditions on the ground and airspace, and finally, it will require conducting thorough tactical and technical rehearsals.

Fire missions have to be processed in four minutes or less to increase the possibility of effects. The time starts when the target is identified to the time when rounds land on the target. In the last six warfighters, fire missions that took less than four minutes achieved the most significant effects. These were fire missions with "catastrophic kills." Unfortunately, those fire missions were exceptions and not the norm. On average, only three out of every 10 fire missions had catastrophic effects on target. Most of the fire missions achieved little to no effects. Some of the delay is caused because most units use the fire mission process that requires a call-for-fire (CFF) to stop at every echelon so it can be checked, logged and sent to the next subordinate unit. Every time the fire mission stops at each echelon, it delays the delivery of fires, giving the enemy more than enough ample time to displace from the area and avoid any effects.

A typical fire mission involves the analysis and control element (ACE), Joint Air-Ground Integra-

Fire mission processing time. (Courtesy illustration)



tion Center (JAGIC), DIVARTY fire control element (FCE), the battalion fire direction center (FDC), and a battery or platoon FDC before it reaches the firing unit. When a sensor detects a target, the information is sent to the ACE at the division headquarters to be analyzed and processed. Once this process is complete, the Field Artillery intelligence officer sends a call for fire (CFF) to the division JAGIC.

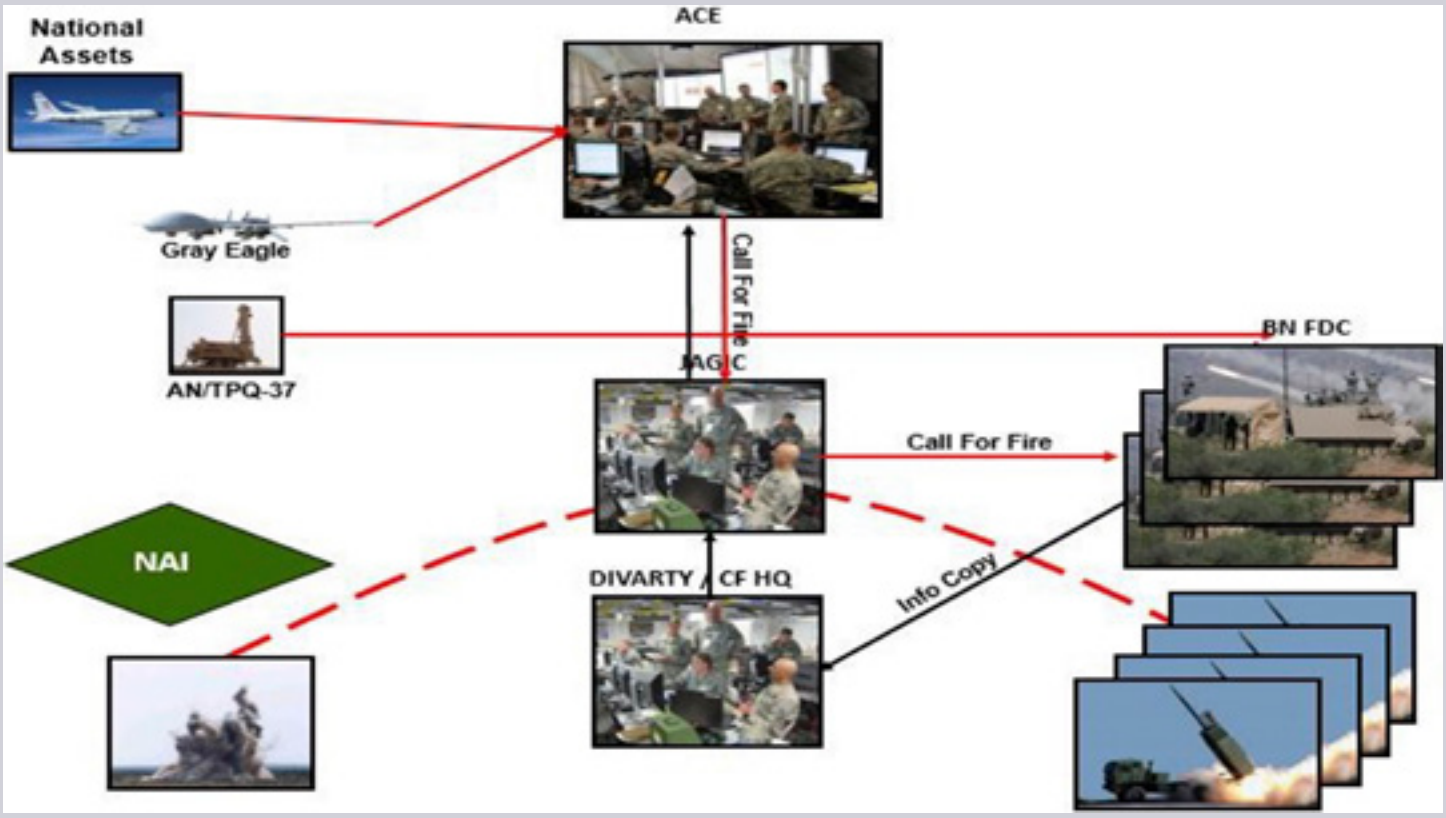
The JAGIC receives the target, analyzes and validates it. The fire support NCO or Advanced Field Artillery Tactical Data System (AFATDS) operator logs the target and distributes the information to the rest of the JAGIC personnel via chatroom and via analog methods. Then the JAGIC decides to prosecute the target with air support or artillery fires. If the JAGIC decides to prosecute the target with artillery, the fire mission goes to the DIVARTY FCE. The FCE analyzes the target, logs and processes the mission in a similar manner as the JAGIC. The FCE decides which battalion is in range of the target and sends the mission to the battalion FDC. The battalion FDC conducts similar actions and then sends the mission to the battery. The battery FDC finally sends the mission to the firing unit, and two to three minutes later, the firing unit finally shoots.

