A JOINT PUBLICATION FOR U.S. ARTILLERY PROFESSIONALS

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Fires

Cross domain Fires: Now and in the future

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Staff

Editor: Marie Berberea
Art Director: Rick Paape, Jr.
Assistant Editor: Monica Wood
The Fires staff can be reached by email at usarmy.sill.fcoe.mbx.fires-bulletin-mailbox@mail.mil or by phone at (580)442-5121.

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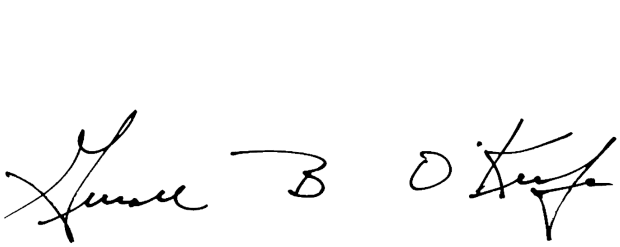

Gerald B. O'Keefe
Administrative Assistant to the
Secretary of the Army
Auth. 1513304

Brian J. McKiernan
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.

On the cover

A High Mobility Artillery Rocket System (HIMARS) practices targeting during Valiant Shield 16 on Tinian, Guam, Sept. 21, 2016. The combat rehearsal demonstrated the HIMARS expeditionary capability in support of the exercise. Valiant Shield is a biennial, U.S. Air Force, Navy, and Marine Corps exercise held in Guam, focusing on real-world proficiency in sustaining joint forces at sea, in the air, on land and in cyberspace. (Lance Cpl. Jordan A. Talley/U.S. Marine Corps)

Fires

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Col. Stephen Maranian
U.S. Army Field Artillery School commandant

The future of the Fires enterprise

It's that time of the year where we come together as a vested community to discuss the successes, challenges and the future of the Fires enterprise. I invite everyone to attend the 2017 Fires Conference "Cross Domain Fires: Now and in the future. The multi-domain battle" either in person or virtually May 3-4, 2017.

This is a great opportunity to learn, understand and discuss all things Fires. This year's conference will focus on what we can do now and in the future to expand the capabilities of cross domain Fires in support of multi-domain battle. Scheduled speakers include Gen. David Perkins, Training and Doctrine Command commander; Rear Adm. Mark Montgomery, U.S. Pacific Command Operations director, and Brig. Gen. Peter Jones, Infantry School commandant. These leaders bring unique personal experiences, perspectives and knowledge that will help us map a clear path forward into a very complex multi-domain environment.

Our field artillery breakout session is scheduled during the second day of the conference from 9 a.m. to noon. Tentatively scheduled speakers include Col. Markus Jones, 8th Army chief of Fires; Col. David S. Lee, 19th Battlefield Coordination Detachment commander, U.S. Army Europe; and Col. Thomas R. Bolen, 1st Infantry Division Artillery commander, who will have an update on successful engagements in Operation Inherent Resolve. Each of these speakers will share extensive knowledge and understanding of their very unique operational environments and how cross domain Fires are integrated and synchronized to meet, and often exceed, their maneuver commander's expectations.

We will acknowledge the winners of the 2016 Knox, Gruber and Hamilton awards on Day 2. Congratulations to C Battery, 4th Battalion, 1st Field Artillery Regiment, the Henry A. Knox Award winner; B Battery, 1st Battalion, 145th Field Artillery Regiment of the Utah Army National Guard as the Alexander Hamilton Award winner; and Sgt. 1st Class Zachary S. Wilkerson, 1st Battalion, 94th Field Artillery Regiment, 17th Field Artillery Brigade, from Joint Base Lewis McChord, Wash., as the Edmund L. Gruber Award winner.

On May 4, we will also host a dedication ceremony recognizing legendary artilleryman, Gen. John William Vessey, Jr. Vessey served in the U.S. Army from 1939 to 1985 beginning as a private in the Minnesota Army National Guard and ending as the Chairman of the Joint Chiefs of Staff. He was a combat veteran of World War II, the Korean War and the Vietnam War. Vessey is remembered as a "Soldier's Soldier," fair and firm, who always stood up for his troops. So, it is very appropriate that Bldg. 6005, which currently houses the 95th Adjutant General Battalion (Reception), will be dedicated to him. The 95th AG BN (Reception) conducts reception operations for Basic Combat Training, Advanced Individual Training, and English as a Second Language Training for Soldiers at Fort Sill, Okla.

If you cannot attend the Fires Conference in person, please log on to the web and participate in understanding and shaping today's Fires force. Thanks for all you do. We are the world's premier artillery force - modernized, organized, trained and ready to integrate and employ Army, joint and multinational Fires because of the tremendous efforts of you and your Soldiers,

24/7/365,
Regardless of weather,
In any terrain,
Quickly, accurately, and danger close!

Former chairman honored with Vessey Hall dedication

By Cindy McIntyre

A plaque honoring Gen. John Vessey Jr. is flanked by (left to right) Maj. Gen. Brian McKiernan, Vessey's daughter Sarah Vessey, and her sons Sam and Evan Krawczyk. The plaque and other memorabilia were part of a dedication ceremony renaming the 95th Adjutant General (Reception) Building as Vessey Hall. (Cindy McIntyre/Fort Sill Tribune)

The 95th Adjutant General Battalion (Reception) building is now known as Vessey Hall, following a dedication ceremony May 4.

Gen. John Vessey Jr. was the 10th Chairman of the Joint Chiefs of Staff and served under President Reagan from June 1982 to September 1985.

Vessey, who died in August 2016, at the age of 94, served in several capacities at Fort Sill after the end of World War II, including the Field Artillery School from 1949-1950; battery officer, then battery commander, 18th Field Artillery from 1950-1951; and as a student in the Artillery Officer Advanced Course, Artillery and Guided Missile School, 1954-1955.

Nearly 30 years later, he returned to Fort Sill as deputy assistant commandant, Field Artillery Center and School.

Vessey joined the Minnesota National Guard in 1939 at the age of 16 as a motorcycle rider after lying about his age, and served in World War II in North Africa and Italy with the 34th Red Bull Infantry Division.

During an intense battle on Anzio Beachhead, he was given a battlefield commission from first sergeant to 2nd lieutenant, and directed artillery fire as a forward observer.

Several distinguished guests spoke of the man they called "the Soldier's Soldier," including retired Gen. Dennis Reimer, a Medford, Okla. native. Reimer was the 33rd Army Chief of Staff when he retired in 1999.

Reimer also served at Fort Sill as deputy assistant commandant, Field Artillery Center and School, from 1983 to 1984; and as commanding general, III Corps Artillery, from 1984 to 1986.

Reimer considered Vessey a mentor.

"Nobody else has ever gone from private E-1 to chairman of Joint Chiefs of Staff," he said. "He is truly an American hero. He has led the military through tough times and good times and left it much better than he found it."

Vessey went to helicopter school when he was 48 years old, twice the age of most of his classmates, said Reimer. It took 27 years for Vessey to attain the rank of brigadier general, another five to reach major general, and two years later he wore four stars on his epaulet.

After his stint as chairman of Joint Chiefs, he was instrumental in getting bodies of Soldiers missing-in-action brought back from Vietnam.

Reimer said the first time he encountered Vessey's name, he was serving as aide de camp to Gen. Creighton Abrams.

After reviewing an assignment list for 12 general officers, Abrams crossed out the name assigned to the 4th Infantry Division.

"He wrote 'Jack Vessey -- he's a Soldier!'" Reimer said that made an impression on him, and he asked to be assigned to 4th Infantry for his next duty. "It was like being in a leadership lab 24 hours a day," he said of his experience there.

After Reimer became Army Chief of Staff, he received invaluable advice and counsel from Vessey. He also researched Vessey's speeches.

"What you saw in those speeches was the man himself. He was plain spoken. He

understood Soldiers. He often quoted Marshall Dillon from 'Gunsmoke' who said 'It's a risky job and sometimes a little lonely.'"

He said Vessey was also a man of faith, and had a good sense of humor.

"He took time, even when he was chairman of the Joint Chiefs, to read the Bible every day. He lived his faith, didn't have to talk about it." Reimer also said, "He lived the Army Values. He was not afraid to speak truth to power."

He said of the building being dedicated, "This is where the Army miracle starts. This is where the drill sergeants take these civilians and turn them into Soldiers. So, it is very fitting that is named after someone that started as a private E-1 and went all the way to the very top. Someone who exemplified the Army Values. Someone who set the standard for all Soldiers."

Vessey's daughter Sarah Vessey, with her two sons Sam Krawczyk, 27 and Evan Krawczyk, 23; all are from the Minneapolis-St. Paul area. They unveiled the general's plaque hidden behind a red cloth, and then brought down the covering over the lettering at the top of the building.

Vessey, who joked that she is often known as "the general's daughter," said she hoped others would be inspired to emulate his character as a "quiet, firm, humble, stubborn, smart, thoughtful, ego-less, humorous" leader.

She spoke of the yin and yang of her father's life lessons, describing how he used the hot, dark fudge on a cold vanilla ice cream sundae to explain the meaning of life to his young grandsons.

"He explained the dark and the light, the highs and the lows, tying in the humor of life, resilience, perseverance, etcetera to make a complete whole."

She said for her, the yin was "I do not want really to be here speaking today. I would much rather be home with my dad chatting about the Minnesota Twins losing their game, sharing a meal, being ordered around to do chores, talking about my mom, or the grandkids, or world events."

The yang for her family is "We have the privilege of knowing that we can, and will, hold our heads high. That my father was a good guy, and now we get to share his story and be proud."

She said her parents came to Fort Sill in 1945 as newlyweds with her dad's 10-year-old brother.

She showed a telegram she had found in an old magazine. Now framed, the telegram was from Vessey asking for an extension of leave "so he could marry my mother before reporting to Fort Sill," she said to applause. Two of her brothers were later born here.

Top: A display area inside Vessey Hall at Fort Sill, Okla., is filled with memorabilia from Gen. John Vessey Jr.'s career, including his medals. Bottom: Vessey's daughter and grandsons pull the cords holding the banner to reveal Vessey Hall along with the joint color guard from the 434th Field Artillery Brigade, and the Marine Artillery Detachment. (Cindy McIntyre/Fort Sill Tribune)

The telegram and other items relating to her father's career, including his medals, are on display inside Vessey Hall.

Retired Rear Adm. Donald Muchow delivered the invocation. Also in attendance was retired Maj. Gen. J. B. Burns, Vessey's former special assistant and speech writer.

The 77th Army Band played music of the Vietnam Era, relating to one of the most significant battles Vessey participated in -- the Battle of Suoi Tre, March 21, 1967.

Spc. Robert McMillan sang the national anthem and, with the band, the various songs of the armed services, until he was joined by the gathering for the singing of "The Army Song."

The joint color guard detail was provided by the 434th Field Artillery Brigade, with Staff Sgt. Nicholas Bogert serving as the non-commissioned officer-in-charge.

The 2016 Knox, Hamilton and Shipton Awards

The U.S. Army Air Defense Artillery School announced the winners of the Air Defense Artillery 2016 Knox, Hamilton and Shipton awards. These awards are presented annually and recognize excellence by unit (active and National Guard) and individual. Congratulations to the 2016 award winners.

AIR DEFENSE ARTILLERY HENRY A. KNOX AWARD

C Battery, 2nd Battalion, 44th Air Defense Artillery provided historic mission capability earning them the 2016 Knox Award. (Courtesy photo)

The Henry A. Knox Award recognizes the outstanding active-duty ADA battery of the year for superior mission accomplishment and overall unit excellence within the air defense community.

The 2016 Knox Award is awarded to **C Battery, 2nd Battalion, 44th Air Defense Artillery** for achieving several notable accomplishments and demonstrating overall unit excellence.

C Battery deployed in support of Operation Inherent Resolve and provided counter-rocket, artillery, and mortar (C-RAM) indirect fire protection and intercept capability at two critically strategic bases in Northern Iraq. The battery's efforts were an integral part of the mission to isolate Mosul and defeat Da'esh in Iraq. With only a 14-day notice, C Battery deployed under contingency circumstances. Given the short turnaround, They converted from an Avenger, short-range air defense battery, to a C-RAM battery prior to deployment. The unit deployed and achieved full operational capability in theater in less than three weeks.

C Battery's deployment and installation of indirect fire protection capability (IFPC) systems at a small firebase called Kara Soar Base Complex, was an undertaking that had never been attempted in C-RAM's distinguished history. In all previous C-RAM operations, the Land-Based Phalanx Weapon Systems (LPWS) were flown directly to designated locations and emplaced on site. Since Kara Soars Base had no airstrip, C Battery was responsible for moving these systems, via ground convoy, over 70 kilometers through local and possibly hostile city streets and highways. This type of movement had never been attempted and never so close to the forward line of troops.

The Soldiers of C/2-44th ADA successfully deployed the system to the most austere and remote location in the program's history, becoming fully mission capable in a record time of 26 hours from arrival on site. Afterward, the operation became a proof of concept of the system's capability to conduct operations in non-traditional environments in support of maneuver forces. C Battery's historic deployment was followed by four months of IFPC operations at Kara Soar Base. C Battery was directly responsible for providing early warning for eight indirect fire events targeting Kara Soar and protecting over 300 personnel.

C Battery coordinated and executed bi-weekly logistical convoys to ensure Soldiers had the necessary life support and logistical systems to maintain operations. This was accomplished by having a battery command post integrated with the Combined Joint Force Land Component Command Division Tactical Command Post; over 70 kilometers from the firebase. Additionally, the battery supported Task Force Erbil by providing personnel and assets for ongoing operations in Northern Iraq. The battery provided eight Soldiers to train and equip local Peshmerga forces as they prepared for major combat operations in the Tigris River Valley. The battery's support and guidance was critical for the peer unit's convoy operations to Kara Soar Base.

With the establishment of Qayarrah West Airbase, or Q-West, C Battery was again tasked to maneuver and emplace its intercept capability. They successfully integrated with 2nd Brigade, 101st Airborne Division (Strike Brigade) , executing multiple convoys of equipment and personnel and successfully emplacing three LPWS, one engagement operations center, and one battery command post at Q-West in support of the mission to isolate Mosul. C Battery's actions were instrumental in the protection of over 400 personnel and millions of dollars of equipment.

C/2-44th ADA demonstrated they are technically and tactically proficient at various levels of air defense operations. They maintain their equipment and themselves, keep safety awareness at the forefront of every operation and exude excellence in all areas. The unit's competency is beyond reproach and exemplifies the spirit and intent of the Henry A. Knox Award.

