

# Fires



## *Competitive convergence*

**How the Army readies  
itself to defend against  
formidable enemies**

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# Fires

Editor

Marie Barberea

Art Director

Rick Paape, Jr.

Assistant Editor

Monica Wood

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

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Fires, a professional bulletin, is published bi-monthly by Headquarters, Department of the Army under the auspices of the Fires Center of Excellence, 455 McNair Ave., Fort Sill, OK 73503. The views expressed within are those of the authors and not the Department of Defense or its elements. The content contained within Fires does not necessarily reflect the U.S. Army's position or supercede information in other official publications. Use of new items constitutes neither affirmation of their accuracy nor product endorsements. Fires assumes no responsibility for any unsolicited material. By order of Mark A. Milley, General, United States Army, Chief of Staff.

Official:



Gerald B. O'Keefe

Administrative Assistant to the  
Secretary of the Army

Auth. 1513304



Wilson A. Shoffner

Major General, United States Army  
Commanding General, Fort Sill, Okla.

## Purpose

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

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Cover photo: Soldiers of the 428th Field Artillery Brigade conducted sling load training with the Soldiers of 2nd Battalion, 211th Aviation Regiment. (Rick Paape, Jr.)



Col. Brian Gibson (left) receives the Air Defense Artillery colors from Maj. Gen. Wilson A. Shoffner, Fires Center of Excellence and Fort Sill commanding general, to become the ADA School commandant, and chief of ADA July 26, 2018, at Fort Sill, Okla. Command Sgt. Maj. Finis Dodson (second from right), ADA School and branch command sergeant major, and outgoing commandant Brig. Gen. Randall McIntire (far right) participated in the exchange. (Maria Baugh/Fort Sill Visual Information)

## Air Defense Artillery School House changes leadership, McIntire continues to serve ADA

By Stephen Robertson

Fort Sill welcomed a newcomer to a top post July 26 and wished another the best of luck in an on-post assignment. In a ceremony in front of post headquarters, Brig. Gen. Randall McIntire stepped down as the Air Defense Artillery commandant and Chief of Air Defense.

Now filling those roles is Col. (P) Brian Gibson, who is in his first assignment at Fort Sill, Okla. He comes to post following his assignment as the Joint Staff Operations Directorate, Regional Operations deputy director at the Pentagon. He is joined by his wife Cheryl and their two children Josiah and Simon.

Maj. Gen. Wilson Shoffner, Fires Center of Excellence and Fort Sill commanding general, said McIntire served at “a time of unprecedented change for the air defense artillery.”

After years of downsizing, Shoffner said the branch has begun to grow. It’s also modernizing to provide better protection against missiles and drones as one of the Army’s top priorities.

To that end, McIntire was named the Air and Missile Defense Cross Functional Team (AMD CFT) director, tasked with drawing plans to meet the priority.

“Our guidance was ‘Randy, make this thing work,’ and he did,” said Shoffner.

McIntire made critical decisions that will affect the Army for years to come. Although he’s transitioning from his job as commandant, McIntire will continue to lead the cross-functional team at Fort Sill.

“I think the fact that he’s staying here is an indication of how important air and missile defense is to the Army,” Shoffner said.

McIntire thanked all those who helped him during his tenure

and said the community support was “the best this Soldier has ever witnessed. It’s been great being here. We’re really happy to have an opportunity to stay here a little longer.”

McIntire said Gibson will “take us to new levels” as the next commandant.

“The Army couldn’t have picked a better officer to be the 42nd Air Defense Artillery commandant,” McIntire said.

Gibson said, “I have a wonderful opportunity in working with Brig. Gen. McIntire as he will continue to serve the branch as the Air and Missile Defense Cross-Functional Team director here at Fort Sill, Okla. The AMD CFT’s purpose is to drive the Army’s modernization priorities by rapidly integrating and synchronizing the requirements development process, acquisition process and resources to deliver air and missile defense capabilities to the war-fighter faster.”

Gibson went on to say, “I look forward to this new endeavor in serving as the 42nd Commandant of the Air Defense Artillery and working with the many talented professionals within our branch. I am always amazed that our branch continues to be the most sought out and deployed force in our Army. I sincerely appreciate the hard work that you all have been doing to maintain the global presence of air and missile defense in the service of our nation and its allies. I look forward to continuing the transformation of the branch and facing the challenges before us. First to Fire!”

*Stephen Robertson is a correspondent for the Lawton Constitution and is the former editor and full time staffer of the newspaper for more than 20 years.*



**Brig. Gen. Stephen Smith**  
U.S. Army Field Artillery  
School commandant

# Hello from the 53rd Commandant of the U.S. Army Field Artillery School

Never for a second did I ever expect to become the 53rd Chief of the Field Artillery and Commandant of the United States Field Artillery School. Having said that, I am thrilled and humbled to serve our Army and our branch in this capacity.

I am excited and energized to work with, and for, our field artillerymen and women and maintaining momentum on all our initiatives. Like anyone else who has served this long, the Army has provided me a wealth of great fire support experiences through multiple deployments and training events, incredible mentorship from senior officers and noncommissioned officers, and opportunities to learn by working with talented Soldiers, Airmen, Sailors and Marines of all ranks and branches. What a fantastic opportunity to give back to our Army.

Going forward, I think we need to keep on our current trajectory that my predecessors have set, to increase academic and physical rigor focused on fighting and winning against a peer threat in large-scale combat operations. Our nation has a tradition of fighting large-scale wars with Fires...we will remain ready to do so when called upon.

In order to accomplish this, our primary and most sacred duty here at the schoolhouse is producing competent, fit and assertive artillery warriors for the operational force, period. To do this, we must routinely take a hard, internal look to make sure our programs of instruction (POIs) are current and address emerging threats, doctrine and senior leaders' vision, our instructors are fully qualified, and that we are applying appropriate academic and physical rigor. We will continue to inform and adjust our internal efforts through routine, two-way and transparent communication with commanders in the operational force, our combat training centers (CTCs) and the Mission Command Training Program.

As a branch we do have challenges, but

they are not insurmountable. We must continue on the current path of restoring our rightful place as the King of Battle! Which means we must focus on the basics of communicate, shoot and move under combat conditions.

Here at the schoolhouse we are meeting challenges by getting to the field more often. We are ruthlessly removing any current academic requirement that is not singularly focused on our mission to destroy our enemies in defense of our Constitution. We are also increasing our rigor during physical training by implementing Army Combat Fitness Test principles.

The future of our field artillery curriculum is bright. We are concentrating on simply building upon the necessary changes implemented by my predecessors, supported by the Fires Center of Excellence, Combined Arms Center and the Training and Doctrine Command.

For example, we pulled out 80 hours of "common core" requirements in Captains Career Course and replaced those with pure fire support and artillery specific skills. We are conducting a similar effort in the Basic Officer Leadership Course-B (BOLC-B) by modifying how we teach skills currently residing in our Joint Fires Observer POI. I anticipate greater changes to the BOLC-B curriculum over the next six months as we drastically increase rigor for our newest officers.

On the warrant officer side, we have already begun implementing reforms in FA Warrant Officer Basic Course that improve our generation of FA technicians (MOS 131A) as system of targeting systems integrators — digitally and procedurally. We've begun to develop significant improvements in the FA Warrant Officer Advanced Course, to integrate additional fire support and joint targeting instruction. Finally, with much-appreciated emphasis from the Combined



Arms Center commanding general, we've begun to develop a Warrant Officer Intermediate Level Education, Phase 3 Course for our senior warrant officers, focused on division/joint task force-level and above.

Command Sgt. Maj. Berk Parsons has also led the way in pursuing revolutionary changes to our Noncommissioned Officer Professional Development System with a rewrite of all POI for the FA Advanced and Senior Leader courses. Our intent is to develop FA NCOs to perform critical duties, train NCOs on the skills and knowledge required to certify their team/section/platoon, and prepare the NCO to lead the team/section/platoon by providing timely and accurate Fires in support of large-scale combat operations.

In conclusion, I can think of no more exciting time to be in the best branch in our Army! I have served as an artilleryman for 27 years, and I have seen firsthand how our Army civilian and military senior leaders have made Fires modernization a top priority. Our field artillery force structure is growing, our maneuver commanders have never had more confidence and appreciation for our warfighting functions, and we continue to demonstrate the awesome lethality of joint surface-to-surface/air-to-surface Fires in combat and at our cornerstone training events during CTC rotations and warfighting exercises. Keep up the Fire! King of Battle!

*Soldiers of the 1st Battalion, 108th Field Artillery Regiment, 56th Stryker Brigade Combat Team, 28th Infantry Division, Pennsylvania National Guard fire an M777 howitzer during a live-fire training exercise at the National Training Center, Fort Irwin, Calif., Aug. 13. (Cpl. Hannah Baker/U.S. Army)*

# Accelerating multi-domain operations

## Evolution of an idea

*By Gen. Stephen Townsend*

Multi-domain battle has a clear origin (<https://go.usa.gov/xU6sg>). Stemming from the idea that disruptive technologies will change the character of warfare, it recognizes that the way armies will fight and win wars will also change. It also reflects the desire to replicate the success of AirLand Battle, which is arguably the most significant case of developing a concept and then materializing capabilities across the DOTMLPF (doctrine, organization, training, material, leadership education, personnel and facilities) spectrum. Origin stories establish the foundation from which lasting ideas emerge. However, for ideas to have a lasting impact they must evolve.

For multi-domain battle there are two things driving the need to evolve the concept.

First, ideas must evolve to ensure alignment with the strategic direction of the enterprise they serve. The 2018 National Defense Strategy (<https://go.usa.gov/xU6sb>) lays out the missions, emerging operational environments, advances in technology, and anticipated enemy, threat and adversary capabilities that the Department of Defense envisions for the foreseeable future. It provides direction for how the joint force must evolve to compete, deter and win in future armed conflict. To this end, multi-domain battle must reflect this strategy.

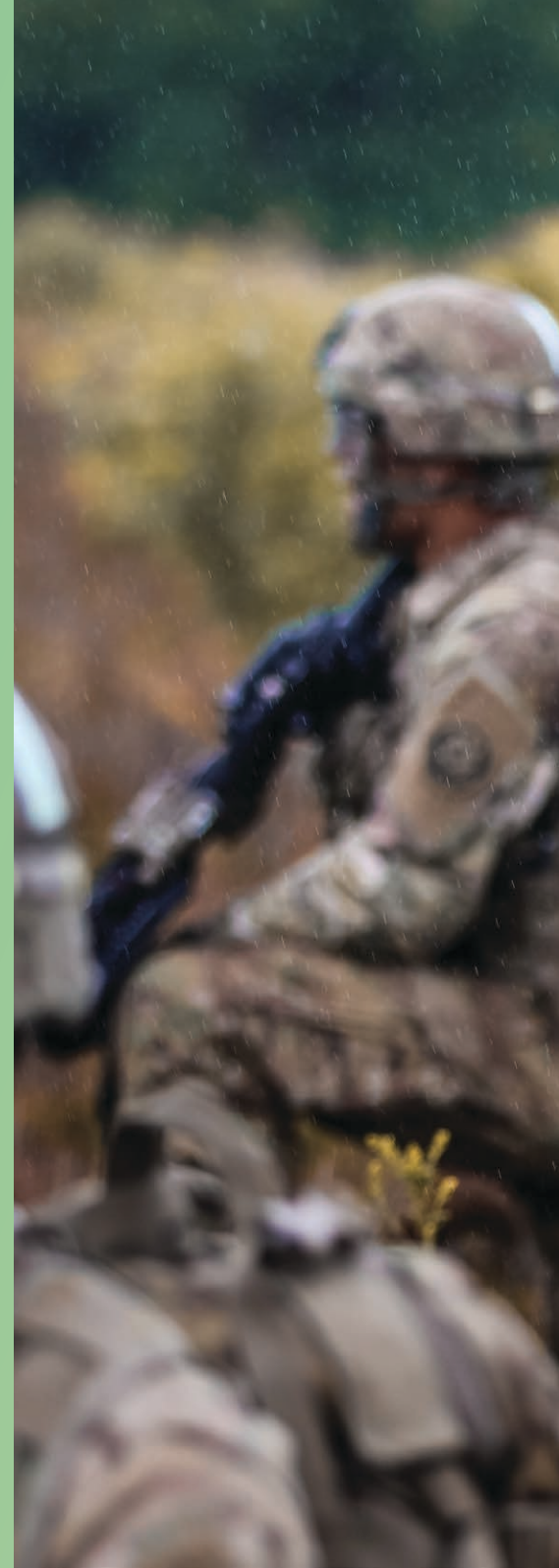
Second, when I took the reins of U.S. Army Training and Doctrine Command, I was specifically directed to “operationalize multi-domain battle” by building upon the foundation created by my predecessor and accelerating its application. And what I found was an incredible foundation. Gen.

Dave Perkins brought together partners across the joint force, driving development of the concept to an articulated idea and a vision of how the army fits into it. The key players are all here and are committed to building and improving the concept and finding real solutions. The concept is ready to grow.

But for that to happen, we need to confront some of the problems others have noted. Over the last 18 months that multi-domain battle has been out there for debate, there have been four consistent critiques. Some noted that the idea was “old wine in a new bottle” (<https://goo.gl/A2eCgV>) in a new bottle (<https://goo.gl/C4Lk4w>).” I think the iPhone analogy (<https://goo.gl/kcTNyn>) articulates why that just isn’t true. What the original iPhone did wasn’t all that new, but how the iPhone did it fundamentally changed not just a market, but people’s behavior. This is exactly what we seek to achieve with this new concept. Though the domains of warfare (air, land, sea, space and cyberspace) are not new, how the U.S. armed forces will rapidly and continuously integrate them in the future is new.

Another critique is that this is an Army-only concept (<https://goo.gl/HPw5KJ>). However the Air Force and Marine Corps have been part of multi-domain battle from the start and recent (<https://goo.gl/TBVyTf>) reporting from numerous forums has made clear the Army’s desire to listen, learn and include our joint and multinational partners in the development of this idea. Recently the Navy and the joint staff have also joined the discussion.

Albert Palazzo’s series of articles in the



fall of 2017 laid out a clear argument. To be successful, multi-domain battle must translate into radical effects on the U.S military’s culture (<https://goo.gl/CNi3v2>). The concept must force us to reconsider fundamental tenets, like our industrial-age means of promoting, training and educating leaders. It must also pull us from the comfort of our tactical-level trenches to develop capabilities that inform up to the strategic level of war (<https://goo.gl/iVUhw5>). Putting “bat-



*Sgt. Tabari Sibby, 1st Squadron, 2nd Cavalry Regiment, secures an area with other Soldiers from his unit during the first of a multi-day, multinational combined arms live-fire exercise with the Battle Group Poland at Bemowo Piskie Training Area, Poland, June 26, 2018. Battle Group Poland is a unique, multinational coalition of U.S., U.K., Croatian and Romanian Soldiers who serve with the Polish 15th Mechanized Brigade as a deterrence force in support of NATO's Enhanced Forward Presence. (Spc. Hubert D. Delany III/U.S. Army)*

tle" into the name both confines the possibilities and limits the result.

In battles, combatants can win time and space and they allow one side to take ground but they do not win wars. The world we operate in today is not defined by battles, but by persistent competition that cycles through varying rates in and out of

armed conflict. Winning in competition is not accomplished by winning battles, but through executing integrated operations and campaigning. Operations are more encompassing, bringing together varied tactical actions with a common purpose or unifying themes. They are the bridge between the tactical and the strategic.

In my first months of command at Training and Doctrine Command, it became clear that the use of the word "battle" was stifling conversation and growth of the concept. There are three concrete reasons why multi-domain battle evolved to multi-domain operations.

First, if the concept is to be truly joint and



*A gunner assigned to A Company, 2nd Battalion, 5th Cavalry Regiment, 1st Armored Brigade Combat Team, 1st Cavalry Division, inspects the range for targets during gunnery at Novo Selo Training Area, Bulgaria, July 19, 2018. As the Army continues to train for possible future conflicts, Gen. Stephen Townsend, commanding general of U.S. Army Training and Doctrine Command, proposes thinking strategically through the lens of multi-domain operations. (Sgt. Marcel Pugh/U.S. Army)*

multi-service, we need clarity and alignment in how we talk. The Air Force talks of multi-domain operations and multi-domain command and control, while we talk of multi-domain battle — often covering similar, if not the same, ideas and capabilities. To this point, none of the many people I have talked to, including my predecessor, are wedded to the use of “battle” — it was what fit best in time, place and circumstances. What they are committed to are the ideas of converging capabilities across the joint force with continuous integration across multiple domains.

Second, we cannot do this alone. The armed services can win battles and campaigns, but winning wars takes the whole of government. It helps the entire effort if our interagency partners are comfortable with and conversant in our warfighting concepts and doctrine. As highlighted to me by a former ambassador at a recent forum, talking in terms of operations instead of battles brings together those who want to

get things done — whether they are civilians or the military.

And third, it is never just about the fight. When it comes to combat, there is no one better than the combined weight of the U.S. military and our allies and partners. However, the operating environment is evolving and nation-state-level competition has re-emerged, as evidenced by recent actions by both Russia and China. Our National Defense Strategy highlights the importance of winning the “competition” that precedes and follows conflict. However, our use of “multi-domain battle” seemed to indicate our concept was only for the conflict phase. While there are battles within competition, winning them is pointless if they are in isolation to the larger context of deliberate operations supporting national strategy.


Multi-domain battle served its purpose—it sparked thinking and debate and it created a foundation. But what we need now is multi-domain operations, and the

next revision of the concept to be released this fall will reflect this change.

Language is important. It conveys meaning. This change is not cosmetic—it is about growing an idea to its greatest potential in order to change the way we fight today and ensure overmatch against our adversaries of tomorrow. To do this we need clarity and alignment across the joint force, whole-of-government inclusion, and perspective that reinforces our need to compete effectively outside periods of armed conflict. Changing the name does not do this by itself, but it communicates a clear vision of what we need to accomplish and where we are headed.

*Gen. Stephen Townsend is the U.S. Army Training and Doctrine Command commanding general. He commanded the XVIII Airborne Corps from May 2015 until January 2018. Townsend served with the 82nd Airborne Division, the 7th Infantry Division, the 75th Ranger Regiment, the 78th Infantry Division and the 10th Mountain Division.*





*A stinger missile team from the 35th Air Defense Artillery Brigade, identifies an unmanned aerial vehicle target at the Pacific Missile Range Facility in Barking Sands, Hawaii. The training exercise demonstrated the ability Soldiers' to detect, track, and defeat air and ballistic missile threats in a joint and allied multi-domain environment. (Courtesy photo/35th ADA BDE)*

# The Army Multi-Domain Targeting Center

Increasing the rate and volume of cross-domain capabilities

By Col. Yi Se Gwon

## Background

The Army targeting process of “decide-detect-deliver-assess” (D3A) has historically been an integral part of U.S. Army operations. Ground forces successfully employed D3A to integrate the highly kinetic combat operations of Operation Enduring Freedom I (OEF-1) and Operation Iraqi Freedom I (OIF-1), and then adapted D3A to synchronize the full-spectrum counter-insurgency operations that followed for over a decade. However, the 2014 Army Lessons Learned Forum collected several observations from OIF and OEF that identified the Army had significant targeting issues in joint interagency multinational environments with meeting a ground force commander’s (GFC) intent for joint Fires.

Operational forces feedback reinforced a 2001 Department of the Army (DA) Targeting Study that identified a growing gap between the Army and the other services to develop targets for integrating and synchronizing joint capabilities across different domains. The 2015 TRADOC Operational Targeting Study re-validated the need to establish a DA proponent office for targeting to both represent U.S. Army interests to the much larger Department of Defense Targeting Enterprise, and to identify a way-ahead for building the Army’s capacity to execute

targeting for joint operations. The Army Multi-Domain Targeting Center was established in 2016 with an initial operational capability of 20 personnel to serve these roles.

## The problem

At the core of the AMTC’s establishment was the following problem statement: How does the Army train, man and equip personnel to execute the joint targeting process in accordance with Department of Defense policies and published joint standards for developing targets for cross-service execution and joint force synchronization? In other words, the Army does not resource ground force commanders with joint certified individuals or qualified crews to execute joint targeting. This cedes the responsibility to shape the joint task force/GFC’s deep area to sister-services.

The mission of the AMTC is to serve as “the Army’s executing agent for cross-domain, cross-warfighting function doctrine, organization, training, materiel, leadership and education, personnel, and facilities - policy (DOTMLPF-P) modernization and integration responsibilities for targeting.”

Key tasks to building an Army capacity for joint cross-domain capabilities integration and synchronization include:

1. Establishing Army targeting training standards and certification requirements.

2. Representing the Army at federal, joint and multinational targeting forums.
3. Facilitating federated target development to the operational force to enable staffs to meet ground force commander’s intent for joint maneuver and Fires; national and theater-intelligence, surveillance, reconnaissance (ISR); pre-planned airspace; and non-lethal capabilities employment (Figure 1).

## Peer adversaries in large-scale combat operations (So why now?)

The assured nature of air, maritime and space supremacy in years past as a pre-condition to the commitment of ground forces reduced the necessity for the Army to have an operational role in joint cross-domain planning and integration. However, advances in technologies and peer threat capabilities have created an operational environment where the Army cannot necessarily rely on another service to get land forces close enough to employ our organic direct and indirect fire weapon systems. The battlefield for all services has an extended anti-access area denial (A2AD) depth, and require simultaneous integration of systems in order to establish temporary windows of domain superiority. These domains include space, cyber and information as contested environments.

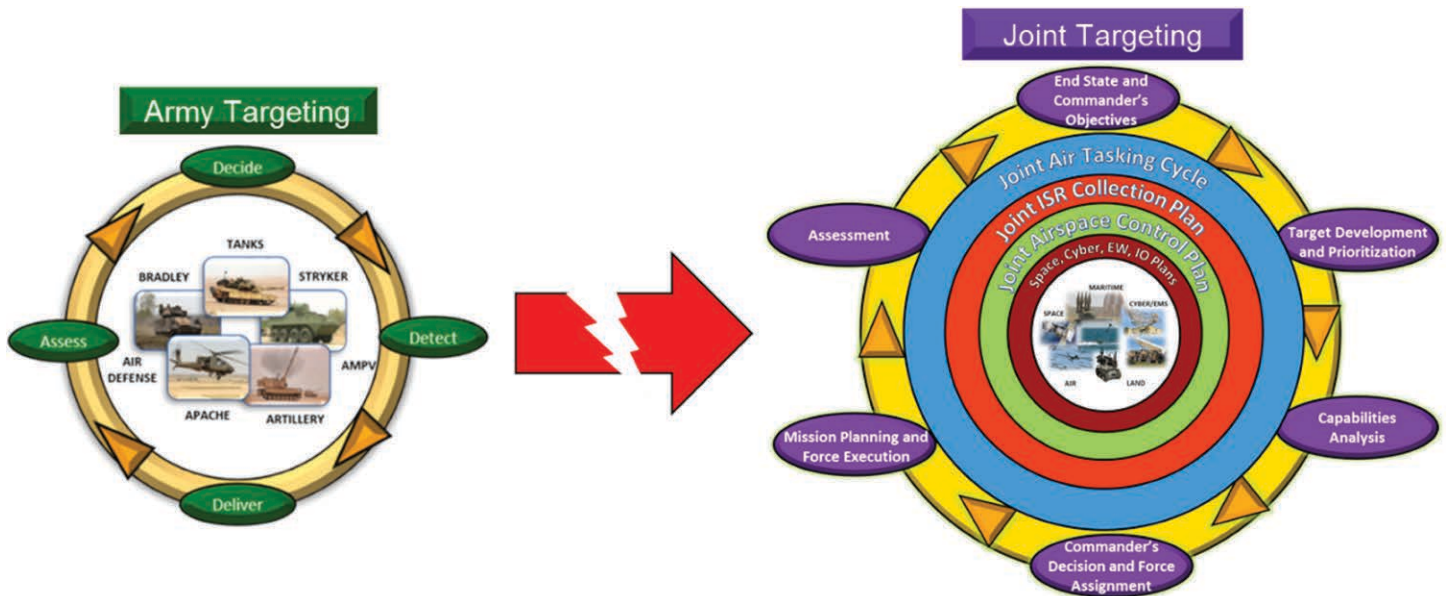


Figure 1. A comparison between Army targeting and joint targeting methods. (Courtesy illustration)

To dominate the modern battlefield, the Army needs to have a more active role in developing overarching joint cross-domain processes to complement the material solutions being developed for defeating peer threats. Currently, Army readiness requirements track a unit's individual certifications, crew qualifications and collective training in the form of gunnery tables and mission readiness exercises prior to deploying to a combined training center. However, the Army has not yet employed the existing DoD and joint staff accredited courses to certify individuals, or require qualified crews/work centers, as depicted below, that can meet Joint Staff standards of target development as a pre-requisite

for command posts to deploy as joint force land component commanders or JTF headquarters (Figure 2).

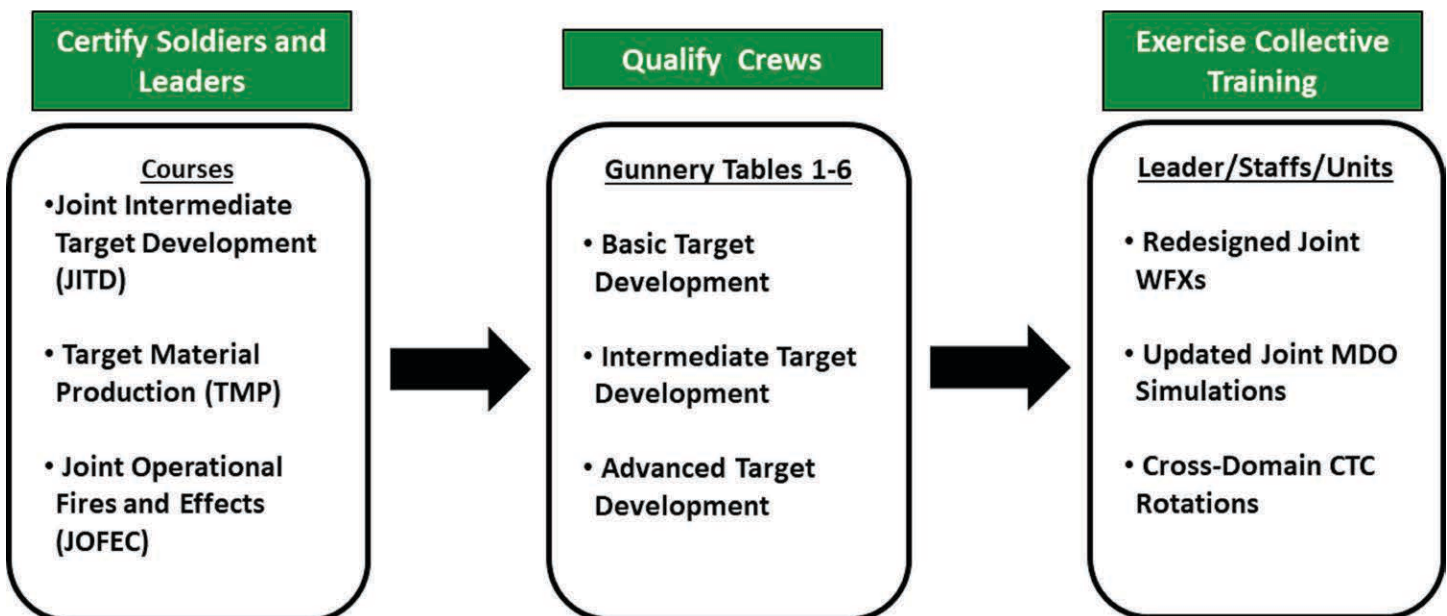
### Transforming for multi-domain operations

Based on assistance from Corps Headquarters, Army Service Component Commands, the U.S. Army Intelligence Center of Excellence and other centers of excellence, and respective branch proponent offices, the AMTC developed a strategic roadmap for modernizing the Army's Targeting Enterprise. The way ahead builds on the tactical Army targeting process of D3A, and adds the operational/strategic processes of joint intermediate and advanced target development. Essentially, GFCs will have joint

qualified crews and staffs that can effectively plan, integrate and execute cross-domain maneuver and Fires in support of multi-domain operations. The result will be a dramatic increase to the rate and volume of joint Fires that GFCs can influence through the joint targeting process. This ability to shape the modern operational environment across different domains will enable tactical units to operate semi-autonomously within a pre-determined decisive space with access to the full range of joint, interagency and multinational capabilities.