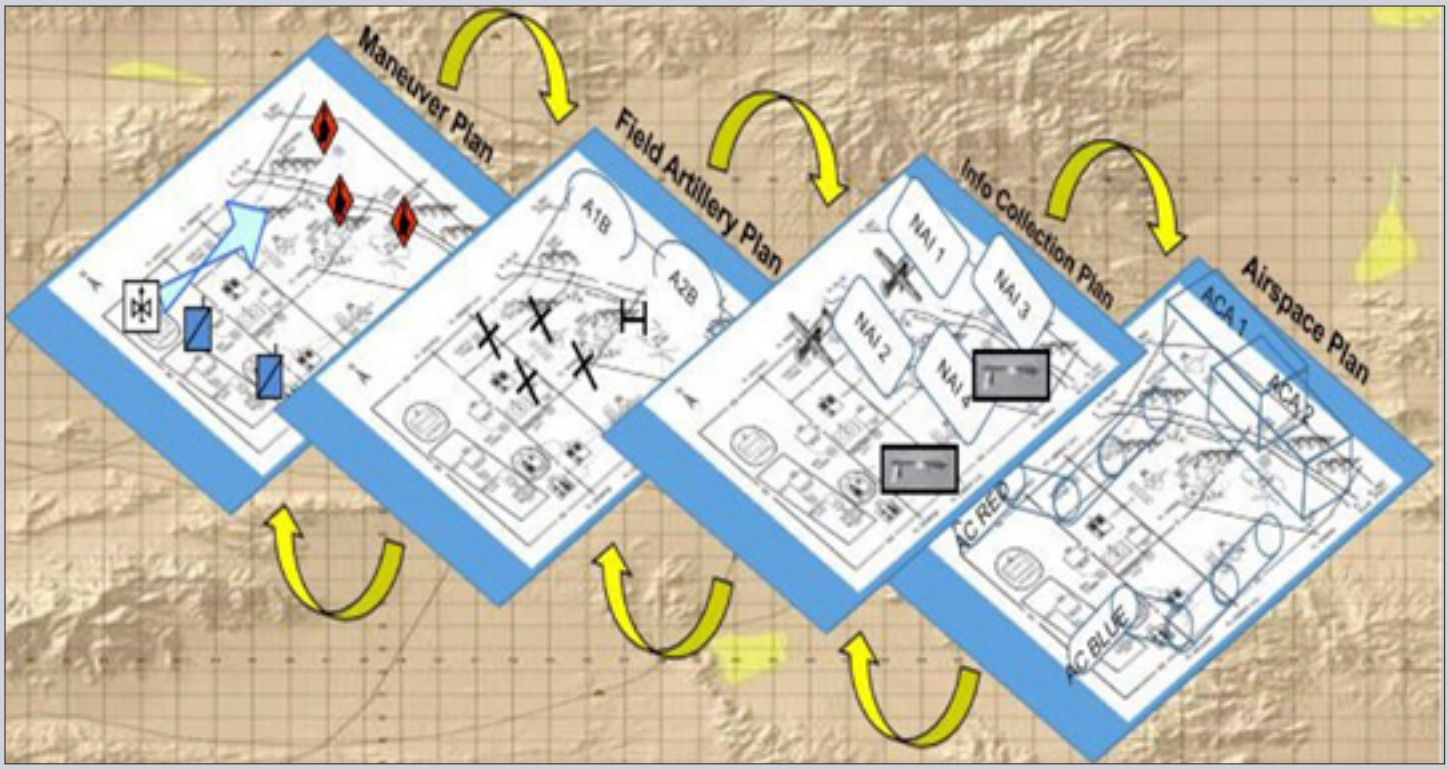
It takes an average of 17 minutes for a fire mission to be processed from sensor-to-shooter. Counterfire is faster, but not by much. The fires community needs to address the fire mission process to be competitive against a near-peer threat. To do so, the fire mission process must be planned and executed with a true sensor-to-shooter link mindset, reducing the number of stations slowing down the process. This does not mean echelons will be completely bypassed; it just means the fire missions will take the quickest and most direct path to an available firing unit. It would be great if a radar acquisition is sent directly to the battery fire direction and straight to the launchers. That would be the simplest and quickest way to increase artillery effectiveness against today's indirect fires threats. But this would require graduate-level planning, training and rehearsing.

Effective fast sensor-to-shooter links require extensive training and multiple rehearsals. It may even require a culture change within the fires community. The AFATDS is capable of automated fires. The system can be configured to immediately process a CFF without intervention. This requires well-trained operators at every echelon to configure the system properly. All units must emphasize training with digital systems as a "fires enterprise" before the warfighter. With the right training and focus, units can truly reach graduate-level automated fires. This method does involve a lot of risks, but the risks can be mitigated by setting the proper conditions through detailed-level planning which can allow a decentralized execution of the fires plan.

Every sensor must be "tied" to a shooter and the sensor must be able to deliver fires on target immediately after detection. Most leaders are not used to doing business this way or feel uncomfortable with the process. But there are methods to help mitigate the

Fire mission network. (Courtesy illustration)





Fire mission process influence. (Courtesy illustration)

risk. Thorough synchronization and integration of four plans will enable the delivery of rapid effective fires. These plans are called the four components of effectiveness; these are the maneuver plan, the Field Artillery support plan (FASP), the information collection plan (ICP), and the unit airspace plan (UAP). None of these plans can be developed in a vacuum. The FASP supports the maneuver plan and the ICP facilitates the FASP. The UAP enables all three plans. Units must give special emphasis to airspace planning because the lack of a thoroughly developed airspace plan can severely hinder the collection plan and delay artillery fires. Airspace clearance is the most significant factor in delaying artillery fires.

Rehearse, rehearse and rehearse! Most units conduct a combined arms rehearsal and a fires rehearsal before the start of the warfighter training event. Most of the time however, these rehearsals do not go into the necessary detail to deliver fires rapidly. Tactical and technical rehearsals are necessary because they involve all the echelons in the fire mission process. Successful units normally employ target synchronization matrices and fire support overlays to rehearse, which enables detailed sensor-to-shooter synchronization. In a decisive action fight, units will probably not have sufficient time to rehearse all assigned targets. However, they can use a target synchronization matrix to prioritize rehearsals on specific targets, especially high payoff targets. Rehearsing even just a few of the planned targets can set the conditions for the rapid execution of all planned and unplanned targets.