AIR DEFENSE ARTILLERY ALEXANDER HAMILTON AWARD

The Soldiers of B Battery, 1st Battalion, 188th Air Defense Artillery, North Dakota Army National Guard earn the 2016 Hamilton Award. (Courtesy photo)

The Hamilton Award recognizes the outstanding Army National Guard Air Defense Artillery Battery of the Year for superb mission accomplishment and overall unit excellence. The 2016 Hamilton is awarded to **B Battery, 1st Battalion, 188th Air Defense Artillery, Grand Forks, North Dakota Army National Guard.**

B Battery contributed significantly to the success of National Training Center Rotation 16-09 by successfully engaging 36 enemy aerial platforms with zero incidents of fratricide; thereby, denying the enemy's ability to observe friendly forces. The battery commander, Capt. Chris Walker and 1st Sgt. Shawn Heck, developed and implemented an aggressive training plan during fiscal year 2016 in order to achieve success during the three-week mission at NTC. This was the battery's first doctrinal "force on force" mission at a Combined Arms Training Center since 1998.

B Battery reported to NTC with 12 Avenger fire units (AFU) and three Sentinel radar teams comprised of 74 personnel to support the rotation. B Battery moved six AFUs forward, conducting screening operations with the cavalry while the rest of the brigade was moving to defensive positions. The Soldiers and AFUs were on the forward line of troops; this tactic worked so well the brigade decided to keep the six AFUs forward with cavalry unit and later with armor units as they moved forward into attack positions. The rest of the battery provided mobile air defense coverage for the supporting field artillery battalion as they moved into position. The Sentinel radars remained with the battery and were the only source of common operating air picture for the brigade, as well as, providing early warning during all phases of the operation.

B Battery also conducted a Stinger live-fire exercise, firing 14 live Stinger missiles in a tactical environment. This was the first time an Army National Guard unit has executed a Stinger live fire during an NTC rotation using a tactical configuration. It was a successful and significant event that was documented by the NTC Operations Group and has paved the way for future live-fire exercises of this type at the NTC.

It is also worth noting that of the 74 Guardsmen that executed this NTC rotation, 45 were also preparing for an upcoming National Capital Region deployment with their parent battalion, 1-188th ADA. They selflessly put in extra time and effort in order to study the visual aircraft recognition hotlist specific to the NCR mission as well as preparing for the General Knowledge Exam and other required U.S. Forces Command tasks.

B Battery performed at an exemplary level during training and all phases of this mission, achieving mission intent, ensuring all key tasks were accomplished. They also refined and documented tactics, techniques and procedures, and the Soldiers gained valuable knowledge and insight related to doctrinal and tactical air defense, which they would not have gained from any other kind of training. The Soldiers of B/1-188th ADA were able to successfully protect an entire brigade combat team during force on force operations against a near peer adversary. B Battery displayed that short-range air defense is relevant in a conventional fight with the capability of providing air defense Fires, early warning and airspace de-confliction.

B/1-188th ADA distinguished themselves and brought tremendous credit to the air defense community. They have demonstrated they are proficient at countless levels of air defense operations. They maintain their equipment and themselves, and keep safety at the forefront in all areas. The unit's competency is beyond reproach and exemplifies the spirit and intent of the Alexander Hamilton Award.

AIR DEFENSE ARTILLERY JAMES A. SHIPTON AWARD

Chief Warrant Officer 2 Kecin M. Kruthers, 10th Army Air and Missile Defense Command, is the 2016 Shipton Award winner. (Courtesy photo)

The James A. Shipton Award recognizes an air defense artillery professional for outstanding individual performance and contributions that significantly enhances the air defense mission and community.

The applicants for the Shipton Award are judged on leadership; technical and tactical knowledge; selflessness and community service; and commitment to excellence. The 2016 Shipton Award winner is Chief Warrant Officer 2 Kevin M. Kruthers, 10th Army Air and Missile Defense Command, Kaiserslautern, Germany.

Kruthers was hand selected by his commanding officer, over five other chief warrant officer 3's, to lead efforts regarding enhancements of existing defense designs; easily a task requiring the expertise and experience of a chief warrant officer 4. He initiated development and implementation of previously non-existent defense designs with the responsibility of providing required levels of protection and effectiveness by, with, and through joint and multi-national assets and interoperability challenges for numerous population centers exceeding one million residents. Kruthers proved to be a leader of character, presence and intellect, who develops highly effective teams and always achieves excellent results. Kruthers demonstrated unmatched technical and tactical expertise that resulted in an initiative garnering Headquarters, Department of the Army-level approval, heavily influencing the development and approval process of Combatant Command-level critical asset list and defended asset list. This allowed for the flawless execution of employment of the Deployable Patriot Integrated Control Center during Tobruq Legacy 2016, and synergizing air and missile defense inputs in air tasking order cycles within air operations center strategy and combat plans divisions; enhancing warfighter and combat readiness holistically. Kruthers' community service efforts are unparalleled with regards to helping so many in desperate need of support, lifting morale and increasing resiliency through a shared vision of hope. His commitment to excellence in every undertaking is evidenced by the numerous times he earned the title of distinguished honor graduate and other prestigious accolades. His military appearance and bearing is truly worthy of emulation by all in the branch and Army.

Kruthers epitomizes leadership qualities, commitment to excellence and innovative energy that has come to define the air defense artillery's founding father, Brig. Gen. James A. Shipton.

The 2016 Knox, Hamilton and Gruber Awards

The U.S. Army Field Artillery School announced the winners of the Field Artillery 2016 Knox, Hamilton and Gruber awards. These awards are presented annually and recognize excellence by unit (active and National Guard) and individual. Congratulations to the 2016 award winners.

FIELD ARTILLERY HENRY A. KNOX AWARD

Members of C Battery, 4th Battalion, 1st Field Artillery, fire an M109-A6 howitzer during section certification and a live-fire exercise-. (Tech Sgt John Houghton/U.S. Air Force)

C Battery, 4th Battalion, 1st Field Artillery Regiment earned the 2016 Field Artillery Henry A. Knox Award.

This award recognizes the outstanding active-duty Army Field Artillery Battery of the Year for superb mission accomplishment and overall unit excellence. Originally called the Knox Trophy and Medal, these awards were established in 1924 by the Chief of Field Artillery and presented annually. They recognize the Best Artillery Battery (Trophy) and Best Enlisted Artillery Soldier (Medal) based on performance, excellence, leadership and proficiency. The awards recognize hard work, talent and determination that resulted in performance at the highest of standards. The awards were halted during World War I and were not re-initiated until 2002. The Knox Medal is no longer presented, but was replaced in 2002 by the creation of the Gruber Award for recognition of the individual Artillery Soldier.

In preparation for their missions in Operation Spartan Shield and Operation Inherent Resolve, C Battery, 4th Battalion, 1st Field Artillery Regiment flawlessly conducted predeployment training and certification. C Battery completed a 30-day battalion field training exercise (FTX), Operation Grapeshot, a division artillery readiness test, Iron Focus FTX and Fires coordination exercise, a National Training Center rotation, as well as the Precision Guidance Kit fielding. Based on their superior performance, the battery was selected to spearhead the battalion's mission in support of coalition forces Land Component Command (CFLCC-1) in Kuwait.

The battery transitioned from a 2x8 M109A6 unit to a 3x6 formation. By Sept. 30, the dispersed platoons fired over 1,200 rounds, across multiple provinces in Iraq, and were credited with significant enemy killed in action. The battery was critical to the fight and their timely and accurate Fires demonstrate the devastating lethality of a well-trained field artillery unit. C Battery's relentless and inspiring dedication to support ground forces epitomizes the bravery of all artillerymen as well as the relevance of the field artillery as a force multiplier.

They have continued their legacy of excellence setting new standards for the battalion and the 1st Armored Division Artillery and clearly show why FA is the King of Battle.

Most Recent Knox Awardees

2015: C Battery, 2nd Battalion, 319th Airborne Field Artillery Regiment, Fort Bragg, N.C.

2014: B Battery, 4th Battalion, 27th Field Artillery Regiment, Fort Bliss, Texas.

2013: A Battery, 2nd Battalion, 15th Field Artillery Regiment, Fort Drum, N.Y.

2012: B Battery, 1st Battalion, 77th Field Artillery, Schweinfurt, Germany.

FIELD ARTILLERY ALEXANDER HAMILTON AWARD

Gov. Gary Herbert hosted a ceremony to award Soldiers from the 1st Battalion, 145th Field Artillery, Utah Army National Guard, Dec. 15, 2016. (Courtesy photo/Utah National Guard)

The winner of the 2016 Field Artillery Alexander Hamilton Award is **B Battery, 1st Battalion, 145th Field Artillery Regiment of the Utah Army National Guard.**

This award recognizes the outstanding U.S. Army National Guard Field Artillery Battery of the Year for superb mission accomplishment and overall unit excellence. The Alexander Hamilton Award was created in 2002 and is named after American statesman and Continental Army artilleryman Alexander Hamilton. Hamilton was an outstanding artillery battery commander and a skilled cohort of Gen. George Washington during the Revolutionary War. Hamilton helped frame the U.S. Constitution and also served as the nation's first Secretary of the Treasury.

Soldiers of B/1-145th FA were tasked with two missions in training year 2016: deliver artillery Fires and support the Homeland Response Force (HRF). B Battery executed both missions flawlessly. The capstone event for the battery was a brigade artillery live fire-exercise at Camp Guernsey, Wyo., and a HRF simulation training exercise in Denver, Colo. In support of the HRF mission, B Battery trained Soldiers to assist and support security and decontamination efforts in a simulated chemical, biological, radiological, nuclear and enhanced conventional weapons environment in order to respond to a domestic disaster.

B Battery also had a very strong presence in the local area and supported the community that supports them. B Battery conducted over 26 community support activities in training year 2016. These activities included funeral details, flag ceremonies, color guards and assisting with local youth recreation programs. The unit members helped with the Santa Flight during Christmas, bringing toys and school supplies to needy children of the local community.

B Battery also deployed four Soldiers during flooding in southern Utah to help with search, rescue and recovery of missing persons. Finally, the unit fired 460 observed rounds without incident and capped the year with a perfect safety record.

Most recent Hamilton awardees

2015: A Battery, 3rd Battalion, 197th Field Artillery Regiment, New Hampshire Army National Guard.

2014: A Battery, 1st Battalion, 181st Field Artillery, Tennessee Army National Guard.

2013: B Battery, 1st Battalion, 121st Field Artillery, Wisconsin Army National Guard.

2012: B Battery, 2nd Battalion, 218th Field Artillery, Oregon Army National Guard.

FIELD ARTILLERY EDMUND GRUBER AWARD

Sgt. 1st Class Zachary Wilkerson (third from the left), 1st Battalion, 94th Field Artillery, 17th Field Artillery Brigade, is awarded the Edmund Gruber Award, Feb. 13, 2017, during an award ceremony at Joint Base Lewis-McChord, Wash. (Courtesy photo/1st BN, 94th FA)

The winner of the 2015 Field Artillery Edmund L. Gruber Award is **Sgt. 1st Class Zachary S. Wilkerson, 1st Battalion, 94th Field Artillery Regiment, 17th Field Artillery Brigade, Joint Base Lewis-McChord, Wash**.

This award recognizes an outstanding field artillery Soldier for superb individual thought, innovation and overall excellence resulting in significant contributions to the enhancement of the field artillery's warfighting capabilities. This award is named after Brig. Gen. Edmund L. Gruber, a noted field artillery officer, who as a first lieutenant in 1908 composed the "Caisson Song," which the Army adopted as "The Army Song" (The Army Goes Rolling Along) in 1952. The Gruber Award was established in 2002.

Wilkerson performed with distinction as the 2nd Fires Platoon sergeant, A Battery, 1st Battalion, 94th Field Artillery Regiment, Al Asad Air Base-Iraq, from Feb. 5, 2016 to Aug. 13, 2016 during Operation Inherent Resolve (OIR). His expertise was instrumental in his battery's ability to provide timely and effective surface-to-surface High Mobility Artillery Rocket System (HIMARS) Fires in support of the Combined Joint Task Force-OIR mission. Wilkerson's platoon successfully fired more than 500 rockets supporting hundreds of combat missions and all without incident. The platoon's timely and accurate Fires resulted in the destruction and degradation of enemy fighters, infrastructure and equipment through Anbar Province, Iraq.

Wilkerson's contributions to the field artillery ensured overall mission success and built confidence in senior Army leaders when employing HIMARS. His leadership, tactical and technical proficiency resulted in a highly-motivated and lethal force that significantly contributed to the fight against the Islamic State of Iraq.

Most recent Gruber awardees

2015: Sgt. 1st Class Jorge A. Moraguzman, 2nd Battalion, 15th Field Artillery.

2014: Sgt. 1st Class Daniel A. King, 1st Battalion, 320th Field Artillery.

2013: 1st Lt. Nathaniel J. Holcomb 1st Battalion, 41st Field Artillery.

2012: Sgt. 1st Class Thomas Robinson 1st Battalion, 377th Field Artillery.

Congratulations to the winners of the 2016 Knox, Hamilton and Gruber awards. The United States Army Field Artillery School would also like to thank the unit leaders who took the time and effort to highlight their Soldiers and units showing the awesome power and effectiveness of the King of Battle.

Some new, some old, all necessary

The multi-domain imperative

By William Dries

"War is both timeless and ever changing. While the basic nature of war is constant, the means and methods we use evolve continuously."
Marine Corps Doctrine Publication 1

William Dries speaks to an audience as an Air Force colonel and command pilot. He is now retired and working with the Army and Marine Corps on a multi-domain battle concept. (Scott M. Ash/U.S. Air Force)

I deployed to the Middle East in 2008 as part of a large U.S. Air Force expeditionary operation. Our group and its squadrons had many challenges: bedding down and feeding hundreds of people flowing in and out of theater, sustaining combat operations for different types of aircraft, and keeping up a non-stop tempo of diverse missions in a fight against terrorists and insurgents. However, we weren't worried about our base getting attacked with long-range missiles. We knew our radios and computer networks wouldn't be jammed or disrupted. We had no doubt that our outfit's huge logistics requirements would be satisfied. While the Taliban, Al Qaeda and other enemies in Iraq and Afghanistan posed a constant danger to Soldiers and Marines on the ground, they presented little threat to operations in the air and space, at sea, or in cyberspace. However, those days are gone. The U.S. military faces a new reality – one with "multi-domain" challenges to our preferred way of fighting. As such, the way the U.S. military builds its force, integrates its planning and synchronizes its operations must change, and it must change quickly.

"Domain" is one of those words thrown around often in military circles. It's worth exploring exactly what we mean here to explain changes in the character of war. A domain is "a region distinctively marked by some physical or virtual feature(s)." In modern military lingo, there are five interrelated domains: land, maritime, air, space and cyberspace. Operations in the land domain are dominated by geographic features: roads, cities, towns, as well as significant limiting factors on the ease of travel, such as mountains or rivers. The maritime domain has different physical limitations. It is constrained by chokepoints and other geographic features, and requires the use of specialized vessels for movement and survival. It includes everything on and underneath the surface of the sea, as well as the shores and islands that touch the sea. The air domain is not as dominated by terrain features and permits faster movement and maneuver than operations on land or at sea. However, like those in the maritime domain, operations in the air require advanced, specialized vehicles. It is also more difficult to stay in the air domain, since "what goes up, must come down" for fuel and other resources at predictable intervals. The space domain — the world of orbits and satellites — is also a physical domain with a unique set of limitations and is the most technology-dependent. Satellites can remain in orbits for years and years, but operations in space are somewhat inflexible. Whatever is in orbit right now is all that can be counted on until a new space launch. Cyberspace is the only virtual domain. It consists of "pathways," made of computers, networks, and IT infrastructure that permit the movement of data. The cyberspace domain is wholly man-made and is ever-changing. The U.S. military uses this five-domain construct to build its future force, to plan and to conduct joint operations.