As we move toward full operational capacity, the AMTC is currently funded in Fiscal Year 18 and standing up the Army's Joint Intermediate Target Development

Figure 2. The joint targeting training strategy. (Courtesy illustration)



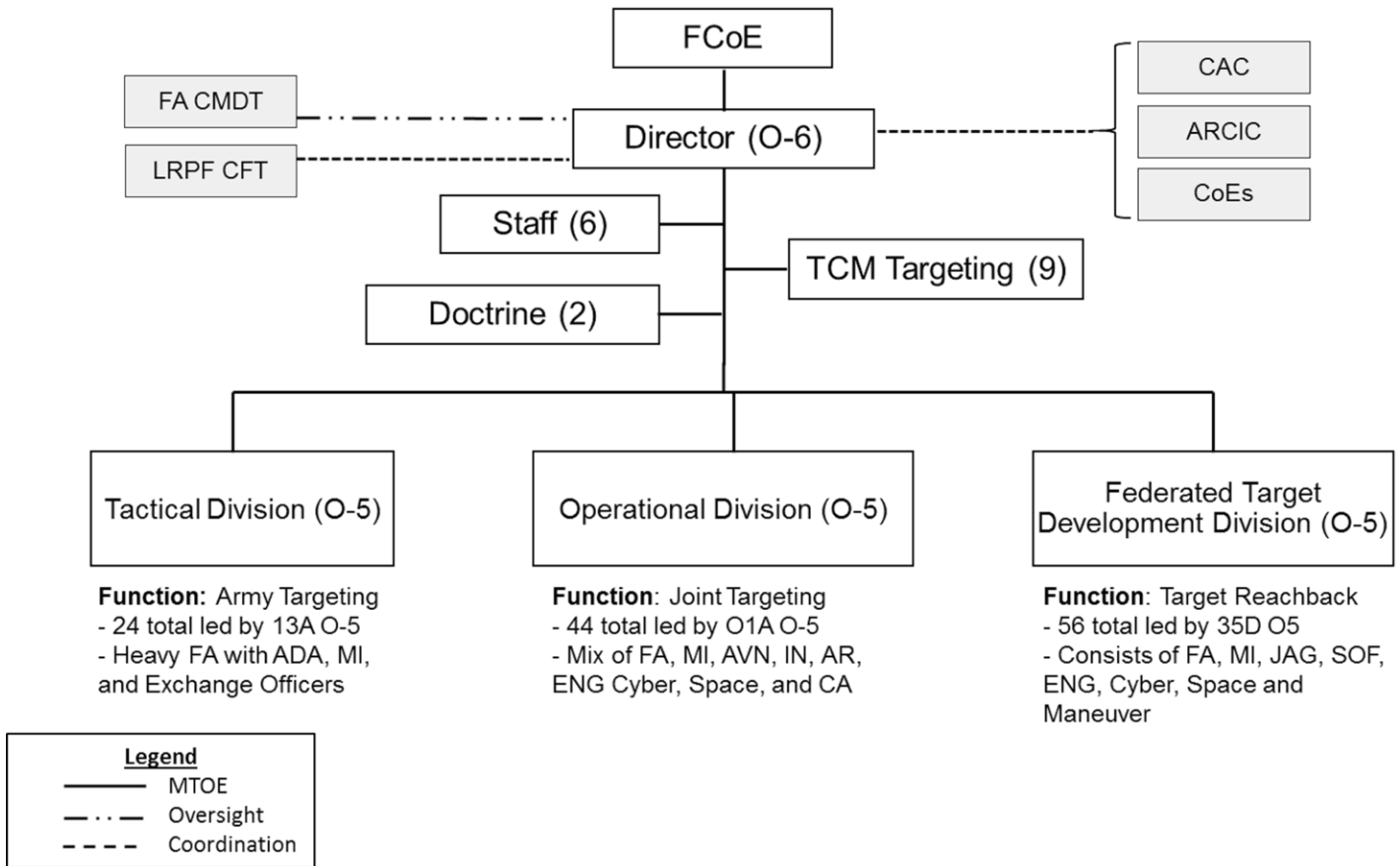


Figure 3. The Army Multi-Domain Targeting Center's proposed FOC task organization. (Courtesy illustration)

Course, and the Target Material Production Course as part of advanced target development. These courses are essential building blocks whose absence in Army professional military education had previously required land forces to sublet to the other services any spare support for the Army's joint targeting requirements. Having Army personnel and crews trained in these joint targeting tasks will give the current and future forces the ability to execute targeting for multi-domain operations. The funding for a provisional DOTMLP-P targeting modernization is approved to begin in Fiscal Year 20.

### Way ahead

DA is currently assessing a permanent Army support capability to the force for joint targeting to begin in 2021. This would be in the form of a fully operational AMTC of 140 personnel. At end state, future land forces will have the operational training and qualifications to enable tactical formations with the full range of lethal and non-lethal capabilities currently available and being developed across the DoD. Tactical formations will have the certified expertise to both understand and employ these cross-domain capabilities at extended ranges beyond a BCTs' organic capabilities

to persistently attack and achieve overwhelming overmatch against an enemy. Tactical units would also have the ability to integrate into joint cross-domain efforts to penetrate and disintegrate any A2AD threats that would impede closing with and finishing the enemy with short-range direct and indirect fire weapon systems in the close fight (Figure 3).

An enduring Army joint targeting support to the force would also provide a mechanism for capturing lessons learned, updating doctrine, and identifying future requirements for designing exercises as units gain proficiency in integrating cross-domain capabilities through targeting. For example, exercise designs for CTCs and warfighters in the future could have a dramatically expanded framework of both friendly- and peer-adversary capabilities. Friendly forces would begin their rotation from home-station with the proficiency to employ the full range of lethal, non-lethal and asymmetric attacks to penetrate and disintegrate enemy A2AD, and mitigate casualties to get to the CTC training area.

The potential increases in the rate and volume of Fires, ISR, space, cyber and electronic warfare capabilities that ground forces can achieve through joint targeting

dramatically exceed pre-established proficiency benchmarks with higher achievable levels of force protection. A continued DA investment in the Army Multi-Domain Targeting Center would ensure that land forces at the operational level of war will have the tools to execute joint targeting and integrate with the other services as part of the joint multi-domain fight well into the future.

The Army targeting process will continue to be an integral part of Army tactical operations, but the additional joint targeting proficiencies will allow for more complex tactical training with developed training aid-assisted and constructive replication of cross-domain effects and assessments. The AMTC is postured to ensure the Army plays a dominant role in the development and execution of multi-domain operations with joint, interagency and multi-national partners for large-scale combat operations.

Col. Yi Se Gwon serves as the U.S. Army Multi-Domain Targeting Center director. He is responsible for executing the Army's cross-domain, cross-warfighting targeting force modernization, and advocating Army interests to the Department of Defense Targeting Enterprise.

# Fires Battle Lab leads multi-domain experiment

By Marie Berbera

The Fires Battle Lab is going to war. The enemy is uncertainty.

As the lead for Unified Challenge 18.3, the Soldiers and civilians in I-SEE-O Hall and battle labs across the Army are looking for answers to the question, “What can we do against a near-peer competitor?”

In September, an entire floor is taken over to conduct this war-game experiment.

“Why do we experiment? To learn and mitigate risk for current and future forces, provide a measure of objectivity and inform on capability gaps and emerging concepts,” said John Haithcock, Fires Battle Lab director.

Opposition for the U.S. has changed. With possible threats looming from North Korea, Russia and China, Army experts are searching for solutions against those who are technologically savvy and resource-rich. This factors into the Army’s picture of the future, and the not-so-far future.

“While our focus is on the 2030 environment, we have to consider what is happening in the world today. Can we implement what we learn in the experiment to today’s operations?” asked Haithcock.

Military role players (MRPs) are acting as great debaters, poking holes in current arguments of what is “known.” MRPs are coming to Fort Sill Sept. 12-21 to act as Fires units. Fires MRPs are going to the Maneuver Battle Lab to play fire support and to the Mission Command Battle lab to fill Fires division roles.

The experiment’s landscape is painted with the broad strokes of the Army’s current contextual knowledge. As the role players act and react to situations, future possibilities come to light.

*Sgt. Bailey Sommers, 83rd Military Police Company, 200th Military Police Command, U.S. Army Reserves, interacts with a group of civilian role players acting as an angry mob during Combat Support Training Exercise at Fort McCoy, Wis., August 16, 2018. (Spc. John Russell/U.S. Army)*

“We can assess how we will conduct operations against a variety of enemy threats,” said Haithcock.

For this experiment, the Fires Battle Lab is going to assess the multi-domain operations concept against a peer competitor. As part of the situation they are going to include a dense urban environment.

“In the [real] world, people are huddling toward cities. We’re going to have to fight in a dense urban environment. Imagine if we had to go into and occupy an environment like Stillwater. Think about what you would have to go through to defeat an enemy,” said Haithcock.

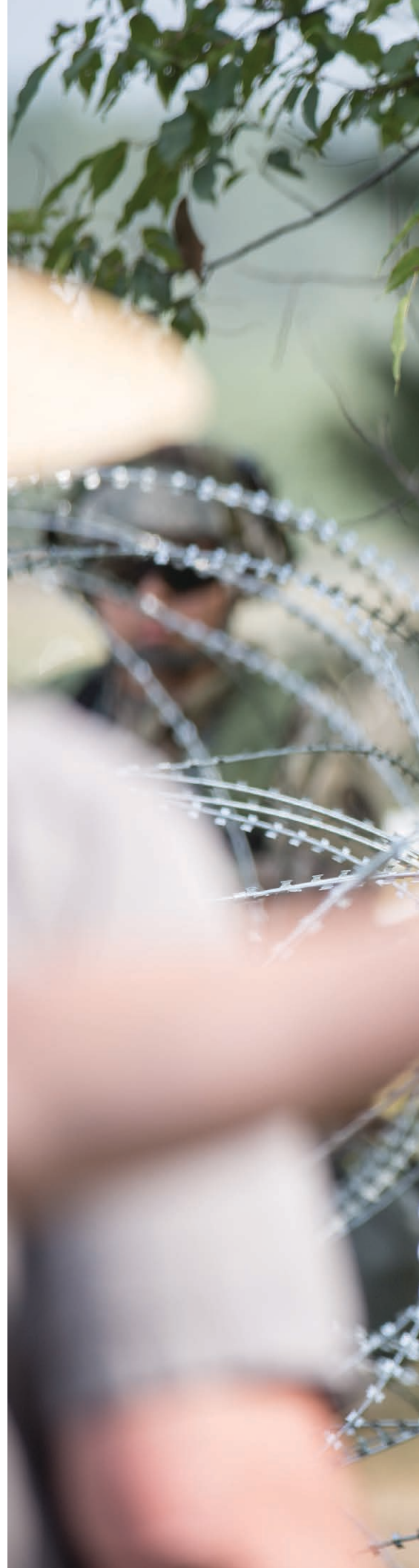
“We want to see if our organizations have the correct roles, responsibilities and capabilities required to defeat the threat and if not, what changes are required? These changes could be changing the organization, developing new technical capabilities, even training and leadership changes,” said Haithcock.

Questions emerge such as how do Fires formations deliver effective cross domain Fires with the capacity, range and lethality to overmatch enemy capabilities?

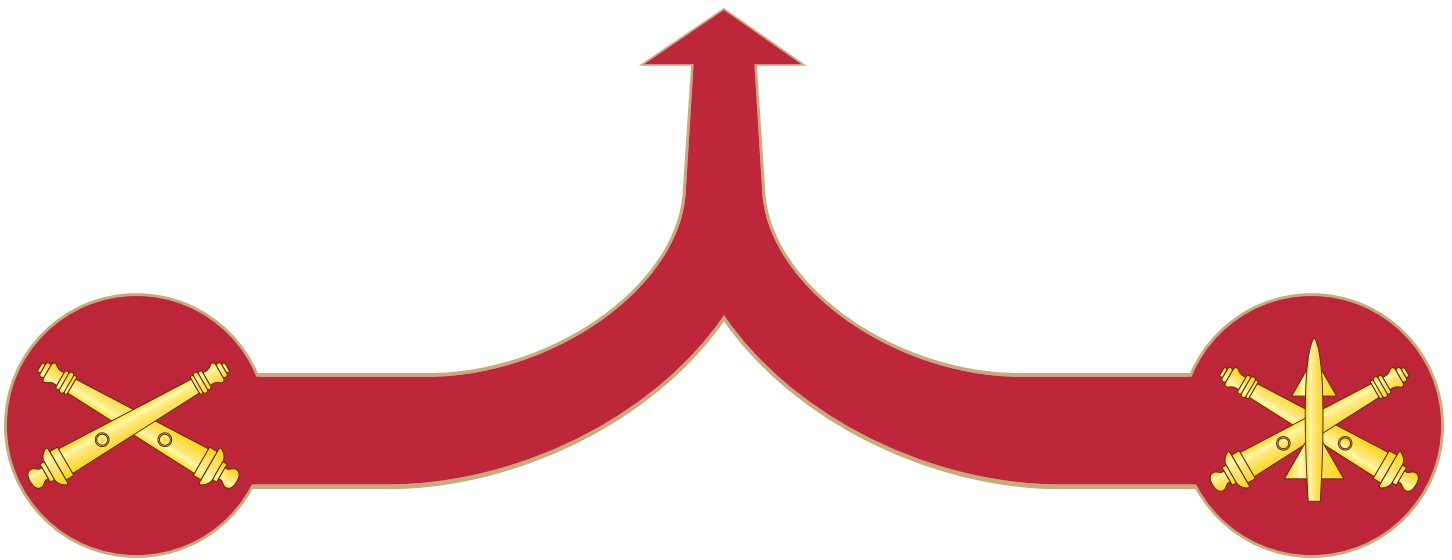
The Fires Battle Lab’s findings to these questions will guide their recommended changes to doctrine, training, material, leadership, education, personnel, facilities and policy.

The Fires Battle Lab’s next experiment is in November, the Maneuver Fires Integrated Experiment. MFI is the Fires Center of Excellence’s live, prototype experimentation campaign.

*Marie Berbera is the Fires Bulletin editor. Berbera has been a journalist for the Army for 10 years.*







# The future of field artillery

## Merging with air defense

*By 1st Lt. Taylor Maroni*

Faced with an uncertain future, the field artillery branch and the United States military as a whole must be prepared for anything. We can look at our branch's past to see how it evolved to meet different challenges and analyze the effectiveness of the decisions that were made in response. We can focus on developing an understanding and building trust with the other branches of service in order to maximize the assets available for our mission. Once we know what we want our future to look like, we can begin developing new doctrine and adjusting the field artillery and air defense artillery job specialties as needed. In order to prepare for an uncertain future, we need to embrace new unit configurations, new equipment and new doctrine that embodies a bold and logical progression from our current standards.

Making the best possible decision going forward concerning the field artillery and air defense artillery branches may seem like a daunting task, but we can look to the past for guidance. By analyzing the deci-

sions that were made and the nuances of the situations, we may be able to discern patterns that are applicable to today's situation. The air defense artillery began as a part of the field artillery branch, and by 1958, momentum was gaining to split the two due to increasing technical and tactical differences. However, it was not until 1968 that the two branches were officially separated. The main argument for the split was that trying to teach officers both kinds of artillery prevented them from attaining the proficiency necessary in order to carry out basic functions in either specialty. Separation was finally achieved in 1968 mostly due to experiences in the Vietnam War.

"Combat in Vietnam required the officer to arrive as a proficient field artilleryman and not a hybrid field and air defense artilleryman. Army commanders in Vietnam simply did not have the time to train an air defense artilleryman to be competent in field artillery [...] who had had insufficient training in the basic techniques."<sup>1</sup>

If you apply the lesson learned here

from Vietnam, you would assume keeping traditional field artillery and all other non-traditional (rocket/missile) operations separate would be the best course of action. However, in 2014, the Army decided to combine the military occupational specialties of traditional fire control specialists and their rocket counterparts. The argument of lack of Soldiers available and costs saved is similar to the reasons used to resist the air defense artillery becoming its own branch. While there might be short term benefits, it is important to consider the significant consequences it could have on future warfare.

In September 2014, Command Sgt. Maj. Daniel Moriarty stated that most of the reasons for the change were based on career progression for Soldiers within the branch, as well as the opinion that traditional and rocket systems are very similar now due to the digital systems they use. "With all of our weapon platforms becoming digitized, the reliance and use of manual gunnery should be relegated to degraded operations only."<sup>2</sup>

<sup>1</sup> *King of Battle: A Branch History of The U.S. Army's Field Artillery*, Boyd L. Dastrup, p. 288. 1992.

<sup>2</sup> *The United States Army Field Artillery Branch's Newsletter*, p. 1, September 2014.



*Soldiers from 2nd Battalion, 8th Field Artillery Regiment, use the Joint Effects Targeting System during a Program Executive Office Soldier limited user test. (Courtesy photo/PEO Soldier)*

An important factor to consider should be how well fire control Soldiers can be trained in both traditional and rocket units, as well as in manual gunnery. A core tenant of the field artillery has always been the ability to perform degraded operations if the situation required it. I do not think that the need for manual gunnery backups will go away no matter how reliable the digital systems get. As things currently stand, it is already a challenge for new fire control Soldiers to learn manual gunnery as they do not learn it at advanced individual training, and now they will have to learn the rocket side as well.

When entering a conflict, the military usually has a certain amount of catching up to do once they have assessed the situation. However, effective solutions are usually only able to be implemented after a significant amount of time has passed. Considering the scale of the technology we face today, it is a big risk to assume we have time to catch-up once a conflict has started. Eventually, the “missile peace” could be

broken by one side or the other launching a serious attack via missile. Considering this, I am afraid that the field artillery’s missile and rocket side will become increasingly vital to success in a future conflict and that Soldiers and officers alike will not be ready. In the Field Artillery Basic Officer Course, we spent a total of two days out of six months learning about the rockets and missiles of the field artillery. Lieutenants sent to rocket units quickly learn the tools of the trade, but what happens when Soldiers and officers who have spent their whole career in traditional field artillery units are suddenly expected to perform in a combat environment with rockets? I do not think that the integration the Army is looking to achieve is feasible without rocket and missile batteries becoming a part of field artillery battalions. In a composite battalion such as 2nd Battalion, 11th Field Artillery, experience in both M119s and M777s can be easily obtained due to the ability to rotate people between jobs. The same could be achieved with rockets.

With advancing technology, traditional field artillery might soon be able to support missions traditionally left up to missiles and rockets. Talk of field artillery hyper velocity rounds has been circulating for at least a couple of years, and they stand to change the game of the “plus one” rule when facing near-peer enemies. The “plus one” rule is where an enemy can easily identify our interceptor missile launchers due to their distinctive signatures. The enemy can reasonably calculate how many projectiles a launcher should have, and can launch stockpiled, cheaper, “dumb” rockets that will force the launcher to use up all its rounds. This is compounded by the fact that for each instance, two interceptors need to fire at the same target for redundancy.<sup>3</sup>

Hyper velocity rounds (HVP) stand to disrupt the current norms by introducing uncertainty in the enemy. They will be guided rounds that are capable of chasing down and intersecting with other missiles. The rounds can be fired from a slightly

3 \$86,000 + 5,600 MPH = Hyper Velocity Missile Defense. Sydney J. Freedberg Jr., Jan. 26, 2018. <https://breakingdefense.com/2018/01/86000-5600-mph-hyper-velocity-missile-defense/>

modified tube already used in M777s and M109s. The enemy will not be able to estimate the amount of hyper velocities rounds a battery might have, especially because they are exponentially cheaper than rockets or missiles. Right now, the estimate for one HVP is \$85,000, which is cheap compared to \$3,000,000 for one Patriot missile. Traditional field artillery batteries also have a smaller signature before firing and can maneuver more easily undetected. This will allow us to match the enemy's number of cheaper "disposable" projectiles and save our expensive sophisticated missiles for when they are really needed.

With that being said, what good are precision munitions if you do not have an observer able to give you a precision target location? Technology must evolve in the fire support and firing battery roles in order to maximize the effectiveness of both. Right now, the standard method for an observer to obtain a Category II, 10-digit target location is the Lightweight Laser Designator Rangefinder (LLDR). Despite its name, anyone who has used one before knows that its components are quite bulky. Having Soldiers carry it around is a significant burden to fire support teams. However, a newer, more compact device may soon replace it.<sup>4</sup> The Joint Effects Targeting System (JETS) is only five pounds and is slightly smaller than the main module of the LLDR. The benefits created by simply switching to a smaller device cannot be understated. Forward observer teams often have to climb to hard-to-reach places for the best view or are tagging along with their maneuver element. Light infantry units move quickly on foot, so every piece of extra equipment has a significant effect on the Soldier's comfort and maneuverability. If the LLDR is opted to get left behind, then the maneuver element likely does not have an alternate means to pull Category II grids. This means that any fire mission called will be significantly less accurate on the initial round, which can result in more rounds being fired and the loss of the element of surprise.

Not only is the JETS more lightweight, but it also features significantly more advanced sensors. It utilizes the Precision

Azimuth and Vertical Angle Module to measure the rotation of the Earth using sensitive gyroscopes rather than relying on celestial cameras. This is a huge improvement because the LLDR can be affected by adverse weather conditions that obstruct the celestial camera. The Department of Defense is looking at fielding the JETS to Army and Marine fire support elements, along with Air Force joint terminal attack controllers (JTACs) and fixed-wing aircraft, bringing everyone on a common platform and proving the worth of this new piece of equipment.

Having the right equipment to get accurate targeting data is important, but what do you do once you have it? It is increasingly likely that in the future, many targets may require engagement with an asset other than the assigned supporting field artillery. It is not surprising when you take a moment to think about how many assets are available to forward observers: Army attack aviation, Air Force, Navy and Marine platforms and countless foreign ally platforms. Joint forward observer (JFO) certification has always been important and the demand for it will only increase in the future. The proof is how Field Artillery BOLC and 13F (forward observers) AIT have changed their curriculums over the past four years in order to keep up with the demand of JFO training. Before, JFO used to be a separate course from BOLC where second lieutenants stayed after graduating in order to attend. A large number of new FA officers missed this opportunity due to classes not lining up with their permanent change of station date or going to another school such as Ranger School. When I went through BOLC, JFO had become part of the curriculum, and passing the written test was a mandatory graduation requirement. However, the only hands-on training my class got was through simulators ran by JTACs, which were similar to the recertification simulations that are ran by JFO-evaluators to keep JFOs current. Now, students in BOLC have the chance to control live aircraft and drop bombs in an impact area as part of their JFO training. Some classes even get lucky enough to do this with ally

nations, further highlighting the importance of this training in a joint environment. Mark Kessens, the Fort Sill Falcon Range operations officer, extends this logic out to our pilots and JTACs as well.

"In combat, American fighter or bomber pilots won't only be dealing with Americans. You have Australians, you have Dutch, you have British, you have Canadians."<sup>5</sup>

There are all these assets that might be missed if there isn't awareness on how to properly acquire and take advantage of them. To support this, in 2014 13F AIT went from being six weeks long to almost nine weeks in order to include JFO training. The 13F Advanced Leaders Course and Senior Leaders Course also received changes to their curriculums to include JFO training. These changes are contributing to the readiness of fire support Soldiers to conduct missions wherever and with whatever assets available, which is priceless in the face of an uncertain future conflict.

Once we achieve this stage of modernization, we cannot stop innovating for the future. We also cannot forget our past problems and issues and how we dealt with them effectively or ineffectively. Building understanding and trust with the other branches of service and foreign allies must continue to be a focal point for our nation. Remembering the past, maximizing assets for the future, and pushing steady logical progression in doctrine is the best way to stay fit for undetermined warfare.

*1st Lt. Taylor Maroni is a field artillery lieutenant and the second platoon leader for B Battery, 2nd Battalion, 11th Field Artillery. She commissioned in May 2016 with a Bachelors in Computer Science from SUNY Brockport in Brockport, NY. She graduated Field Artillery Basic Officer Leaders Course in October 2016. She was assigned to 2-11th FA, a composite field artillery battalion. From November 2016 to October 2017 she was a targeting officer and fire support officer. In October she went to B Battery as a fire direction officer, and took over as platoon leader in December. She has been through the Joint Readiness Training Center as both a fire support officer and platoon leader.*

<sup>4</sup> The Army Wants To Make Forward Observers Deadlier Than Ever With This Sleek New Targeting System. Jared Keller. Jan. 19, 2018.

<https://taskandpurpose.com/army-joint-effects-targeting-system/>

<sup>5</sup> British exchange officer fills key role supporting Fires training. Fort Sill Tribune. Feb. 15, 2018. [https://www.army.mil/article/200710/british\\_exchange\\_officer\\_fills\\_key\\_role\\_supporting\\_fires\\_training](https://www.army.mil/article/200710/british_exchange_officer_fills_key_role_supporting_fires_training)



# Winter warfare

Supporting maneuver in ice, snow, cold

By 1st Lt. Anthony Lombino

Russia, China and North Korea: Many of the United States' potential adversaries live and routinely operate in frigid and snow covered environments. They are experts in winter warfare. Their artillery has no qualms with sending rounds downrange and delivering effects on target in subzero temperatures. If the U.S. wants to compete with these powers in the realm of indirect Fires we must increase our capability to operate in these same conditions.

The Soldiers of the 10th Mountain Division at Fort Drum, N.Y., are no strangers to the snow and cold. Second Brigade Combat Team's recent culminating training exercise (CTE) gave 2nd Battalion, 15th Field Artillery Regiment significant experience with shooting, moving and communicating in winter conditions. We ran into our share of problems, but the lessons we took away from these experiences and the cold weather training in preparation for this

*Soldiers of the 2nd Battalion, 15th Field Artillery Regiment place an M777 howitzer during a unit cold weather training exercise. (Courtesy photo)*



event taught us an effective approach to supporting the maneuver fight under these conditions.

Winter is long in Fort Drum. There is usually snow on the ground from mid-October to mid-April, with temperatures fluctuating between 8 and 29 degrees Fahrenheit. During the CTE, the average temperature was 21 F, with two days of heavy snowfall at the beginning of the exercise. Snow accumulation and heavy winds resulted in snow drifts up to three feet deep. The sunlight hours involve movement and survivability moves, often in deep snow. Snow blindness afflicts drivers and hampers visibility. Heavy snowfall drops this visibility to almost nothing. Nights are even worse with temperatures reaching their lowest. We learned to focus on three areas in order to aid us in these cold weather conditions: equipment, preparation and tactics.