A good tactical rehearsal enables the unit to ensure they are at the right place and at the right time to execute the mission. This is important because it will ensure designated firing units are within range of the targets and they have proper munitions on-hand to engage the targets. One of the most common delaying factors is assigning fire missions to a unit that is out of range or does not have the right munitions on hand. Additionally, units can avoid delays by conducting technical rehearsals and testing every digital and analog system in the fire mission chain.

The enemy artillery fires of today are fast and they are extremely lethal. Every enemy sensor is directly connected to a shooter that can deliver fires rapidly. That is the science that units need to master to have a chance at achieving effects on the enemy. What is old is new. The best chance units have to increase artillery effectiveness is by setting the conditions on the ground and in the air, establishing effective sensor-to-shooter links to allow decentralized execution of fires, and rehearsing diligently and frequently.

CW4 Jimmy Mannings is a former observer coach, trainer assigned to Operations Group Foxtrot which focused on training Division Artillery and Field Artillery brigades during warfighter exercises. CW4 Mannings currently serves in the Joint Fires Element, Combined Forces Command, U.S. Army Garrison, Yongsan, South Korea. He received a Bachelor's degree in Applied Management from Franklin University, a Master's degree in Military Arts and Science from the Command and General Staff College, and a Master's degree in Cybersecurity with focus on threat detection from Webster University.

Soldiers from 2nd Battalion, 15th Field Artillery, 10th Mountain Division fire an M777 during a live-fire exercise during a rotation at the Joint Readiness Training Center, Fort Polk, La. (10th Mountain Division)

Observer planning

CPT Andrew Agee

Rotational units at the Joint Readiness Training Center (JRTC) routinely fail to mass the effects of fires assets in support of brigade combat team (BCT) operations. Contributing to this shortfall is the inability of BCTs to properly develop and implement an observer plan. Units regularly do not develop an observer plan beyond identifying primary and alternate observers in the target, trigger, location, observer, delivery system, attack guidance and communication portion of the fires plan. In a decisive action fight, a top-driven observation plan with bottom-up refinement increases the likelihood of effective fires. Placing observers in the right place with the right tools aids in massing effects and achieving the BCT commander's intent for fires. Utilizing the doctrinal tools for the development and tactical employment of the observer plan exponentially increases the BCT's lethality with fires. The common trend observed at the JRTC is that the BCT leaves the site selection for observation posts (OP) to the subordinate units. As a result, integration and shared understanding of the BCT observation plan in not achieved across the warfighting functions. Commanders should understand why they are establishing an OP and the fire support tasks associated with the desired effects needed to meet the BCT commander's intent for fires. Units at the JRTC often see the observation plan as independent of the fires warfighting function and do not coordinate across the warfighting functions in the development of the plan. The ATP 3-09.42, *Fire Support for the Brigade Combat Team,* provides

a six-step, top-driven technique for observation planning that includes:

1. Determine the desired effects of fires.
2. Determine target observation suitability.
3. Develop the observation course of action.
4. Task observers and observation points in a top-down observer plan.
5. Refine and rehearse the observation plan.
6. Monitor and adjust observer plan execution.

This method allows the BCT planners to develop an integrated observer plan with built-in flexibility to adapt the plan as the landscape of the battlefield changes. The more robust BCT staff is better suited to develop the observation plan given the resources at their disposal.

Determine the desired effects of fires

The first step in the process requires a clear understanding of the BCT commander's intent for fires. The fire support coordinator (FSCOORD), BCT fire support officer (FSO), BCT targeting officer, and fires cell planners work in conjunction to translate the BCT commander's guidance into actionable fire support tasks. These fire support tasks will initially inform the number of BCT targets required to achieve desired effects as well as the number of observers required to support each target.

Determine target observation suitability

Through the targeting process, the fires planners will determine the location for each target. This will allow the BCT staff to analyze possible observer locations and suitability of observation. The BCT fires planners in conjunction with the BCT intelligence section have the means for in-depth terrain and line-of-sight analysis to inform this process. The fires and maneuver planners determine observer location, method of attack and factor in risk-estimate distances (REDs). This enables the FSCOORD and BCT FSO to inform the BCT commander of risk decisions as it relates to the observation of targets.

Develop the observation course of action (COA)

The entry argument for this step is a diagram depicting target locations, possible OP locations, line-of-sight analysis and REDs in relation to OPs. During wargaming, the staff will identify primary and alternate observer locations, covered and concealed routes to and from the OPs, time analysis associated with the establishment of the OP and the time needed to deliver effects on the given target. The fires and maneuver planners allocate assets to each target and the overall COA developed must be feasible and suitable. Development of the observation COA in this fashion alleviates planning pressure from subordinate units and allows them to provide a bottom-up refinement to the plan.

Task observers and observation points in a top-down observer plan

The observer tasking includes a clear task and purpose and covers the five Ws. An example observation task found in ATP 3-09.42 is as follows, "Task Force 3-316 Infantry maneuvers to and establishes observation of AE0030 from OPs 301 and 302 not later than 0530 hours to neutralize a suspected antitank firing line to limit the enemy's ability to impede BCT movement along with AXIS ARROW. The OPs may disengage once task force trains are in position at Command Post 3." Observer tasks need to be descriptive in nature in regards to expectations and capabilities required of the observer. The base operation order within "tasks to subordinate units" is the best place for observation tasks and not solely within the Annex D. This technique enables the synchronization of the observation plan with maneuver. Additionally, it allows maneuver commanders to understand and visualize how the observation plan, and in turn, the fires plan supports the scheme of maneuver.

At the JRTC, units fail to task units with the establishment of OPs. BCTs also fail in developing defined triggers associated with the targets. Frequently the trigger identified by the BCT staff is positive identification (PID) of the enemy and in no way is the trigger tied to friendly or enemy movement, events, or time. Using PID as a trigger does not allow for bottom-up refinement and places the development of the trigger on the subordinate unit. A top-driven plan ensures units understand their role within the BCT observation plan and affords them the necessary buy-in to provide refinements to the plan.