After the fall of the Soviet Union and before the rise of China, the U.S. military experienced a fairly long period of unchallenged dominance. The military services focused on excellence in their domains of warfare: the Army on land and the air above in support of operations on land; the Navy and

Marine Corps on the seas, littorals, and the air above; and the Air Force in air and space. For decades, these forces have been used by the Pentagon in a specific way and in accordance with a consistent model: With the Air Force and Navy providing air superiority, maritime superiority, theater-wide awareness and long-range communications, Army and Marine forces move into theater and freely maneuver. This model relies on combatant commanders to plan, task and execute operations using functional components. These components, aligned largely along domain lines with the special operations component being a notable exception, plan and execute all operations for the unified combatant commanders. For a particular task, a component is designated as the lead and is then "supported" by the other components to complete its mission. To sustain this model, the military departments develop capabilities to dominate their domains. The Army develops forces to dominate on land, naval forces dominate the maritime environment, and the Air Force focuses on control of air and space. Integration across service or component lines occurs mainly after deployment into a theater. This warfighting model has been effective at deterring and defeating conventional adversary forces. This is not to say U.S. forces have not been successfully taxed and challenged by low-end enemies, but with almost no challenge in these theaters in the air, maritime, space, and cyber domains, the U.S. military been able to effectively mass Fires and maneuver and operate as a joint force the way it is designed.

The end of assured U.S. dominance

How long can the traditional American warfighting model endure? Perhaps not much longer. This way of organizing to fight remains useful for combat against the Islamic State, Al Qaeda and the Taliban. But when it comes to Russia, China and other nation-states, the times are changing. These states are developing capabilities to counter or undermine U.S. advantages. The character of war (the distinction between war's character and its nature was succinctly explained by Chris Mewett in these pages) is changing as a result. A good example of this change is a new generation of Russian and Chinese ballistic and cruise missiles. These advanced missiles are precise, have longer ranges, boast several forms of guidance and can be launched from a variety of platforms. Other nations are not simply "playing catch up" and attempting to field forces similar to those of the United States. If this were the case, the U.S. military could comfortably stay ahead using the same methodology that produced its advantages in the first place. Instead, competitors are deliberately seeking and presenting asymmetrical challenges to U.S. operational access, basing, communications and freedom of action. America's ability to dominate domains, relied upon since the end of the Cold War, is being rapidly undermined.

These changes not only contest U.S. dominance in each domain, they present challenges that transcend these domains in a complex way. Traditionally, the best way to attack a fielded force operating in a domain is with a capability from a different domain. For example, attacks from the air domain against land forces are particularly devastating because of the mismatch in speed of maneuver, the unpredictability of the direction of attack and the fact land vehicles like tanks have specific defensive weakness that air attacks exploit. This has not changed. However, in the emerging "multi-domain reality," an attack will often come from multiple domains simultaneously: jamming of radios and datalinks, persistent surveillance, and precise, long- range Fires, from any or all domains. Potential adversaries have only recently achieved this level of complexity and asymmetry. For example, an American land force (like a tank battalion) can now be effectively attacked from land, sea, air and cyberspace (and maybe soon space). And this can all happen from long range, in ways that are difficult to defend against, and all at the same time. This was not true 20 years ago.

Given these challenges, should the U.S. military simply improve integration along the lines of the traditional model or build a new multi-domain model? Any answer to this question must address two additional questions. First, can the U.S. military fully integrate space and cyberspace into its operations? Second, can the services learn to think of each other as teammates rather than adjuncts and build command and control mechanisms which make that possible? Thinkers from all services and outside the military are starting to advocate that the Department of Defense must think, plan and operate with a multi-domain approach.

But is this really necessary? Operations in multiple domains has existed since the first attack on land from sea. Militaries have been operating in air and space for decades. Cyberspace is more pervasive than ever, but is at least 30 years old as well. It is tempting to stay the course and continue to lean on the current warfighting model. After all, U.S. forces have demonstrated their operational superiority many times in the recent past. But before we reaffirm our confidence in the traditional model, we need to consider what is actually new today: Adversaries are increasingly targeting U.S. proficiency in the information environment — the complex area wherein space, cyberspace, communications, and command and control networks intersect.

U.S. forces, along with the rest of American society, are increasingly reliant on exquisite and assured communications, information technology and infrastructure. Much of the qualitative advantage enjoyed by U.S. forces is rooted in advancements in space and cyberspace. Yet both are now contested domains in which adversaries can exploit vulnerabilities and weaken U.S. advantages. A theoretical but realistic example is a successful cyberspace attack on U.S. naval communications networks that degrade situational awareness and cause surface combatants to resort to slower and less efficient back-up networks. In a conflict where U.S. advantages are already small, this type of disruption may be all an adversary needs to seize the initiative.

I am not arguing that the required solution to this problem is revolutionary. In fact, multi-domain operations are another form of jointness, but far more advanced and profoundly different than the kind of jointness the U.S. military has been accustomed to since the Goldwater-Nichols Act. My point is that relying on the traditional warfighting model presents vulnerabilities that capable enemies will exploit, potentially at great cost in American blood and treasure. Trusting in improvements to the fringes of the old way of doing things is the equivalent of just "trying harder." Rather than

ignoring the new reality and assuming domain dominance as some sort of American birthright, the U.S. military should engineer multi-domain thinking into what it buys, how it plans and how it executes. The military needs more than just having and using capabilities across the five domains. It needs the ability to integrate planning and conduct operations with capabilities from all domains regardless of which service, component, or level of command they come from. This will be a tall order, for certain, but the strategic environment demands it.

The ability to understand an enemy's activities and direct actions in multiple domains with speed and agility is the key to all of this. Multi-domain operations will require truly integrated joint planning, tasking and execution — from the theater/campaign level to the level of tactical units. This will probably prove impossible without a high degree of automation to enable U.S. forces to gather more data than ever before, make sense of it more accurately and more quickly, and direct actions and make decisions as immediately as possible. Yet automated systems come with their own vulnerabilities. So, along with advanced information technology, the U.S. military needs to instill in its commanders the ability to deal with ambiguity and incomplete information — the fog of war in the digital age — yet continue to operate in a manner consistent with the higher commander's intent. This idea is sometimes called "mission command" or "command by negation" and is most effective when it enables well-trained and independent-minded people with powerful decision support tools. While this will be more difficult and complicated across domains, the value of pushing decision-making authority – based on the commander's intent – to the lowest practical levels will be critical.

While the services remain tied to domain-centric force structures, the good news is the services seem to collectively understand the nature of the challenges and the requirements of the solution. Each of the services is developing operational concepts to describe its specific role in the multi-domain solution. This includes the Air Force's Adaptive Basing concept, the Marine Corps' Expeditionary Advanced Base Operations (EABO) concept, and the Navy / Marine Corps' Littoral Operations in Contested Environments (LOCE) concept. The Army and Marine Corps recently completed a white paper describing "multi-domain battle." This will be followed by a multi-service concept document. In the interest of full disclosure, I am one of the Air Force folks working with the Army on this concept.

The need for a multi-domain battle concept

In a widely read War on the Rocks article earlier this year, Air Force Col. Mike Pietrucha offered a critique that made many advocates of multi-domain battle sit up and take notice. He took the Army and Marine Corps proposals to task, reminding the Army of how dependent land forces are on the Air Force. While his descriptions of the force of today and yesterday are undeniably accurate, they do not have to be true for the force of tomorrow. If anything, Pietrucha's article reinforces the fact that no single service can go it alone – the notion that animates multi-domain battle. Rather, force posture, power projection, and presence in all domains will require a yet unseen organization and operational construct that integrates all services and agencies.

The fact that the U.S. Army does not currently possess a truly multi-domain force does not invalidate the idea. If that were the case, nothing would ever advance past the concept phase. The ideas behind multi-domain battle are what matter for future force development, not a rehash of the history of operations based on a different model. These ideas must become ingrained in U.S. military culture across the services. This, however, comes at a cost: The services are understandably reluctant to trade proficiency in their core competencies for futuristic-sounding but potentially empty promises of multi-domain prowess. This is why the concept of multi- domain battle is important for the U.S. Army and the entire military. To become skilled at integration across service and functional boundaries, each service must first instill multi-domain thinking into its own force.

The Army and Marine Corps multi-domain battle white paper calls for a mobile land force that can deny freedom of action to an adversary while protecting itself from attack. Such a force requires organic firepower (including cyber teams), tactical intelligence, surveillance and reconnaissance, and air defense capabilities. Additionally, this force must also possess the ability to distribute tactically and withstand adversary attack. This land force would not operate alone. The contested environment demands forces from all domains to fight as a single, complex, adaptive organism. Such a fully integrated multi-domain force can generate opportunities for itself while creating multiple dilemmas for an adversary. This integrated U.S. team, made up of forces from multiple domains, can act quickly and regain the initiative over an adversary. As an example, the Army does not sit and wait for air (or maritime) superiority to be created — it is inherently involved from the beginning in achieving this objective.

The point of multi-domain battle is not to develop land forces that independently create their own access and freedom of action. This would be duplicative of what an integrated joint force offers. Multi-domain battle as a concept cannot be about any one service. It is instead about all services playing on the same team in an environment in which deconfliction, supported/supporting relationships, or basic synchronization are no longer sufficient. The future land force cannot remain a heavy force that becomes relevant only after other forces create theater-wide air and maritime superiority. It should be forward, tailorable, and able to rapidly maneuver and conduct integrated multi-domain operations. This can only be accomplished by working continuously with the other services, creating habitual relationships between tactical units, and training according to a "multi-domain, all the time" mindset. To this end, a multi-service, multi-domain battle concept is a welcome step in the right direction. It serves as a clear recognition of the changing complexion of the character of war, and the necessary moves the entire Joint Force must make to succeed in the security environments of today and tomorrow.

Bill Dries is a strategist working in the Air Staff's concept division. He is a retired U.S. Air Force colonel and command pilot with over 3,000 flight hours. He has commanded at the squadron and group level, and is currently working with the U.S. Army and Marine Corps on a multi-domain battle concept.

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The Hunter (pictured) and Killer vehicles were experimented on during the Maneuver Fires Integrated Exercise, April 3, at Fort Sill, Okla. The intent of the vehicles is to provide rapidly-deployed platforms that give Soldiers cross-domain Fires capabilities. (Monica K. Guthrie/Fort Sill PAO)

Fort Sill experiments with future military capabilities

By Monica Guthrie

An anti-unmanned aerial vehicle defense system searches the skies of Fort Sill, Okla., April 6, during the Maneuver Fires Integrated Experiment. (Monica K. Guthrie/Fort Sill PAO)

The future of military capabilities was tested during the Maneuver Fires Integrated Experiment (MFIX) at Fort Sill. The event took place April 3 through 13 and brought more than 40 industry partners and government agencies together to experiment on new equipment and technologies. Additionally Soldiers from across the country took part in the event, using equipment that for some projects were only concepts a year ago.

"This is a collaborative effort between the Fires Center of Excellence and the Army Capabilities Integration Center," said Lt. Col. Jeff Erts, chief of experimentation and war gaming Fires Battle Lab.

The first objective of the MFIX was to look at systems and processes to decrease the time it takes to engage targets said Erts. Targets on the battlefield may be fired against using precision munitions and therefore require the ability to gather precise locations rapidly.

The Hunter and Killer vehicles were two new platforms experimented at MFIX that would provide Soldiers with multi-domain capabilities to defeat multiple enemies swiftly. Mounted on vehicles resembling dune buggies, the Hunter and Killer platforms have the ability to deploy rapidly, track aircraft and perform three-dimensional Fires targeting among other capabilities.

"We want the forward observer to fight in their domain which is land-based Fires, precision firing," said Scott Patton, science and technology strategist for the U.S. Army Aviation and Missile Research Development and Engineering Center Battlefield Operating Systems Suites Team, who helped design the Hunter and Killer. "In the land domain, precision Fires, everything is about getting precision fast so you can shoot."

The Hunter and Killer vehicles were also experimented on to see if Soldiers would be able to do their primary mission as forward observers, and then be able to handle the additional workload should they be confronted with a threat from another domain. This multitasking was the second objective of MFIX which was to evaluate if current Fires support Soldiers could add another duty to their mission. The experiment evaluated the ability of Soldiers to conduct their traditional artillery mission but also added a counter unmanned aerial vehicle mission to their responsibilities.

The Hunter/Killer vehicles gauged Soldier's multitasking abilities as did the AUDS, which stands for anti-unmanned aerial vehicle defense system, which works against UAVs, or drones, by detecting, tracking, identifying and defeating them said Tom Scott, president of LITEYE Systems, who helped create AUDS. With AUDS, which was deployed to units in October 2016, users can detect a UAV on their radar, slew up a camera, see the drone, pull a trigger and send a concentrated amount of energy toward it which would interrupt the signal between the UAV and its operator.

"The radar portion is not my (military occupational specialty) but anything can happen and you have to learn multiple jobs," said Pvt. Shamar Paulhill, 108th Air Defense Artillery, air missile defense crew member. Paulhill came to Fort Sill from Fort Bragg, N.C., to experiment with the AUDS. "I can see where this will help us in the future."

The third objective of MFIX was to continue the study of high-energy lasers. Last year MFIX featured a compact laser weapons system using a 2-kilowatt laser mounted on a Stryker armored vehicle called the Mobile Expeditionary High Energy Laser (MEHEL). The 2016 experiments used the laser against UAV threats and boasted an ability to provide an "unlimited magazine" to Soldiers for as little as the cost to run the generator. This year, the experiment pushed the abilities and increased the laser to 5 kilowatts.

"We're working with Space and Missile Defense Command, using their mobile expeditionary high-energy laser to engage various targets to include low-flying UAV," said Erts. "For the very first time here at MFIX 2017, U.S. Army Soldiers engaged and destroyed aerial targets."

Soldiers defeating UAVs with the MEHEL's laser was an accomplishment echoed by Adam Aberle, with the U.S. Army's Space and Missile Defense Command. Aberle said last year contractors operated the experiments and this year Soldiers were incorporated into the experimentation. They were trained on the systems and then operated the systems for the entire duration of MFIX.