Special attention must be paid to equip-

ment and vehicles when temperatures drop below freezing. At least once a day during CTE we ran into something freezing at a critical moment. Metal had to be handled with gloves and the battery life of digital systems and radios was greatly reduced. Tow hitches were a particular problem with the retaining pins freezing in place making it difficult to emplace howitzers and attach trailers. Water freezing in the water cans was the most frustrating issues encountered. Some tactics, techniques and procedures (TTPs) we developed to overcome these problems include using vehicle exhausts to thaw water cans and carrying spray bottles full of denatured alcohol to unfreeze the breeches and other metal parts. Checking for and combating frozen equipment quickly became the main priority of work after security. The number one thing we learned is that cold weather requires essentially constant monitoring of equipment that will freeze if left unattended for any period of time.

The second area we learned to focus on is preparation. Second Brigade has a standard cold-weather packing list that is very comprehensive. The moniker "Light Infantry" has often been taken as an ironic joke at Fort Drum given the amount of gear the individual is expected to carry around with them in the field, but this took it to a whole new level. We each brought special snow boots, the entire extended cold weather clothing system, a full sleep system, mittens, arctic gloves, snow camouflage outer garments, full personal protective equipment and full nuclear/biological/chemical suits in addition to the myriad of items common to every Army packing list. We also learned to pack every pair of socks we own and a spare pair of boots since the feet are particularly susceptible to cold weather injury, even with snow boots.



*Soldiers from 2nd Battalion, 15th Field Artillery Regiment, fire an M109 howitzer during a unit cold weather training exercise. (Courtesy photo)*

In the end each Soldier brought along a rucksack, an assault pack and a full duffel bag in their vehicles adding on to their section's equipment and the other equipment needed to accomplish the mission like radios and first aid equipment. This made storing and securing anything in a logical fashion extremely difficult and slowed us down by forcing everyone to rifle through a veritable mountain of gear to get at, or put away what they needed. A balance has to be struck. The packing list must be streamlined, but unit load plans must also take into account the increased space required for more personal equipment. The infantry also ran into problems with their packing list, but because they are limited by dismounted movement they are more focused on "trimming the fat." Despite our mounted capabilities, the artillery needs to get into the same mindset. Movement becomes harder in the snow and an overabundance of gear will only exacerbate the problem.

The third area we learned to focus on was tactics which had to be altered in these frigid conditions. Terrain analysis becomes much more difficult when the ground is frozen, with a layer of ice on the surface and a blanket of snow as it was during CTE. We had to rely more heavily on map recon due to the fact that the naked eye cannot pick up

what is under the snow during a physical recon. But there is only so much leaders can glean from a map. There were times when we ended up setting up on top of a stream or swamp without even realizing it. It goes without saying that our vehicles got stuck more than once. We found tire chains to be extremely helpful, but our overloaded vehicles still got stuck. Self-recovery in the snow is a skill that must be learned through hands-on experience.

Artillery is particularly vulnerable to air attacks and enemy unmanned aerial system. Artillery unit's primary defense against an air threat is concealment. Usually camo nets are set up over artillery to conceal them from the air, however our desert camo nets stuck out like a sore thumb during CTE. If we had had winter nets we would have been nearly invisible to air and ground threats. The snow also made vehicle tracks easily distinguishable. Moving during periods of heavy snow fall masked our tracks and decreased our chances of being detected.

Artillery is also vulnerable to counter fire. When a howitzer fires a round, enemy radar can track the round in the air and trace it back to the firing unit's location. The typical answer to this threat is survivability moves: a quick displacement of the unit

after a certain amount of time or certain number of rounds fired. The snow makes this much more difficult. Decreased mobility means that exfiltration routes must be planned and prepared beforehand. Extra time must also be allocated for vehicles and equipment should be thawed as much as possible before the expected movement.

The dynamic nature of the modern battlefield demands a high level of competence in all types of environments and the cold weather environment is no exception. These tactics and techniques that we have developed over our training at Fort Drum enable us to improve our ability to support the maneuver fight despite freezing temperatures and massive snow buildup by focusing on three areas: equipment, preparation and tactics. They are how we have built competence operating in freezing conditions. We expect to face a tough and determined enemy who is already accustomed to these kinds of conditions. In the end, we learned that it is experiences like CTE that will enable a unit to be effective in a winter conflict.

*1st Lt. Anthony Lombino is the fire direction officer of a 105 mm platoon in A Battery, 2nd Battalion, 15th Field Artillery Regiment, stationed at Fort Drum, NY.*

# Yuma Proving Ground remains on artillery cutting edge

By Mark Schauer

For most of its history, artillery testing has been Yuma Proving Ground's core mission.

As artillery technology evolved over the decades, YPG remained on the cutting edge of testing guided and semi-guided munitions capable of hitting within mere meters of a target many kilometers away.

Today, the Chief of Staff of the Army has identified long-range precision guided munitions as the service's top priority, with aspirations of fielding systems within four years capable of accurately firing at targets 100 kilometers away.

In perspective, a currently fielded 155 mm artillery piece typically fires at targets no more than about 30 kilometers away.

One critical component of the Extended Range Cannon Artillery (ERCA) program currently being tested at the proving ground is the XM1113 projectile, which exceeded 60 kilometers in a test conducted in late May.

"This is a fairly traditional artillery round, but putting a bigger rocket on it allows us to achieve much farther ranges," said Tyler Heagney, test officer. "Precision and long-range are the objectives."

For the test, the projectiles were fired from an Extended Range Cannon developed under the ERCA project. Though capable of substantially longer ranges, the new projectile is remarkably similar to currently fielded 155 mm rounds.

"The prototypes of XM1113 projectiles being manufactured today use tooling that is relatively close to what we would use once the round moves into production," said Ductri Nguyen, ERCA lead. "It would be a relatively easy transition, though there are some optimizations we could do for cost-cutting."

The most significant difference is in the round's much larger rocket, which pushes out more than twice as much thrust as the legacy system. Methodical test Fires of the new round are vitally important, and recovering the fired rounds for careful analysis even more so.

"We look for nozzle degradation or erosion," said Nguyen. "There are insulators

that protect the heat from intruding into the explosive. We certainly don't want to raise the high explosive to critical temperatures. We also want to examine the performance of the rotating band we are using from the legacy system."

Further, the XM1113 is designed to utilize the currently fielded Precision Guidance Kit (PGK), a fuze that turns a conventional artillery round into a semi-guided one.

"It is intended to be compatible with PGK, so we are designing it in collaboration with the PGK team to ensure this round will work with it," said Nguyen. "There may be some required modifications for one or both systems, but I think we can exceed our objective of meeting PGK's current accuracy threshold."

Guided munitions are designed for pinpoint accuracy, yet safely testing them requires an enormous amount of range space. YPG is the fourth largest facility in the Department of Defense in terms of land area.

"In the development of smart muni-

tions, you have very large safety fans because it's not just ballistic anymore," said Kermit Okamura, Munitions and Weapons Division chief. "If I shoot a rifled cannon, it's going to go straight and a little to the right. With guided munitions, anything going wrong, from electrical to mechanical, can make it go way off course."

The Hyper Velocity Projectile, another aspect of ERCA testing by YPG personnel, has already achieved a distance that exceeds YPG's range space.

"As large as Yuma Proving Ground is, we're running out of room," said Okamura. "It isn't just YPG, it's also many other installations in the Department of Defense."

As a temporary solution, YPG personnel have conducted two test Fires at the Barry M. Goldwater Range, a larger facility south of the proving ground that is shared by the Marine Corps and Air Force and primarily used for operational testing of high-performance aircraft. The two test Fires were carried off flawlessly, but posed extraordinary challenges for YPG personnel.

*As a temporary solution, U.S. Army Yuma Proving Ground (YPG) personnel have conducted several recent test Fires at the Barry M. Goldwater Range, a larger facility south of the proving ground that is shared by the Marine Corps and Air Force and primarily used for operational testing of high-performance aircraft. The two Fires were carried off flawlessly, but posed extraordinary logistical challenges for YPG personnel. (Courtesy photo/U.S. Army)*





One critical component of the Extended Range Cannon Artillery program currently being tested at the proving ground is the XM1113 projectile, which exceeded 60 kilometers in a test conducted at U.S. Army Yuma Proving Ground in late May. The most significant difference is in the round's much larger rocket, which pushes out more than twice as much thrust as the legacy system. (Mark Schauer/U.S. Army)

"We had to fire on weekends to avoid a conflict with the Marine and Air Force missions," said Diep Ho, test officer.

Test personnel had to transport and emplace numerous pieces of large, specialized and expensive test-support equipment, then quickly take it down and return it to the proving ground, a multi-day effort. For a variety of reasons, the Goldwater Range will eventually be unable to support the long-range test Fires slated to take place over the next several years. YPG leaders hope to eventually be granted a special use permit for a small number of test Fires from a patch of completely unpopulated Bureau of Land Management-controlled land north

of YPG's boundaries that will effectively meet the long-range munitions' safety fan requirements.

Though much more ERCA-related testing remains in future plans, testers are excited about what has already been achieved.

"That we are effectively at least doubling the range of traditional artillery is pretty exciting," said Heagney. "Once we get this fielded, it will be really cool to put this in the hands of our Soldiers and have them even further out of danger and still hitting targets."

Testers have also been impressed with YPG's flexibility in accommodating rapidly changing test requirements.

"YPG has been absolutely fantastic," said Nguyen. "We've made a lot of changes during testing — sometimes we have to change the test sequence on the fly based on the data we are seeing. YPG's test officers have been very accommodating."

"At many U.S. test ranges, flexibility is limited," added Steve Flores, Artillery and Mine Branch chief. "Here, because of our efficiency in conducting tests, we can schedule tests weeks in advance instead of months in advance."

*Mark Schauer is the editor of "The Outpost" and has worked in the public affairs office at U.S. Army Yuma Proving Ground since May 2008.*

# HIMARS forward basing/aircraft tethering concepts

By Col. Joe Russo

Over the past 17 years, the Marine Corps has routinely operated at ranges in excess of 600-800 miles and beyond from the littorals. Concurrently, the decrease in available amphibious shipping has created gaps which have been partially mitigated by the creation of Special Purpose Marine Air-Ground Task Forces as well as split/disaggregated Marine Expeditionary Unit formations. In doing so, gaps in fire support capabilities have emerged.

The M142 HIMARS is a C-130/C-17 deployable, all-weather, persistent fire support platform capable of delivering precision Fires in excess of 300 kilometers with the Army Tactical Missile System, or in excess of 84 kilometers with the Guided Multiple Launch Rocket System (GMLRS). Ongoing munitions developments will soon generate significantly greater ranges and capabilities. Given the ranges of munitions both available and emergent, HIMARS,

while not always optimal, is capable of supporting company landing teams/special operations forces/vertical assault elements operating in a distributed manner, while providing the advantage of being able to offset the delivery platform. While developments in maritime/amphibious-based GMLRS Fires offer a degree of flexibility to the force in support of niche requirements, they likewise produce significant challenges to mobility, range and ammunition/logistical management. The air transported HIMARS option enables flexible precision Fires to forces operating at distances/depth on the battlefield - beyond the current reach of sea based platforms — or beyond the limits/capabilities of combatant command-based tactical aircraft.

If positioned on a rotational basis in the European Command area of responsibility (AOR), a HIMARS platoon supported by C-130 aircraft or equivalents is capable of

responding to the requirements of Special Purpose Marine Air-Ground Task Force – Crisis Response, transiting Marine Expeditionary Units, or of participating in steady state theater security cooperation/joint exercises throughout EUCOM and U.S. Africa Command. Note: the Unit Deployment Program of 5th Battalion, 11th Marines HIMARS to Okinawa in the spring of 2016 has established a similar, forward deployed HIMARS capability to III Marine Expeditionary Force/Pacific Command, enabling rapid employment and further development of coastal defense/maritime long-range precision munition initiatives in the PACOM AOR. This concept may be further enhanced by the forward staging of HIMARS support equipment and munitions. (Example: U.S. European Command/Marine Corps Prepositioning Program-Norway). While there are few scenarios in which battalion sized formations of HIMARS are

*Marines from K Battery, 2nd Battalion, 14th Marine Regiment, reassemble an M142 High Mobility Artillery Rocket System (HIMARS) after being transported on an Air Force MC-130, at Dugway Proving Grounds, Utah, March 30, 2018. Marines from Kilo Battery flew from Fort Campbell, Ky., to Dugway where they offloaded and fired four HIMARS missiles, demonstrating a unique capability that will give commanders more options to deal with threats when other options are not appropriate. (Lance Cpl. Niles Lee/U.S. Marine Corps)*



*Marines assigned to 2nd Battalion, 14th Marine Regiment, launch a rocket from a High Mobility Artillery Rocket System during their mission rehearsal exercise. (Sgt. Ray Lewis/U.S. Marine Corps)*



optimally employed, it is in proximity to those particular geographic scenarios that the pre-staging of HIMARS support equipment is optimal, reducing the time and lift requirements necessary to support the logistical/sustainment requirements of HIMARS Fires in support of high end conventional operations. HIMARS, when desired, can additionally provide a very visible signature and demonstration of commitment to allies/NATO partners.

HIMARS platoons within both the U.S. Army and Marine Corps have demonstrated a proven capability to conduct raid/airlift delivered operations in conjunction with supporting C-130/C-17 aircraft, and effect command and control with narrow-band and broadband satellite communications, and high frequency voice and digital communications. A total of three batteries

(nine HIMARS platoons of three x two launchers per battery) are organic to the 14th Marine Regiment. A total of four batteries are organic to 11th Marines, and additional HIMARS structure/capabilities are envisioned. Recent maturation of HIMARS employment tactics, techniques and procedures, and rapid innovations in long-range, surface-to-surface precision munitions, including seeker warhead capabilities have created relevant opportunities for the operational integration of the M142 HIMARS. **HIMARS sustainment/aircraft-airfield tethering concepts**

Among the most critical factors when planning for the employment of HIMARS, is a recognition of the capabilities and limitations of the M142 Launcher Module (LM) and chassis, and facilitation of the ability to conduct rapid resupply of the MLRS Fam-

ily of Munitions (MFOM) are paramount. HIMARS employment requires both staff and commander to give serious consideration to both how a HIMARS unit will be introduced into theater, and most notably, how it will be resupplied, particularly during phases of operation in which munition expenditures are expected to be high.

Planning considerations:

- While exercise planning often theoretically includes the movement and off-load of HIMARS units and ammunition via amphibious shipping, it must be noted that the RSSs of a HIMARS battalion alone consume a significant portion of available deck space on an LPD-17. Furthermore, storage space and special handling requirements of MFOM (missile pods) make the throughput of ship-to-shore movement challenging. The



unique materiel handling equipment requirements of GMLRS munitions make the external sling loading of MFOM pods by rotatory wing aircraft challenging. Damage, which may occur during transit and offloading, causes the pods to become unserviceable.

- The Family of Medium Tactical Vehicles chassis, of great expeditionary value because of its ability to be internally loaded into a C-130, is conversely over-burdened by the LM, and highly susceptible to dead-lining chassis damage when operated aggressively off-road.
- Finally, the expected high volume of ammunition expenditure of HIMARS MFOM in a distributed operating environment, and at the high end of the range of military operations will neces-

sitate a speed and complexity of ammunition resupply which is not common to artillery administrative and logistics operations centers, or Marine Logistics Group capabilities. Arguably, unless stockpiled, expenditure rates of MFOM will necessitate the execution of GMLRS resupply actions before the first rockets/missiles are fired.

With each of the above noted factors in mind, and considering the emergent range capabilities of the M142, the most operationally supportable/flexible means of initial introduction, employment and sustainment of HIMARS are arguably in conjunction with aircraft movements and airfield tethering. The ability to operate from existing strategic lift capable airfields/runways facilitates the employment of

HIMARS, maximizes the range of its munitions at stand-off ranges, preserves the sustainability/survivability of the M142 chassis, and most notably facilitates timely resupply of MFOM.

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

*Col. Joe Russo is the Marine Corps Recruit Depot assistant chief of staff/G-3 in San Diego. He has deployed multiple times in support of Operations Enduring and Iraqi Freedom, and has most recently commanded 14th Marine Regiment.*

# Enabling a force field artillery

## The necessity of protection

By Capt. Nicholas Calangi

The 17th Field Artillery Brigade is an organization with unique force projection capabilities. Its High Mobility Artillery Rocket Systems (HIMARS) have an effective range of 300 kilometers and can target enemy forces with pinpoint accuracy and devastating effects.

The ability to shape deep into the enemy's area of operation (AO) makes it a lucrative target for hostile adversaries and requires the 17th Field Artillery Brigade commander to implement both active and passive defensive measures to deny the enemy targets of opportunity. To determine what defensive measures must be enacted, the inherent vulnerabilities of 17th Field Artillery Brigade will be explored and analyzed through the lens of the protection warfighting function (WFF).<sup>1</sup> For the purposes of this analysis, the rear area vulnerability and HIMARS signature

will be used to study how 17th Field Artillery Brigade operates as America's First Corps Force Field Artillery (FFA).<sup>2</sup> While far from comprehensive, this analysis will highlight methods used to bridge capability gaps and help advance the protection WFF at the field artillery (FA) brigade level.

The 17th Field Artillery Brigade deployed to the Korean peninsula in support of I Corps' Warfighter (WF) 18-02 in November 2017. While deployed forward, it quickly became evident of the importance of having a vigorous protection cell to collect, analyze and disseminate information concerning a wide range of threats to include chemical, biological, nuclear and radiological effects, cyber-attacks, ground and air attacks, enemy artillery fire and missile launches. After analyzing the multitude of threats presented against the FFA headquarters, the protection chief must in-

tegrate seamlessly with I Corps in order to synchronize defensive measures with adjacent units and to use active interdicting effects to disrupt enemy offensive operations. During WF 18-02, the protection cell crafted metrics for performance that allowed for easily digested assessments to drive decision making.

### Metrics

Assessing the vulnerabilities of a brigade-size element is crucial in determining how resources will be allocated for protection. A critical vulnerability FA units have is a function of their employment. FA units operate within the AO's rear, effecting targets several kilometers away. While operating in the rear affords an FA unit relief from the immediate pressures of direct enemy engagement, it can expose the unit to bypassed enemy units. When assessing a HIMARS unit, its vulnerability is fur-

<sup>1</sup> U.S. Department of the Army. Protection. (Army Doctrine Reference Publication 3-37. 2012), 1-10.

<sup>2</sup> "The force field artillery headquarters... is normally the senior field artillery headquarters organic, assigned, attached, or placed under the operational control of that command. The supported maneuver commander specifies the commensurate responsibilities of the force field artillery headquarters and the duration of those responsibilities." U.S. Department of the Army. Fires (Army Doctrine Reference Publication 3-09, 2012) 2-23.

The 17th Field Artillery High Mobility Artillery Rocket System and radars vulnerability assessment. (Courtesy illustration)

Unit	Time on Location	# Fire Missions Processed	Risk Assessment	Notes/Recommendation
17 <sup>th</sup> TOC	96 hours		LOW	
17 <sup>th</sup> TAC	12 hours		LOW	
A/5-3 FA	72 hours	125	HIGH	Received IDF 7/hour
B/5-3 FA	24 hours	25	MEDIUM	
A/1-94 FA	72 hours	0	LOW	Recommend move; No shaping fires executed.
B/1-94 FA	12 hours	15	LOW	
A/17 <sup>th</sup> Radar	96 hours		LOW	
B/17 <sup>th</sup> Radar	96 hours		LOW	
No Move Required		Deliberate Survivability Move		Hasty Survivability Move
<ul style="list-style-type: none"> <li>No direct fire or IDF received</li> <li>No offensive CBRN used</li> <li>M26A2 can effectively shape I Corps' fight (Pending critical CLV shortages)</li> </ul>		<ul style="list-style-type: none"> <li>IDF received in volleys of 6/hour</li> <li>Offensive CBRN effects used</li> <li>Loss of M26A2 range effects within 12 hours</li> </ul>		<ul style="list-style-type: none"> <li>Direct fire from PLT (+)</li> <li>IDF received greater 6/hour</li> <li>EW effects noted</li> <li>M26A2 no longer shapes I Corps' fight</li> </ul>



ther enhanced because it can operate at a greater range — thus the AO's rear area can be much larger. As friendly combat forces maneuver into the enemy's AO, they must bypass smaller units in order to maintain the initiative toward the final objective. It is expected the enemy will operate with a degree of impunity as they cannot be comprehensively engaged. Protecting 17th Field Artillery Brigade is challenged by enemy Special Purpose Forces and bypassed enemy forces executing disruption operations in I Corps' rear area. This vulnerability makes prioritizing I Corps' available maneuver assets critical. A HIMARS battery must rely on dedicated nonorganic security packages to secure position areas for artillery (PAA). Doing so will enable the HIMARS battery to continue to shape the deep fight unmolested. For ease of command and control as AOs shift, a case can be made that the allocated security package be under tactical control to 17th Field Artillery during the operational phases requiring security. It must be noted these security packages must be both robust and mobile to stay with a battery of HIMARS as they execute survivability moves to new PAA.

While a HIMARS unit is distinct in the mode of which they deliver artillery strikes, it possesses many of the characteristic vulnerabilities that are found in traditional artillery brigades. The assessment of the inherent vulnerabilities is not a mental exercise and should always end with recommendations on how to protect the force. The risk of employing the force in one fashion should list out exactly what risk the brigade commander is assuming by choosing a particular force posture. For example, an artillery unit's signature on the battlefield can influence the force posture and defensive measures adopted. If the signature is managed haphazardly, it becomes an indicator that allows enemy forces to mass direct or indirect fire on the unit. A HIMARS' "signature" on the battlefield is defined by the number of fire missions processed while operating within PAA. The risk to Soldiers and equipment is directly proportional to this ratio and can be mitigated when the HIMARS execute survivability moves. An example of a HIMARS and radars vulnerability assessment (opposite page). Battery commanders are empowered to execute deliberate survivability moves or a hasty survivability moves



*Soldiers in 17th Field Artillery Brigade participate in a live-fire exercise. (Courtesy photo/17th FAB)*

based on the commander's guidance. The 17th Field Artillery commander establishes the survivability move criteria during the military decision-making process (MDMP) and modifies the conditions as the mission matures.

The complexity of protecting the force is further compounded when 17th Field Artillery is designated as the FFA for I Corps. An FFA headquarters synchronizes the activities of each field artillery brigade under it, but must do it with a small staff in relation to the task. Furthermore, a typical FA brigade does not have the staff that would be seen in brigade combat teams (BCTs). For example an infantry BCT would have military police officers to assist in police marshalling activities, explosive ordnance disposal (EOD) advisors, and an engineer officer to plan survivability operations. An FA brigade is not assigned those staff complements so the inputs must be generated at I Corps to help the FFA protection cell determine the scheme of protection. This requires the FFA staff to integrate seamlessly with I Corps to garner information required to protect the force. It is at this touch point with I Corps that affords the FFA protection cell the ability to help facilitate the coordination of protection assets for the counter-fire headquarters and division artillery units. The integration is just one component to ensuring a robust protection cell. In order to develop synchronized efforts, the structure of the brigade protection cell must be clearly defined. There are 14 different tasks that fall under the responsibility of the protection WFF.<sup>3</sup> Each of these supporting tasks derive inputs from the other WFF and specialty staff. Units that fall under the FFA umbrella must be prepared to bridge capability gaps that are present at each re-

spective brigade due to the lack of organic assets and available staffing. Simply put, the designated FFA "protection chief" must synchronize both organic and nonorganic assets so that the assessed critical asset list remains protected. Seventeenth Field Artillery Brigade chose to designate its chemical officer to be the protection chief, but the role can also fall on the air and missile defense officer.

Commanders apply combat power according to the inputs generated from the analysis of the six WFF for unified land operations. The application of each WFF input to the collective organization allows shared understanding to occur with the commander and his staff from the start of MDMP until the end of the operation. Each commander is able to tailor the information garnered from the WFFs through their leadership for their unit organization. Within an FFA headquarters, the protection cell gathers input from the other WFFs and offers recommendations on how to best preserve the force. A stout FFA protection cell will minimize combat losses to I Corps' longest reaching asset — a cost I Corps cannot afford in a decisive engagement.

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*Capt. Nicholas Calangi is the 17th Field Artillery Brigade chemical officer/protection chief. Commissioning out of Loyola University Chicago, his previous assignments were 2nd Battalion, 22nd Infantry Regiment; 3rd Squadron, 71st Cavalry Regiment; and 7th Engineering Battalion.*

<sup>3</sup> Supporting tasks include: (1) conduct operational area security, (2) employ safety techniques, (3) implement operational security, (4) provide intelligence support to protection, (5) implement physical security procedures, (6) apply anti-terrorism measures, (7) conduct law and order, (8) conduct survivability operations, (9) provide force health protection, (10) conduct chemical, biological, radiological, and nuclear (CBRN) operations, (11) provide EOD and protection support, (12) coordinate air and missile defense, (13) conduct personnel recovery, and (14) conduct internment and resettlement.

# Enabling decisive action in Korean theater of operations

By Lt. Col. Michael Fisher



*Soldiers with the 2nd Infantry Division board CH-47 Chinook helicopters during an air assault raid. (Capt. Richard Packer/U.S. Army)*

One of the unique aspects of 2nd Infantry Division/Republic of Korea-U.S. Combined Division's responsibilities, and the operating environment in the Korean Theater of Operations (KTO), is the Counter Weapons of Mass Destruction (CWMD) mission. The focus is specifically on counter-proliferation of WMD which creates some distinctive requirements with respect to decisive action (DA). The most significant issue is that U.S. forces are not assigned an area of operations in the KTO because the Republic of Korea forces are "land owners" and the U.S. are an enabling force with a specific mission. Even with the discreet nature of the CWMD mission, task forces conducting CWMD operations require the ability to conduct DA in the course of their CWMD operations. This applies to DA while en route to, or while on, their objective.

A CWMD TF will transit through multiple ROK Unit areas of operation while

en route to their objective. Without prior coordination, the TF has no control over the ground they are transiting or air space above them. During 2nd ID/RUCD's Warfighter Exercise 18-02, it was necessary for the 2nd Armored Brigade Combat Team, 1st Cavalry Division to conduct a wet-gap crossing (WGC) to reach a specific WMD site. In order to enable the TF commander's ability to employ organic capabilities, the division established an operating area over the WGC site that included the ground and air from surface to 20,000 feet mean sea level. This operating area provided the TF commander with the authorities to use organic capabilities (artillery, mortars, unmanned aerial vehicles [UAV]) and to control attack aviation. In order to establish the operating area, the division coordinated with adjacent ROK units and with the battlefield coordination detachment to publish coordination measures in the air coordina-

tion order. This enabled the TF to employ screening and obscuration Fires, employ their organic UAV, and suppress enemy attempting to delay the TF at the WGC.