Refine and rehearse the observation plan

During this step in the process, the BCT fires cell will determine a cutoff time for all targets and trigger refinement from subordinate units. At the JRTC, BCTs commonly fail to set a cutoff time or allow for so much time that the BCT fires cell cannot refine products and reissue a complete plan before execution. The BCT fires rehearsal, BCT combined arms rehearsal and FA technical rehearsal further provide the opportunity to validate the BCT target list worksheet, observation plan and triggers as well as generate a shared understanding of the plan across the warfighting functions. The top-driven technique results in rehearsals of a synchronized plan as opposed to a back brief or quasi war-gaming session.

Monitor and adjust observer plan execution

With a top-driven observation plan and maintained fires running estimates, the BCT can adjust the observation plan as needed to adapt to the ever-changing battlefield.

Once the BCT has developed a cohesive observation plan and issued the operation order, subordinate units through their own planning process provide refinements to the plan and tactically employ their OPs as part of the larger BCT observation plan. The ATP 3-09.30, *Observed Fires*, provides the memory aid SLOCTOP for the tactical occupation of an OP that stands for security, location, communication, targeting, observation and position improvement. The observer party executes the phases of the SLOCTOP method concurrently and not necessarily as a step-by-step process.

At the JRTC, units establishing OPs rarely do so utilizing the SLOCTOP method, which makes for an incomplete BCT observation plan. The result is a piecemealed observation plan that does not promote massing effects to meet the BCT commander's intent for fires.

Security

The unit executes reconnaissance of the proposed OP covering 6,400 mils and a radius of 500 meters around the OP. The most suitable location for the OP is determined through the reconnaissance.

Location

The position should not be skylined or easily identified as an OP. The observer party occupies the position, and determines the location of the OP post with the most accurate means possible and reports the location to their higher headquarters and adjacent units. The observer party will maintain an accurate common operating picture and develop a terrain sketch from their OP. When the location allows or if digital means are possible, the observer party forwards a terrain sketch to the higher headquarters to provide them with situational awareness. This will enable the BCT to maintain an accurate observation plan picture and update their fires running estimates. At the JRTC, terrain sketches are rarely developed and forwarded to the higher headquarters. A successful observation plan generates a graphical display of the holistic view of the unit's observation plan at echelon within the command posts.

Communication

The number one priority during the establishment of an OP is communication. The observer party will establish communications with their higher headquarters and adjacent units during the security and location phases. At the JRTC, OPs commonly lack sufficient communications equipment to coordinate with adjacent units and their higher headquarters. Exclusive use of FM communications platforms is common and rarely are redundant means utilized.

Targeting

Observers will utilize the most accurate means available to them to determine the target location. Regularly observed at the JRTC is underutilized targeting equipment, which forces observers to rely on map spot for target location. Units often do not integrate organic optics and targeting equipment into the tactical employment of OPs. It is common to see zero pieces of targeting equipment employed during the course of a JRTC rotation.

Observation

In this phase, the observer party ensures clear fields of view from their OP post and provides refinements of the fires plan to their higher headquarters. The best time to provide refinements to the fires plan may be from within the OPs, however, the BCT must account for the time needed to receive refinements and publish new products before execution. During this phase, a great opportunity exists for the establishing unit's commander and FSO to execute battlefield circulation to verify positions, terrain sketches and equipment operability.

Position Improvement

Position improvement is a continuous process. The areas of focus for the observer party should include cover and concealment, camouflage, security, noise and light discipline, weapons and equipment maintenance, and communication. The observer party will also determine alternate OP locations as well as routes to and from the alternate locations. At the JRTC, units do not execute continuous position improvement and rarely identify alternate OPs.

The development and execution of a successful observation plan requires input and refinements at echelon across the BCT's warfighting functions. While many factors play a role in a BCT's ability to mass the effects of fires the units that excel at the JRTC have a well-developed and executed observation plan. BCTs that methodically establish an observation plan using a top-driven technique and refine their plan based on real-time feedback from subordinate units find far more opportunities to mass effects on enemy elements.

CPT Andrew Agee serves as a fire support observer, coach or trainer at the Joint Readiness Training Center. His previous assignments include battery commander and squadron fire support officer with the 3rd Infantry Division, Fort Stewart, Ga. He has deployed to Afghanistan in support of Operation Enduring Freedom and to the Republic of Korea in support of Regionally Aligned Forces. He is a 2009 graduate of the University of Kentucky.

FA SUSTAINMENT

Wagging the dog

CPT John Oliver and CPT Russell Vickers

The Fires Warfighting Function is an ineffective tool for the brigade combat team (BCT) without the rounds to support a brigade commander's priorities and intent for fires. Integration and ample time between planning and execution are critical to the successful sustainment of the Field Artillery battalion. Observer, coach or trainers of Field Artillery (FA) cannon battalions at the Joint Readiness Training Center (JRTC) are firsthand witnesses to the success and failure of operationalizing logistics into a maneuver and fires plan, promptly to support the maneuver operation. Directed Field Artillery tasks and enemy formations should drive the unit's fire order (the quantity of ammunition required to achieve a specific target effect), not the sustainment enterprise. This paper discusses the best practices observed at JRTC, to ensure that the sustainment tail does not wag the dog.

Successful planning in the FA battalion has to be collaborative and iterative with the BCT planning timeline. In a competitive environment with a constrained timeline the military decision-making process (MDMP) needs to evolve into a collaborative, rather than a sequential process that focuses on product creation and dissemination. Warfighting products must be produced early to provide the brigade sustainment enterprise the time it needs to execute mission requirements. Due to a lack of ammunition platforms in both the forward support company (FSC) and the brigade distribution company, Class V typically is not stored in large quantities within the brigade. Therefore, it must be requested through division and delivered by the combat service support battalion. Through multiple rotations, we have observed that this process takes anywhere between 48 and 72 hours from request to delivery to the FSC. When an order gets published 72 to 96 hours before the execution, the battlefield calculus and Class V order require a quick turn-around to meet the commander's intent. The MDMP timeline must be closely managed by the FA battalion executive officer to enable successful sustainment operations. It must not only be timely, but also complete, and collaborative. Class V planning requires staff integration and in-depth analysis to get the right munitions to the right place at the right time. The FA battalion S2 must provide an accurate intelligence preparation of the battlefield focused on the enemy artillery assets. Through pattern analysis, the S2 can estimate the quantity and types of targets of opportunity for a given battle period (attack, defense, counter-attack). In conjunction with the S2, the counterfire officer can estimate the quantity of counterfire missions the unit can anticipate. The fire direction officer (FDO) develops the fire order for given targets. The fire order is derived from estimates combined with planned targets from the target list worksheet and legitimizes the final required supply rate for fuzes, charges, primers and rounds. The FDO must work with the battalion S4 to identify any shortfalls from the known controlled supply rate or unit haul capacity that will require further prioritization.