"Really one of the biggest things, and the thing that we're highlighting, is that this

Top: Spc. Brandon Sallaway (right) 2nd Battalion, 12th Field Artillery, 1st Brigade, 4th Infantry Division, shows Staff Sgt. Eric Davis, 4th Infantry Division Artillery, an unmanned aerial device he shot down with a laser during the Maneuver Fires Integrated Experiment at Fort Sill, April 5. The lasers, Mobile Expeditionary High Enegry Laser, were mounted on Stryker armored vehicles. (Monica K. Guthrie/Fort Sill PAO)

Bottom: A joint tactical autonomous air resupply systems (JTAARS) carries a small package during the Maneuver Fires Integrated Experiment at Fort Sill, April 12. The JTAARS experimented with the possibility to use unmanned aerial vehicles, autonomously, to deliver supplies to service members. (Monica Wood)

was the first time Soldiers destroyed a UAS," he said. "They're a very small target flying in clutter. Being able to maintain a track on them is very challenging."

The final objective of MFIX was to delve into the realm of resupply, looking at ways to deliver supplies to the forward edge of the battlefield using autonomous unmanned aerial systems, said Erts. Right now the system called joint tactical autonomous air resupply systems can carry small packages, but industrial partners have plans for it to be scaled to carry 600 pounds around the battlefield.

"Anytime you don't have to put Soldiers' lives in danger to deliver supplies, that's a benefit," said Erts. "So generally sustainment convoys are lightly armored, they don't have a lot offense or defensive capabilities. If we can fly over the heads of the enemy and deliver supplies without having to engage possible enemy along the way, that's going to save Soldiers' lives."

Monica Guthrie is an award-winning photojournalist. She is a Fires Center of Excellence media relations specialist and regular contributor to the Fort Sill Tribune.

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Future Army cross domain Fires

Bridging tomorrow's implications with initiatives today

By James Howard

"Today's security environment is dramatically different than the one we've been engaged in for the last 25 years and it requires new ways of thinking and new ways of acting. We will be prepared for a high-end enemy. In this context, Russia and China are our most stressing competitors."

- Secretary of Defense Ash Carter

In order to provide timely and accurate Fires, effective targeting must be conducted; coordination with Army and joint, interorganizational and multinational (JIM) partners is required before, during and after targeting. The Fires warfighting function focuses on the ability to synchronize the capabilities of Army and JIM partners, to identify shortfalls in coordination, integration and targeting, and to align efforts focused on learning and mitigating these shortfalls. Exercises, studies, wargames and seminars conducted in 2015 and 2016 demonstrate problem areas for future joint forces. Lessons learned from real-world situations demonstrate gaps in integration of targeting through all domains. Airspace deconfliction and clearance of Fires remain a challenge with most solutions being developed as regional work-arounds. The Army continues to learn and develop mitigation strategies through experimentation and participation in joint and multinational venues.

Understanding the operational environment through a Fires lens

Easily transferred military technologies enable potential adversaries to develop capabilities that counter U.S. power projection and limit U.S. freedom of action. Of particular note, their maturity of weapons and methods in relatively new domains of cyberspace and space conceptually challenge traditional U.S. strengths, and arguably access, to the air and maritime domains. Potential enemies invest in technologies such as long-range precision Fires, air defense systems and unmanned aircraft systems, with the intent of denying the U.S. ability to achieve overmatch. Because of adversary anti-access and area denial (A2/AD) capabilities, the joint force's ability to achieve air dominance and sea control is suspect, as is the ability project land power. Additionally, some potential adversaries have more weapon systems, more munitions, greater range of indirect fire systems, and more lethal capabilities than the joint force can realistically deploy, especially on a short timeline.

Further exacerbating the shortfalls in numbers and capability, peer threat A2/AD strategies limit freedom of action over wide areas. Opponents will position forces and capabilities to support rapid, massed attacks against air and seaports, staging bases and other force generation assets, intending to interrupt the flow of forces and sustainment. They will also seek to deny the use of wide geographic areas to friendly forces, further limiting the buildup of combat power and attriting friendly forces as they move into a theater. Adversaries are developing increasingly capable systems such as unmanned aerial platforms, submarines, tube and rocket artillery, and cruise and ballistic missiles intended to accomplish these objectives. Besides directly threatening military forces, adversaries may also threaten regional allies who provide basing, overflight and other support by threatening their infrastructure and populations. Adversaries may also use other elements of national power such as diplomacy, economics or mass media to influence regional players and populations to support their A2/AD strategies.

The cyberspace domain and the electromagnetic spectrum (EMS) have risen in priority over the last decade. Cyberspace and EMS superiority are not only a critical enabler for all joint functions, but it fosters the cross-domain integration essential to success in any major combat operation. Achieving EMS superiority is a precondition for successful joint combined arms operations. Army and JIM forces face serious competition in cyberspace and the EMS, particularly at tactical levels where friendly capabilities are far less mature than those of peer competitors.

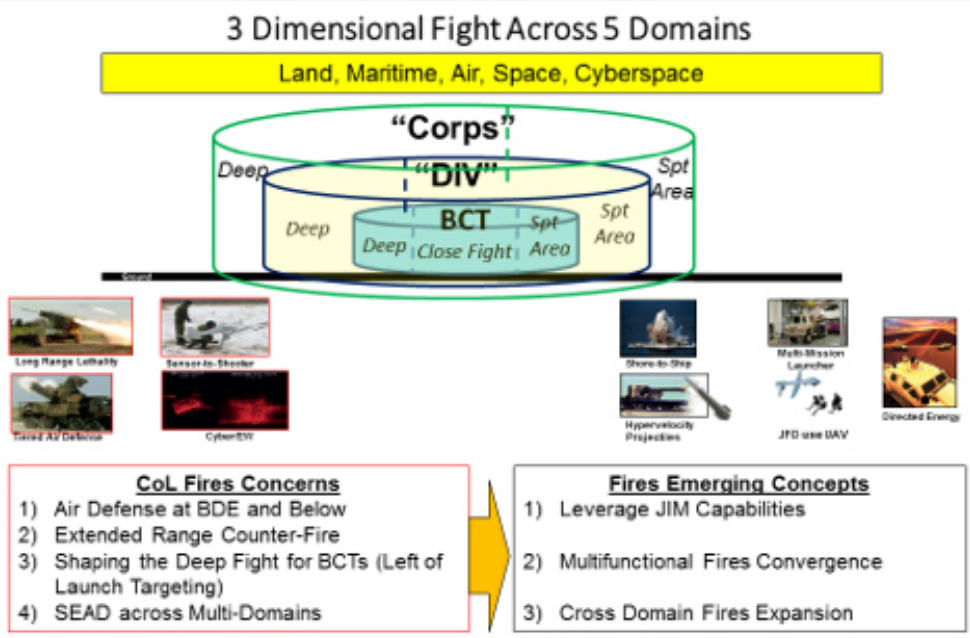


Figure 1: An approach to learning: one close fight, with bubbles of deep fights and support areas requiring defense in terms of Fires capabilities. As points of reference and acknowledging that future formations may look dramatically different than today, the Fires Center of Excellence relied on current responsibilities and authorities by echelon for cumulatively increasing the understanding of future implications. The term "bubbles" refers to the three dimensional aspect of the battlefield: front, rear, flanks, above, and in some environments, below the surface. Campaign of learning events over the course of the last year informed running estimates with variations of thematic concerns: short range air defense, long range fires, shaping the deep fight, and suppression of enemy air defense. As described in the draft Army Functional Concept for Fires, the approach to address these growing concerns shaped around three emerging concepts: Cross Domain Fires Expansion; Multifunctional Fires Convergence; and, Leveraging Joint, Interoganizational and Multinational Capabilities. (Courtesy illustration)

As the Fires Center of Excellence addresses these concerns, the construct visualized in Figure 1 has become a revisited frame of reference. Air defense at the brigade level and below is deliberately not air defense artillery, as in many cases, such as the fight against enemy unmanned surveillance capabilities. The problem cross-cuts Army-wide concerns and is beyond the scope of a sole branch or warfighting function. Further, this is deliberately brigade and below, not restricted to brigade combat team (BCT) and below, particularly in those support areas falling outside of the BCT "bubble." Arguably, the majority of critical assets such as friendly points of entry, reside in the bubbles outside of BCTs. Of concern with regard to extended range counterfire as described in the opening paragraphs, our adversaries can influence the close fight with impunity in many scenarios. Shaping the deep fight for BCTs starts with the operational targeting of larger, longer-ranged integrated air defense systems and threat-fixed wing aircraft in an attempt to gain air superiority and freedom of action in the air domain, as well as threat tactical ballistic missile launch sites prior to firing "left of launch," thereby setting conditions for the tactical fight. Suppression of enemy air defenses across multiple domains speaks to adversaries establishing air supremacy from the ground with tiered air defense integrated cyber capabilities. The joint force requires moments of local air parity at a specific time and place in order to establish access to denied areas. Through targeting, Fires synchronizes with a scheme of maneuver by integrating available Army, joint, interorganizational and multinational capabilities to achieve the necessary lethal and non-lethal effects to that end. Additionally, the future operational environment will demand Fires expand passed traditional land and air domains and produce lethal and non-lethal effects into the maritime, space and cyberspace domains. Additionally, the evolutionary combination of organizations, systems, skills, training and education common to both air defense artillery and field artillery and possibly beyond the Fires community, clearly frames the future of Fires. Lastly, increased threat capabilities coupled with reductions in resources across all services highlights the need for improved Army integration with JIM partners. More than ever, the future requires understanding partner capabilities and integration challenges that facilitate targeting to enable freedom of maneuver through all domains.

American military power is joint power, and joint operations are critical to cope with such complexity. The Joint Operational Access Concept (JOAC) identifies the challenge for future joint forces to project military force into an operational area and sustain it in the face of armed opposition by increasingly capable enemies and within contested domains. The JOAC proposes employing cross-domain synergy – the complementary vice merely additive employment of capabilities in different domains such that each enhances the effectiveness and compensates for the vulnerabilities of the others — to establish superiority in some combination of domains that will provide the freedom of action required by the mission.

Understanding implications of the operational environment

Because enemies and potential adversaries in the future threaten U.S. advantages in the land, air, maritime, space and cyberspace domains, the Army must project power across all domains to ensure joint force freedom of action. In other words, every domain in the future may be contested. Additionally, capable and elusive potential adversaries may employ advanced anti-tank, air defense, and indirect fire capabilities that disrupt our ability to fight as a joint force, resulting in a future Army that must operate in dispersed fashion across wide areas with the ability to concentrate rapidly as necessary. That is to say, the future battlefield will likely be a lethal place to form up in mass for any period of time. Continuing along this line of reasoning, future enemies will avoid U.S. strengths and emulate U.S. capabilities to counter our advantages in the land, air, maritime, space, and cyberspace domains, meaning the Army must see, fight, learn and adapt operations across wide areas while maintaining contact with the enemy across all domains. To be clear, this lethal and dispersed battlefield must also facilitate organized collaboration and shared understanding.

Lastly, because enemies will attack systems critical for joint and Army opera-

tions to disrupt the ability to integrate joint combined arms capabilities, the Army must employ cross domain capabilities that are resilient, hardened and degrade gracefully under attack. Degraded operations are more of a likelihood on the future battlefield. With these four implications in mind (contested domains, lethal battlefield, dispersed organizations and degraded operations), the future operational environment requires Army commanders to integrate cross domain capabilities creating temporary, near-simultaneous windows of domain superiority to seize, retain and exploit the initiative in close combat.

Reframing the Army Fires problem

The Fires Center of Excellence approached fiscal year 2016 Campaign of Learning with the intent of informing efforts to lessen the impact of two out of 20 total Army warfighting challenges (AWFC):

#17. How to coordinate and integrate Army and joint, interorganizational, and multinational Fires and conduct targeting, across all domains to defeat the enemy and preserve freedom of maneuver and action across the range of military operations.

#18. How to deliver Fires to defeat the enemy and preserve freedom of action across the range of military operations.

FCoE successfully reintroduced targeting to AWFC #17 in fiscal year 16, however, excluding the delivery aspect of the decide, detect, deliver, assess cycle from this problem-set facilitates conceptual seams in both challenges. Further, AWFC #18 and specifically delivering Fires, is seemingly disconnected from the informative targeting cycle and necessary kill-chain actions to be of specific use. These observations among a multitude of conceptual others, results in FCoE reframing the root problem informing further learning efforts:

How does the Army integrate and deliver cross domain Fires through targeting to create lethal and non-lethal effects in a JIM environment that enables friendly freedom of action and defends critical assets?

Bridging implications with initiatives

Anticipated future conditions require Army Fires to include material-centric solutions, but must also broaden the scope to counter and overmatch enemy capabilities. As Figure 2 depicts, the Army requires an integrated and approved approach to synchronize efforts, across doctrine, organizations, training, material, leadership development, personnel, facilities and policy.

Focusing on the cross-cutting challenge of countering enemy unmanned aerial systems (UAS), FCoE seeks to identify cross-domain solutions by utilizing capabilities from all warfighting functions in a coordinated manner, to detect, identify, and defeat threat UAS. This effort also seeks to integrate joint capabilities, multinational partner capabilities, and a "whole-of-government" approach, recognizing that capabilities can be developed from various sources.

There are several organizational initiatives worth exploring, to include emerging growth for the division artillery in the Total Army Analysis (TAA) 20-24 for Long Range Shooter and Sensor capabilities. An organic UAS platoon to the DIVARTY provides an organic deep sensor which will allow the division to shape the fight for BCT success, provide a defense in depth, and conduct post-strike battle damage assessment (BDA). Building on the success of the joint air ground integration cells (JAGICs) controlling airspace at the division level, FCoE is looking at expanding the current brigade-level air defense and airspace management/brigade aviation element cell into a brigade AGIC to control the airspace over the brigade. Maneuver/Fires Integration Exercise 2015 also identified that the addition of a 14-series noncommissioned officer at the maneuver battalion Fires cell had a positive impact on mission execution.

Current sustainable readiness model requirements and the current plan to stand up only two active duty integrated fire protection capability (IFPC) battalions created a sufficiency gap for the projected requirements, similar to the current operational tempo issue with Patriot battalions. Resourcing a third IFPC battalion mitigates this gap by using the same rules of allocation established in TAA: one IFPC battalion per corps. A third IFPC battalion needs to be added to the recommended solutions approach list. That said, IFPC is not necessarily the sole short range air defense (SHORAD) solutions at the tactical level, and BCTs and divisions do not have any organic SHORAD capability. The Army must consider adding a SHORAD capability at the brigade combat team and below. Adversaries have shown the capability of using unmanned aerial vehicles to detect ground targets and engage with long range artillery. The Army must deploy a SHORAD capability at the brigade and below to defend their airspace against low, slow, small UASs. The Vice Chief of Staff of the Army directed the FCoE to include current and future SHORAD capability in an Army warfighting assessment to inform risk to the force via the opportunity to demonstrate SHORAD capabilities in a robust threat or operational environment. The Army can demonstrate a ready, viable solution to defeat real-world air threats.