U.S. forces conduct similar coordination when conducting their CWMD mission. Division enables DA by establishing areas of operations, providing TF commanders the ability to employ all organic weapon systems and control of enablers like attack aviation and close air support (CAS). To mitigate the risk of fratricide, U.S. forces must establish appropriate control measures between the CWMD TF and ROK Isolation Forces. We use the same process and same control measures to enable the CWMD TF during site exploitation operations. Direct-fire control measures are even more important with ROK forces being directly adjacent to the objective. To help define these direct fire control measures,



the objectives are broken down into three concentric zones:

- Zone 1 – ROK Isolation Force
- Zone 2 – CWMD TF Security
- Zone 3 – WMD Site Exploitation Operations

The U.S. area of operations includes only zones 2 and 3. The boundary between U.S. and ROK forces is the line between zones 1 and 2. This boundary also serves as a restricted fire line (RFL). The air space associated with the WMD site may follow the contours of the RFL or may extend beyond the TF footprint if necessary to enable UAV operations, attack aviation or CAS. These authorities enable the CWMD TF commander to conduct limited DA in support of the CWMD mission.

Coordination for operating areas is done at the division level. The Division Fires Support Element templates the area of operations 15 days prior to execution in

accordance with priorities established by the higher headquarters during the Operational Effects Working Group and in accordance with the division's planning horizons. Brigade liaison officers participate in the plans synchronization meeting and the targeting process. They are able to conduct parallel planning against emerging WMD sites as the division conducts shaping operations for the CWMD TF. The CWMD TF is responsible to refine the parameters of the area of operations at least 72 hours prior to execution. The division is responsible for providing accurate locations of adjacent ROK units, to coordinate with Special Operations Forces, and to ensure fire support coordination measures are in place. During the WGC, the TF was unable to employ timely 'Fires' in support of their WGC because the controlling headquarter could not verify the location of SOF units in the area. Templating the area of operations 15 days

prior to execution provides ample time for liaison officers at the division level to coordinate with subordinate units, even if their mission only allows them to check in with their higher headquarter periodically.

U.S. commanders and staffs operating in Korea need to understand that they are operating in the Republic of Korea's areas of operations, and need to coordinate appropriately. If coordination is done early, commanders can bring to bear their full range of capabilities during decisive action and in support of the CWMD mission, despite the unique environment of the KTO.

*Lt. Col. Mike Fisher has served in numerous command and staff positions and deployed multiple times in support of the Global War on Terrorism. He has worked closely with partnered and allied militaries and he currently serves as the deputy fire support coordinator for 2nd Infantry Division/Republic of Korea-U.S. Combined Division.*

# Letterkenny Army Depot overhauls Avenger system

By Nora Zubia and Ron O'Donnell

In support of one of the Army Chief of Staff's priority initiatives, Letterkenny Army Depot, a subordinate unit of the U.S. Army Aviation and Missile Command, recently completed the overhaul of 72 Avenger systems.

Air and missile defense capabilities that ensure our Soldiers are protected from modern and advanced air and missile delivered Fires including drones, is one of six modernization priorities laid out by the U.S. Army Chief of Staff, Gen. Mark Milley, last fall.

The 72 Avengers will be used as part of the European Deterrence Initiative, a series of defense initiatives that enhance the United States' deterrence posture and improve the readiness and responsiveness of U.S. forces in Europe.

"This capability gives combat units the ability to maneuver, even when facing threats from close air attacks," said U.S. Army Aviation and Missile Command commander Maj. Gen. Doug Gabram. "That's a key component of what we need to fight and win."

The AN/TWQ-1 Avenger is a fully automated, short-range air defense system. It is mounted on a M1097A1 HMMWV chassis, making it highly mobile and easily transportable. The surface-to-air missile fire unit has eight Stinger missiles in two missile

pods. The system is capable of acquiring, identifying, tracking and engaging targets from a stationary or moving position.

With national security interests to protect maneuver forces increasing, Letterkenny was selected to overhaul and recapitalize 72 Avengers, a full complement for two battalions.

In order to build 72 operational Avenger systems to support the European Command mission requirements, U.S. Army Aviation and Missile Command inspected and overhauled legacy Avenger systems that were stored in Pennsylvania and had been awaiting disposal.

Starting in March 2017, Letterkenny's workforce carried out the "overhaul" process of rebuilding or replacing all of the major components on the Avenger system. The entire process took more than 110,000 man hours with the work taking place across 21 of the depot's work centers.

The Letterkenny team disassembled the majority of the Avenger system by removing the turret assembly from the truck, then separating the cab from the chassis. Each turret was further disassembled; cables, line replacement units and chassis each sent to separate buildings where the parts were either rebuilt or replaced. All sub-components were torn down, inspected, re-assembled and tested to ensure 100

percent compliance with original equipment manufacturer specifications.

After each system was reassembled and received a fresh coat of paint, the depot staff put the system through final testing before being processed for shipping. The Letterkenny team completed the Avenger overhaul mission on schedule and millions under budget. Their efforts generated a significant savings while simultaneously providing recovered assets for the program.

The Avengers will be shipped to Germany, where one battalion set will be activated and the other battalion set will be placed in prepositioned storage.

*Nora Zubia is a Letterkenny Army Depot Public Affairs specialist. She previously worked for the installations Directorate of Operations Planning and Support in the Industrial Business Division and the Enterprise System Support Office. Zubia holds a bachelor's degree in Journalism and Media Studies from the University of Nevada, Las Vegas.*

*Ron O'Donnell, is the Route Clearance Vehicle Portfolio manager for the Directorate of Operations Planning and Support at Letterkenny Army Depot. He was previously the Logistics Management specialist for the Avenger Program and has been at the depot since 2015. O'Donnell is a retired U.S. Army chief warrant officer 4.*

*The LEAD workforce stands in front of the rebuilt Avenger Systems in the back garage of maintenance facility, Building 350. (Courtesy photo)*



# Targeting with a combined staff

By 2nd Infantry Republic of Korea/US Combined Division

The Korean Theater of Operations presents challenges across multiple domains due to the threat of weapons of mass destruction (WMD). Through unified actions, 2nd Infantry Division/Republic of Korea-U.S. Combined Division targeting methodology is nested with Eighth Army, Ground Component Command and United States Forces Korea, in order to achieve the desired effects. This also includes the targeting priorities of all three higher commands. Every target nominated requires a combined

effort across the peninsula to ensure lethal and non-lethal targeting efforts are weighted across all 2nd ID/RUCD objectives to achieve synergy in a combined process.

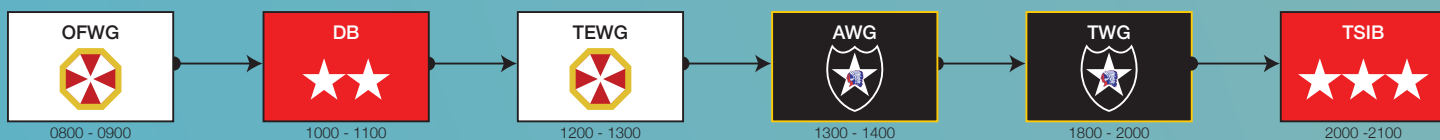
The 2nd ID/RUCD is the only fully combined organization on the peninsula with a primary mission of Counter Weapons of Mass Destruction (CWMD), which is paramount in the Korean Theater of Operations. Targeting in 2nd ID/RUCD is driven by a framework consisting of two ancillary working groups (assess-

ment working group/targeting working group) and one decision brief to the 2nd ID/RUCD commanding general. Nested within the framework are Eighth Army operational effects working group (OEWG), targeting effects working group (TEWG) and the targeting senior integration board (TSIB), which serves as a facilitator to the division's process. A very unique function in 2nd ID/RUCD is the co-chair of the assessment working group and targeting working by the fire support coordinator and the 48th Chemical Brigade commander. The working group and two boards are 2nd ID/RUCD battle rhythm events. There are several ancillary working groups based on different Warfighting Functions (WFFs) that happen outside of this framework, but populates the process to ensure there is cross-domain synergy (Figure 1).

Second ID/RUCD targeting is based on the isolation zone establishing for a WMD site. The site is a part of the network, which must be understood in order to achieve effects on a critical node within the network. The exploitation of these sites provides valued intelligence in shaping the network. Within the 2nd ID/RUCD site exploitation concept of operations, there are three layers: the outer zone or Zone 1, which is Republic of Korea Army-led; center zone or Zone 2, which is U.S./coalition force; and inner zone or Zone 3, which is the U.S.-led exploitation zone. The majority of the external coordination with ROK forces is achieved through 2nd ID/RUCD's combat advisor team. These teams are collocated with the four separate ROK Corps headquarters within Third Republic of Korea Army's area of operations (AO). The TWG also serves as an integral portion for coordination and war-gaming of target nominations with the combined staff. This working group consists of U.S. and ROK Soldiers from different WFFs collaborating on target sets to obtain the commanders desired effects. This allows for the targeting team to focus and synchronize the unit's combat

Figure 1. The 2nd Infantry Division/ Republic of Korea-U.S. Combined Division Targeting Framework depicted over a 24-hour cycle. (Rick Paapel Courtesy information)

## 2ID/RUCD Targeting Framework



### Legend

- Operational Effects Working Group (OEWG)
- 2ID/RUCD Decision Board (DB)
- Assessment Working Group (AWG)
- Targeting Working Group (TWG)
- Targeting Senior Integration Board (TSIB)
- Targeting Effects Working Group (TEWG)

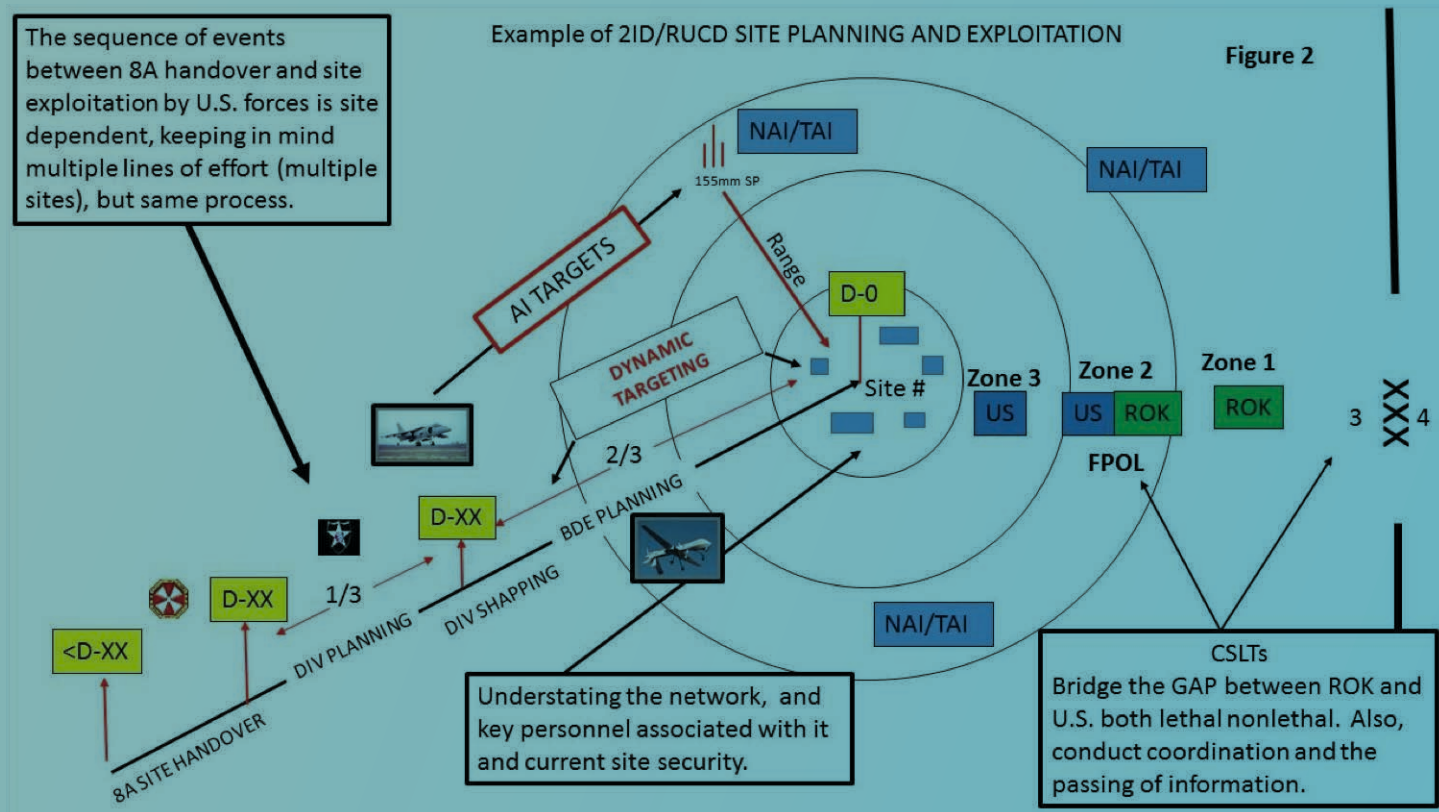


Figure 2. An example of an isolation zone within, 2nd Infantry Division/ Republic of Korea -U.S. Combined Division weapons of mass destruction site. (Courtesy illustration)

power and resources towards shaping sites and continued effort to assess high-payoff targets (HPTs) by the field artillery intelligence officer (FAIO). See Figure 2.

Second ID/RUCD's Targeting Team initiates the decide, detect, deliver and assess (D3A) with the Eighth Army OEWG, which provides 2nd ID/RUCD and 17th Infantry Division ROK prioritization of sites within the ROK Corps AO. The handover process for sites occur from Eighth Army with a 15-day threshold to allow for 2nd ID/RUCD to shape prior to ROK isolation.

The outputs/guidance from the OEWG drive the assessment working group (AWG), which serves as the decide function and produces answers to the following questions:

- What sites should be shaped?
- What determines the size of the isolation zone?
- What are the ROK targeting priorities?
- When and where are the ROK in the isolation process?
- What major subordinate command (MSC) will exploit the site?
- Who is authorized to exploit the site? Resource allocation?
- Does it answer the 2nd ID/RUCD commanding general's three questions?
- Who is in charge?

- Can we do what we said we can do?
- Do we have the resources necessary to accomplish the mission?

The primary products to capture this information are as follows: HPT list, attack guidance matrix (AGM), target synchronization matrix (TSM), target assessment and target taxonomy (as required). The 2nd ID/RUCD staff develops the recommended HPTs. The HPTL is prioritized list of targets based on the threat posture to a site and the isolation zone. Once approved by the commanding general, the HPTL provides the overall focus and sets priorities for intelligence collection and shaping planning.

According to (Joint Publication 3-60), the detect phase is designed to acquire the targets selected in the decide phase. In this phase, target acquisition assets and agencies execute the intelligence collection plan and focus on specific areas of interest within 2nd ID/RUCD prioritized WMD sites. Targets must be monitored after detection (especially mobile targets) such as a scientist tied to a network. Tracking is an essential element of the detect function. Tracking priorities are based on the commander's concept of the operation and targeting priorities. Detection and tracking are executed through the use of the collection plan.

The 2nd ID/RUCD detect function (with

the assistance of Eighth Army) focuses mostly on synchronizing organic collection with theater- and national-level assets. This helps answer 2nd ID/RUCD commander's priority intelligence requirements (PIR). In the Republic of Korea, unlike other areas of operation, intelligence, surveillance and reconnaissance (ISR) is used for the refinement of the WMD common operating picture and supporting MSC operations. Utilization and ISR assets by phase and WMD priority, is described below:

- a. Information collection (IC) posture options: During phase III, 2nd ID/RUCD commander request allocation(s) from Eighth Army on theater-level ISR capabilities.
  1. Counter intelligence (CI) and human intelligence (HUMINT): 2nd ID commander request allocation(s) of CI and HUMINT collection capabilities to increase support to force protection, and collection against North Korean WMD network personnel.
  2. Unmanned aerial systems: These systems can provide time sensitive imagery through imagery intelligence, full motion video and moving target indicator. These capabilities are used against known and suspected WMD sites, support targeting and answer

PIR. They are used to set conditions and allow MCS's freedom of maneuver as they prepare to exploit WMD sites.

b. Second ID/RUCD IC Priorities (PHASE III): Examples; WMD (by priority), Special Operations Forces (observers included), fire support (FS) that directly affect WMD sites and guerilla operations.

The deliver function of 2nd ID/RUCD is to shape operations outside of Zone 1 (ground unit boundary). The intent is to isolate a site by engaging targets based on the threat template in zones 1, 2 and 3. During 2nd ID/RUCD targeting working group, the staff identify targets that affect the maneuver units' ability to execute operations. Once HPTs have been located and identified, they are engaged based on the commander's approved AGM.

During dynamic targeting (from D-10 to execution), the FAIO executes emerging targets of opportunity and identifies any systems that could potentially disrupt current and future site exploitation. The FAIO, based on his assessment, informs the staff of any changes to enemy disposition, composition, and tactics that can affect operations. The information given by the FAIO and the analysis and control element (ACE) is then war-gamed during the TWG for possible changes to the HPTL and the TSM. The TSM allows the staff to identify, prioritize and synchronize both lethal and non-lethal effects based on 2nd ID/RUCD and Eighth Army capabilities. Division artillery targeting officers provided precision-Fires capabilities to complement those nominations requiring that level of fidelity for submission into the joint targeting cycle.

Throughout all the phases of the operation, 2nd ID/RUCD provides lethal and non-lethal means to achieve the commander's desired effects. When an emerging target exceeds 2nd ID/RUCD's capability of engagement due to restrictions or range, it is sent to Eighth Army for coordination and de-confliction through the liaison officer for engagement by other U.S. units or ROK forces. Second ID/RUCD targets that are nominated to Eighth Army for engagement will be included on the joint targeting cycle. The execution date of the target can be determined by the CAGER/ATO and the target progress can be tracked through each decision board during the target review assessment. This will answer one of the commanding general's questions, did we do what we said we can do?

The outputs and guidance from the AWG drive the TWG, serving as the assess function. The principal products utilized to capture the assessment within the area of operations is the TSM, and the target nomination card. Within each of these products we are able to answer if the division is doing things right: measures of performance (MOP) and doing the right things, measures of effectiveness (MOE).

The AWG within the 2nd ID/RUCD framework allows for the following key assessment questions to be answered:

- Where are we right now? (Time and space)
- What are we wanting to achieve/desired effects? (MOE)
- What did we achieve?
- What do we want to do next?
- Should we reengage?
- Should we adjust plan? (MOP)
- Should we reallocate resources? (MOP)
- Where do we accept risks?
- Is this the end of mission?

Being able to address these concerns/questions allows the division staff to further assess current conditions within the operational environment, determine the readiness of the friendly force to execute WMD operations, evaluate the progress of the execution of operations and refine the varying effects the friendly force is having on the adversary.

Targeting is a complex process that requires proper planning and integration throughout the division. The 2nd ID/RUCD Targeting Team accomplishes this by formalizing a deliberate and dynamic targeting process; focused on both deep and close Fires and effects that set favorable conditions for our MSC and ROK units. The division targeting team's overall objective is to holistically shape the opposing force's combat power to provide a relative combat advantage for MSC's. This is achieved by effectively selecting and nominating HPTs in the threats within the site, through both lethal and nonlethal actions, in order to achieve the commander's desired effects.

Chief Warrant Officer 4 Rico Bussey is the 2nd Infantry Division targeting officer, at Camp Red Cloud, Republic of Korea. Bussey's military schools include, Special Operation Tactical Controller Course, Air Assault Course, Personality Network Course, Military Deception Course, Information Operation Course, Fire support Coordinator Course, Warrant Officer Candidate School, Warrant Officer Advance Course, Advanced Field Artillery Tactical Data

Course, Joint Fires and Effects Course, Collateral Damage Estimation Course, Precision Fires Course, Master Resiliency Trainer Course and the Total Army Instructor Trainer Course.

Chief Warrant Officer 3 Andres Giraldo is the 2nd Infantry Division targeting officer at Camp Red Cloud, Republic of Korea. Giraldo's military schools include, Tactical Information Operation, Collateral Damage Estimation Course, Precision Fires Course, Joint Air Operations Command and Control Staff Course, Joint Targeting Course, Joint Firepower Course, Joint Fires and Effects Course, Red Team, and he is a graduate of the Warrant Officer Advance Course.

Chief Warrant Officer 2 Rafael Rijos Negron is the 2nd Infantry Division Field Artillery intelligence officer at Camp Red Cloud, Republic of Korea. He graduated from Field Artillery Warrant Officer Advance Course, Joint Air Operations Command and Control Course, Army Airspace Cadre Course, Digital Master Gunner, Battle Damage Assessment Course, Joint Targeting School, Digital Master Gunner Course, JADOCs Operation Course, AFATDS Operators Course, Electronic Warfare Course, Collateral Damage Estimate Course, Target Mensuration Only Course, and Joint Weaponneering Course.

Chief Warrant Officer 2 Rafael Fernandez is the 2nd Infantry Division targeting officer, at Camp Red Cloud, Republic of Korea. Fernandez's military schools include, Precision Fires Collateral Damage Estimation Course, Joint Air Operations Command and Control Staff Course, Joint Targeting Staff Course, Precision Fires Weaponneering, Joint Firepower Course, Army Operational Electronic Warfare Course, Precision Fires Target Mensuration and he is a graduate of the Field Artillery Warrant Officer Advance Course.

Chief Warrant Officer 4 Juan Gutierrez is the 2nd Infantry Division targeting officer at Camp Red Cloud, Republic of Korea. Gutierrez's military schools include the Personality Network Course, Army Operational Electronic Warfare Course, Precision Fires Target Mensuration, Precision Fires Weaponneering, Collateral Damage Estimate Course, Central Command Advance Collateral Damage Estimate Course, Joint Fires and Effects Course and Integrated Munitions Effects Assessment Course. He is a graduate of the Field Artillery Warrant Officer Advance Course and the Warrant Officer Intermediate Level Education Course.

# Running estimates for a fire support officer

By Capt. Timothy Lewin

This piece examines how current doctrine can be used by a fire support officer (FSO) to improve their ability to support their maneuver commander. It does this by presenting how the concept of running estimates found in Field Manual 6-0 (Commander and Staff Organization and Operations) relate to an FSO. Erring in this subject causes fire support officers to present over-complicated and irrelevant information to their maneuver commanders leading to either a lack of useful planning

guidance for the military decision-making process or a desynchronization of the Fires warfighting function during execution. FSOs will be more capable of supporting the commander's decision-making process and thus more effective to the unit during future and current operations at any echelon.

Maneuver commanders seek absolute excellence from their FSOs knowing they are trained, capable and willing to provide the best information available pertaining

to the Fires warfighting function. They know the end result of this partnership is an enemy that is disrupted, destroyed and ultimately defeated with a combination of fire support and maneuver. In today's complex world, FSOs face unpredictable and unknown environments with unique challenges. As the operational environment increases complexity across multiple domains with additional variables, friendly forces upgrade with diverse systems, and other warfighting functions get more





complicated. The U.S. Army possesses an array of capabilities, but also faces dilemmas with these systems. The challenge is to create multiple unsolvable dilemmas for the enemy, not ourselves. The field artillery community should revisit doctrinal basics on how to review with a maneuver commander on the integration of the Fires warfighting function with intelligence, sustainment, protection, mission command and movement and maneuver. The basis of this discussion involves the staff procedures and military decision-making process that are described in Field Manual 6-0. Commanders drive the operation process while the staff supports the commander. Their guidance for fire support is a function and result of the running estimates that the FSO provides to the commander during the mil-

itary decision-making process. This piece will examine how running estimates apply to an FSO and how they can enable their maneuver commander to utilize the Fires warfighting function to best accomplish the mission while integrating Fires assets into combined arms.

An FSO must understand what running estimates are defined as, how they support the operations process, and how they ultimately make the Fires warfighting function more viable. A running estimate is a “continuous assessment of the current situation used to determine if the current operation is proceeding according to the commander’s intent and if planned future operations are supportable” (Army Doctrinal Publication 5-0). To an FSO, running estimates assess current operations for the Fires war-

*Second Lt. Francis Buckley (right), a fire-support officer with the U.S. Army’s 2nd Battalion, 503rd Infantry Regiment, 173rd Airborne Brigade, trains soldiers from the Ukrainian national guard’s 3005th Regiment as forward observers for mortar and artillery fire. (Sgt. Alexander Skripnichuk/U.S. Army)*





ighting function as well as provides a better analysis for future operations. Units have various standard operating procedures that essentially do this. They take the form of commander's update briefs or trackers displayed around the main command post relaying information. Unfortunately, FSOs lose the conceptual understanding that though important, trackers, sync meet-

ings or commander's update briefings are a function of the information that the staff officer brings with them. Bad information inputted by the staff officer; potentially bad decisions outputted by the commander. FSOs must improve these products with an understanding that doctrinal running estimates are the baseline to ensuring a commander best understands the current and

is able to understand the future situation so that they may achieve a better visualization of the outcome and issue a better commander's intent and guidance for Fires. This ensures that any FSO will achieve a more viable, integrated and commander-nested fire support plan.

The first element of a running estimate starts with specified, implied and essen-

*First Lt. Maychee Zah, the fire support officer for C Company, 2nd Battalion, 325th Airborne Infantry Regiment, 2nd Brigade Combat Team, 82nd Airborne Division, and Spc. Andrew Auton, the company radio operator, observe indirect Fires during a combined arms live-fire exercise near White Sands Missile Range, N.M. (Staff Sgt. Jason Hull/U.S. Army)*



tial tasks. Within this step, specified tasks should be found first. To an FSO, specified tasks from an Annex D include assigned targets that they must observe, delivery systems they are assigned to execute fire support tasks and communication nets they are assigned to monitor (depending on the message routing and clearance of Fires procedure). Starting with assigned observers

for targets, FSOs understand that the superior echelon is specifically requiring that unit's observer to suitably observe those targets on the assigned communication channel when the trigger is achieved. With each TTLODAC (target, trigger, location, delivery system, attack guidance, communication method), one can start to see the various implied tasks that are associated

with that specified task. To suitably achieve the observer task for just one target set, many implied tasks are created and must be included in the FSO's running estimates. To establish an observer, the first implied task to the unit is to establish a primary and alternate observer platform. In order to determine this, the FSO must consider the trigger for when the target will be engaged. This will determine the observer platforms that they assign. For example, considerations the FSO must take into account already are the maneuver plan, the security plan of those observers, and the equipment necessary. The trigger also specifies the time in which that observer must be in position and ready to observe. This surmises that the FSO must develop implied tasks that determine the movement criteria for that observer to make movement to that position. The communication channel also possesses certain tasks associated with it. For instance, the observer must conduct various communication checks on that net with all involved command posts. It also implies the FSO decide how to develop their message routing and clearance of Fires procedure. If the trigger is quick and the target has a quick degradation time, then the FSO might consider developing an implied task that routes the observer straight to the superior echelon. If the FSO is assigned a delivery platform, then they have many implied tasks associated with that target. A requirement supposes the firing platform is in position ready to fire before the trigger is required. This also implies the same as the observer: a movement plan that incorporates various coordination measures and include timelines, routes and security plans, etc. The FSO must consider to properly synchronize and coordinate the warfighting function. After isolating the specified tasks and creating the necessary implied tasks from those specified tasks, the FSO needs to analyze the resources that must accomplish those tasks.