During continuous combat operations as observed at JRTC, the FA battalion S4 must find opportunities within the battle rhythm to anticipate requirements. One of those opportunities is the targeting working group. ATP 3-60, *Targeting*, lays out all of the lethal and non-lethal sections of people who are required to participate in the targeting working group and targeting board. However, the Sustainment Warfighting Function is absent from the attendee roster. The targeting cycle provides an opportunity for logisticians to conceptualize bulk Class V consumption and drive updates to the logistics common operating picture (LOGCOP). The targeting working group also provides updated fire support tasks, attack guidance, and target selection standards that will significantly impact distribution operations. These planning figures provide the battalion S4 an opportunity to update their running estimates with ammunition requirements.

Two other critical battle rhythm events are the brigade and battalion logistics synchronization meetings (LOGSYNC). The FA battalion S4 must maintain an accurate LOGCOP that includes Class V from the firing platoon up through the BSB. The battalion XO must conduct daily LOGSYNC to ensure that the reports building the LOGCOP are accurate and that batteries have visibility of when to expect their next resupply. Utilization and validation of the LOGCOP during the battalion LOGSYNC empowers the S4 to prepare and communicate needs at the daily brigade LOGSYNC with the support operations officer in the brigade support battalion. Brigade LOGSYNCs also provide the forum for the battalion S4 to communicate his stock shortfalls of Class V and also his distribution limitations and where the distribution company can assist in battery resupply.

In summary, Artillerymen always want to shoot the proper fire order, and sustainers want to provide the right logistics package, but these separate operations are intrinsically linked. Commanders must show the proper emphasis to the sustainment aspect of fire order derivation to achieve the desired endstate. Timely and collaborative MDMP supported by a battle rhythm that consistently synchronizes the warfighting functions is critical to a unit's ability to have the desired effect on the enemy. Each staff section must understand its impact on the other warfighting functions, and they must be active participants in one another's processes. If sustainment ever determines what you're shooting, it is time to relook the process.

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CPT Russell Vickers is a native of Griffin, Ga., and commissioned in the Transportation Branch from Georgia Southern University ROTC in 2010. As a lieutenant he served in multiple roles in Echo Company, 3-227th Aviation Regiment, 1st Air Cavalry Brigade, 1st Cavalry Division. Following the career course he served as the supply operations officer for 401st Army Field Support Brigade. Before joining the Fire Support Team as an OC/T, CPT Vickers commanded Echo Company, 16th Ordnance Battalion, 59th Ordnance Brigade. He holds a Master's degree in Logistics Management from Florida Institute of Technology.

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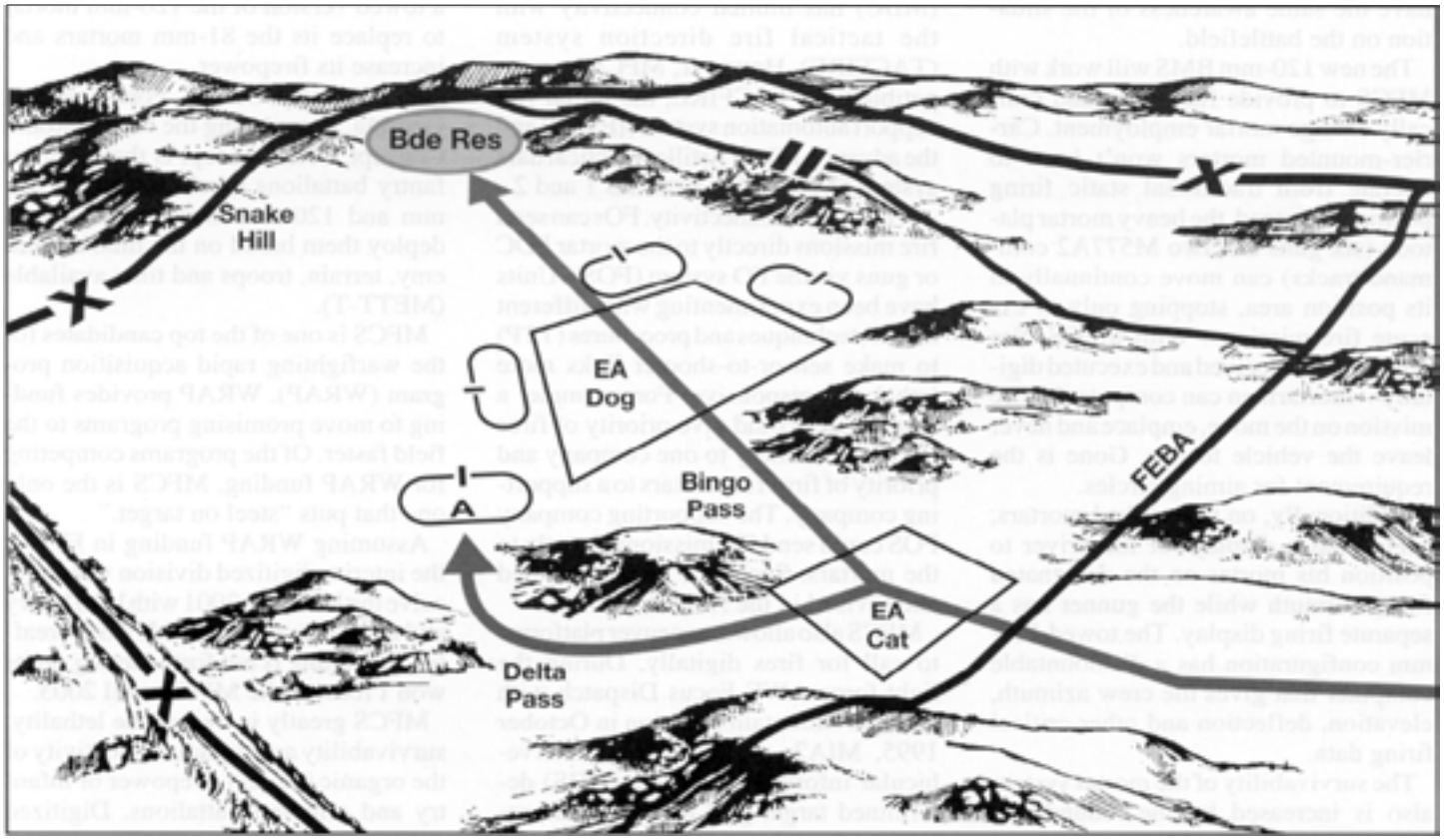