> "...the Army's got to be able to sink ships, neutralize satellites, shoot down missiles and deny the enemy the ability to command and control its forces...."
> Adm. Harry Harris, U.S. Pacific Command commander

In order to integrate partner capabilities in regional operations, Army organizations develop procedural workarounds, tactics, techniques and procedures to ensure interoperability of systems for both air missile defense and field artillery. Policy restrictions that have been in place for, in some cases decades, prevent the Army from sharing data. The technology and doctrine exists to enable partners to both send and receive data, but lack the human procedural and policy technical means to standardize. Through the current Artillery Systems Cooperation Activities (ASCA) program, several partner nations (U.S. Germany, Italy, France and Turkey) work together to develop field artillery command and control (C2) systems and policies that streamline call for fire operations by taking differences in language-and how they designate targets-out of the equation. This was demonstrated at Bold Quest 15.2 at Fort Bliss, Texas, and can be expanded to include more partners.

Targeting within the Army is a challenge itself. When planning joint capabil-

"As an alliance, we need to step back and take a look at our capability in a military sense to address an A2/AD challenge. This is about investment. This is about training."

Gen. Philip Breedlove, U.S. European Command commander

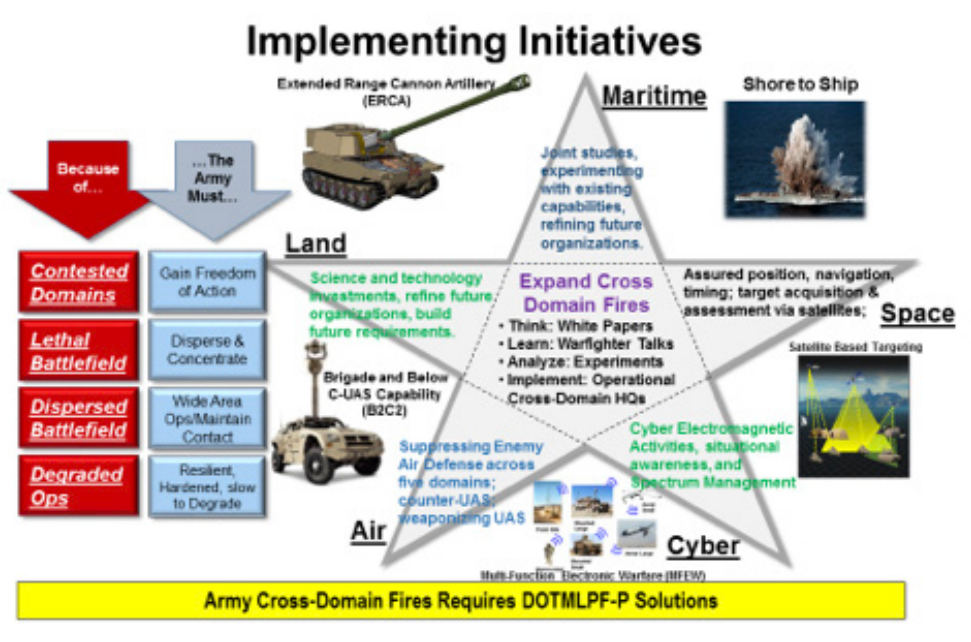


Figure 2: Because of anticipated changes to the future operational environment on which the U.S. would possibly conduct major combat operations, the Army must adapt accordingly by addressing doctrinal, organizational, training, material, leadership development, personnel, facilities, and policy refinements across the five domains and in conjunction with the joint services. (Courtesy illustration)

ities, the challenge is even greater. Army forces rely on joint enablers to conduct operations in all domains. The Army requires leaders and Soldiers that have the certifications to synchronize critical joint capabilities such as close air support, naval gun fire, as well as those in electronic warfare and offensive/defensive cyber. During the 1st Stryker Brigade Combat Team, 2nd Infantry Division National Training Center rotation, the brigade staff was challenged to synchronize joint Fires with ground operations in a fluid, dynamic and challenging operational environment. To meet the challenge, the staff developed and applied a simple targeting battle rhythm to focus on identifying resource needs 72 hours in advance and providing it to the current operations cell for the following 24 hours. The unit developed a simple and effective solution to mitigate the problem.

A recommendation developed by 1st Battalion, 2nd Stryker Brigade Combat Team, 7th Infantry Division in Fiscal Year 2015 reads: "… the lack of having a doctrinal knowledge base of integrating Fires through the targeting process across all [warfighting functions] can be addressed in the near-term by developing institutional training to bridge the gap to those who do not have a shared understanding. This would require deliberate inter-branch training of all personnel involved in the targeting cycle. In conjunction with this recommendation, the Army needs to institute technical training for all lethal and non-lethal specialists in an effort to empower subject matters experts with the inherent intricacies surrounding the proposed targeting process …"

The Army is critically short in trained and certified joint forward observers. Currently, the Fires Center of Excellence conducts a two-week course to prepare Soldiers to request, control and adjust surface-to-surface Fires (such as artillery, mortars and naval surface gunfire); provide close air support (CAS) targeting information to a joint terminal attack controller (JTAC) or a forward air controller as well as talk directly to the pilot if authorized to do so by the JTAC; and give autonomous terminal guidance operations as any kind of visual, voice, mechanical or electronic measure (such as lasers or smoke grenades) as targeting information to the pilots. Divisions and brigades require greater numbers of these specially trained Soldiers to be force multipliers.

The Army must develop a hypervelocity projectile (HVP) multi-mission munition. The HVP is a next-generation, common, low drag, and guided projectile capable of completing multiple missions for gun systems such as the Navy 5-inch, 155 mm, and future railguns. The HVP's low drag aerodynamic design enables high-velocity, maneuverability, and decreased time-to-target. These attributes, coupled with accurate guidance electronics, provide low-cost mission effectiveness against current threats and the ability to adapt to air and surface threats of the future. Currently HVP is at Technology Readiness Level 7.

Expediting the acquisition and fielding of the brigade and below C-UAS capability (B2C2) is key to the success of a counter UAS capability at the brigade and below. The B2C2 concept is a combined arms solution for detecting, identifying and defeating low altitude, slow moving, small (LSS) unmanned aircraft systems (Groups 2 and below). The capability leverages existing systems to provide a ground-based CUAS capability to the tactical edge (below brigade). The capability includes an Electronic Warfare Surrogate System (EWSS) and sensor on an extendable mast integrated on a fire support team vehicle using the Pocket-sized Forward Entry Device Increment II. B2C2 makes use of the AN/TPQ-50 radar by adding the Lightweight Surveillance and Target Acquisition Radar. The software upgraded for detection, tracking and targeting of low, slow, small UASs. Existing command and control structures such as the Fires cell, air defense airspace management and fire support element make use of current and future data processing systems such as the Advanced Field Artillery Tactical Data System (AFATDS) and the forward area air de-

fense command and control (FAADC2) for common tactical air picture, airspace clearance, identification of air threats and fire support. Tactics, techniques and procedures will be developed for the persistent fusion of radars, sensors, mission command enablers, and the EWSS to counter enemy LSS UASs. These refined technologies make it possible to rapidly coordinate, integrate and deliver Fires which address Army Warfighter Challenges 1, 13, 15, 17 and 18.

The Army must continue to develop directed energy and employ it in the air defense mode. Current directed energy near-term activities integrate a 10-kilowatt laser on the current High Energy Laser Mobile Test Truck (HELMTT) platform (in cooperation with Space and Missile Defense Command), and a two-kilowatt laser on a Stryker to demonstrate high power laser capability, atmospheric compensation and an entry-level military capability (counter unmanned aerial vehicles and small mortars). The HELMTT is scheduled to integrate a 50-kilowatt laser in Fiscal Year 2018.

The Army must design ranges, simulators and virtual reality trainers for suppression of enemy air defense (SEAD). The FCoE call for fire training facility is being modernized to include Joint Effects Targeting System and Lightweight Laser Designator Rangefinder 2H systems and improved AFATDS interoperability. With these improvements, the facilities can also include simulations that will incorporate SEAD training, which will include planning and execution of SEAD missions across the five domains.

Science and technology implications

With an appreciation for the anticipated implications of the future operational environment coupled with a refined understanding of the Army Fires-specific challenge, science and technology needs primarily focus on cross domain Fires expansion; however, the areas of combat vehicles, expeditionary mission command, cyber electromagnetic activities, and robotics and automation will be key enablers to future Fires systems. Fires forces of the future must be precise, flexible, tailorable and responsive to maintain overmatch against all threats and in all domains. Fires units must deliver timely effects against targets through all domains in order to achieve overmatch against enemy Fires. Currently, Fires forces focus largely on the ground and air domains. The future operating environment, however will demand Fires that can also effectively operate across maritime, space, cyberspace, as well as the electromagnetic spectrum. Fires systems of the future will support target identification, discrimination, de-confliction and airspace control through all domains and precisely deliver capabilities with scalable effects to create the desired effects on target with the first engagement.

The prioritized capability needs and potential candidates for mid-term science and technology (S&T) initiatives deliberately strengthen the traditional domains while expanding into the aforementioned, less mature domains. Army Fires identifies a requirement to defend critical assets against theater ballistic missiles, rocket, artillery and mortar, unmanned aerial systems, and cruise missile threats. Due to this continued need, efforts are underway to introduce improved 360-degree capability to the current air and missile defense portfolio. Enemy indirect fire systems currently out-range U.S. artillery, which limits friendly forces' ability to engage targets at extended ranges, as well as the ability to detect, engage, and defeat targets in littoral waters. U.S. policy eliminates the use of cluster munitions beyond a one-percent dud rate in 2019, ultimately removing the Army's ability to provide area effects against armored targets. New and innovative S&T efforts must keep pace with societal changes without ignoring threat capabilities. Fires sensors (both field artillery and air defense artillery) require the ability to conduct both air surveillance and counterfire roles to provide flexibility to the commander. Additionally, Fires sensors require electronic protection to ensure our ability to detect and deliver Fires as adversaries develop electronic attack capabilities. This mid-term investment strategy leans toward consolidating platforms to support joint combined arms operations.

Deepening the prioritized capability requirements look to the far-term, the Army's vision is to achieve real time integration and optimization of targeting data for a range of Fires applications while minimizing the numbers of sensors required on the battlefield. The Army envisions future sensors fusing data from all joint, national, multinational and commercial sensors from space to subterranean to achieve real time integration and optimization of targeting data with Category 1 coordinates for a wide range of field artillery applications and fire control quality data for air and missile defense applications. The Army will leverage and support emerging advanced technologies such as directed energy, electro-dynamic kinetic energy weapons, and hypervelocity projectiles to achieve scalable effects. The Army will leverage robotics to support manned and unmanned platforms which reduce force structure and improve expeditionary capability. The Army envisions one information system that enables Fires forces to plan prepare, and execute Fires in real time and in all domains. The future Army information network must provide decentralized network structure, automated battle management aids, fused sensor data, targeting assistance, and fire control quality of service. Ultimately, the goal in the far-term is to achieve a single Fires mission command system with the capability to support future multifunctional weapon systems.

Future Fires

The future operational environment promises greater complexity and ambiguity, challenging Army Fires leaders, Soldiers, and units to be more adaptable. Adversaries are employing integrated systems and sensors, across domains, to defeat and disrupt U.S. and friendly air, land, cyberspace, maritime and space capabilities. Fires forces will support ground maneuver forces with cross-domain Fires capabilities that will provide the capability to deter adversary aggression and deny enemy freedom of action. Responsive Army cross-domain Fires with extended range, enhanced precision and extended range sensors will enable the joint force to overcome anti-access and area denial threats, support Army operations on land across wide areas and project power from land into the other domains to preserve joint force freedom of action. Fires forces will enable maneuver forces to provide the ability to overcome enemy countermeasures, compel outcomes and consolidate gains for sustainable outcomes.

Scalable control interface

An asymmetric advantage in the multi-domain environment

By Col. Paul Cravey and Maj. Ariel Schuetz

"Manned-unmanned teams enable operational fire and maneuver efforts, enhance mission command and increase reconnaissance capabilities available to the commander."

Army Techniques Publication 3-04.1, Aviation Tactical Employment

Author's note: The following is a hypothetical scenario to show how the scalable control interface and future unmanned aircraft systems could be used.

Sgt. Fox lay hidden behind a rocky outcrop. His job was to watch the landing zone (LZ) and make sure any artillery or anti-aircraft systems were identified, targeted and neutralized before the air assault was inbound from the release point. He went into the area by covert means and had limited communications due to his location and mission, but echeloned Fires support was just a tap away on his tablet device. While he observed the LZ, he also watched the full motion video feed of the unmanned aircraft system (UAS) that shows the objective and landing areas. Occasionally he keyed in on something of interest on his tablet, like a moving vehicle, and would zoom in to positively identify the target. So far, he had not seen any air defense artillery and no icons had been added to his tablet from the other Soldiers watching the same feed from the staging area.

As mission time drew close, he monitored the execution checklist calls from the messages on the screen and chatted with the assets checking in for the mission about target engagement areas. He drew fire support control measures with his finger on the tablet and messaged them to an attack aircraft crew and artillery unit on call for suppressive Fires. He also confirmed cyber effects were in place to degrade the integrated early warning radar. The silence was broken by the sound of tracked vehicles rolling through the brush and Fox immediately slewed the UAS sensor and identified an ADA system emplacing close to the treeline along the LZ. It was heavily camouflaged so he messaged a request for another platform to confirm its heat signature. He received a message that it appeared to be a ZSU (self-propelled, radar guided anti-aircraft weapon system) so he dropped a pin for the target and sent it to the Fires cell and the attack aircraft. The air assault was just departing the staging area so he needed to neutralize the target before it visually identified the formation. He sent

Sgt. Fox (a fictional character from the scenario) scrolled the unmanned aerial system payload on the tablet and identified a second vehicle moving toward the landing zone. (Courtesy photo)

Figure 1. Example of 9 line on video terminal is from U.S. Marine Corps fielded software on the target handoff system. (Courtesy illustration)

Figure 2. Video terminal example display screen capture is from U.S. Marine Corps fielded software on the target handoff system. (Courtesy illustration)

a message on his tablet to the Fires cell for an electronic warfare effect to ensure the air assault remained clear of radar detection. He tapped the FIRES app and the target pin and sent a 9-line call for fire to the attack platform.

The attack aircraft pulled up the UAS feed in their cockpit, confirmed the target location and 9 line information and made sure to add a "no fire area" over Fox's location. As the air assault flew toward the release point, the air mission commander confirmed the cyber and electronic warfare effects from the screen in his cockpit and acknowledged the flight would be clear of the engagement area based on time. As the flight came to their release point, Fox ensured the UAS laser designated the target for the fighter team and the cooperative engagement went off flawlessly with the ZSU exploding a moment before the aircraft landed. Fox continued to scroll the UAS payload around on the tablet and identified a tracked vehicle rapidly moving from the former ADA location toward the LZ area. There was no time to request a fire mission, so he took full UAS payload control, double tapped to lock onto the vehicle and with the press of a button engaged the vehicle with a missile. He launched a handheld UAS to confirm battle damage from both of the locations and ensure there would be no further movement. He didn't need to monitor or control the device once he drew the reconnaissance squares on his tablet. If the UAS spotted movement it would lock on and notify him instantly. As the last of the Soldiers exited the LZ, Fox remained in communication with the air mission commander and let him know all the troops had made it safely off the aircraft. He shouldered his pack and messaged the ground force commander a pin with a link up location nearby.