The next running estimates the FSO needs to examine are the assets available and the resource shortfalls for the tasks they just studied. It allows the commander to make educated decisions about resource allocation and better understand what resources to fight for from higher echelons. To identify these two categories, an FSO requires the tasks they determined in the previous step. Assets available are those resources that are directly needed to accomplish those tasks. For example, if a battalion fire support element is tasked to observe a

target at a given trigger, and that FSO identified implied tasks associated with that observation, then they must determine the observation equipment necessary to observe that target, the vehicle needed to meet the implied task of movement, and the personnel needed to operate that equipment. Furthermore, the implied task associated with communication indicates that the FSO needs to examine if they have the operational communication systems in order to meet the specified and implied tasks. An FSO should keep in mind the five requirements for accurate fire. These requirements allow the officer to codify requirements to deliver Fires and not forget critical actions to enable them. Once the FSO has identified these assets for every specified and implied task, they determine the availability, functionality and status of what is needed. If at any time there exists a shortage of manning, equipment or ability, then this becomes a resource shortfall. Thus by definition, specified and implied task accomplishment are diminished by the last of resources that cannot accomplish them. The commander and staff need to understand these shortfalls to either petition superior echelons for their procurement or to assume risk because the ways and means to an end will be out of balance. Identifying and briefing assets available and resource shortfalls in this way better informs the commander about mission accomplishment rather than just arbitrarily stating random equipment statuses that don't relate to critical tasks. Once resources are calculated, the FSO may determine restrictions upon the mission they are going to execute.

Constraints and limitations as running estimates allow the FSO to determine the restrictions placed upon actions that can be taken by their warfighting function. Constraints are restrictions imposed by commanders and staff at any echelon. They are restrictive in nature because they confine friendly actions and activities to either safeguard friendly forces, protect civilian populations or synchronize operations. Key constraints to an FSO involve all fire support coordination measures, airspace coordination measures, no-strike-lists and the rules of engagement. These may impose restrictions on the FSO's ability to accomplish their specified and implied tasks. For example, a coordinating altitude located below the maximum ordinate of the trajectory of a mortar round, implies that the echelon must contact the owner of the coordinating altitude measure. This implies that Fires

must be both centralized and approved by a higher organization and will take longer to execute or be denied by that echelon. Another example might include that the rules of engagement prohibit indirect fire into an area without the proper collateral damage estimation. This would imply that the executor of the fire mission would need the necessary software and capability to determine that estimation, further adding on time to fire mission processing. These constraints, though simple in nature, have vast consequences to the commander's ability to achieve responsive, accurate and effective fire support and must be incorporated into their understanding of the Fires warfighting function.

Secondly, the commander must also understand the limitations of the warfighting function. Limitations are physical restrictions imposed on the unit based upon the operational environment. Key examples include the physical range of the Fires weapon systems based upon the weather, terrain and ammunition available. For instance, the maximum range of a 120 millimeter mortar system might be 7.2 kilometers in perfect conditions, but in a colder, windier, adverse environment, the range might be significantly less. Limitations must always be updated based on current conditions. Firing units might not possess the maximum charge for their weapon platforms and thus will also have a decrease in range. If an FSO informs their commander of the perfect-conditions maximum range for their weapon systems, then their understanding will be skewed. Remaining data and information will finalize the running estimates for the commander.

Once the previous running estimates are determined, the FSO must isolate facts and if needed, make assumptions to bridge the understanding gaps that the staff might possess. Facts are pieces of information that are believed to be true at the time (FM 6-0). They are necessary to complete the commander's understanding because they allow commander's to process what estimates thus far are nested in truth. For example, the observer who had the implied task to move from one position to their observation post, their present position could be stated as a fact. This allows the commander to trust, based on their tacit knowledge, that this action is attainable. Facts could also take the form of coordinating instructions from higher level orders. For instance, if the unit is the priority of fire for a respective phase, this could be stated as fact. When facts are



unprovable, but the need for a running estimate still exists, an FSO must make an assumption to bridge the planning gap. An assumption is a supposition of the current situation or a presupposition of a future situation. For example, if the FSO does not know exactly how much ammunition the battalion mortar platoon possesses, but needs this information to determine either an asset available or resource shortfall, the officer might assume that they are 50 percent of their maximum capacity. Assumptions must be valid in that they are more likely true than not, and they must be necessary in that they serve a specific function to bridge a planning gap. A valid assumption in the mortar platoon example means that the FSO will determine something that is reasonable (Not 0 percent or 200 percent ammunition on-hand, these would be in-



Sgt. Matthew Nix (left), Pfc. Hunter Johnson (center) and Sgt. Jacob Robles (right), from 4th Battalion, 27th Field Artillery Regiment, use their equipment to coordinate with the Bradley Fighting Vehicle (top), and the fire direction coordinator during the unit's Table XII gunnery exercise March 28, 2018. (Staff Sgt. Matthew Keeler/U.S. Army)

valid assumptions). The staff officer also must constantly try to convert assumptions into facts. They can be achieved one of two ways. If the assumption made pertains to a subordinate unit, the staff officer will file a friendly forces information (FFIR) requirement questioning the very information that the officer needs to make the assumption a fact. An alternate option is to file a request for information (RFI) to the superior echelon asking them the necessary information to convert the assumption to a fact. Once FFIR and RFIs are published, the commander will know that the staff officer is taking an active role using mission orders to seek a better understanding of the situation. The FSO now has all of the running estimates necessary to better inform the commander about the current and future situations for the Fires warfighting function.

All of these running estimates provide the commander a better understanding of the state of the Fires warfighting function for both current and future operations. If done effectively and in concert with the rest of the staff and their respective warfighting functions, the commander can now issue better guidance and intent and the operation will be more successful. This solves numerous problems. First, this creates efficiency in the information that FSOs communicate to their maneuver commanders. Too often FSOs present irrelevant or inadequate information to their commanders during the military decision-making process. This leads to either no guidance for Fires given or the warfighting function being orchestrated in the wrong direction. Synchronization and integration with the maneuver fails and ultimately this leads

to a degradation of combat power. More unsolvable dilemmas are created and not enough forced upon the enemy. Mission command is based upon the commander's ability to drive operations that are supported by the staff. Becoming more proficient at this very simple idea will allow maneuver commanders to possess more trust with their FSOs and ultimately lead to winning in an increasingly complex world.

*Capt. (Promotable) Timothy Lewin currently serves as a Field Artillery Captains Career Course small group instructor at the Fires Center of Excellence at Fort Sill, Okla. He has served within various brigade combat teams as a battery commander, battalion fire support officer and staff officer.*

# Fires solutions for the division targeting board

By Maj. Gen. (retired) Richard Longo and Lt. Col. Jeff Schmidt

Having served as both a Mission Command Training Program senior mentor and Fires warfighting function chief over the last three years with a focus on division-level targeting for over 17 Mission Command Training Center warfighter exercises, we often see units struggle to get their targeting processes up and running at the start of an exercise. The causes are many. The most common of which are that all members of the team are not grounded in the targeting methodology and, quite simply, have not worked together as a team.

The purpose of this article is to provide the division “targeteers” with a starting point from which they can adjust for their own particular operating environments. These recommendations on how to conduct a targeting board at the division level can be modified to apply at different echelons of command.

As one division commander told us, “The targeting board is the single most important hour of my day.”

That is exactly as it should be. The board does several important things for the division. First, it ensures the division is fulfilling its responsibility to set the conditions for subordinate units’ success in future fights specifically by influencing “when, where and in what condition enemy forces commit to the close area” (Field Manual 6-0). We have seen divisions where both the main and tactical command posts become mired in the close fight. Second, it helps us gain access to resources outside of the division which are available to assist us in delivering effects. And finally, when executed well, it gives the commanding general a great snapshot of the integration of all warfighting functions over the next 96 hours.

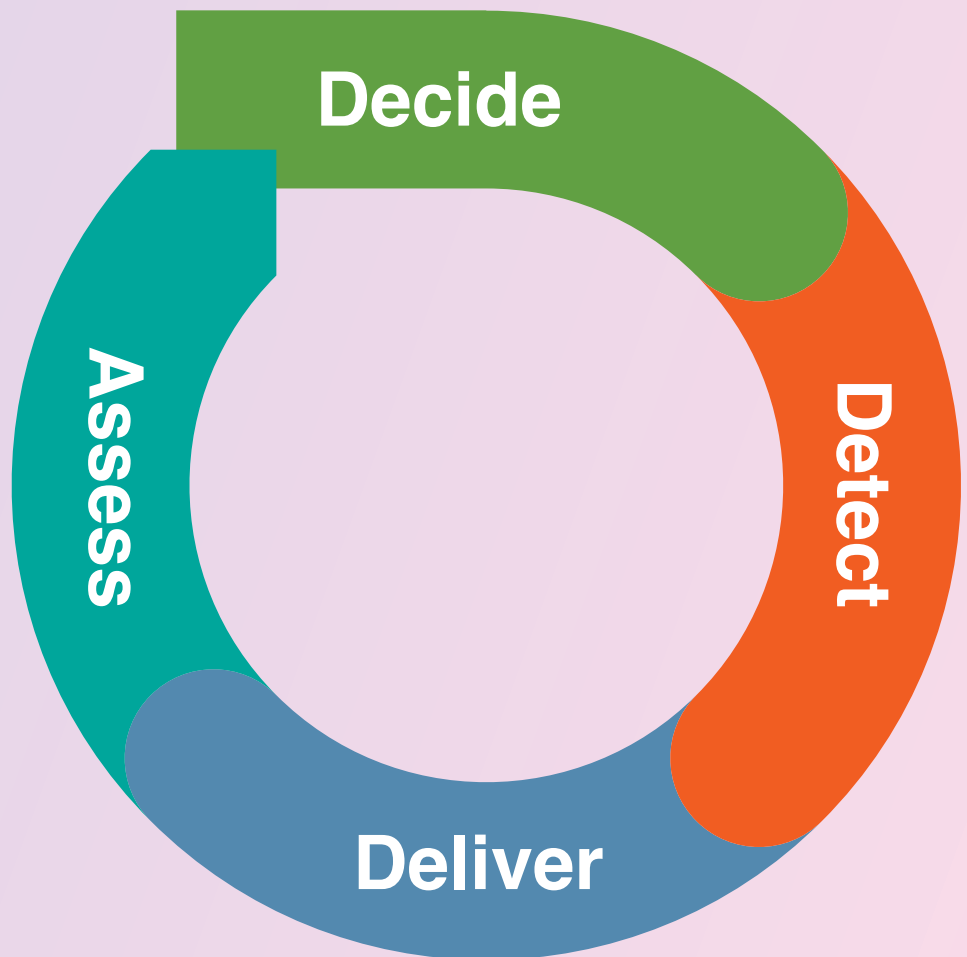
This article intentionally does not delve into the additional working groups and cells that support the targeting effort. Suf-

face it to say, the targeting board is the culmination of a myriad of different efforts captured in different working groups and cells. By describing what we consider a model targeting board, each of the feeder battle rhythm events that contribute to it should be optimized to make the targeting board the single point in which the commander can see the synchronization of intelligence, maneuver and Fires to shape the fight for the division. These battle rhythm

events include, but are not limited to, the targeting working group, assessment working group, cyber-electromagnetic activity working group, collection working group, intelligence synch and operations synch.

The fundamental organizing principle of a good targeting board is to use the framework of the Army’s targeting methodology of decide, detect, deliver and assess. We have not found a single operating environment in which this tool failed to provide the

Figure 1. The decide, detect, deliver and assess targeting process. (Rick Paape, courtesy information)



necessary structure to see ourselves, the environment and the enemy very well. When units stray from this organizational construct, it usually leads to a confusing flow and omission of key elements required to synchronize the division's shaping efforts.

### Targeting decision board

As a short preface, it might be useful to briefly describe the timing of the targeting board – where it best fits in the battle rhythm. There are two primary considerations with respect to the timing. The outputs of the division board serve as the inputs to the higher headquarters' targeting board. Therefore, the principle consideration of timing is to ensure the nesting of battle rhythms. Secondly, since the first decision the commanding general must make during a board is whether to re-attack based on our assessment, the board must be held early enough in the day (or the air tasking order cycle) so a re-attack decision can have an immediate effect.

To begin the targeting decision board, it is helpful to lay out decisions we will be asking the commanding general over the course of the meeting. These range from re-attack decisions that must be made immediately, to adjusting and refining previously made decisions in the H+24, 48 and 72 hour timeframes; and finally, the focus of collection and Fires for submission into higher headquarters processes that ultimately result in air tasking order, airspace control orders and the joint integrated priority target list.

### Assessment

Although we call the targeting process decide, detect, deliver, assess (D3A), we think it might be more accurate to call it A-D3-A because the cycle must start with a good assessment. We must start by asking the question, "What effect did we intend to have on the enemy by this time and did we have that effect?"

A common struggle with many training units is defining what they are trying to achieve with their shaping efforts. Too often, we hear "Sir, we intend to 'shape' the long-range artillery." The problem with this lack of specificity is that it is near impossible to assess our effectiveness at accomplishing that task. How do we know whether we really set the conditions for the future success of our subordinate units once the close fight is joined? We must provide much more detail in terms of enemy capabilities or combat strengths. We must have something we can measure so we can turn with confidence to the commander

and say, "We have had the necessary effects and have set the conditions."

An example of a better articulated targeting objective is, "We intend to reduce the capability of the enemy long-range artillery to mass on our forces at the wet gap crossing. We define that as destruction of 70 percent of his 9A52 Multiple Rocket Launchers (16 systems) that are within range and the disruption of command and control at the battalion and brigade level."

With that degree of specificity, we can measure the effects of our lethal and non-lethal efforts and make an informed recommendation to the commanding general. When we "assess" that we did not have the effects we intended, the commander must make one of three decisions: devote some of today's resources to meet the targeting objectives (re-attack), adjust the plan (e.g. delay the maneuver of ground forces) or finally, accept risk, which probably mandates a call to the subordinate commander who was counting on the promised effects.

Many units are not sure where they would get the specifics of the targeting objectives. For both deliberate and hasty planning, the best source is the discussions taking place during the wargame step of the military decision-making process. This is where we discuss details such as, "What do we need the correlation of forces to be at this point in the battle to ensure the success of our subordinate unit?"

A targeteer should be an intimate player in the larger wargaming process and then bring those detailed targeting objectives to the rest of the targeting team as they conduct their concurrent planning.

### Intelligence/operations update

The next key part of the targeting board is intelligence. This should include weather and operations updates to ensure the longer-range targeting process is linked to the current situation. We do not want to get "bogged down" in this current situation, but it helps many leaders organize their minds to link the current with future operations. The intelligence officer briefs the enemy's current disposition, composition and intent. The weather officer, usually from the United States Air Force, then briefs weather only as it impacts our operations during this time frame. The operations officer then briefs the current friendly situation much the same as the intelligence officer. This is sometimes augmented by a fire supporter detailing assets available to the division based on release of the air tasking order

and strengths and locations of various delivery assets.

This information and more importantly, analysis, sets the conditions for a discussion about the next 24 hours. This is generally a review of previously made decisions and refinements and an update on the acquisition of necessary enablers from outside the division. This discussion is usually very short and can go something like this, "Sir, three days ago you approved this approach and we are still on plan based on what the enemy and friendly forces have accomplished in the interim. We don't have the air tasking order yet, but in my discussions with our higher headquarters at their targeting meeting, I am confident we will get the collection and delivery resources we have asked for."

What is more likely is that the enemy will NOT have done what we predicted 72 hours before and we will have to make adjustments based on emerging changes to mission, enemy, troops available and time. This is how the dynamic targeting process is embedded in the deliberate process. We refine and adjust as the battle evolves. This allows us to do what every single division commander has asked us to do: fight the enemy, not the plan. It also forces us to do what has become a lost art, and that is refining our targets over time.

### Assess

After we receive the intelligence, weather and operations update, we look at H+24 through the lens of A-D3-A. First, we look at assessing whether our activities over time have had the effect we set out to achieve. "We have reduced the enemy long-range artillery's ability to impact the wet gap crossing by destroying 50 percent of his Multiple Rocket Launchers, but have not had any measurable effect on disrupting his C2 [command and control] capability. We are confident that with the air interdiction we have on station today and the electronic attack capability that we have requested for tomorrow, we will be able to meet our targeting objectives." A common shortcoming across the Army is failing to include the results of our higher headquarters' and adjacent units' shaping activity into our assessment. Many times, they are going after many of the same targets and capabilities. The best way to capture their efforts is through active participation in their targeting processes.

### Decide

During this portion of the H+24 discussion, we review the key decisions our com-

mander has made such as determining the prioritization of effort through the use of the high payoff target list, attack guidance matrix, fire support coordination measures and recommending any changes based on the emerging operational environment. Just as a review, the high payoff target list is a prioritized list of targets whose loss to the enemy will significantly contribute to the success of the friendly course of action. (Field Manual 3-09) The attack guidance matrix is a targeting product approved by the commander which addresses how and when targets are to be attacked and the desired effects. (Army Techniques Publication 3-09)

### Detect

During this portion of the H+24 discussion, we review our intelligence collection plan and determine if any adjustments need to be made. Often, our collection managers are new to the job as the warfighter training begins and they need coaching. Invariably, they will have broad swaths

and boxes all over the map linked to echelon-above-division collection assets with the thought process being “We will vacuum up everything and sort it out in the analysis control element.”

The much better approach is to focus specifically on the high payoff target list and describe in detail how they are going to find and track a specific target through detection, delivery and assessment. One division commander describes this as “putting a hook in him and never letting go.”

Another common shortcoming in the intelligence collection process is failing to adjust the plan when it is not working. There are two fundamental assumptions we must make. First, the enemy is there somewhere executing a plan. Second, with the totality of systems we have at our disposal, we can find the enemy if we are looking in the right place with the right asset. Too often we see no adjustment in the collection plan for several days even though we are not finding the things we have identified as

most important, the high payoff target list. Einstein’s definition of insanity may be too harsh, but we have to show some agility in adjusting our plans until we start to see some benefit.

One last common shortcoming in our collection plan is when we task one line of division full motion video (FMV) in the form of a Grey Eagle to both try to answer the commander’s priority intelligence requirements AND be used by targeting for detection and assessment. We have not seen this work successfully a single time and strongly recommend some division collection capability be devoted to the targeting effort.

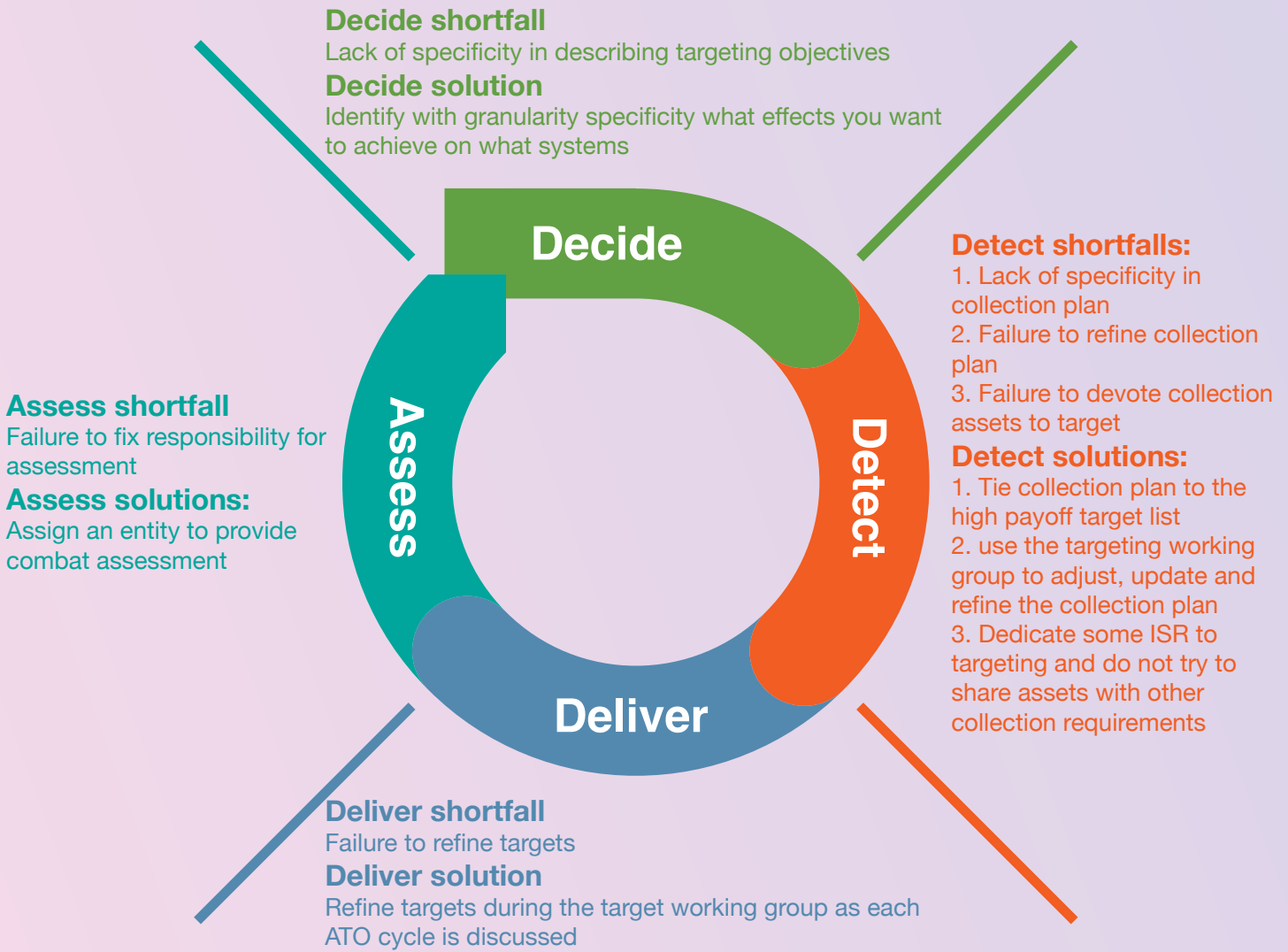
### Deliver

Again, at H+24, we are reviewing the delivery decisions we made three days ago and comparing them to the anticipated enemy and friendly situation during this time-frame to see what refinements need to be made. A couple of examples of things that could impact these adjustment decisions

Figure 2. An example agenda for a targeting board meeting. (Rick Paape, courtesy information)

<p><b>Purpose</b> Approve targeting priorities, collection assets and planning efforts IOT anticipate emerging requirements, make recommendations to the commander and ensure continued execution of both lethal and non-lethal targets</p> <p><b>Frequency</b> Daily</p> <p><b>Duration</b> One hour</p> <p><b>Location</b> Briefing tent</p>	<p><b>Chair</b> Commanding general or designated representative</p> <p><b>OPR</b> FSCoord</p> <p><b>Attendees</b> G2, SWO, G2 CM, CUOPS, G2 BDA, FUOPS, FUPLANS, G3 AVN, ENG, IO, CEMA, CMO, MISO, PAO, SJA, AMD, CBRN, ALO/TACP, Targeting officer, G4, LNOs</p>
<p><b>Inputs</b></p> <ul style="list-style-type: none"> <li>• Weather update (G2)</li> <li>• Operational timeline (G3)</li> <li>• G2 Assessment/BDA (G2)</li> <li>• Collection asset/delivery system status (CM)</li> <li>• Target nominations, 24-hour blocks (Fires)</li> <li>• Current HPTL/AGM, collection priorities (Fires)</li> <li>• Targeting Guidance</li> </ul> <p><b>Outputs</b></p> <ul style="list-style-type: none"> <li>• Updated HPTL/TSS/AGM</li> <li>• Targeting priorities</li> <li>• Target nominations</li> <li>• Synchronized IC plan</li> <li>• CG Guidance for future targeting</li> </ul>	<p><b>Agenda</b></p> <p><b>Assess previous ATO (last 24-48 hours)</b></p> <ul style="list-style-type: none"> <li>• Review operational timeline</li> <li>• SIGACT assessments</li> <li>• Tasks to effect review</li> <li>• Commander's guidance</li> <li>• OE updates</li> <li>• HPTL update</li> </ul> <p><b>Review next 24-48 hours and decisive operations</b></p> <ul style="list-style-type: none"> <li>• Weather impacts to operations</li> <li>• Enemy situation update</li> <li>• Lethal and non-lethal</li> <li>• Friendly situation update</li> <li>• Info collection emphasis</li> </ul> <p><b>Validate next ATO 48-72 hours</b></p> <ul style="list-style-type: none"> <li>• Weather impacts to operations</li> <li>• Enemy situation update</li> <li>• Lethal and non-lethal</li> <li>• Friendly situation update</li> <li>• Info collection emphasis</li> <li>• Initial consequence management</li> </ul> <p><b>Recommend/Approve ATO Cycle &gt; 96 hours</b></p> <ul style="list-style-type: none"> <li>• Friendly situation</li> <li>• Enemy situation (Predictive analysis)</li> <li>• Recommended AI, EW, IO nominations</li> <li>• Recommended priorities for 48-72 HPTL</li> </ul>





could be interim assessment from our higher or adjacent units that tell us they have met our targeting objectives with activity of their own, or we may have lost a resource we were counting such as destruction of a friendly artillery unit.

### Assessment

During this final phase of the H+24 discussion, we need to describe our plan for assessing our effectiveness. Divisions infrequently dedicate collection resources to assessment efforts and we therefore lose the ability to understand the effectiveness (or lack thereof) of our efforts. This leads us to redundant Fires with scarce resources, or worse, to not fully appreciate an enemy capability that still exists. We cannot have FMV everywhere. We need to broaden our scope of collection capability to include use of our subordinate units, other division "ints," special operations forces in the area, allied militaries, national assets, local resources such as civilians on the battlefield and non-governmental organizations, and when necessary, predictive analysis based

on acceptable models. A common problem in our "plan to assess" is that the responsibility is not fixed on any single entity, though we acknowledge the collaborative nature of the requirement. Some units use their Organizational Research and System Analyst to do this. Others place it in the G2 and still others put it in a subordinate unit, most often the division artillery. Wherever this responsibility is placed, the "Chief of Assessments" needs to be a part of the targeting process so he, or she understands what needs to be assessed, when and in what level of detail.

### H+48, H+72

This same format carries through in the discussion of H+48 and H+72, the plan for tomorrow and the day after tomorrow. Start with an intelligence assessment of likely enemy disposition, location, strengths and intentions. Follow with anticipated weather as it applies to our operations. Then have the G3 planner give a best guess of friendly disposition, strengths and missions. With that information as a

starting point, as flawed as it might be in a dynamic environment, then go through the same A-D3-A format. In many cases, there will be no change at this time. That is OK. Go through that part quickly. But again, remember that we should be making refinements to the requests for resources that we made previously.

### H+96

Finally, we get to the portion of the board where we need to extract the commanding general's guidance for our submission of requests to external organizations such as those described in the air tasking order (including detection and delivery assets), the full range of non-lethal capabilities, permission to use airspace and permission to shoot the Army Tactical Missile System. In most theaters, these requests must be submitted between 72 and 96 hour before execution. Some theaters may have more lengthy requirements and that is usually based on the number of intervening headquarters between the division and the joint force commander.

Most units find it useful to follow the structure we have described in chronological order detailing the 24, 48 and 72 hour efforts prior to asking for the necessary decisions in the 96 hour timeframe. The targeting team needs to protect against unnecessarily “re-wargaming” every time period.

Once again, the intelligence and operations officer must lead us off with a best guess of what the enemy and friendly dispositions, compositions and intentions are at this stage of the fight. Many are hesitant to make this prediction because of the very small likelihood of it actually playing out as predicted. There is some merit to this because, in effect, we are trying to predict what the enemy is going to do even before he decides using his very effective decision point tactics. However, we must use our best professional military judgement and make the prediction. Doctrinally, an event template, or EVENTEMP, (Army Techniques Publication 2-19.3) is the best tool for the intelligence officer to use. Without doing so, we will not be able to submit justifiable requests for external resources from which we can adjust as the picture becomes clearer.