Battle Calculus and Fire Support Planning

by Major Thomas L. Kelly

You are the new fire support officer (FSO) for Task Force 1-89 Armor and are part of a 3x6 155-mm Paladin direct support battalion. It's your first opportunity to plan combat operations as part of the task force battle staff. The mission is to defend the Bingo-Delta pass complex against a motorized rifle regiment (MRR) at 70 percent strength to prevent the MRR's penetration of the task force's defense. The regiment is leading the attack with a Forward Detachment, a motorized rifle battalion-plus-sized formation. The Detachment's mission is to control one of the two passes so the remainder of the regiment can follow on its way to seize the defensible high terrain just east of Snake Hill.

The task force commander outlines his concept of the operation: "I want Team A to limit the Forward Detachment's ability to control Delta Pass, forcing the remainder of the regiment to go through Bingo Pass. This will allow me to mass the effects of the other three company teams' direct and indirect fires into EA [Engagement Area] Dog on the reverse slope of Bingo Pass to destroy the rest of the MRR.

"Fires must disrupt the Detachment's ability to seize Delta Pass from Team A. allowing me to focus the other three teams into EA Dog. I believe Team A can retain Delta Pass if fires can destroy at least one of the Forward Detachment's MRCs [motorized rifle companies] in EA Cat."

The commander looks up at you from his notes and says, "Can you do it?"

How can you possibly answer the commander's question? One tool to help you is battle calculus. While the term "battle calculus" may not be familiar, the idea of applying planning factors, combat power values and other numeric and scientific parameters to military planning is not new.

The brigade trainers at the National Training Center (NTC), Fort Irwin, California, have defined battle calculus as "the process of using doctrinal rates, factors, speeds and other data to conduct detailed analyses that support military decision making. Through this process, commanders and staffs are able to analyze relative combat power, estimate and verify capabilities, translate [those capabilities] into missions, conduct predictive analyses and allocate resources to defeat the enemy."

For fire support planning, battle calculus can help answer questions such as "How long will it take?" "How much ammunition is required?" and "When do I need to trigger fires?" While battle calculus does *not* provide certainty, it does improve the likelihood of success. There is a danger in "over quantifying" your planning: the more you must assume as you calculate, the less realistic and accurate your work may become.

The real benefits of battle calculus occur with practice. As the task force battle staff consistently employs battle calculations, the process becomes routine and results in better developed and detailed plans and orders.

The fire support element (FSE) and the maneuver battle staff begin to "calculate" as a natural part of course of action (COA) development. The "science

of war" is reflected in realistic plans that can achieve the commander's intent. The detailed, step-by-step logical process used in battle calculus (such as the example in this article) becomes second nature and quickly gives way to "rules of thumb." When the FSO can build feasible plans rapidly and train his commander to have realistic expectations of fire support, the fire support planning process is streamlined and more effective.

Can You Do It?

Using basic battle calculus, you can determine the feasibility of your fires achieving the commander's guidance. Note that this example is based on the assumptions outlined in the scenario and is not "the formula" for answering all commanders' Can-you-do-it questions. Rather, this example shows the process of trying to best-guess the integration of time, space and asset variables to achieve a specific goal.

Step 1: Translate the commander's guidance into a quantifiable effect. Once you've defined the task and purpose for fires (critical fire support task), you quantify that task to measure success or failure.

In this case the commander's guidance was..."destroy at least one MRC in EA Cat," and his purpose was to "disrupt the Detachment's ability to seize Delta Pass from Team A, allowing me to focus the other three teams [against the MRR's main body funnelled] into EA Dog."

You must at least destroy one MRC. You consult with the S2 to confirm how many combat vehicles are in an MRC: 3 T-80 tanks and 8 BMP infantry combat vehicles.

Step 2: Equate the required effects to the required ammunition. This calculation normally is based on the graphical munitions effects tables (GMETs) as captured manually or using an automated device. For this example, I use the NTC "GMET": to kill one tank, it takes 54 155-mm dual-purpose improved conventional munitions (DPICM) and to kill one BMP, it takes 18 155-mm DPICM.

Therefore, you can calculate how many rounds it takes to achieve the effects:

3 Tanks x 54 RDs	=	162 DPICM
8 BMPs x 18 RDs	=	144 DPICM
Total RDs Required	=	306 DPICM

You've already checked to see how many rounds of DPICM your battalion has on hand: enough for 54 battalion-three volleys of DPICM—more than enough to achieve the effects.

Step 3: Determine the minutes available for the attack. For this step, you need some additional facts and must make some assumptions. You must attack the Forward Detachment with fires in EA Cat. Because time is a function of distance, rate of movement and formation size, you gather the information you need. From the S3 and operations overlays, you determine that EA Cat is nine kilometers long. In consultation with the S2, you assume that a Forward Detachment in march formation in EA Cat is about one kilometer long by 250 meters wide. Also in conjunction with the S2, you assume the enemy rate of march in EA Cat is 30 kilometers per hour (KPH). From your FSO's "Smart Book," you determine that 30 kilometers per hour is one kilometer (KM) every two minutes.