New reality

This may sound like a scene from a Hollywood movie, but soon it will be reality. The Army is developing new ways to enhance how Soldiers shoot, move and communicate on the battlefield. Technology already exists to share control of payloads, platforms and even weapons from integrated handheld controllers not much larger than current tablets and phones. In a few short years Soldiers won't have to lug a bulky Single Channel Ground and Airborne Radio System in a backpack hoping for line-of-sight communications with an aircraft. They also won't have to drive a Ground Control Station and a Light Medium Tactical Vehicle's worth of equipment out to the field just to fly a UAS. From anywhere on the battlefield, Soldiers will be able to message, draw, point and click through a live-fire engagement from a single device just as if playing Mobile Strike on a smartphone.

The core concept behind streamlining this sensor-to-shooter linkage is manned unmanned- teaming (MUM-T). MUM-T is the synchronized employment of Soldiers, manned and unmanned air and ground vehicles, robotics and sensors to achieve enhanced situational understanding, greater lethality and improved survivability (Capability Manager-Unmanned Aircraft Systems, "MUM-T: Leveraging Aviation and Unmanned Teaming".) MUM-T combines the inherent strengths of different platforms to produce synergy and overmatch with asymmetric advantages. Today, as the Army is faced with enhanced anti access and area denial (A2AD) threats, it is imperative to integrate UAS into the multi-domain battle (MDB) to maintain the asymmetric overmatch they currently provide. MDB revolves around a "combined arms methodology to include not only those capabilities of the physical domains, but also greater emphasis on space, cyberspace and other contested areas such as the electromagnetic spectrum, the information environment and the cognitive dimension of warfare." (United States Army and Marine Cops white paper, "Multi-Domain Battle: Combined Arms for the 21st Century")

Emerging threats to Army aviation are such that battlefields of the future will require synchronized cross-domain teaming to create windows in space and time for aviation to execute its core competencies. One of the guiding principles of the multi-domain battle is formations "must be able to employ multi-domain combined arms capabilities at the lowest practical echelons to enable dispersed operations, thereby reducing vulnerabilities to enemy massed Fires while maintaining the ability to rapidly aggregate to mass at decisive points to create overmatch." (United States Army and Marine Cops white paper, "Multi-Domain Battle: Combined Arms for the 21st Century") Army UAS must be taskable and responsive in an austere environment, digitally integrated into a common signal architecture, possess a control interface that integrates and enables all aspects of decide, detect, deliver, assess (D3A) and have the degree of autonomy required to function in spectrum and space-degraded environments.

Maneuver units on future battlefields will use cross-domain Fires in the traditional realms of air, land and sea, as well as information warfare to enable windows of advantage where the future Army can decisively and rapidly defeat the enemy. Lethal targeting is inherent in this concept and UAS teamed with maneuver, Fires, intelligence and cyber will result in the integrated, synchronized and sequenced ability to find, fix and finish forces in abstract and physical domains. Due to the standoff distances

required based on threats in the physical domain, UAS payloads and munitions will be the key to both creating and exploiting windows of advantage. Army aircraft and maneuver forces will be constrained by deterrents unless enablers are used to make the environment permissive enough to achieve temporary dominance or overmatch. The key to success for joint combined arms maneuver and targeting in this type of environment begins today with the development of integrated and interoperable systems to enhance existing links between the Army's attack and reconnaissance aircraft, lethal Fires and the Army Battle Command Systems that control and integrate them.

To achieve the type of integrated targeting required on the multi-domain battlefield, the Army plans to develop the scalable control interface (SCI) as the foundation of the family of unmanned aircraft systems. SCI will move the current portfolio of Army UAS from differentiated and aircraft-centric systems, to a common operator qualification-based framework that reduces training time and expands the tactical employment of Army UAS across all echelons. SCI is based on an open architecture software that will support "apps" allowing users to access different UAS payload and control features based on their level of training. Handheld, mobile and static variants of this device will replace both the One System Remote Video Terminal and the Universal Ground Control Station beginning in fiscal year 2022. Each variant will allow users to access payload information like full motion video (FMV), have digital messaging, airspace, integrated targeting features and will allow Soldiers to control the system under differing levels of interoperability. For all variants, software will include improved cognitive aiding to reduce user workload, signature management to avoid detection and hardened data links.

The foundation of the Army's MUM-T strategy is the cooperative integration between the payloads and weapons resident in the Army's family of UAS, the scalable control interface, the AH-64D/E Apache, Future Vertical Lift, and brigade combat teams and division Fires. A tactical common signal architecture will interconnect all these systems resulting in the ability to expedite fire missions, streamline sensor inputs and to cross cue between platforms. Embedded metadata, symbology and messaging between all systems will support maneuver and Fire's ability to rapidly and decisively conduct D3A in multiple domains. Use of emerging spectrum capability will permit larger, higher fidelity mission information to be disseminated more quickly with less bandwidth resulting in enhanced real time shared understanding. Rather than simply viewing FMV from Army UAS and rotary wing platforms as "kill TV," Soldiers will be able to control the payloads and weapons on UAS platforms themselves, shortening the kill chain and enabling mission command at decisive points in the battle. Army aircrews will be able to enhance their situational understanding from places of security and even conduct cooperative engagements from outside of threat areas as part of a developing lethality strategy. Fire supporters will rapidly, and digitally, call for fire, de-conflict airspace and assess battle damage on one consolidated screen. Intelligence analysts will have multi-modal payload ability, enhancing the ability to layer and cue the cross domain in real-time and drive the operations process.

The pilot of an AH-64 Apache attack helicopter engages and destroyes the ZSU, a self-propelled, radar-guided anti-aircraft weapon system, moments before the aircraft reached the landing zone. (Courtesy photo)

While all of this seems light years away from the current capabilities Army systems possess, units can access some of these interoperable features short-term. Bandwidth efficient common data link will more than double spectrum capacity in the near-term resulting in more aircraft able to operate in closer proximity with higher fidelity FMV. Soldiers already use AH-64E, Gray Eagle and Shadow platforms for cooperative engagements and share feed and payload control into the Apache cockpit. Improved digital messaging will significantly shorten traditional timeline call for fire and 9-line missions between artillery, close air support and Army aviation. Multi-mission UAS are in development with new payloads, munitions, and capabilities that will change the way the Army fights.

To achieve the integration and synergy envisioned above, today's leaders and Soldiers must integrate MUM-T into collective unit training and look at ways unmanned systems can enable operations across all domains. The key to winning on the battlefield of tomorrow is integrated collective training with effects and systems from all domains at home stations today.

Col. Paul A. Cravey is the Training and Doctrine Command Capability Manager for Unmanned Aircraft Systems director at Fort Rucker, Ala.

Maj. Ariel M. Schuetz is the Training and Doctrine Command Capability Manager for Unmanned Aircraft Systems operations officer at Fort Rucker, Ala.

Responsive rockets through proactive airspace management

By Capt. Brennan Deveraux

The "big sky, little bullet" theory, the idea that shooting down an aircraft with an artillery round is highly unlikely, has been a running joke in the artillery community when frustrations arise with the inability to clear airspace in a timely manner. This becomes a major problem when dealing with rocket artillery, which can travel as high 75,000 feet and cover over 80 kilometers of battlespace. Formal education conducted regarding airspace management is minimal for artillery officers and they are often left to rely solely on the expertise of the airspace command and control (AC2) officer to facilitate the necessary airspace control measures for artillery missions.

Soldiers use a High Mobility Artillery Rocket System to practice targeting during Valiant Shield 16 on Tinian, Sept. 21, 2016. (Lance Cpl. Jordan Talley/III Marine Expeditionary Force)

Proactive airspace management improves the response time of rocket artillery in both conventional and non-conventional conflicts.

The AC2 will perform all necessary coordination to accomplish the rocket mission as long as they are given the fire mission data: location of the firing unit, location of the target, the gun target line (GTL) and the maximum ordinate of the mission. The lack of understanding on how to perform the rapid airspace coordination required to execute a rocket artillery mission wastes valuable time, jeopardizing lives and momentum.

While serving as the Combined Joint Operations Command-Baghdad High Mobility Artillery Rocket System (HIMARS) liaison officer (LNO) in support of Operation Inherent Resolve, I was able to develop and improve the tactics, techniques and procedures (TTPs) for proactive airspace management. Firing over 450 rockets in support of operations along the Euphrates River Valley, Iraq, was a unique experience and these lessons learned are tools which will strengthen the rocket artillery community.

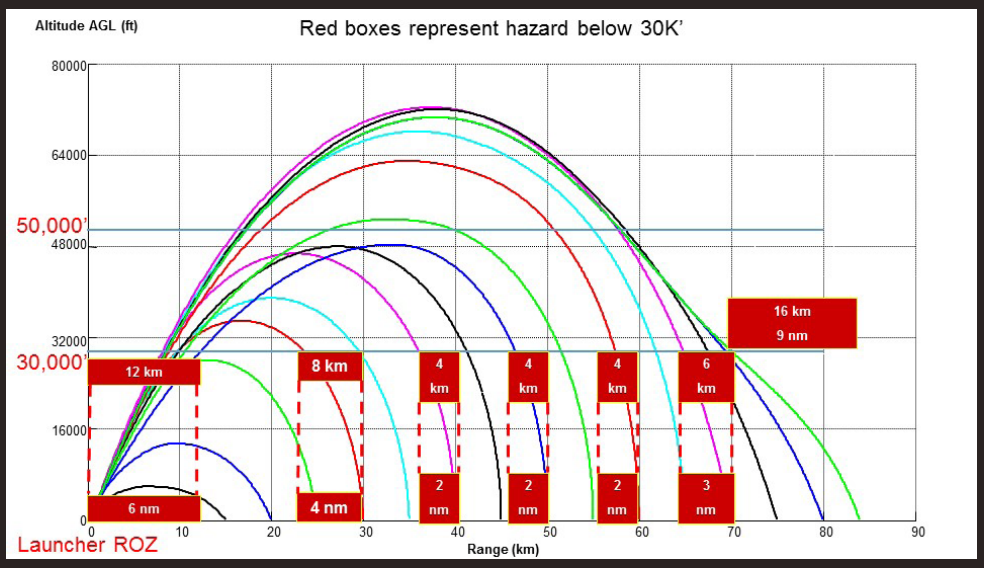
Proactive airspace management improves the response time of rocket artillery in both conventional and non-conventional conflicts. This article defines the two common methods of airspace clearance for rocket artillery, as well as discusses TTPs for proactive airspace management in conventional warfare and the current conflict in Iraq.

Airspace clearance

The primary means of clearing airspace for artillery is the hotwall method, which is the establishment of a large restricted operating zone (ROZ) created for surface-to-surface Fires. The ROZ covers the area from the ground to the maximum altitude of the artillery round and from the artillery point of origin (POO) to the target area point of impact (POI). The ROZ prohibits the entry of any aircraft without coordination, which then allows the artillery unit to fire its mission without the risk of hitting an aircraft. The hotwall is the accepted method for airspace clearance for all cannon artillery missions and is a viable option for rocket artillery missions as well. Examples of this include using non-precision rockets or firing a mission at ranges less than 30 kilometers. Although the hotwall is highly effective due to its simplicity, the shutting down of large areas of airspace over long distances of battlespace for extended periods of time is too restrictive to operations and is not a preferred method. When this is the case, a more practical method for managing airspace can be used, i.e., the goal post.

When conducting precision rocket missions beyond 30 kilometers, the goal post method is effective and decreases the amount of airspace required to conduct an operation. This method is more complicated than the simple ROZ and hotwall. The goal post is a combination of two small ROZs, one at the POO and one at the POI and a large crossbar ROZ that connects them at a given altitude up to the maximum altitude of the mission. The AC2 and HIMARS LNO can use the Tactical Air Integration System (TAIS), with historic trajectories, to establish the lowest crossbar altitude and the size of the small ROZs. Each ROZ is established large enough that a rocket is never outside of a small ROZ while below the crossbar. This means that as long as aircraft do not enter a ROZ and stay below the set crossbar altitude, they have freedom of maneuver in the area (see Figures 1 and 5). To execute a mission with the goal post method, the actual airspace cannot be cleared until the target is identified. This is an excellent tool when striking a preplanned target or preparing for a strike on a building or other small target area. Both of these methods for clearing air-

Figure 1. Historical vertical trajectories. (Courtesy illustration)



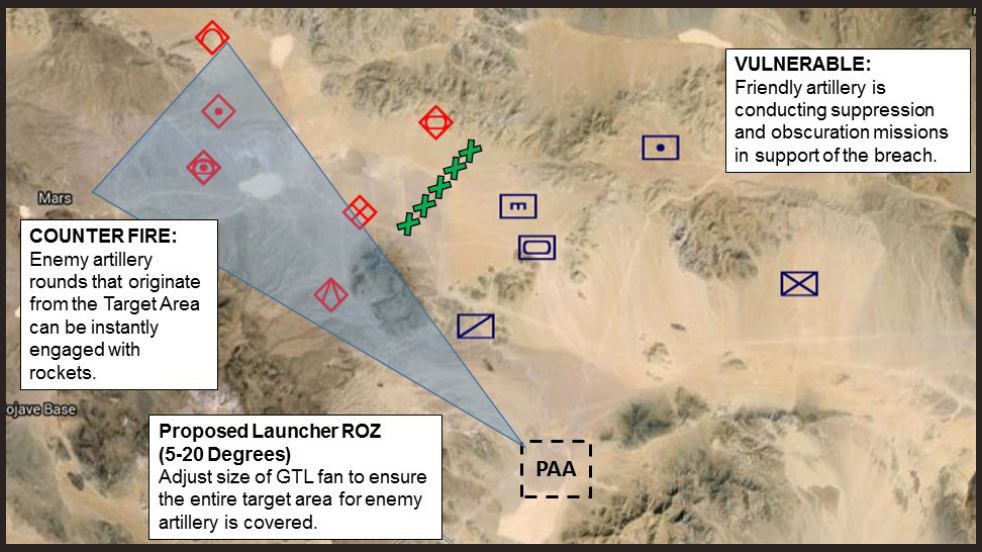
space can be utilized when training to employ rockets in a conventional fight.