We also must articulate to the commanding general what our higher headquarters and adjacent units are trying to accomplish during this timeframe. This information gives him a better overall context for operations.

## Decide

Next, we will walk the commanding general through the A-D3-A process and make recommendations on the necessary focus, guidance and decisions. During the decide phase of the briefing, we must provide a recommended and updated high payoff target list and attack guidance matrix based on the anticipated evolving operational environment. This is informed by all of our assessments to date as well as our understanding of emerging plans and operations. This must be tied to the intelligence and operations officers’ discussion of what the future fight will look like.

## Detect

Then we must describe with some specificity how we are going to find (detect) those high payoff targets, put a “hook” in them and track them through detection to assessment. We must talk specific targets, sensors, cuing of secondary sensors, likely named and targeted areas of interest and what specifically we are looking for. The commander must approve the focus of key

collection assets and have an understanding of the echelon-above-division capabilities available.

## Deliver

At this point, we need the commander to approve the general focus of lethal and non-lethal Fires. We don’t need him approving specific targets or even the method of engagement. We just need a general approval of the focus given the assets expected to be available. Our recommendation should sound something like “Sir, we intend to focus air interdiction on the enemy reserve tank brigade. We will focus Army Tactical Missile System on SA-20s and long-range shooters. We will use our Army attack aviation capability to destroy the remaining multiple rocket launcher systems associated with the committed division tactical group and we will suppress all remaining indirect Fires capability with our rocket systems.”

As we have discussed earlier, we will add specifics of our targeting objectives as we continue to conduct our analysis. We know that we will need to refine those targets from submission through execution. One common mistake we see is that the non-lethal subset of the team will be working a completely different set of priorities off a completely different high payoff target list. Emphatically, we want to say there is one priority list and it is the combination of all these capabilities that gives us the best effects.

## Assessment

As stated earlier, there must be a plan to assess and some of the assessments require a long lead time. The most common long lead time is when we need a special forces team to reposition in order to be where they can provide an assessment and that is not something that can be done without significant planning and time to execute. Another division commander said, “If it is important enough to do, it is important enough to assess.”

Our recent history has told us that lethal assessment, though not easy, is usually easier and timelier than non-lethal assessment. That must be accounted for in the targeting plan. Finally, we must acknowledge that the assessment plan must be continually refined through execution just like the detection and delivery plan.

Once the commanding general approves the focus of Fires and the refinement decisions presented throughout the meeting, the decision board is concluded, but the

work is not done. It is critical that the results of the targeting board be promulgated to the division staff, the subordinate units and the higher and adjacent units. The intra-divisional communication is usually a specific targeting fragmentary order (FRAGO), or the inclusion of the results into a division daily FRAGO. At the minimum, the FRAGO must include refinement decisions, the high payoff target list, the attack guidance matrix and a target synchronization matrix. The redundant yet very necessary back-up method of sharing this information is the work of the brigade liaison officers who participate in all phases of the targeting process and keep their units informed on a regular basis.

## Targeting

A good targeting process is essential to keeping the division focused at the proper depth in time, space and purpose. It also enables the aligning of resources with priorities in a constrained environment. The targeting board is fundamental to making the appropriate decisions and the organizing principle is D3A, or as we have suggested, A-D3-A. There are many common shortfalls that we have described throughout, however each of these is surmountable if addressed and understood by the key contributors to the targeting process. By using the recommendations included in this article, we are confident that divisions can overcome these easily fixed shortfalls and truly set the conditions for their subordinate units’ future fights.

*Maj. Gen. (retired) Richard Longo serves as a Mission Command Training Program senior mentor since his retirement while serving as U.S. Army Europe deputy commanding general. He conducted targeting at the battalion, brigade, division, corps, Army and Combined Joint Inter-agency task force level.*

*Lt. Col. Jeff Schmidt is the current Mission Command Training Program, Fires Warfighting Function chief for Ops Group Delta. He provides observation, coaching, and training to division, corps, and Army Service Component Command-level staffs. He has served in key field artillery billets from battalion through division, to include time as a target acquisition battery commander, deputy fire support coordinator, and field artillery brigade deputy commander. Schmidt has also served as a division chief of operations, a division chief of future operations, and an instructor at the Command and General Staff College, where he taught Joint Operations and Joint Fires.*



Soldiers assigned to 2nd Battalion, 17th Field Artillery Regiment, 2nd Stryker Brigade Combat Team, 2nd Infantry Division, perform calibration on an M777 howitzer during Decisive Action Rotation 16-03 at the National Training Center. Decisive action rotations give Soldiers a realistic training experience to enhance their skills, and prepare for future deployments. (Pfc. Kyle Edwards/U.S. Army)

# The right way to rehearse at NTC

By Lt. Col. Jonathan Shine

For years, observer coach trainers (OC/Ts) at the National Training Center at Fort Irwin, Calif., have been giving units the same feedback after their rehearsals, "That was a pretty good back-brief, but it sure wasn't a rehearsal."

When I came to the NTC as a fire support coordinator (FSCOORD), I was determined that I was not going to get that observation from my OC/T. I soon realized, however, that I did not really know what the difference was, or why it mattered. Even when I completed my rotation, I knew that I was not conducting effective rehears-

als, but I did not have model of "what right looks like" to draw on. During my year as Wolf 07, the senior FA/Fires OC/T, I have observed similar struggles with enough FSCOORDs to believe that this trend persists.

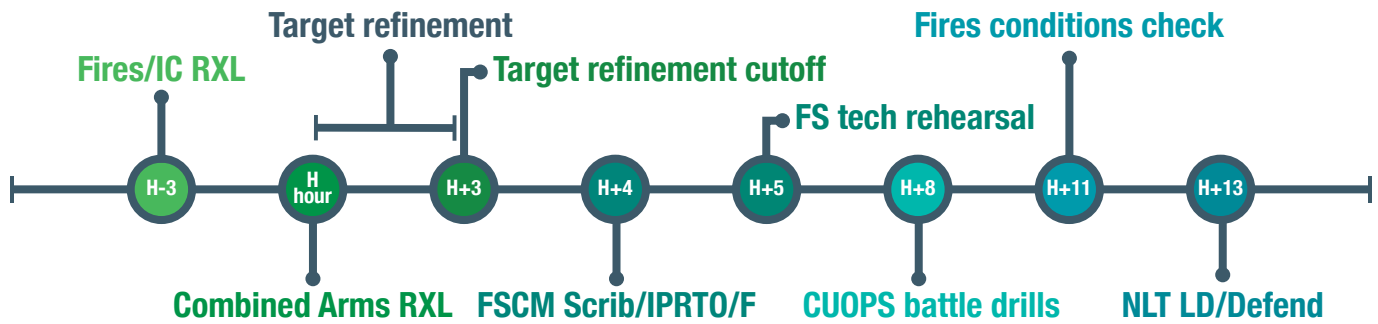
## Why?

The simplest explanation for why a planned rehearsal turns into a back-brief is that a rehearsal requires all participants to fully understand the plan from the beginning. With the extremely short timelines of action at the NTC, this is a luxury few units can achieve. In that case, a back-brief

is absolutely necessary. As a force, we have embraced the importance of rehearsals, but we place less emphasis on back-briefs as scheduled events prior to operations. Trying to rehearse a plan that is poorly understood is a waste of time. In a time-constrained environment, the FSCOORD may have to accept that a back-brief is the best the team can accomplish prior to the technical rehearsal.

## Think of it like sports

I played soccer in high school. When coach wanted to teach us a new play, he would first draw it up on a white board



Fire support coordinator's tasks based on H-hours. (Rick Paape, courtesy information)

(he called this a “chalk talk”) with X’s and O’s to represent each player on the field. The operation order brief is the brigade’s chalk talk. Afterwards, we would stand on the field and coach would physically place each player in their correct position. One at a time, we would walk through what we thought we were supposed to do, with coach correcting us if we had not fully understood our role. He called that “lineup.” Once we all knew where we were supposed to be on the field, we would move on to practice, where players moved and reacted with respect to their position to the ball, each other and the other team. This would start slowly, with the tempo increasing until we were ready for a scrimmage at “game speed,” with other players trying to stop us from scoring. That is a rehearsal.

### What’s the difference between a back-brief and a rehearsal?

A back-brief confirms that everyone on the Fires team understands their tasks, targets, triggers and observation responsibilities. It usually begins with the brigade combat team fire support officer (FSO) or FSCOOD describing the commander’s intent for Fires and the decisive point of the battle. Fire supporters should speak one at a time, with battalion FSOs typically briefing in regimental order following a pre-formatted script from the brigade’s standard operating procedure. During the back-brief, FSOs should cover the details of their targets (most often using the target, trigger, location, observer, delivery asset, attack guidance, communication net or TTLO-DAC method), and the FSCOOD injects little or no friction as the brief proceeds.

Once the team knows the plan, the FSCOOD can proceed to a BCT Fires rehearsal. Unlike a back-brief, the rehearsal is event-based. If the BCT has the initiative, then fire supporters move in accordance with the scheme of maneuver, calling out they are in position ready to observe, or IP-

RTO times and the targets as they meet the triggers. Adjacent players move at the same time, and if targets are triggered simultaneously, both FSOs call them out at the same time. The FDO allocates the targets to firing units and calls out the fire order for each mission as he receives them from the BCT. Simultaneously, the aviation representative and the intelligence collection manager move along the planned air routes for manned and unmanned aircraft in accordance with the air coordination order. These techniques help the whole team identify potential synchronization challenges and determine how to overcome them. In addition, the team works through the high payoff target list, rehearsing the entire kill chain as planned in the targeting process, from identification by a collector, through ground and airspace de-confliction, strike, and assessment communicated to the BCT commander. The FSCOOD, S2, or FSO induces additional, unplanned friction in the middle of the rehearsal (like opposing players during a scrimmage), with the Fires team reacting to the friction appropriately. The most obvious example is a counter-fire acquisition in the middle of a critical massed fire mission. At the end, the most successful FSCOODs will re-set the board and rehearse again, at an increased tempo. The FSCOOD continues to have the team “do it again” until he or she is comfortable with the level of understanding and coordination amongst the team. At the end of the rehearsal, a designated officer or non-commissioned officer reviews any required coordination that has been identified, and the FSCOOD directs the target refinement cutoff time and the time of the Fires technical rehearsal.

### The toughest constraint: time

When time is limited, the FSCOOD directs the most decisive or most complicated portion of the fight to rehearse, with players moving to their position on the ter-

rain model that they would occupy at that phase of the battle. Even in this scenario, re-rehearsing the critical event at faster speed after a walk-through may be a better use of available time than working through the entire target list, ensuring the decisive tasks are well understood and synchronized. Regardless of constraints, the Fires team must enforce a target refinement cutoff time and a disciplined Fires technical rehearsal. In establishing the cutoff time, FSOs and FSCOODs should consider the time required for FSOs to travel from the rehearsal site back to their own battalions and the time they need to conduct analysis and refine their targets and observation plan. From that point, time must be allocated to the BCT fire support element to validate the refinements and publish a refined target list worksheet (TLWS), and to the field artillery battalion fire direction officer to analyze the TLWS and conduct initial tactical fire direction. This allocation determines start time for the Fires technical rehearsal (see figure above).

A brigade Fires plan that is not rehearsed will not be responsive. Many FSCOODs and FSOs fail to execute an effective rehearsal either because they try to rehearse a plan that is poorly understood, or because they are simply unable to visualize what an effective rehearsal looks like. Adding a back-brief to the schedule, even if it occurs immediately prior to the rehearsal, ensures understanding of tasks and allows the team to truly rehearse the plan prior to execution. Thinking of the rehearsal in terms of sports practice, rather than a scripted military briefing, helps many FSCOODs direct a more effective and efficient rehearsal process.

*Lt. Col. Jonathan Shine is currently a student at the U.S. Army War College. Shine formerly served as a National Training Center senior fire support trainer.*

# The ground liaison officer

## Blending art, science to achieve success

*By Capt. Victor Cortese and Capt. Jesus Urrutia*

The ground liaison officer and noncommissioned officer positions are critical cogs in the wheel of air-to-ground integration. Unfortunately, the positions are often overlooked as opportunities for field artillery officers and senior non-commissioned officers to amplify their professional experience. Offered typically as broadening assignments for a senior captain and sergeant first class, the position provides unique opportunities to work with another service.

The Ground Liaison Detachment is assigned to a Battlefield Coordination Detachment but attached to an air wing or squadron away from BCD headquarters. The team functions autonomously and represents the United States Army as embedded advisors and enablers within a fighter, bomber or mobility wing. Perhaps most importantly, GLOs deploy as liaisons with

fighter and bomber wings and coordinate between ground elements and aircrews to maximize integration. The GLOs represent the Army and often brief commanders from sister services on tactical and operational updates and ground commander's intent.

Effective communication, detailed professional knowledge and technical savvy are all traits that contribute to the "science" of GLO service. However, transformative GLOs employ an "art" enabling them to anticipate, coordinate and verify requirements in today's dynamic global environments. They prove themselves invaluable resources to Army, Air Force and Navy units all over the world.

Simply stated, the inherent GLO mission is consistent: integrate with the supported squadron or wing and serve as a conduit to ground forces. Most critically, the GLO

provides real-time ground tactical and operational updates to air support assets. Yet the dynamic environments, missions and situations add complex layers to the GLO mission. While the intent is to deploy with the attached Continental United States squadron, operational requirements often dictate otherwise. For example, a GLO may deploy to support an Air Force squadron in Jordan and finish the deployment supporting a different squadron in Afghanistan. Or, a GLO may spend two months in Qatar at the Combined Air Operations Center and then six months aboard an aircraft carrier in the Mediterranean and Persian Gulf. As an Army officer, I never imagined myself aboard an aircraft carrier and briefing F/A-18 Hornet pilots on critical mission details prior to their launch supporting Operation Inherent Resolve. While this is just one unique example of many, it lends insight to the diversity of the GLO mission. Although not inherently associated with naval air wings, carrier air wing commanders (referred to as CAG) consistently request GLO support during deployment operations. Ground liaison officers have continuously supported carrier air wing operations since the start of the Global War on Terror and continue to do so in the fight against the Islamic State.

The drastic differences in support requirements call for a sharp understanding of different rules of engagement, tactical situations and commander's intent across the operational spectrum. Additionally, a robust knowledge of joint Fires capabilities and integration is critical; the Joint Fires Course is a fantastic block of instruction affording GLOs the opportunity to elevate their knowledge and understand the "science" behind joint operations. A successful GLO leverages technical knowledge and important character traits to balance the science and the art of their duty.

In today's advanced technological environment, information and intelligence sharing is easier. However, sifting through the volumes of information – commander's updates, read books, story boards and situation reports – takes dedication and attention to detail. It is crucial to filter the information and provide very busy aircrew with relevant and concise information. To do this, GLOs need to use email distribution, instant chat platforms and a common operating picture to maximize their own understanding and efficiently translate information to aircrew. Additionally, to capitalize on the inordinate amount of information



*U.S. Army Capt. Andrew Littell, 555th Expeditionary Fighter Squadron ground liaison officer, reviews information with a pilot before takeoff at Bagram Air Field, Afghanistan. As a GLO, Littell briefs pilots on mission parameters as well as provides pilots with a good perspective of what guys on the ground are going through. (Senior Airman Cierra Presentado/U.S. Air Force)*

and navigate dynamic situations, a GLO needs to build and maintain positive relationships with joint tactical air-controllers (JTACs), battle captains and operational or tactical planners. Tapping into the GLO network is also critical since our operational support expands across theatres. Sgt. 1st Class Chris Boyer, a recently deployed GLO shared, “Without the GLO network I would have been at a serious disadvantage. The more experienced GLOs, and those who had been deployed already in that capacity brought me up to speed quickly and efficiently helping to streamline my work load and serve as an immediate asset to the aircrews I supported.”

The wealth of knowledge and information shared between GLOs is essential to mission success. All in all, this takes professional tact and sometimes discretion in knowing when to push the right buttons to obtain necessary information. While reading reports and developing products involves the “science,” our relationship building underscores the “art.” It is important to understand that while dynamic changes are part of warfare, they significantly impact the aircrew’s mission planning. Changing support requirements including locations, munitions and time-on-station all critically impact flight operations. As a GLO, it’s critical to anticipate changes by maintaining

positive relationships with all key players in order to provide aircrews an advantage.

Anticipation is a catalyst for successful coordination and is crucial to enable an aircrew’s mission success. The GLO serves as the linchpin for that coordination. Pilots mission planning starts the day prior to their launch and involves detailed preparation and rehearsals. They consider immense amount of planning factors such as jet maintenance, routes, enemy air and air defense threats, fuel, weather and emergency procedures. They often do not have time to thoroughly coordinate with JTACs or interpret a vague joint tactical air request. These are important GLO functions. For instance, during service on the USS G.H.W. Bush we worked in the Carrier Intelligence Center providing critical information during the mass brief two hours prior to mission launches. While the mass brief served as our main information conduit, pilots often visited our workstation for updates or requested ready room briefings a day or two prior to their missions.

“I loved visiting the GLOs at their workstation – anything to get a leg up prior to my mission. They made themselves available at any time and always had timely and relevant information which greatly improved my own mission planning on how best to support the ground forces. They kept me informed on updates to support

coordination. Their recommendations for ammunition load outs and heads up on potential re-tasking were equally valuable,” Navy flight officer Lt. Robert Mayer stated.

Maintaining consistent communication enabled us to relay timely updates to aircrew about our coordination with their JTACs. A rapidly changing operational environment increases the necessity for detailed coordination. Therefore, GLOs need to anticipate changes and directly ensure all parties understand critical mission information and requirements.

On the carrier, dynamic changes to mission requirements occurred either immediately before or after the mass briefs. In some cases, JTACs or battle captains called our workstation only minutes before launch or when aircrew were already airborne. However, by leveraging our strong relationships with JTACs and our understanding of the operating environment, we anticipated changes and coordinated ahead of time. On average, the air wing launched three to four waves of jets a day (each wave consisting of three to four sections) supporting ground forces all over the area of responsibility (AOR). As the GLOs, we stayed abreast on all operations to support the air wing, but keeping organized proved essential to get the most accurate information to the right aircrews in time for their mission. During the summer of 2017, efforts to liberate the Syrian city of Raqqa relied heavily on fixed-wing air support. Russian and Syrian air and ground activity only complicated friendly coordination efforts against ISIS combatants and de-confliction measures sometimes changed by the hour. By staying organized and engaged with our ground counterparts and closely monitoring the situation, we were able to extract a newly created coordination line and brief the pilots as they headed to the flight deck. Additionally, by gleaning information from the ground, we accurately predicted another section would be re-tasked in flight to support operations in Raqqa. During their missions, the controlling JTACs referenced the line while providing target talk-on, and one section delivered an air-to-air strike against a target that violated the coordination measure. By anticipating changes and coordinating as early as possible we provided critical information to the aircrew which helped enable their mission success. Providing important, timely information and coordination builds trust and reliability between GLOs and aircrews. While the “art” of relationship building with counterparts

on the ground is certainly crucial, it also extends to relationships with the aircrew.

The situational awareness and ground tactical understanding a GLO provides to aircrew is essential and credibility is imperative for a GLO. Lt. Nathan Shuey, F/A-18 pilot put it, "The GLO is so important for our overall situational awareness on the ground. They speak the language and can break it down for us to understand and use. I didn't really need a robust check-in brief from the JTACs since our GLOs covered everything. We just got to work right away. Our intelligence folks aren't really able to do that and are already focused on other stuff any way."

An updated and informed aircrew significantly shortens the kill-chain to support friendly ground forces in potentially life or death situations. Equally critical, is understanding the rules of engagement as aircrew will count on the GLO to help them properly prepare for diverse scenarios. During long sea transits, flight operations ceased temporarily. To help pilots maintain situational awareness, we briefed entire squadrons on ground updates and rules of engagement scenarios.

The most successful GLOs leverage all available assistance, including technology, to maximize their support. Typically, GLOs are forced to print multiple copies of products with imagery, grid references and common operating pictures for aircrew use during the mission. Referred to as GLO Books, the bulky packets are not user friendly inside a cockpit, difficult to maintain and time-consuming to update. Importantly however, technological improvements are changing how situational awareness is shared and maintained.

The Air Force and Navy are employing tablets (ATAK and KILSWITCH respectively), for aircrew use during mission planning and execution. Both are replacing thick paper packets with a simple handheld device loaded with imagery. The KILSWITCH (Kinetic Integration Lightweight Software Individual Tactical Combat Handheld) is very helpful in augmenting naval aviators' mission planning and situational awareness in the cockpit during missions. Speaking of the KILSWITCH, Cmdr. Spencer Roberts, a seasoned F/A-18 pilot remarked, "Absolutely invaluable during a mission. I could

easily reference what the JTAC was talking about and then quickly get my sensor pod on it. The GLOs made sure anything relevant was uploaded and kept it current. Instead of trying to flip through mountains of paper in the cockpit, I could scroll around the tablet, find the reference point and go from there. It put us on the same page with the JTAC's right away."

This equipment is replacing the standard GLO packet and infinitely improving shared understanding.

Only one squadron intelligence officer of five received any instruction on the KILSWITCH in time for the deployment aboard the G.H.W. Bush. Aircrew and other relevant users did not use the system until the start of the deployment, and as GLOs we only learned of its existence upon arrival. Realizing its importance and usefulness, we filled in the knowledge gap by learning the system and providing instruction to aircrew – taking on the "science" of our role. Instead of printing volumes of products we loaded KMZ (Keyhole Markup Language Zipped) files associated with imagery onto the tablets for the aircrew. We designed the KMZ files as overlays by pulling relevant pieces from other products received from ground units. An overlay file from a battle captain or JTAC is usually tailored to completely fit their situational awareness and operational understanding. The entire file containing loads of information isn't suitable for an aircrew supporting operations for a few hours from 15,000 to 20,000 feet.

Through critical thinking and pilot feedback, we optimized the KILSWITCH's usefulness with timely and relevant overlays and tutorials on employing the device during mission planning and execution. By creating our own overlays, we ensured only relevant information for aircrews made it on the tablets. As a standard operating procedure, we requested aircrew follow along with our briefs by using their assigned tablets to improve their familiarization with critical data such as: grid locations, current forward line of troops, artillery positions, Gridded Reference Graphics and other coordination measures. To highlight its practicality, Lt. Brandon Rodgers, F/A-18 pilot and squadron training officer commented, "Between the mass briefs and informal updates with the KILSWITCH from the GLOs,

I had the best situational awareness and operational understanding of the ground forces that I've ever had in my 14 years' experience and four deployments."

The digital medium paired with our updates significantly enhanced aircrew situational awareness before checking on station with the JTAC, significantly heightening their support to ground forces. Learning systems that aren't familiar is an important function for a successful GLO.

An entire naval air wing's understanding of the ground forces scheme of maneuver within Iraq and Syria came down to two army captains. While this is just one lens to view a GLO experience through, it's entirely common. Ground liaison officers are deployed all over the world on challenging and highly autonomous assignments. Charged with coordinating between two military services often in dynamic environments, successful GLOs are excellent communicators, adaptive and critical thinkers. GLOs are important elements in the joint fight, working behind the scenes to integrate combat arms. By leveraging positive relationships and important technology, they balance the 'art' and 'science' of their role and maximize support to the fight.

*Capt. Victor Cortese is the 4th Battlefield Coordination Detachment ground liaison officer on Carrier Air Wing 8, part of Carrier Strike Group 2 – in the Eastern Mediterranean and Arabian Sea. The air wing supported Operation Inherent Resolve from February through July, delivering one of the highest amounts of ordinance for any Naval air wing in recent history. Previously, Cortese served previously as a company fire support officer, cannon platoon leader, assistant operations officer, fire direction officer, a battalion logistics officer and battery commander.*

*Capt. Jesus Urrutia is a student at the U.S. Navy Command and Staff Course at the Navy War College. He served with the 4th Battlefield Coordination Detachment from 2016 to 2018. Urrutia was a ground liaison officer to Carrier Air Wing 8, part of Carrier Strike Group 2 – in the Eastern Mediterranean and Arabian Sea. The air wing supported Operation Inherent Resolve from February through July, delivering one of the highest amounts of ordinance for any naval air wing in recent history.*

# Fire support for the aviation task force

By Capt. John Walsh



*Flight crews from Joint Aviation Command, United Arab Emirates prepare UH-60 Black Hawk helicopters on a tarmac at the National Training Center prior to the start of an air assault mission during Decisive Action Rotation 17-09, Sept. 21, 2017. (Sgt. David Devich/U.S. Army)*

The purpose of this article is to illustrate the importance of fire support integration in the aviation task force. I will attempt to use my experience as a fire supporter in an aviation task force to describe areas of self-induced friction in command relationships between the aviation task force and the brigade combat team (BCT), outputs of the military decision-making process (MDMP) unique to the fire support officer in the aviation task force and unique considerations the Fires community must understand in order to enable aviation maneuver.

Task Force Saber deployed to National Training Center at Fort Irwin, Calif., in support of 2nd Stryker Brigade Combat Team's decisive action rotation 17-09. TF Saber conducted reconnaissance, attack, and air assault operations in support of the BCT.

The TF consisted of a heavy attack reconnaissance squadron (HARS) headquarters, an AH-64 troop with organic unmanned aircraft system (UAS) platoon, a UH-60 assault company, a CH-47 platoon, a medevac detachment, two command and control UH-60s, in addition to a United Arab Emirates element consisting of lift and attack reconnaissance elements. My experience as the fire support officer (FSO) of this task force led me to write this paper to help other fire supporters understand the fire support requirements of an aviation task force.

In combined arms operations, relationships between commanders and planners of adjacent units are extremely important. In this respect, the aviation task force starts at a disadvantage. The aviation task force is not organic to the BCT. It usually fights in an operational control role or has a di-

rect-support relationship. It is extremely important for the FSO to quickly introduce his or herself to, and establish a working relationship with, the BCT fire support coordinator (FSCoord), FSO, brigade aviation officer, and the other TF FSOs during reception, staging, onward movement and integration or prior to deployment. During operations the aviation task force FSO can quickly transit the battlefield using organic lift assets from the task force. The entire task force staff should endeavor to meet their counterparts in the BCT headquarters and as many sister battalions as possible, especially in the cavalry squadron and artillery battalion. The FSO should determine methods of information sharing between counterparts as well as educating ground-based counterparts on the unique capabilities of the aviation task force across all war-





fighting functions. Many BCTs do not have the opportunity to train extensively with an aviation task force prior to deploying and could perhaps be unaware of the direct fire capability, information collection assets, or air movement capabilities resident in the aviation task force.

The initial fire support challenge for our task force was to coordinate airspace in the BCT's area of operations. The BCT FSCORD's initial planning guidance was that we would operate in restricted airspace in order to enable permissive Fires. Our squadron resolved to enable permissive aviation maneuver as well as permissive Fires. Aviation formations and Fires assets are the primary users of airspace, thus the FSO and the aviation mission survivability officer (AMSO) are well positioned to plan geometries that enable aviation maneuver

without restricting planned or probable Fires. The AMSO is not only responsible for aircraft survivability equipment, but also tactics and flight procedures throughout the squadron. At the squadron headquarters, the AMSO and fire support officer became the primary airspace planners. This was only possible thru detailed and deliberate planning of each operation and only successful when the staff conducted a deliberate MDMP process and participated in the BCT's planning process. The aviation task force fire support officer must be familiar with fire support coordination measures dealing with airspace as well as airspace coordination measures.