With this info, you calculate the time available to attack the enemy in EA Cat:

1-KM Det Pass Time	=	2 MIN
Travel 9 KM in EA x 2 MIN per KM	=	18 MIN
Total Time Available	=	20 MIN

Step 4: Determine if the required ammunition can be delivered in the time available. Now you determine if we can deliver 306 DPICM (Step 2) in 20 minutes (Step 3). You look in your Smart Book to verify that your battalion's 18 155-mm tubes' rate-of-fire is one minute per round, based on the battalion's most recent Army training and evaluation program (ARTEP) times. Therefore:

20 MIN x 18 Tubes per RD per MIN = 360 RDs in Time Available

In this step, you've learned that the battalion can deliver 360 rounds in the time available—more than the 306 rounds required to achieve the desired effects. It would appear your mission is do-able.

Unfortunately, the enemy formation you must engage is moving, so you also must calculate how many volleys your battalion can fire on the Forward Detachment at a single target location.

Step 5: Determine maximum volleys that can be fired on the moving formation at one target location. With your assumptions that the Detachment is 1,000 meters long by 250 meters wide while in march formation in EA Cat and that it will move at 30 kilometers per hour, you can calculate a pass time of two minutes—the time from the lead vehicle to the trail vehicle's crossing the same point on the ground.

Figure 1 shows how you calculate that your FA battalion can fire three volleys on the moving formation before the enemy can pass completely through the target location.

Step 6: Determine the number of attacks (battalion-three volleys) needed to deliver the required ammunition. You know that the battalion's 18 tubes firing a three-round volley is 54 rounds per attack. Therefore:

306 Required RDs + 54 RDs = 6 Attacks on Distinct Targets

Because the battalion must fire at a target and then shift six times, you now must determine if the enemy will be in EA Cat long enough—if EA Cat has enough space—to achieve the desired effects.

Step 7: Determine if time and space are available to execute the required attacks. From your Smart Book ARTEP data, you know it takes your battalion two minutes to deliver a battalion-three

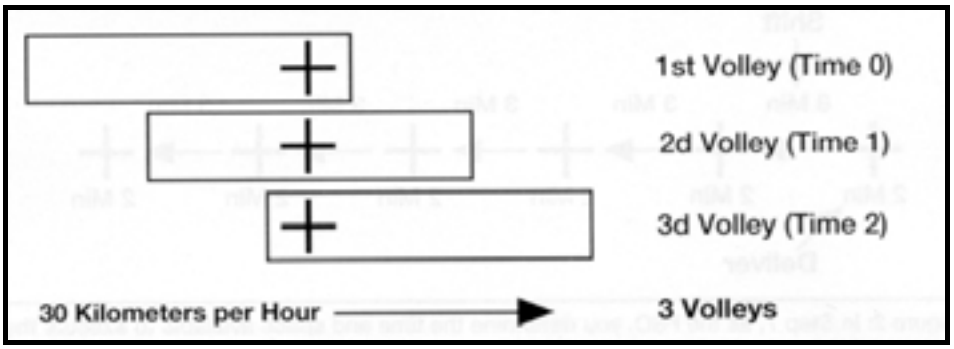

Figure 1: In Step 5, as the FSO, you determine the number of volleys your DS battalion can fire at one target location in EA Cat before the 1,000-by-250 meter enemy detachment moving 30 kilometers per hour can pass through that location.

and three minutes to shift a volley from one target to another. Figure 2 shows how you add up the shift and fire times to determine how long it will take the battalion to achieve the required effects—in this case, it's 27 minutes.

You already know the moving enemy formation will have passed through EA Cat in 20 minutes. Therefore, the answer to the question, "Can you do it?" is "No, Sir" ....That is, unless you can increase—

•The space available. Can you put an observer in position to acquire the enemy farther out? Can the battalion range the enemy farther out?

•The time available. Can you slow the enemy down in the EA with family of scatterable mines (FASCAM), other obstacles, jamming, mechanical smoke, etc.?

•The volume or lethality of fire. Can you get reinforcing artillery, close air support (CAS) or attack aviation? Can you fire Copperhead rounds?

This example demonstrates that battle calculus is not a pure science and won't generate a flawless solution to every battlefield fire support problem. In fact, the battle calculus "answer" is rarely a definitive "Yes" or "No" but instead suggests how you can make success more likely by integrating obstacles, employing intelligence and electronic warfare (IEW), repositioning observers or adding killing assets and other combat multipliers. The answer should only be "It can't be done" after you've exhausted all means to meet the commander's guidance.

There are many ways to use battle calculus in fire support planning. Even the steps in the example in this article may change as mission, enemy, terrain, troops and time available (METT-T) change. To facilitate the process, the FSO should have at least the planning information listed in Figure 3 readily available in his Smart Book or through his FSE. The basic thought process of applying reasonable assumptions and tested planning factors to try to improve the feasibility of fire support plans and their synchronization with maneuver is sound.

- Number of Killer Missions by Munitions and Target Types
- Time Required to Fire Killer Mission by Munition (Ready to Rounds Complete)
- Artillery Shift Time by Weapon and Target Types (Planned or Target of Opportunity)
- Minimum and Maximum Ranges by Weapon and Munition Types and Primary Method of Delivery
- Copperhead Planning Factors (Copperhead Coverage Template)
- Observer Status (Location, Equipment, Observation Limits)
- Radar Status and Capabilities
  - Systems Available
  - Ranges
  - Cumulative Cue Time/Threat
  - Zone Planning Factors/Considerations
- Close Air Support (CAS)
  - Available Aircraft by Types and Sorties
  - Aircraft Capabilities
  - Available Munitions and Restrictions/Limits of Each
  - Response Time for Immediate CAS (Request to Command Post)
  - Station or Loiter Time (Command Post to Off-Station)
  - CAS Tactical Planning Data: Threat and Tactics, Required Airspace, Coordinating Alternative and Suppression of Enemy Air Defenses (SEAD) Timing/Separation
- Radio Ranges by Radio Type/Configuration
- Family of Scatterable Mines (FASCAM)
  - Number of 400 by 400 Medium Density Minefields
  - Time Required to Emplace by Battery/Two Batteries/Battalion for On-Order and Be-Prepared
- Number of Minutes of Illumination by Weapon Type
- Number of Modules of Smoke: 600 x 15 Minutes x Wind Direction x Conditions
- Target Spacing Minimums: Rate-of-March (Kilometers/Minutes) x [Shift Time + Deliver Time]
- Trigger Leads: Rate-of-March (Kilometers/Minutes) x [Time-on-Target Process Time + Time of Flight]
- Commander's Intent
- Commander's Planning Guidance

Figure 3: Fire Support Planning Factors for Battle Calculus. This kind of information and more should be readily available in the FSO's "Smart Book" or through his FSE.