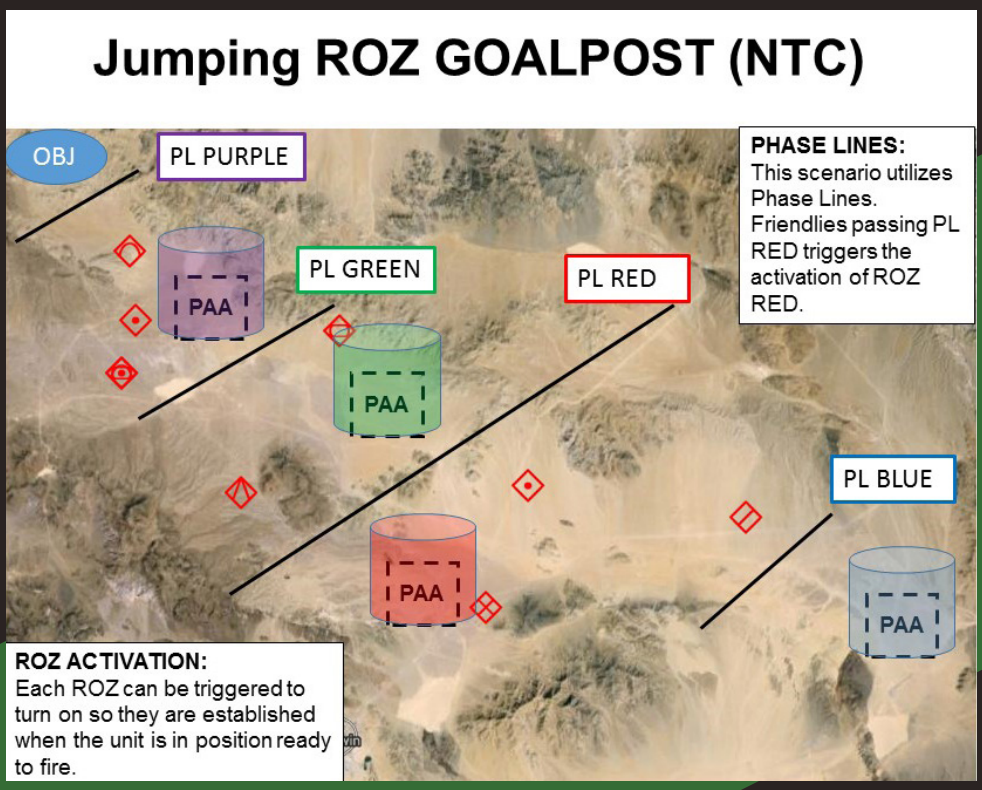
Conventional warfare

At large training events, like warfighter exercises or combat training center (CTC) rotations, units are faced with conventional combat scenarios and can often incorporate rocket artillery as a fire support asset. The primary rocket munition used in this scenario is not precision guided, and requires the hotwall method for airspace clearance. Having supported these operations at the division level, I was able to identify TTPs which expedited the airspace clearance processes. The two main TTPs developed for the conventional fight are the preplanned hotwall and jumping ROZ goal post.

The first recommended TTP that proved effective in the conventional fight is a preplanned hotwall. It is established from a planned firing point into an area with suspected enemy. Due to lack of knowledge of enemy positions, it is imperative to use a GTL fan to turn the hotwall into a large cone and cover the suspected area. This can be anywhere from five to 20 degrees depending on the size of the target area (Figure 2). A preplanned hotwall in a conventional fight can greatly improve artillery response time, and for the National Training Center the key was identifying the times of increased rocket usage. The two main times for our rotations were when an artillery unit was shooting a family of scatterable mines (FASCAM) and when maneuver forces conducted breaching operations and required cannon artillery to fire sustained suppression and smoke missions. It is during these operations that enemy artillery forces will be able to take advantage of friendly artillery that must remain static and vulnerable. This preplanned hotwall ensures that airspace is already clear from the launcher to the target area where the enemy artillery round is identified. If an enemy artillery mission is identified from the target area, and is beyond the coordinated fire line, the rocket artillery unit in support can instantly conduct a counterfire mission without coordination. This rapid response

Soldiers of A Battery, 1st Battalion, 94th Field Artillery Regiment, fire a rocket from a M142 High Mobility Rocket System during a decisive action training environment exercise on Oct. 4, 2016 near Camp Buehring, Kuwait. (Sgt. Aaron Ellerman/U.S. Army)





Top: Figure 2. Preplanned hotwall breach. (Courtesy illustration)
Bottom: Figure 3. Jumping restricted operating zone goalpost at the National Training Center, Fort Irwin, Calif. (Courtesy illustration)

disrupts the enemy's ability to mass artillery and achieves enhanced desired kinetic effects. Preplanned hotwalls were incredibly effective during NTC Rotation 15-08.5 and limited the massing of enemy artillery throughout the training exercise rotation.

Precision rockets are not as often employed at the CTCs, however they do provide the capability to engage static, fortified enemy positions. This becomes valuable when supporting offensive operations where scout elements can identify dug in armor positions or enemy artillery. In these instances, the goal post can be used to accelerate airspace clearance times.

The second recommended TTP that proved effective in the conventional fight is the Jumping ROZ. This requires the creation of ROZs around planned rocket firing points. The established ROZs are activated when the position is occupied, which allows the first part of the goal post to be in place as soon as the unit is in position ready to fire (Figure 3). When a target is subsequently identified, the airspace can be quickly cleared with a small ROZ over the target and the establishment of the crossbar. The development of these TTPs helped set a solid knowledge base of understanding before deploying to Iraq.

The fight in Iraq

Current operations in Iraq exclusively utilize precision rockets. The pre-deployment assumption was that airspace is being cleared primarily with the goal post method, however, this is not the case. The simplicity of the hotwall makes it the easy solution, however, the time required to conduct all of the coordination is not conducive to the required combat responsiveness. The two main TTPs developed in Iraq to facilitate the hotwall are:

1. Make the ROZ as least restrictive as possible to accomplish the mission.
2. Ensure controlled entry of aircraft into the ROZ.

Upon arriving in Iraq, the TTP for the size of a ROZ around the POO and POI was from a four to six nautical mile radius, as well as four to six miles wide, depending on the crew on shift. The justification for the size of the ROZ space requested was that it was safer and it was the measurements used in training. This amount of airspace could take upwards of 30 minutes to coordinate and was too restrictive for other airspace users.

The first recommended TTP that proved effective for utilizing the hotwall in the current fight was establishing the ROZ as small as possible. As the mission developed and confidence grew in the precision of rocket artillery, the size of ROZs gradually decreased and required dramatically less airspace. Currently, a rocket hotwall in Iraq requires a one nautical mile ROZ over the POO and POI, and is made one- and one-half miles wide (Figure 4). The decrease in size not only allowed more airspace for aircraft to use, it dramatically reduced the time required to establish the ROZ. The initial establishment of the hotwall still remains a time consuming task, however, planning time was reduced from over 30 minutes to 15 minutes or less, with much faster times depending on the operation.

As the requestor of the ROZ for a rocket artillery mission, the AC2 takes ownership of the airspace. Once a hotwall is established, no aircraft can enter the hotwall ROZ without permission.

The second recommended TTP that proved effective for utilizing the hotwall in the current fight was to establish controlled entry of aircraft into the ROZ. All strikes were centrally controlled, meaning the re-

lease approval of weapons from an aircraft comes from the same location that provides the approval and fire command for a rocket artillery mission. Once a hotwall was established, the AC2 could allow entry of local aircraft, as long as the GTL stayed cold. The AC2 and HIMARS LNO work closely together to allow specific aircraft to enter to conduct a strike or conduct a last minute scan of the area before rockets are fired. This required the vital announcement of "airspace clear" as the aircraft leave the ROZ, then the fire command can be transmitted to the HIMARS launchers. This method allowed for joint attacks on large structures, as well as targets with numerous aim points that were required to be engaged together. These TTPs crucially increased the responsiveness of rockets, and decreased the time required to engage targets, however, not every mission was conducive to the hotwall method.

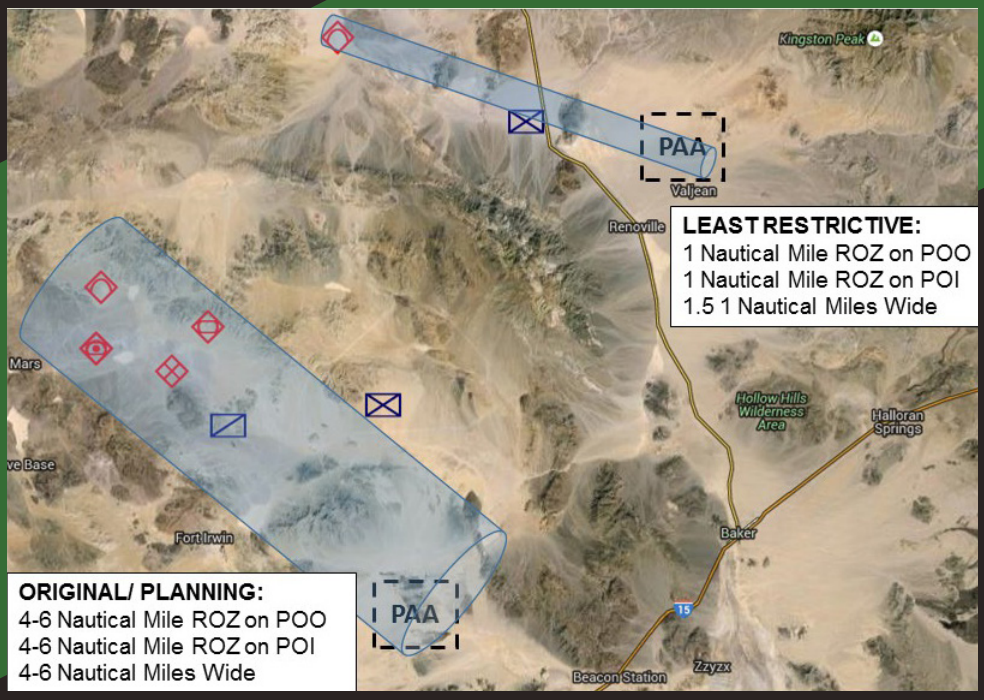
When planning firing points that conduct operations in busy civilian airspace, the goal post was the best option. The recommended TTP that proved effective for utilizing the goal post in the current fight was the establishment of an informal permanent ROZ. This method required establishment of an informal permanent ROZ around the launchers, only activated before fire missions, with a standard altitude established for the crossbar ROZ. Current procedures use 30,000 feet as the standard altitude required, a permanent ROZ at the launchers of six nautical miles and a target ROZ of four nautical miles, for all missions from 30-70 kilometers (Figure 5). This effectively allowed the majority of the airspace open for civilian traffic use.

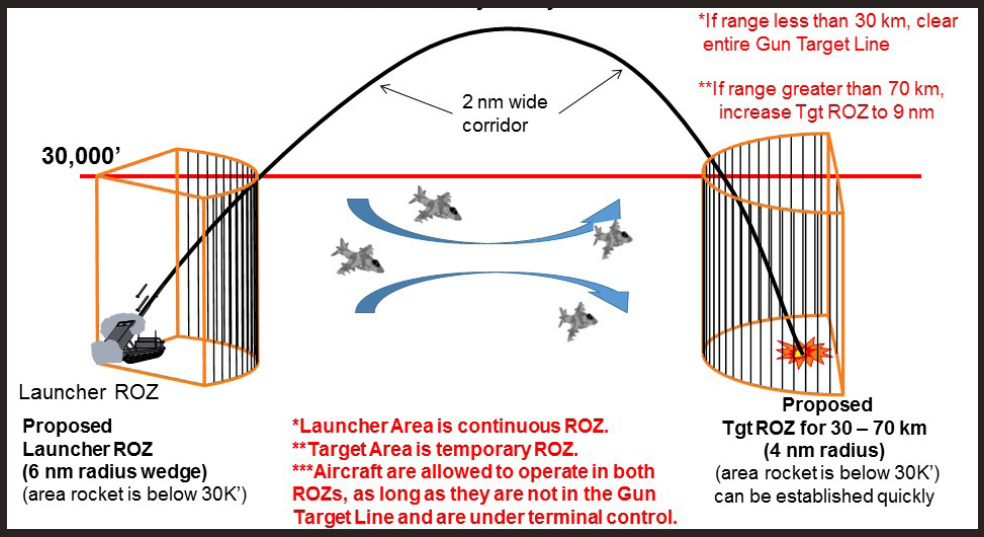
The most challenging aspect of the goal post was not calculating the dimensions that ensured safety, but to convince Iraqi Air Force or civilian aircraft authorities that it was safe to fly under a fired rocket. The unsubstantiated fear that a rocket may possibly plummet from the sky at any given moment made this coordination less about creating an airspace control measure, and more about marketing an awareness. This method was not used as much in theater due to this lack of understanding. These TTPs that started at NTC and grew throughout the deployment have been invaluable in conducting rocket artillery missions in Iraq.

Artillery's role

Airspace management is not the sole responsibility of the AC2 or Air Force personnel. The artillery community is reliant on air space management to execute fire missions and response time for rocket artillery is a direct reflection of the unit's ability to manage airspace. Not only should artillerymen be proponents of being proactive in airspace management, they should actively be seeking more efficient ways to conduct operations. The TTPs discussed above are tools to help artillerymen get involved in the broader discussion of integrating Fires. The easy answer of promoting the "big sky, little bullet" theory is a quick way to find the artillery community sitting on the sidelines.

Proactive airspace management greatly improves the response time of rocket artillery. In a profession where every second counts, the ability to decrease minutes or seconds from each fire mission's processing has saved the lives of friendly forces in Iraq. The application of these TTPs will save the lives of American Soldiers in future conflicts.





Top: Figure 4. Least restrictive hotwall. (Courtesy illustration)
Bottom: Figure 5. Goalpost, standard altitude of 30,000 feet. (Courtesy illustration)

Capt. Brennan Deveraux is the Combined Joint Operations Command-Baghdad High Mobility Artillery Rocket System liaison officer assigned to 1st Battalion, 94th Field Artillery Regiment at Joint Base Lewis McChord, Wash. Deveraux fired over 450 Guided Multiple Launch Rocket System rockets in Iraq as the HIMARS LNO. He also helped develop all HIMARS-related air space control measures currently being used in Iraq. He served as a HIMARS LNO at the division-level during National Training Center Rotation 15-08.5.

Wargaming multi-domain battle

The base of sand problem

By Shawn Woodford

As the U.S. Army and U.S. Marine Corps work together to develop their joint multi-domain battle concept, wargaming and simulation will play a significant role. Aspects of the construct have already been explored through the Army's Unified Challenge, Joint Warfighting Assessment and Austere Challenge exercises, and upcoming Unified Quest and U.S. Army, Pacific war games and exercises. U.S. Pacific Command and U.S. European Command also have simulations and exercises scheduled.

A great deal of importance has been placed on the knowledge derived from these activities. As the U.S. Army Training and Doctrine Command recently stated, "Concept analysis informed by joint and multinational learning events…will yield the capabilities required of multi-domain battle. Resulting doctrine, organization, training, materiel, leadership, personnel and facilities solutions will increase the capacity and capability of the future force while incorporating new formations and organizations.[1]"

There is, however, a problem afflicting the Defense Department's wargames, of which the military operations research and models and simulations communities have long been aware, but have been slow to address: their models are built on a thin foundation of empirical knowledge about the phenomenon of combat. None have proven the ability to replicate real-world battle experience. This is known as the "base of sand" problem.