The fire support officer has a pivotal role in the task force's military decision-making process. During mission analysis, the FSO's running assessment must include a

current understanding of the BCT's scheme of maneuver and scheme of Fires throughout their assigned boundaries, in addition to the aviation tactical maneuver plan. The best way to maintain this common operating picture is to maintain constant communication between the FSO and the BCT Fires cell and battle captain. Additionally, the FSO must strive to maintain digital Fires connectivity between the task force Advanced Field Artillery Tactical Data System (AFATDS), the BCT AFATDS and the ground maneuver task force AFATDS. With this knowledge the FSO and AMSO can determine appropriate air corridors that enable safe transit of aircraft through the BCT's area of operation (AO) as part of course of action development and war gaming. The FSO and AMSO should ensure with each troop or company that their

specific platform or mission considerations are taken into account when planning airspace and fire support geometries that enable their safe and effective maneuver and movement.

The fire supporter must create an airspace coordination area (ACA) that allows for maximum freedom of maneuver while being defined geographically and by altitude. Consideration must be made to allow for maximum use of surface Fires to enable aerial maneuver and coordinate with the brigade FSO. In conjunction with the squadron intelligence officer the FSO must consider surface-to-air threats en route to and on the objective. The requirement to maintain constant communication between sister battalions, the BCT, and the internal to the aviation task force proves difficult with the current modification table of organization and equipment (MTOE) of a HARS. One satellite transportable terminal and one AFATDS do not allow for the necessary redundancies during jump command post operations. This is a shortfall that must be rehearsed in war gaming. Additional expeditionary mission command and signal equipment can alleviate this shortfall.

The FSO must participate in all fire support technical rehearsals at the BCT and conduct internal fire support rehearsals for the aviation task force. In order to participate effectively in fires technical rehearsals the FSO and AMSO should submit fire support coordination measures (FSCMs) and airspace control measures (ACMs) during the mission analysis step of the military decision-making process. This will allow the BCT time to refine, approve and share necessary geometries prior to any rehearsals. Critical to this process is the AFATDS. At the aviation task force the AFATDS is the most capable tool to provide a common operating picture of all ACMs and FSCMs. All geometries must be built and shared on AFATDS to ensure all fire supporters and airspace users understand the same geometries and rapid coordination can be conducted if necessary. As the establishing authority and user of most ACAs it is extremely important for the aviation TF FSO to be present at each BCT fire support rehearsal and to ensure all air corridors and ACAs are properly represented and considered. Additionally, the FSO must attempt to be at each BCT CAR in order to understand the adjacent TFs' schemes of maneuver in their respective AOs to ensure that air cor-

ridors and ACAs do not negatively affect that TF.

Fire support for Apache formations used in a maneuver role is planned similarly to how a ground cavalry squadron would use Fires to enable their maneuver. Aviation operates best with effectively integrated fire and maneuver. Attack aviation should receive a high priority of fire during deliberate operations due to the type of target the BCT commander has asked them to destroy and the aviation TF FSO must make this argument to the FSCoord. The Apache platoon is a deadly effective and capable formation unmatched by any weapons system in a BCT. Apache maneuver is only possible if surface-to-air threats are suppressed or neutralized. Suppression of enemy air defense and destruction of enemy air defense are required for all aviation maneuver. Additionally, the UAS organic to HARS formations are often overlooked as observers for surface Fires. The RQ-7B can observe Fires from a safe standoff distance and with a laser. They should be incorporated into the observer plan and used as air scouts. It is difficult for the fire support officer and NCO to participate in planning for every mission the aviation task force conducts. In TF Saber we relied on the aid of aviators who had been fire supporters earlier in their careers or officers who showed a thorough grasp of Fires integration.

It is incumbent on the aviation TF FSO to train UAS operators and Apache crews to act as observers. UAS operators must understand basic TTLODAC (target, trigger, location, observer, delivery, ammunition, communication) and be trained as scouts. One System Remote Video Terminal feeds monitored by the S2 and FSO enable a rapid call for fire to the artillery battalion or the BCT transmitted by the TF's AFATDS digitally. The Apache crews must be thoroughly trained to conduct a voice call for fire. The ideal call for fire is routed through the AO owner in which the aircraft are operating. If the Apaches or organic UAS are operating beyond the CFL the CFF should be routed through the aviation TF FSO through over-the-horizon communications and then sent digitally through AFATDS to enable rapid processing.

Fire support in the aviation task force is much like fire support in the ground combat element. Fires are meant to enable maneuver and the destruction of the enemy.

What is unique to the aviation task force is that it will operate in every corner of the BCT's AO and beyond the coordinated fire line (CFL). The situational awareness necessary for the safe and effective operation of the task force's aircraft requires constant vigilance by the staff to ensure friendly and enemy situations are as accurate as possible throughout the BCT AO and beyond. The fire support element in the HARS is small and under-equipped.

Task Force Saber was fortunate to be built around a HARS staff. The staff composition of an assault or general support aviation battalion headquarters may be different and may have more challenges unless supplemented by the Combat Aviation Brigade/HARS staff with an FSO and attack planner. The FSO must leverage the experience of aircrews and the FSNCO. Equipment shortfalls should be addressed by the aviation and Fires community as soon as possible. Expeditionary signal equipment should be fielded to provide upper tactical internet at two locations simultaneously. Every fire support element should have at least two AFATDS equipped with taclinks to enable digital FM communication. The FSE should also be manned with at least two additional forward observers or fire direction specialists to man the AFATDS and other mission command systems and to aid troop commanders in integrating Fires into mission planning.

In summary, the Fires and maneuver community must recognize the capabilities of attack reconnaissance utilized in a maneuver role and understand the detailed coordination necessary for the safe movement and maneuver of aircraft. The benefits of utilizing HARS in a maneuver role far outweigh the cost of supplementing these staffs with modified fire support teams and assigning priorities of fire or priority targets observed by organic UAS in support of attack aircraft maneuver.

*Capt. John Walsh serves as the fire support officer for 2nd Squadron, 6th Cavalry Regiment, which is the attack reconnaissance squadron of 25th Combat Aviation Brigade. Walsh served as the Aviation Task Force FSO for National Training Center Rotation 17-09 in support of 2nd Stryker Brigade, 2nd Infantry Division. Second Squadron, 6th Cavalry Regiment is preparing to deploy to the National Training Center again in February in support of 1st Stryker Brigade, 25th Infantry Division.*



The muzzle of an M777 howitzer smokes after Soldiers from C Battery, 1st Battalion, 258th Field Artillery, New York Army National Guard, conduct a live-fire exercise during their annual training on Fort Drum, Watertown N.Y., May 22, 2018. (Spc. Andrew Valenza/U.S. Army National Guard)

# The utility of $MVV_{WEAR}$ in enhanced muzzle velocities

By Capt. Michael Wish

In “Enhancing Muzzle Velocity Management,” Army and Marine captains from the Fort Sill Gunnery Department identified current knowledge gaps across the field artillery in regards to the enhanced muzzle velocity mode used by the Advanced Field Artillery Tactical Data System (AFATDS) and Digital Fire Control Systems (DFCS<sup>1</sup>).<sup>2</sup> Most of the confusion concerning the new system revolves around the  $MVV_{WEAR}$  term, which is often conflated with tube wear or simply not understood at all. This article will elaborate further by first defining the type of muzzle velocity data that  $MVV_{WEAR}$  represents, then demonstrating how this data is determined and applied, and finally by assessing its current and future

utility in meeting the third requirement for accurate predicted fire: accurate weapons and ammunition information.

A measured Muzzle Velocity Variation (MVV) developed through firing contains all 14 factors that affect muzzle velocity. Traditionally, only propellant efficiency (PE/ $MVV_{LOT}$ ) and tube wear (measured as a shooting strength or in equivalent full charges (EFCs) were included in the predictive calculation for an MVV. The other factors were either averaged out by firing six usable rounds<sup>3</sup>, or ignored because they are preventable through good training and supervision, or were simply too difficult to measure.<sup>4</sup> Assuming the unit follows proper procedures and accurately accounts

<sup>1</sup> For succinctness, DFCS will be used as an umbrella term to include both the PDFCS (Paladin) and DFC (M109A3), as all three systems have the same enhanced muzzle velocity capability.

<sup>2</sup> Wish, Guglielmo, Williams, Kilgore, Muma, Dunham, and Leija. “Enhancing Muzzle Velocity Management.” *Fires*, 2018, pp 52-59.

<sup>3</sup> Less than six rounds could be used, with decreasing assurances of validity, MCRP 3-10E.4 Chapter 10, p10-6 (TC 3-09.81 Chapter 10, p10-4).

<sup>4</sup> A third case includes those that are measureable, but the increased accuracy is negligible and therefore does not justify the measurement. Projectile temperature is an applicable example.

for tube wear through pullover gauge (POG) measurements and predicting EFCs, the remaining factors are captured in the  $MVV_{LOT}$  (PE) measurement.

The enhanced muzzle velocity system attempts to isolate and quantify some of these factors from the  $MVV_{LOT}$  value yielding a new term called  $MVV_{WEAR}$ .  $MVV_{WEAR}$  is the effect, measured as a change in muzzle velocity, of machining tolerances in chamber and tube construction.

“In a new tube, the size of the powder charge and the interior dimensions of the bore” can cause non-standard muzzle velocities wherein “a variation of 4 meters per second between the cannon developing the greatest muzzle velocity and the cannon developing the lowest muzzle velocity would not be unusual.”<sup>5</sup>

The differences in tube and/or chamber construction is represented by the  $MVV_{WEAR}$  term and can be determined with the enhanced system.

### Calculating $MVV_{WEAR}$

The fundamental problem in determining  $MVV_{WEAR}$  is that the equation yields two unknown variables with no easy method of isolating one in order to determine the other. In order to isolate the two variables,  $MVVs$  must be measured across multiple propellant lots and a relative comparison can be made by assuming that the average PE of a sufficiently large sample of lots is zero. In other words, if a howitzer fires a large number of lots and the all of the PEs it measures average to a large positive number, it is more likely that this howitzer simply fires faster than the standard howitzer.

$$MVV(\text{Measured}) = MVV_{EFC}(\text{Measured}) + MVV_{LOT}(\text{Unknown}) + MVV_{WEAR}(\text{Unknown})$$

An example best illustrates the principle. Suppose a brand new howitzer arrives at a unit. Given it has not yet fired its first round, its shooting strength is zero.<sup>6</sup> In this case the howitzer’s powder chamber was constructed slightly smaller than the standard howitzer and it therefore fires 1.0 m/s faster than the standard muzzle velocity. If this howitzer then fires several rounds from six different lots of propellant, whose PEs average to zero, then the data might appear, see table below.

Shooting Strength	$MVV_{WEAR}$ R	$MVV_{LOT}$ (PE)	MVV
0.0	1.0	-2.3	-1.3
0.0	1.0	1.2	2.2
0.0	1.0	1.5	2.5
0.0	1.0	-0.3	0.7
0.0	1.0	-3.9	-2.9
0.0	1.0	3.6	4.6
<b>Average:</b>		<b>0.0</b>	<b>1.0</b>

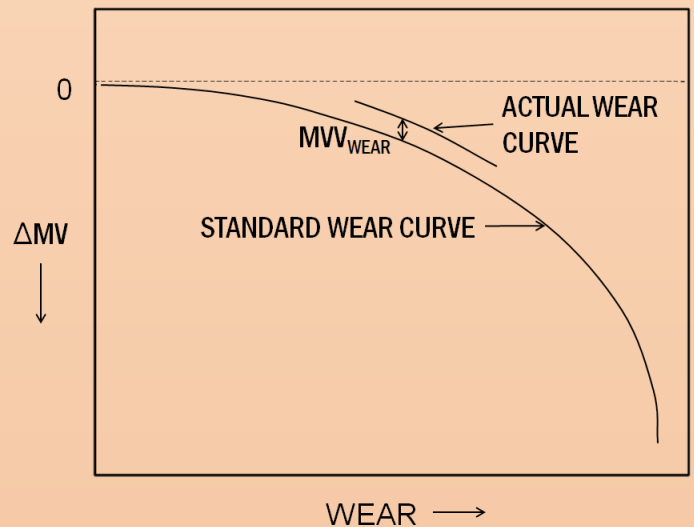
Note that the average PE is zero. However, because the DFCS does not yet know what its  $MVV_{WEAR}$  value is, it assumes  $MVV_{WEAR}$

is zero, so to the DFCS the data will actually appear as in the table below.

Shooting Strength	$MVV_{WEAR}$ R	$MVV_{LOT}$ (PE)
0.0	0.0	-1.3
0.0	0.0	2.2
0.0	0.0	2.5
0.0	0.0	0.7
0.0	0.0	-2.9
0.0	0.0	4.6
<b>Average</b>		<b>1.0</b>

Because the PEs average to +1.0 m/s and the DFCS assumes they should average to zero, it strips out the +1.0 and stores it as  $MVV_{WEAR}$ , rightly assuming that the one meter per second bias is due to the howitzer firing faster than the standard. This method only works if the howitzer fires a sufficient number of different lots in order to achieve an appropriate sample size. Six lots is suitable per the assurance of validity table.<sup>7</sup>

The term  $MVV_{WEAR}$  derives from how this initial bias affects the wear curve of a howitzer. Tube wear still causes a loss in muzzle velocity in all cannon tubes<sup>8</sup> in approximately the same way, depicted below by the “standard wear curve.” In essence, a variation in a tubes initial conditions (tolerances in new weapon systems) shifts this curve up or down by a specific amount ( $MVV_{WEAR}$ ), producing the “actual wear curve.” The figure below represents a positive  $MVV_{WEAR}$  value.<sup>9</sup>



### Errors in $MVV_{WEAR}$

The underlying assumption that allows the system to capture the magnitude of tolerances in new weapon systems is that the average variation of PEs across many lots is zero. This assumption may not be warranted given the incorrect muzzle velocity of the Charge 1L (propellant model M231), degradation of propellant lots

5 MCRP 3-10E.4 Chapter 3, p 3-8 (TC 3-09.81 Chapter 3, pp 7-8)

6 This example assumes shooting strength remains zero for the duration of firing, which is a valid assumption when firing low charges as the fractional effect of an EFC has a marginal effect on muzzle velocity (i.e. charge 1L is equal to 0.01 EFCs; even when accounting for various projectile families the change in muzzle velocity is less than 1/1000 m/s).

7 MCRP 3-10E.4 Chapter 10, p10-6 (TC 3-09.81 Chapter 10, p10-4). The same logic is applied for selecting six usable rounds in manual calibrations.

8 The wear curve is different in chrome lined tubes; these tubes experience very little wear, generally losing less than 2 m/s over the life of the tube. Currently there are very few units that employ chrome-lined tubes.

9 Note:  $MVV_{WEAR}$  can change over time: the DFCS will compare future  $MVV_{LOT}$  values determined during firing and can update the original determination. However, the DFCS will have to fire a large quantity of new propellant lots and the updated value will have to significantly differ from the original estimate. The procedure used has a low likelihood of changing the original  $MVV_{WEAR}$  value.



U.S. Marines with B Battery, 1st Battalion, 12th Marine Regiment, fire an M777 towed 155 mm howitzer during live-fire training as part of Rim of the Pacific (RIMPAC) exercise at Pohakuloa Training Area, Hawaii, July 17, 2018. RIMPAC provides high-value training for task-organized, highly capable Marine Air-Ground Task Force and enhances the critical crisis response capability of U.S. Marines in the Pacific. Twenty-five nations, 46 ships, five submarines, about 200 aircraft and 25,000 personnel are participating in RIMPAC from June 27 to Aug. 2 in and around the Hawaiian Islands and Southern California. (Lance Cpl. Adam Montera/U.S. Marine Corps)

over time, and reported inconsistencies with Charge 1L when firing the M795 family of projectiles.

The standard muzzle velocity for M231 Charge 1L is incorrect in the Tabular Firing Tables by approximately -2.0 m/s. This is reflected in the procedures for predicting an MVV for 2L, which requires that “from 1L data” one must “apply a +2 m/s correction.” Averaging the most recent Modular Artillery Charge System PE tables confirms this bias and actually produces an average Charge 1L PE of -2.4 m/s.<sup>10</sup> Due to the error in standard muzzle velocity, any unit predominantly firing Charge 1L during its first six lots will likely produce an  $MVV_{WEAR}$  value that is negatively biased. Because of the incorrect  $MVV_{WEAR}$  value, all future  $MVV_{LOT}$  measurements determined by the DFCS will be affected. This effect is likely to occur for units that tend to fire on smaller installations with limited opportunities to fire higher charges.

While more empirical data is needed, the general experience of most fire direction center Marines and Soldiers is that PEs tend to

be more negative than the published list. While the causes may not be definitely known, it seems unlikely that propellant will somehow gain efficiency over time. Rather it is much more likely that humidity, temperature, storage procedures and handling procedures combine to degrade PEs, especially over prolonged periods. Some older lots of M231 propellant have produced astonishingly negative PEs, some as extreme as -25 m/s.<sup>11</sup> Should any of these older lots be present during the firing of a howitzer’s first six lots, the  $MVV_{WEAR}$  value would be heavily biased and very likely inaccurate.

Finally, another general report from field artillery units is large variability in firing the M795 projectile family with Charge 1L and 2L.<sup>12</sup> Recently India Battery, 3rd Battalion, 11th Marines reported a discrepancy in  $MVV_{LOT}$  data while firing coordinated illumination missions. The fire direction officer (FDO) discovered that all four of their howitzers determined an average  $MVV_{LOT}$  of -6.4 m/s when firing the M485A2 illumination projectile, which is in the M107

10 FTaB 155mm Modular Artillery Charge System Propellant Efficiencies (PE) — Version 6-02, updated 07 JUL 2016

11 As Battery XO, the author supervised the calibration of a M231 lot stored in the Middle East for unknown period of time which produced a measured PE of approximately -25 m/s.

12 Both charges have been observed as unusually negative, although general observations seem to indicate larger variability and inconsistency with Charge 1L.

projectile family. Yet, those same four howitzers determined an average  $MVV_{LOT}$  of -12.3 m/s when firing M795.<sup>13</sup> More empirical data is needed in this case as well, but it is not uncommon for units firing M795 with M231 propellant to report measured  $MVV_{LOT}$  values in the negative double digits, far below that of the published tables and significantly different from the same lot when firing other projectile families.

### The utility of $MVV_{WEAR}$

Even if one assumes a reasonable accuracy in measuring  $MVV_{WEAR}$  values, the utility of capturing this value still remains in question. In reality, the principle benefit of determining  $MVV_{WEAR}$  is not to allow a unit to fire more accurately, but rather to determine more accurate PEs. When conducting calibrations in basic mode,  $MVV_{WEAR}$  was never individually accounted for, yet units managed to accurately meet the third requirement for accurate predicted fire. All of the muzzle velocity data was simply captured in one term ( $MVV$ ). The enhanced system even further reduces the need for  $MVV_{WEAR}$  as it begins calibrating with the first rounds fired and continues to calibrate with each subsequent round. Without an  $MVV_{WEAR}$  all remaining muzzle velocity data is simply captured in  $MVV_{LOT}$ . It does not matter to the firing unit where the data is captured, as long as it is captured and applied the howitzer will fire accurately.

If the capturing the total  $MVV$  allowed units to fire accurately, then the utility of determining  $MVV_{WEAR}$  appears to be diminished, but stripping out this value is still useful in that it produces a more accurate PE. However, if this PE is not useful in some capacity, then its accurate determination is not necessary. The only use for this PE is to provide the most recent propellant lot data to other units, who may choose to predict muzzle velocities for a more accurate first round until the unit begins firing rounds and determines its own PE data. The problem with this practice is that it is not often used for two reasons: Most battalions and regiments do not currently track PEs<sup>14</sup> and when they are shared many units do not trust the values, preferring instead to simply fire and measure their own data. To borrow from the field of economics, the marginal benefit of producing and applying slightly more accurate PEs for only one round fired (the first round on a new lot) does not appear to justify the relatively large cost of managing and tracking the measured data on a large scale. This is especially true when units already have access to PE data from the established tables.

In the case where a unit does use a PE determined from another firing unit (or the published PE tables), the unit cannot transmit the predicted data to the DFCS before it has fired its first six lots. Any forced  $MVV_{LOT}$  from AFATDS to the DFCS will reset the counter on the DFCS for the six lots it needs to determine  $MVV_{WEAR}$ . The irony is that if a few units develop largely accurate PEs for many lots, other units who have not yet fired six lots will simply force the PEs to the DFCS in an effort to be as accurate as possible on the very first round and delay their own ability to determine  $MVV_{WEAR}$ .

Consider that the validity of the  $MVV_{WEAR}$  measurement entirely rests on the assumption that six randomly fired lots will produce PEs that average to zero; this assumption rests on the fact that the published PE tables average to zero. If howitzers with  $MVV_{WEAR}$  values determined in this way later on measure any PE that departs significantly from the PE tables, then its  $MVV_{WEAR}$  value accuracy is automatically suspect, because it conclusively demonstrates that the tables do not actually average to zero. In other words, if



the current tables are accurate and stable over time, then there is no need to measure PEs. If they are not accurate, then  $MVV_{WEAR}$  values are being determined incorrectly and the PEs being determined are not accurate. Finally, if the PE tables truly are accurate, then why aren't they simply stored in the DFCS as permanent  $MVV_{LOT}$  data? If there is an institutional acceptance that the values in the table are subject to change, then the initial premise for the validity of the  $MVV_{WEAR}$  calculation is at best questionable.

The determination and application of  $MVV_{WEAR}$  has unnecessarily caused a large amount of confusion in the fire direction commu-

<sup>13</sup> The battery was firing M231, Lot GDB04H-072295, Charge 2L. The PE table value for the charge and lot is -2.0.

<sup>14</sup> The 10th and 11th Marine Regiments have recently updated their muzzle velocity management policies in an effort to track PE data.



*Marines with M Battery, 3rd Battalion, 11th Marine Regiment, 1st Marine Division, fire an M777 howitzer at known targets during training Aug. 9, 2018, at Mount Bundy Training Area, Northern Territory, Australia. This is the first time an entire artillery battery deployed in support of Marine Rotational Force – Darwin and demonstrates how the Marine Air-Ground Task Force is equipped and organized to carry out national objectives in cooperation with international partners. (Staff Sgt. Daniel Wetzel/U.S. Marine Corps)*

nity. The calculation of the value is entirely tied to an assumption that, pending further empirical data, may prove to be unreliable. In real world terms, there is little value added to the unit, which only cares that muzzle velocity data is captured and saved by lot. It matters very little if the  $MVV_{LOT}$  value is truly the PE, or also contains captured data from the other factors that affect muzzle velocity. In terms of data collection, the process of updating PE data provides little utility when units are willing to accept a small amount of inac-

curacy on the very first round fired, especially given a system that will immediately begin calibrating with each round fired. This risk may be larger if units are experiencing severely negative PEs, but if this is the case it only buttresses the case against the calculation assumptions for  $MVV_{WEAR}$ .

No matter the utility of  $MVV_{WEAR}$  it is vitally important that units use the current system as designed in order to gather data for further analysis. No conclusive case can be made if units do not

fire digitally with the enhanced muzzle velocity system. Artillery headquarters units should establish muzzle velocity management policies that track all  $MVV_{WEAR}$  and  $MVV_{LOT}$  data within the unit and all accumulated data should be submitted to the Fires Center of Excellence aboard Fort Sill, Okla.

### The way forward

In order to better account for the third requirement, the community needs to update the Charge 1L standard muzzle velocity, develop and consolidate as much firing data as possible in order to determine the validity of the PE tables over time, and assess any potential problems with the M795 projectile family. Simple tests can be conducted by training and force units to accomplish this collection. However, it is incumbent upon unit leaders to ensure data collection occurs under as ideal conditions (meeting the five requirements) as possible. With the right data, it is entirely possible that the issues presented here are unfounded or affect the determination of  $MVV_{WEAR}$  by a sufficiently small magnitude that the procedures for its computation still remain valid. Assuming these issues are validated, then the assumption concerning average propellant lots may no longer hold true.

If this is the case, two options remain: disregard  $MVV_{WEAR}$  and allow those values to be trapped in the measured PEs, or find a new method for determining  $MVV_{WEAR}$  one that relies on a different assumption. On this second option there exists another possibility for the measurement. Instead of assuming the average PE of a significantly large sample of propellants is zero, it may be more reasonable that the average  $MVV_{WEAR}$  value of a significantly large sample of howitzers is zero.

Each howitzer coming off of the assembly line may fire slightly faster or slower than the standard howitzer, but the average change across many howitzers should be zero. In this assumption, there seems to be no reason for a negative bias like there is for the PEs. If this is the case, then a battery of six howitzers (or any larger unit) can fire one lot of propellant and compare each howitzer's PE measurement with the average of the battery's PEs across all howitzers and the difference may be stored as the  $MVV_{WEAR}$  value. Again, an example best illustrates the principle. As before, assume that shooting strength is zero to simplify the problem. Also suppose that the battery has drawn one of the propellant lots with a an extreme PE of -15.0 m/s. Notice that the  $MVV_{WEAR}$  value of the howitzer will influence the PE, which produces a battery average PE of -15.0 m/s. Each howitzer then compares its measurement to the average in order to determine its  $MVV_{WEAR}$  value.

Shooting Strength	$MVV_{WEAR}$ R	$MVV_{LOT}$ (PE)	MVV
0.0	1.0	-15.0	-14.0
0.0	-1.0	-15.0	-16.0
0.0	0.6	-15.0	-14.4
0.0	-0.3	-15.0	-15.3
0.0	-0.6	-15.0	-15.6
0.0	0.3	-15.0	-14.7
<b>Average:</b>	<b>0.0</b>	<b>-15.0</b>	<b>-15.0</b>

In the example above, the first gun actually measure -14.0 m/s, but the battery average PE is -15.0 m/s. The gun can therefore imply that because it is shooting 1 m/s faster than the battery average PE, its  $MVV_{WEAR}$  must be +1.0 m/s.

Given that this method does not suffer the drawbacks of the current average PE assumption, it may be a more accurate method for determining  $MVV_{WEAR}$  although empirical testing is required. It does suffer from a practical drawback however, namely that the DFCS does not have access to the information it would require for the calculation of  $MVV_{WEAR}$ . Because each howitzer operates independently, it does not know what PEs the other howitzers are firing and therefore cannot determine the battery average PE. Furthermore, the validity of this method is reduced when less than six howitzers are able to fire and determine data. A method like this would have to use the AFATDS to receive the battery PE information and transmit that data to the howitzers.

A system change such as this, even if needed and desired, cannot be accomplished in the short term. For units concerned about PE issues and determining  $MVV_{WEAR}$  there is an option available now to work around the problems. All new tubes should be 'calibrated' as quickly as possible. This is not a calibration in the manual sense, however, using the DA Forms 4982-1 and -1-R. Instead, units should attempt to draw six different and relatively new lots of M231 and fire multiple rounds (ideally six) on charge 2L from each lot under controlled conditions in order to develop as accurate an  $MVV_{WEAR}$  value as possible.<sup>15</sup> This calibration should also be conducted on howitzers with suspect  $MVV_{WEAR}$  values (it may be necessary in these cases to delete previous PE data). By calibrating the  $MVV_{WEAR}$  value under controlled circumstances, both  $MVV_{WEAR}$  and future  $MVV_{LOT}$  values should be more accurate.