To use battle calculus will not guarantee your fire support plans will succeed; but, when used routinely, battle calculus will result in fire support plans that *can* succeed. And that may be all an FSO can plan on.

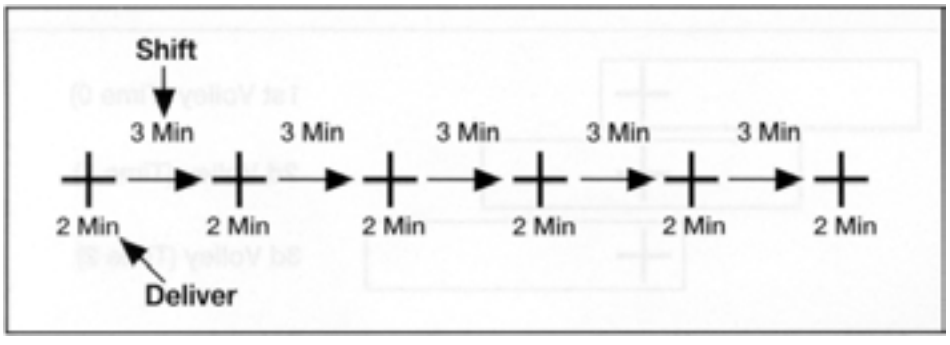

Figure 2: In Step 7, as the FSO, you determine the time and space available to execute the attacks. You know your battalion can deliver a battalion-three in three minutes and it takes three minutes to shift from a volley on one target to a volley on another. With that information, you can determine the battalion will take 27 minutes to deliver enough rounds to have the required effects.

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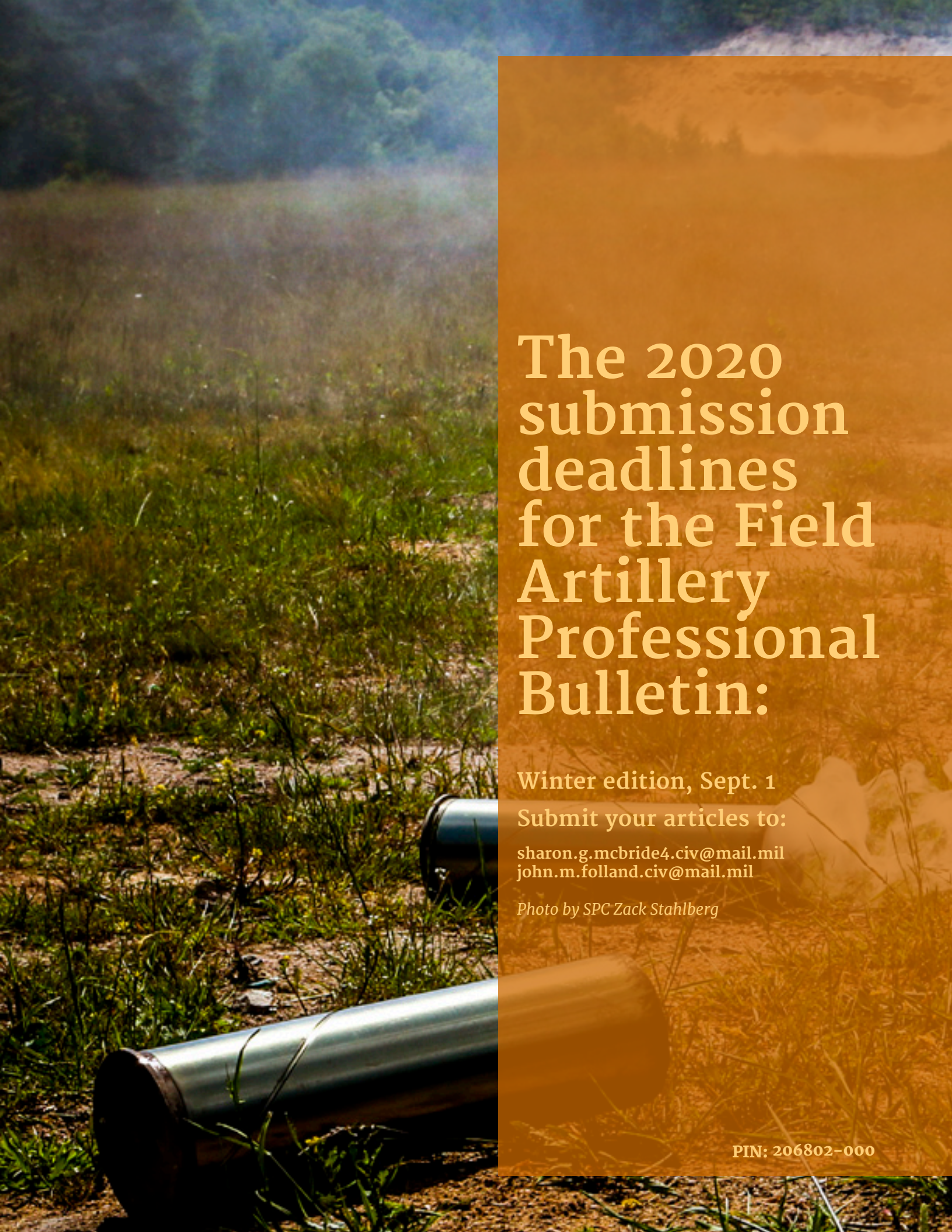

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