In manual gunnery procedures, units were able to meet the third requirement for accurate predicted Fires, but were far less efficient than is now possible and those procedures were unable to isolate every variable that contributed to the total MVV. Meeting the third requirement in the enhanced mode is far easier and faster than ever before, but the FA must ensure that reliance on the digital system does not create complacency in knowledge, skills and procedures, especially when there exists doubt on the validity of MV values which are so vital to accuracy in Fires. The enhanced MV system should be leveraged to employ accurate first round fire for effect for maneuver, especially with new lots of propellant. Maneuver commanders have little interest in the technical aspects of achieving first round fire for effect. As artillerymen, it is our duty to provide those effects no matter the conditions. Collecting the data is absolutely crucial to solving this problem and to more accurately meet the third requirement for accurate predicted fire.

*Capt. Michael Wish is the Artillery Training School director of the 11th Marine Regiment and serves as the regimental fire direction officer. Previously, Wish was a fire direction officer and platoon commander with Sierra Battery, 5th Battalion, 11th Marines, and an executive officer for Tango Battery 5/11th Marines, deploying to Afghanistan with both units. He recently finished a tour as a gunnery instructor at Fort Sill, Okla.*

15 According to FtAIB's PE Tables, Charge 2L's average PE is closest to 0 (+0.1 m/s) and, disregarding charge 1L, has the smallest standard deviation (1.5 m/s). Charge 4H is next preferred charge for this procedure. Additionally, if problems with the M795 projectile family are validated, the M107 projectile family should be preferred.



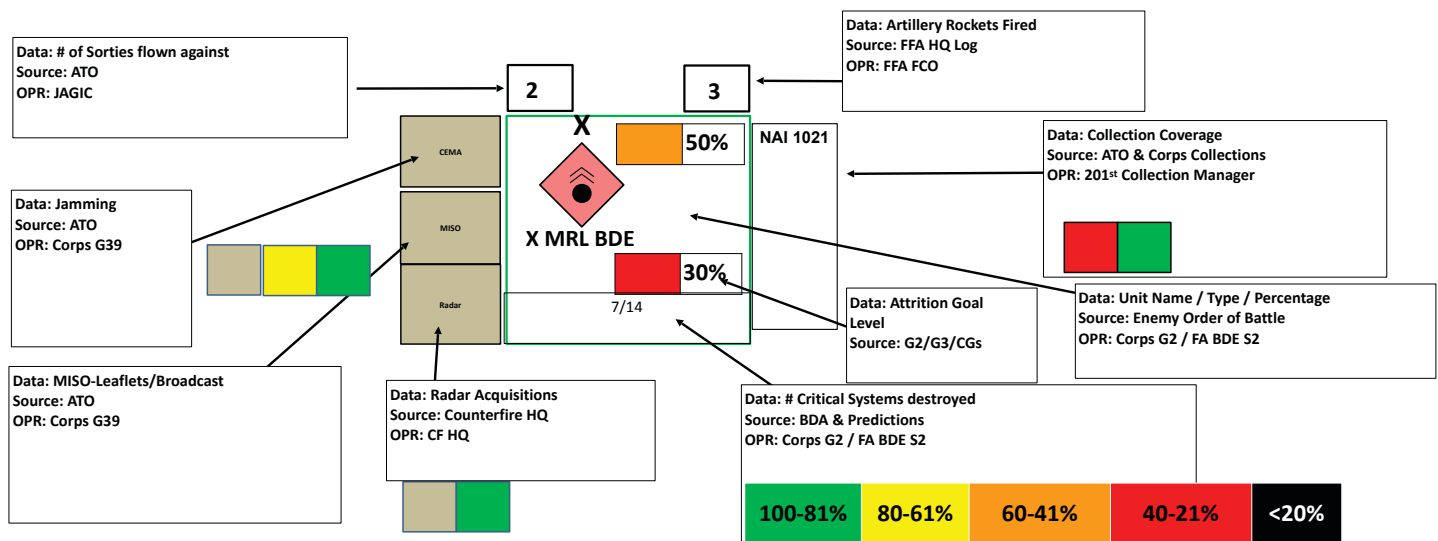
*Soldiers from 1st Battalion, 94th Field Artillery Regiment, 17th Field Artillery Brigade conduct a mock artillery raid with an M142 High Mobility Army Rocket System at Orchard Combat Training Center, Idaho. (Sgt. Jacob Kohrs/ U.S. Army)*



# Defining the corps fight

*By Col. Christopher Wendland*

In the land domain, the corps provides three main functions to better enable the division fight. The corps delivers overarching mission command to the operation, gives necessary sustainment to enable the division's operational tempo, and provides the necessary lethal and non-lethal shaping of the enemy formations to attrite the enemy to acceptable levels for the divisions to have overwhelming combat power against the enemy formations in their path.



A missile rocket launcher brigade currently attrited to 50 percent in aggregate with seven of 14 critical systems remaining. Three rockets fired and three sorties flown against this formation. This system was not acquired by radar and the collection asset assigned against named area of interest 1021 is not currently sourced (unmanned aerial system or similar). Early-warning jamming was employed with reported good effects. Military information support operations leaflets and broadcast messaging were employed with the effects being unknown. Assess that 24 more hours of shaping to reach goal of 30 percent attrition. (Courtesy illustration)

This article will not focus on the mission command or sustainment functions of the corps, but will instead focus on how the corps (in this case America’s First Corps) shapes deep operations for their divisions by synchronizing joint lethal and non-lethal effects.

In order to do this effectively, and limit confusion, the corps is required to “define the fights.” For America’s First Corps, the fire support coordination line (FSCL) “defines the fights” between the corps and the division(s). The FSCL also serves as the intelligence handover line (IHL) and defines where the corps employs their sensors and shooters to shape the battlefield. Essentially, the corps owns the battlespace long of the FSCL to include intelligence collection and the planning/execution of both lethal and nonlethal effects.

For shaping, the corps and division lethal and non-lethal Fires teams work with the corps and division(s) intelligence teams to determine the most dangerous enemy threats to each of their divisions or separate brigades. Once identified, the corps and division(s) staff work to set the conditions for a dialogue between the corps and division(s) commanding generals where an agreement is made on expectations of how the corps can best shape the deep fight and best enable each of their subordinate division’s success in their fight against enemy: How much of what enemy capability should be attrited to what level? Since the corps has limited assets for shaping and must balance the expectations of many

subordinate units, the staff must determine what critical capability the corps “must attrite” to ensure optimal success for the division(s) fight.

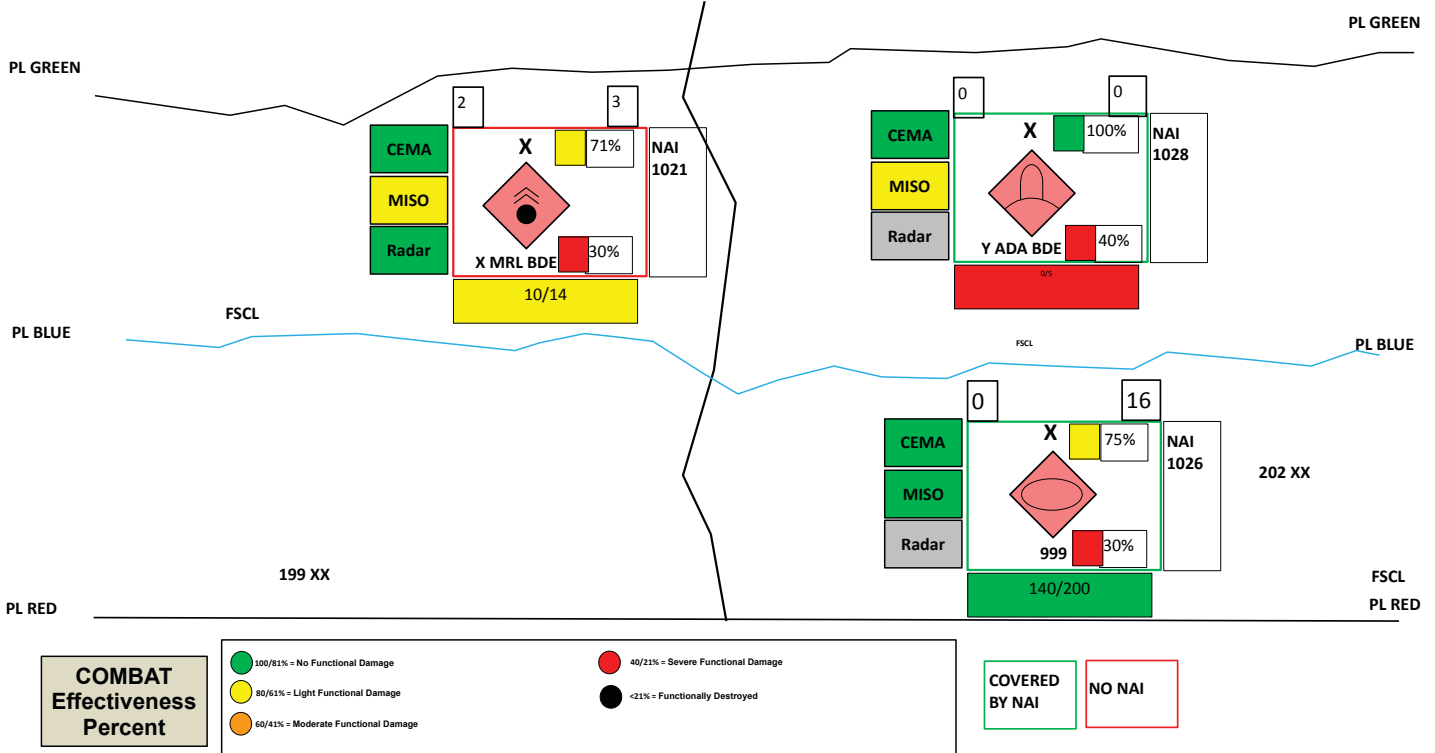
In a 72-hour targeting cycle, the corps future operations along with Fires, intelligence, surveillance and reconnaissance (ISR) collection must anticipate where the FSCL and IHL will be based on the timing and tempo of the divisions. This is the starting point for defining the corps fight versus the divisions fight and sets the conditions for the corps targeting working group and the corps targeting decision board. At the decision board’s conclusion, the corps is able to allocate and prioritize corps resources to shape division future operations and request additional resources as required from both corps’ higher headquarters and air tasking order (ATO) target nominations from the air operations center. The following team of officers work together to ensure the corps successfully shapes the battlefield for division operations long of the FSCL: the corps G3, the 201st Expeditionary-Military Intelligence Brigade commander, who dual hats as the corps ISR manager; the 17th Field Artillery Brigade commander who dual hats as the corps fire support coordinator and also normally serves as the corps force field artillery headquarters; the air support operations group (ASOG) commander who dual hats as the corps air liaison officer (ALO); the corps G39 who serves as corps lead for non-lethal effects (space, cyber, electronic warfare and military information support operations or MISO);

and the corps aviation officer (if the corps is allocated a combat aviation brigade). These officers meet together routinely and conduct their own meetings with their senior/subordinate technical chains to ensure the corps remains nested with the corps commanding general’s shaping vision/intent for division future operations.

If the corps has a higher headquarters, the corps “defines the fight” again with their higher headquarters using the forward boundary which, similar to the FSCL, is the IHL between corps and its higher headquarters. Essentially, the corps “owns” the battlespace between the FSCL and the forward boundary and directs ISR, lethal and nonlethal effects in this portion of the battlefield.

With the “fights” defined, each staff echelon knows their portion of the fight and the commanding generals (at echelon) are able to gain the information they need to visualize and shape the battlefield for their subordinate commanders. The “define the fight” simplicity obviously increases in complexity on a fluid battlefield where the FSCL and forward boundary are required to change.

In America’s First Corps, the corps commanding general fights the corps by maintaining the FSCL close to the divisions and thereby compressing the division fight and allowing the divisions to focus their efforts and not be spread too thin. The FSCL is usually set no further than the maximum range of their longest range munition (typically extended range rockets) if the corps



This graphics defines the current fight for each echelon: Corps is focused on the missile rocket launcher brigade (MRL BDE) and the air defense artillery brigade (ADA BDE). The 202nd Division is focused the 999th Tank Brigade. The fire support coordination line (FSCL) will move when the MRL BDE is attrited to 30 percent and the ADA BDE is attrited to 40 percent. Corps employed air to attrite the 999th Tank Brigade to the requested 30 percent before the FSCL moves to Phase Line Blue. (Courtesy illustration)

provides a rocket battalion to the division artillery in a reinforcing or general support reinforcing role. This allows the division to focus their ISR assets and artillery assets to about 30-45 kilometers forward of their forward line of troops. The corps then assumes the ISR, lethal and nonlethal responsibilities long of the FSCL. The corps then looks to identify those enemy assets that would impact the division decisive operation (normally enemy long-range artillery, radars, air defenses, armor capability and mission command) and attempts to attrite those assets to an acceptable predetermined level with air interdiction, corps artillery, non-lethal effects or corps attack helicopters.

Anticipating where the FSCL will be 72 hours out can be extremely challenging. A shared understanding is the major tenet of success. The corps headquarters and the division headquarters must continually cross talk and validate their common operational picture. America's First Corps employs two major products to facilitate this shared understanding.

### No. 1: The scorecard

The scorecard is a comprehensive tool requiring routine input from across the corps staff. It establishes an agreement between the commanding generals (at echelon) for setting and achieving the acceptable

levels of attrition before a FSCL move, and serves as a visual tool to discern if all available multi-domain assets are employed effectively against the enemy formations. It follows the "decide, detect, deliver, assess" methodology to integrate easily within the America's First Corps targeting methodology.

To build the scorecard, first you must "decide" what to attack. The corps G2, corps FA information officer, and the FA brigade S2 review the enemy order of battle and assess which formations are the most critical within the corps area of operations and those formations in the corps area of influence that could affect corps operations. Once those formations are identified, the intelligence teams identify which assets in those formations have the critical capabilities that must be effectively neutralized (target system analysis in accordance with Joint Publication 3-60). Those two data points set the bedrock for the entire scorecard. These units are depicted on the scorecard as boxes with their approximate aggregate unit strength. The critical capabilities within these units are depicted as a banner with the number destroyed displayed first, followed by the total number of systems present in the formation. Normally these critical capabilities are long-

range artillery pieces, radars, air defense artillery systems or high-end armor systems. The corps G2, G3 and fire support coordinator (FSCoord) must discuss the high payoff target list (HPTL) and attack guidance matrix (AGM) during this portion of scorecard development, revise these documents based on the enemy threat, and then gain corps commanding general concurrence. The corps and division must then come to an agreement on the decide phase because the considerable amount of targeting work will proceed after this phase is set. The intelligence team will depict the boxes conceptually on the scorecard to depict the relative unit locations in regards to phase lines and unit boundaries and will move the box locations as required with each scorecard iteration.

The next phase is to align ISR assets to "detect" the location of the units and facilitate lethal and nonlethal targeting for their neutralization or destruction. The Expeditionary Military Intelligence Brigade commander who dual hats as the corps ISR manager now works to align corps named area of interest (NAI)/target area of interests (TAIs) over these unit locations. If an NAI is aligned to the unit on the scorecard, the NAI is depicted in the unit box. If the ISR is active, the corps ISR manager ensures

the box has a green outline. If the corps NAI is uncovered for any reason, either due to a lack of available ISR resources or inclement weather, etc., the enemy unit box is colored red. The intent is to ensure cross-talk between the G2 and the ISR manager as well as ensure situational awareness and shared understanding between the intelligence teams at echelon. It is imperative that the ISR teams have a copy of the HPTL and AGM to ensure the entire corps ISR community is searching for those critical targets identified on the scorecard and time and ammunition are not wasted on unnecessary enemy assets.

The next phase is to determine which corps assets will “deliver” effects against the selected enemy units and if the corps is effectively integrating all available multi-domain assets against those enemy units. The central box has two smaller boxes on the top. The top left box is used to determine how many artillery missions were fired against the unit and the top right box is used to determine how many air interdiction sorties actually flew against the enemy unit. There are three boxes on the left side of the box. The top box is used to determine if any type of electronic warfare (cyber, space, EW) are employed against the unit to degrade their operations and facilitate lethal delivery assets (artillery, air interdiction or attack helicopters). The center box on the left side is used to determine if MISO are being employed against the unit (leaflets or other messaging), and the lower box is used to determine the corps integrated radar network successfully acquired enemy artillery Fires originating from that templated enemy unit location. Each of these data injects require input from multiple different sources: the artillery missions fired is provided by the FA brigade fire direction office, the number of sorties flown against the unit is provided by the corps ALO on the joint operations center floor who monitors the execution of the daily air tasking order, electronic warfare and MISO employment are updated by the G39 (also based on ATO execution), and whether the corps acquired enemy artillery Fires from an enemy units templated location is provided by the FA brigade counterfire officer. Obviously the HPTL and AGM developed during the decide phase of scorecard development must be understood and followed by the entire lethal and nonlethal Fires community to prevent the unnecessary depletion of critical resources.

The final phase is the “assess” phase

which is updated routinely by corps G2 from various methods to acquire battle damage assessment from pilots after air interdiction or rotary-wing attacks, from ISR, or from special operations forces deep within the corps area of operations. The assessment phase is discussed daily at the corps targeting working group and decision board and is critical for leaders to reprioritize corps resources to effectively attrite enemy units to the pre-agreed upon level and facilitate movement of the FSCL and forward boundary and ultimately the “responsibilities” between corps, their higher headquarters and the divisions.

Each of these scorecard data points, when consolidated, provide a holistic tool for corps and division commanding generals and their primary staff to gain shared understanding. For example, the FSCOORD could review the scorecard and assess that one portion of the corps’ AO long of the FSCL is effectively attrited to the prescribed level agreed upon by the corps and division commanding generals, but another portion of the corps AO long of the FSCL is not having effective results and will subsequently require a decrease in division operational tempo to ensure the units are attrited appropriately. If identified early enough, the corps FSCOORD could work with the corps shaping team to recommend the re-prioritization of corps ISR, lethal and non-lethal assets to include the employment of the corps attack aviation (deep attack). The FSCOORD could now easily scan the scorecard and discern if the enemy may be masking his artillery units or choosing not to fire them to prevent their identification and destruction (not acquired by the corps integrated radar network), could identify if corps units are fixated on some enemy units more so than necessary at the expense of some enemy units not being engaged or at the expense of a greater depletion of corps critical munitions, and could identify if corps lethal and nonlethal assets are complementary to maximize a multi-domain effect on enemy unit formations.

## No 2: FSCL movement tool

Movement of the fire support coordination line is a critical event as it shifts the corps and division targeting and ISR responsibilities with each movement iteration. America’s First Corps identifies the resolution of four critical requirements prior to the recommendation for the corps CG to approve the FSCL adjustment:

1. Did the corps successfully attrite the enemy unit critical capabilities to an ac-

ceptable level agreed upon by the corps CG and the division CG (based on the scorecard)?

2. Are the divisional artillery assets in position to support the FSCL shift and does their divisional artillery have the munition range to cover the area short of the FSCL shift?
3. Are the divisions able to shift their ISR assets to support the increased area short of the FSCL shift?
4. Did corps Fires adjust the artillery radar common sensor boundary to ensure enemy artillery acquisitions long and short of the new FSCL are routed to the proper artillery counterfire headquarters?

FSCL movement projections are discussed in a number of corps to division forums throughout the day and are usually initiated during the G3 synchronization meeting, where the corps G3 synchronizes operations for the next 72 hours. Weather is also a consideration for FSCL movement since if the ATO or ISR plan is degraded by weather, the shaping conditions may not be successfully achieved and the FSCL shift may be delayed. If a FSCL move is projected, the previously discussed scorecard is used to ensure the first requirement will be met. If that requirement is not met, that may require a reduction in both the division and corps operational tempo. The scorecard is now a visual discussion point to ensure corps assets are re-prioritized to best support division operations. The corps G2 discusses the same topics during their corps to division G2 synchronization meeting and will likely reprioritize ISR to fill any intelligence gaps. Finally, the corps targeting decision board is the forum to adjust corps lethal and non-lethal targeting priorities as required to best enable the FSCL shift.

Based on the corps operational tempo and battlefield success, the corps attempts to work within the Air Force to shift the FSCL in alignment with the air tasking order. Essentially, aircraft flying long of the FSCL are flying air interdiction sorties while those aircraft flying short of the FSCL are flying close air support sorties. A sudden forward FSCL shift may require a pilot originally flying an air interdiction sortie to now be required to “check-in” with a joint terminal attack controller or forward air controller (Airborne) before expending their ordnance on the enemy target due to the proximity of friendly troops, or an additional coordination measure may be required, such as establishing a kill box to fa-

COMBAT Effectiveness %		No Functional Damage				Severe Functional Damage				Condition not met		Condition met		N/A		
		81-100%		61-80%		40-61%		21-40%		<20%						
		Light Functional Damage				Functionally Destroyed										
CONDITIONS																
Recommendation	Attrition				FA assets in position	Air Support de-conflicted		Collection Gap covered		Common Sensor boundary coordinated						
<b>Assessment: conditions not met for enemy attrition of all key units</b>					25 ID			25 ID			25 ID			25 ID		
					JFACC BCD			JFACC BCD			JFACC BCD			JFACC BCD		
<b>Recommendation: ICW 25 ID move the FSCL to PL BLUE with a Purple Kill Box over the 214 FA BDE IVO OBJ ROCKIES</b>					201 <sup>st</sup>			201 <sup>st</sup>			201 <sup>st</sup>			201 <sup>st</sup>		
					FFA			FFA			FFA			FFA		
					16 CAB			16 CAB			16 CAB			16 CAB		
<b>Threat:</b> Focused threat attrition to 40% or less					FFA: Shaping & CF BNs in PAAs with RG to SHORE		AVN: SEAD tats (planned) adjusted		ISR: Corps assets are adjusted, DIV assets cover of Corps Shaping area		Radars: FFA or DIV coverage of Corps Shaping area		ALO: AI & CAS adjusted			

Fire support coordination line decision matrix. (Courtesy illustration)

cilitate strikes without further coordination with the establishing headquarters.

Application of the scorecard and the FSCL movement tool assists the America's First Corps commanding general to see the corps and division "fights" on the battlefield and determine where and when to apply corps resources to best shape for the division's fights. By compressing the division's battlespace, the divisions are able to concentrate their resources and effectively dominate their enemy within their battlespace. This method of fighting requires a considerable amount of trust and cross-talk between the corps and division. The divisions must trust the corps to neutralize any long-range artillery Fires long of the FSCL. Since the FSCL is a permissive fire support coordination measure, the divisions can always fire long of the FSCL, but since the FSCL is also IHO, the divisions do not need to have ISR assets long of the FSCL. If they are receiving enemy artillery Fires, the corps counterfire headquarters is charged with engaging enemy targets long of the FSCL, so division long of FSCL artillery Fires should not be required.

### Special considerations

At times, the divisions may find their shaping assets overwhelmed and may be unable to provide effects across the breadth

of the battlespace short of the FSCL. The division can request that the corps provide in-extremis assistance. In this case, the corps will create a Purple Kill Box short of the FSCL which essentially allows corps assets (lethal and nonlethal) to engage targets without clearing the air or ground within the Purple Kill Box. If the effects are longer term, the corps and division could agree to shift the FSCL, but for a short-duration the kill box is quick and efficient.

Another concern is enemy long-range artillery Fires originating from outside the corps boundary and having effects on a subordinate division. Since cross-boundary Fires coordination is timely and requires corps to coordinate with their higher headquarters and their adjacent unit headquarters from where the Fires originate, America's First Corps works to create pre-planned kill boxes within their adjacent unit's battlespace. If the adjacent friendly unit does not have friendly forces in proximity to the enemy long range artillery fires, the activation of the pre-planned kill box allows extremely responsive Fires (normally from corps artillery, the redirection of an Air Force air interdiction asset from that day's ATO, and/or the employment of corps attack aviation). In some cases, the corps could also establish an "operations

box" and direct the division or separate brigade (Corps Reserve) to maneuver toward where the enemy long-range artillery originated within the adjacent unit's AO as a temporary corps boundary change. The corps shaping team integrates the possibility of enemy cross-boundary into their ISR plan for early indicators and warnings and develops these pre-planned kill boxes to mitigate the enemy's ability to surprise the corps and impact the division's fight.

Overall, America's First Corps developed the previously described tools and procedures to perform as a "fighting corps headquarters" and employs the FSCL to compress division battle space to allow the divisions to maximize and concentrate their resources for their "fight" short of the FSCL while the corps shapes (attrites) those extremely critical enemy capabilities long of the FSCL. These tools and procedures evolved and proved effective over the course of four corps-level command post exercises from July to December, 2017, and were even successfully employed with some of our Pacific allied partners (Australia, Japan and Korea).

Col. Christopher Wendland is the 17th Field Artillery Brigade commander and is the fire support coordinator for America's I Corps at Joint Base Lewis-McChord, Wash.

# The 2018



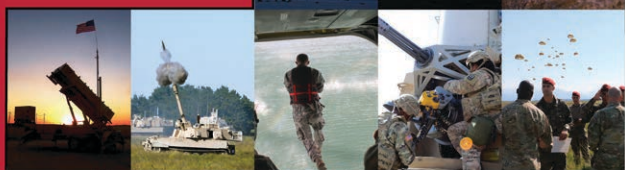
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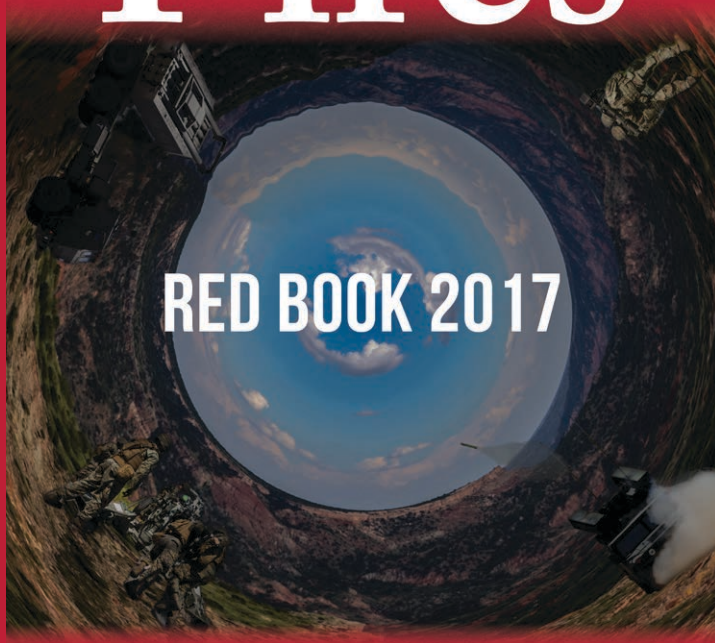


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*Soldiers from 2nd Cavalry Regiment and 3rd Battalion, 4th Air Defense Artillery Regiment fire Stinger missiles using Man-Portable Air Defense Systems and Avenger systems during Artemis Strike, a live-fire exercise off the coast of Crete, Greece Nov. 6, 2017. (Photo by the 10th AAMDC PAO Office)*