A brief history of the base of sand

All combat models and simulations are abstracted theories of how combat works. Combat modeling in the United States began in the early 1950s as an extension of military operations research that began during World War II. Early model designers did not have large base of empirical combat data from which to derive their models. Although a start had been made during World War II and the Korean War to collect real-world battlefield data from observation and military unit records, an effort that provided useful initial insights, no systematic effort has ever been made to identify and assemble such information. In the absence of extensive empirical combat data, model designers turned instead to concepts of combat drawn from official military doctrine (usually of uncertain provenance), subject matter expertise, historians and theorists, the physical sciences, or their own best guesses.

As the U.S. government's interest in scientific management methods blossomed in the late 1950s and 1960s, the Defense Department's support for operations research and use of combat modeling in planning and analysis grew as well. By the early 1970s, it became evident that basic research on combat had not kept pace. A survey of existing combat models by Gary Shubik and Martin Brewer for RAND in 1972 concluded that basic research and knowledge is lacking. The majority of the MSGs [models, simulations and games] sampled are living off a very slender intellectual investment in fundamental knowledge…. [T]he need for basic research is so critical that if no other funding were available we would favor a plan to reduce by a significant proportion all current expenditures for MSGs and to use the saving for basic research.[2]

In 1975, John Stockfish took a direct look at the use of data and combat models for managing decisions regarding conventional military forces for RAND Corporation. He emphatically stated that "[T]he need for better and more empirical work, including operational testing, is of such a magnitude that a major reallocating of talent from model building to fundamental empirical work is called for."

Davis and Blumenthal contended, "The [Defense Department] is becoming critically dependent on combat models (including simulations and war games) — even more dependent than in the past. There is considerable activity to improve model interoperability and capabilities for distributed war gaming. In contrast to this interest in model-related technology, there has been far too little interest in the substance of the models and the validity of the lessons learned from using them. In our view, the DoD does not appreciate that in many cases the models are built on a base of sand … [T]he DoD's approach in developing and using combat models, including simulations and war games, is fatally flawed—so flawed that it cannot be corrected with anything less than structural changes in management and concept." [Original emphasis][3]

As a remedy, the authors recommended the Defense Department create an office to stimulate a national military science program. This Office of Military Science would promote and sponsor basic research on war and warfare while still relying on the military services and other agencies for most research and analysis.

Davis and Blumenthal initially drafted their white paper before the 1991 Gulf War, but the performance of the Defense Department's models and simulations in that conflict underscored the very problems they described. Defense Department wargames during initial planning for the conflict reportedly predicted tens of thousands of U.S. combat casualties. These simulations were said to have led to major changes in U.S. Central Command's operational plan. When the casualty estimates leaked, they caused great public consternation and inevitable Congressional hearings.

While all pre-conflict estimates of U.S. casualties in the Gulf War turned out to be too high, the Defense Department's predictions were the most inaccurate, by several orders of magnitude. This performance, along with Davis and Blumenthal's scathing critique, should have called the Defense Department's entire modeling and simulation effort into question. But it did not.

1 https://www.army.mil/standto/2017-03-08

2 http://www.rand.org/pubs/reports/R1060.html

3 http://www.rand.org/pubs/notes/N3148.html

An M1A1 Main Battle Tank, assigned to 1st Battalion, 35th Armored Regiment, breaches through obstacles during the Army Warfighting Assessment (AWA) 17-1 at Fort Bliss, Texas, Oct. 21, 2016. The training was conducted as a part of AWA 17-1, a series of Soldier-led assessments designed to enable readiness, force modernization, and joint and multinational interoperability. (Pfc. Frederick Poirier, 55th Signal Co.)

The problem persists

The Defense Department's current generation of models and simulations harbor the same weaknesses as the ones in use in the 1990s. Some are new iterations of old models with updated graphics and code, but using the same theoretical assumptions about combat. In most cases, no one other than the designers knows exactly what data and concepts the models are based upon. This practice is known in the technology world as black boxing. While black boxing may be an essential business practice in the competitive world of government consulting, it makes independently evaluating the validity of combat models and simulations nearly impossible. This should be of major concern because many models and simulations in use today contain known flaws.

Some, such as Joint Theater Level Simulation (JTLS); Corps Battle Simulation, based on JTLS; and Warfighters' Simulation use the Lanchester equations for calculating attrition in ground combat. However, multiple studies have shown that these equations are incapable of replicating real-world combat. British engineer Frederick W. Lanchester developed and published them in 1916 as an abstract conceptualization of aerial combat, stating himself that he did not believe they were applicable to ground combat. If Lanchester-based models cannot accurately represent historical combat, how can there be any confidence that they are realistically predicting future combat?

Others, such as the Joint Conflict And Tactical Simulation and MAGTF Tactical Warfare System adjudicate ground combat using probability of hit/probability of kill algorithms. While these probabilities are developed from real-world weapon system proving ground data, their application in the models is combined with inputs from subjective sources, such as outputs from other combat models, which are likely not based on real-world data. Multiplying an empirically-derived figure by a judgement-based coefficient results in a judgement-based estimate, which might be accurate or it might not. No one really knows.

Potential remedies

One way of assessing the accuracy of these models and simulations would be to test them against real-world combat data, which does exist. In theory, Defense Department models and simulations are supposed to be subjected to validation, verification, and accreditation, but in reality this is seldom, if ever, rigorously done. Combat modelers could also open the underlying theories and data behind their models and simulations for peer review.

The problem is not confined to government-sponsored research and development. In his award-winning 2004 book examining the bases for victory and defeat in battle, "Military Power: Explaining Victory and Defeat in Modern Battle," analyst Stephen Biddle noted that the study of military science had been neglected in the academic world as well. "[F]or at least a generation, the study of war's conduct has fallen between the stools of the institutional structure of modern academia and government," he wrote.

This state of affairs seems remarkable given the enormous stakes that are being placed on the output of the Defense Department's modeling and simulation activities. After decades of neglect, remedying this would require a dedicated commitment to sustained basic research on the military science of combat and warfare, with no promise of a tangible short-term return on investment. Yet, as Biddle pointed out, "With so much at stake, we surely must do better."

Shawn Robert Woodford, Ph.D., is a military historian with over a decade of research, writing, and analytical experience on operations, strategy, and national security policy. His work has focused on special operations, unconventional and paramilitary warfare, counterinsurgency, counterterrorism, quantitative historical analysis, nineteenth and twentieth century military history, and the history of nuclear weapon development.

Joint air ground integration

A recognized Army problem that can be solved

By Maj. Keith R. Williams

Over the last 15 years, the U.S. Army has fortunately operated in environments in which the joint and coalition forces have maintained complete air supremacy enabling readily available and effective air support to the land component in the conduct of ground operations. With the strategic and operational landscape of global military operations in continual transformation, it is readily apparent that peer and near-peer threats are narrowing the gap in land, sea and air capabilities. It is absolutely imperative that we as an Army recognize our shortfalls specific to air ground integration and implement the required changes at both the individual and collective levels of training to overcome these gaps. To achieve this, the Army at division and corps levels need to 1. be aware of the proven training venues that already exist and 2. make the necessary commitment to ensure the right personnel are receiving joint air ground integration training prior to execution of operations worldwide.

Joint air ground training venues

The Army currently supports and provides joint air ground training and education at both the tactical and operational levels. The Army Joint Support Team (AJST), which is subordinate to the Combined Arms Center for Training, has operating locations at both Hurlburt Field, Fla., and Nellis Air Force Base, Nev. At Hurlburt Field, the AJST provides instructor support and expertise to both formal and informal courses, focused at the operational level. The formal training courses include the Joint Air Operations Command and Control Course (JAOC2C) and the Air Operations Center Initial Qualification Course, both conducted by the 505th Training Squadron. Further, the AJST team at Hurlburt Field also provides unit specific training and education to divisions, corps and battlefield coordination detachments, tailored to their specific requirements. This training is germane to unit participation in warfighter exercises (WFXs) that are also supported by the AJST Contract Team. The AJST team at Nellis Air Force Base provides training and education at the tactical level and includes formal courses such as the Joint Firepower Course, Air Support Operations Center Initial Qualification Couse and the Air Liaison Officer Qualification Course, to name a few.

By effectively utilizing the combination of both formal and informal training available in concert with the AJST Hurlburt and AJST Nellis teams, the Army has sufficient opportunity for both acquiring the training and gaining the expertise in joint air ground integration. However, in order to achieve effective performance, select individuals who are charged with mission planning and execution at the division and corps levels must understand airspace planning, multi-service command and control (C2), and applying the processes for the systems within the Theater Air Ground System (TAGS). Only then can we hope to truly achieve effective joint air ground integration. The courses and training offered at both Hurlburt Field and Nellis Air Force Base can satisfy these requirements, but history has shown through multiple warfighter exercises, that there is not enough emphasis at the division and corps level to push Soldiers and staff to receive this training. Units and staffs that send Soldiers to the resident courses and receive Specialized Joint Aerospace Training perform at a much higher level during WFXs. They have a better understanding of the Theater Air Ground System and the Joint Air Tasking Cycle as it relates to the division/corps mission-essential tasks to include Fires, fire support and mission command. Because AJST supports every WFX, we observe this outcome time and again. So what is the solution?

Recommended adjustments

Over the last few years, the Army has incorporated an organizational methodology known as the joint air ground integration center (JAGIC) which is located at the division. The JAGIC technique is an effective tool to synchronize joint air ground operations and systems during execution to achieve desired effects on the battlefield. Nevertheless, tasking the staff organized as a JAGIC to execute joint air ground operations without proper training is like asking an Army captain to be an operations planner without attending the Captain's Career Course. It can be done, but probably not the most preferred course of action. Division and corps staffs that execute joint air ground operations need to understand beyond the "who, what, when and where." In order to achieve the "how and why" level of understanding, these individuals must receive formal training on airspace planning, command and control and the overall process of TAGS.

The solution to this problem is two-fold. First, in order for units to achieve successful joint air ground integration during WFXs, it is recommended that commanders, at the division and corps levels, incorporate formal training via the Specialized Joint Aerospace Training at Hurlburt Field or through the AJST Mobile Training Team (MTT). Second, key individuals working in the Fires cell or JAGIC should attend the formal JAOC2C that is available for enrollment via Army Training Requirements and Resources System, or ATTRS. JAOC2C is a two-week resident joint course that awards the 5A additional skill identifier, joint air tactical operations officer. The purpose of JAOC2C is to educate and train U.S. and multinational personnel on joint air operations command and control, with the training objectives of graduates understanding the fundamentals of joint air operations C2, the associated joint C2 processes and the relevant insights into key service-specific operations processes at the nexus with joint C2 processes.

The problem identified in this article is not systemic, but needs immediate attention. The Army Joint Support Team, with the support of CAC-T leadership, recognizes that division and corps staffs tasked with planning for joint air ground integration in the conduct of their mission should receive formalized training, both individually and collectively, prior to executing WFXs. As stated, units that have received joint air ground operations training have performed substantially more effectively than those that have not. Additionally, AJST is currently exploring opportunities to conduct JAGIC-specific mobile training teams and are developing an Airspace Control resident course at Hurlburt Field. Unit staffs interested in collective training should contact the AJST operations officer at 850-884-9389. To attend JAOC2C or any other formal courses, contact Keith Wells, commercial: 850-884-6181, DSN: 579-6181 or email: keith.wells.5@us.af.mil.

Editor's Note: *The opinions and characterizations in this article are those of the author and do not necessarily represent official positions of the U.S. Army or government. Maj. Keith Williams is a field artillery officer assigned to the Army Joint Support Team at Hurlburt Field, Fla. His recent assignments include 2nd Battalion, 4th Artillery Regiment and the 214th Fires Brigade at Fort Sill, Okla., where he served as operations officer at both units.*

A Soldier from B Battery, 2nd Battalion, 32nd Field Artillery Regiment, 101st Division Artillery, configures a solar panel for use during a field exercise. (Courtesy photo)

Solar powered artillery solves more than environmental issues

By Capt. Michael Wentz

B Battery, 2nd Battalion, 32nd Field Artillery Regiment, 101st Division Artillery, is paving the way for the use of renewable energy in tactical vehicles, and artillery raids. In the past six months by working directly with PowerFilm Solar, the only U.S. producer of amorphous silicon foldable solar panels, *Boldsteel Battery* proves that renewable energy can be tactical, reliable and hassle free. The experiment began with solar panels originally designed for the Nett Warrior end user device system. Several of the foldable 120-watt panels were collecting dust in a locker when the idea arose to test their usefulness in powering other equipment.

Energy solutions

Energy efficiency. Sustainable energy. Renewable solutions. These are not terms often associated with the U.S. Army, but they should be. Our infrastructure, vehicles and most of our equipment is built around the concept of an unlimited supply of fuel. We are information obsessed. This requires power supplied to miles of cable lighting up dozens of dazzling LED screens and Keurig coffee gurgling persistently day and night.

The nation is slowly coming to terms with the fact that oil is not going to last forever. The Army is working to solve this problem through the Office of Installations, Energy and Environment. According to a presentation on https://www.army.mil/asaiee on Army power and energy, the Army's fuel consumption has expanded to an average of more than 20 gallons per Soldier per day. In fiscal year 2012, the Army spent $3.6 billion on fuel. While the Army Energy and Sustainability Program is making great strides towards supplying power solutions with renewable energy, the process of operational needs statements, development, contract bidding, testing and finally, fielding, takes far too long for an immediate impact. Furthermore, commanders need to have buy-in to use these often cumbersome systems that take time to learn and perfect. It is much easier to fire up the generator and maintain the status quo. But there could be an easier solution, and *Boldsteel Battery* is on the path to a more tactical and sustainable future.

As the commander of B Battery, I began researching stand-alone solar power systems that could be used to recharge vehicle batteries. I discovered with a simple maximum power point tracking (MPPT) charge controller, I could connect the panel through the firewall in our M1152 High Mobility Multi-Purpose Wheeled Vehicles (HMMWVs) to the vehicle battery compartment. Initial testing in the motor pool proved promising and most importantly it didn't cause a power short

Top: A Soldier from B Battery, 2nd Battalion, 32nd Field Artillery Regiment, places solar panels on the roof of the unit's tactical operations center. (Courtesy photo)
Center: Soldiers from B Battery, 2nd Battalion, 32nd Field Artillery Regiment, configure a solar panel during a tactical operations exercise. (Courtesy photo)

or damage to equipment. So I moved on to field testing with and without nets. The surprising result was that with a single panel, even under camouflage nets, produced enough power to maintain a full battery charge for indefinite static operations.

The next step was to test the theory on a full platoon of vehicles, to include the most energy consuming vehicle, the fire direction center (FDC) HMMWV. After receiving approval from DIVARTY to order five MPPT charge controllers, *Boldsteel* conducted a full-scale test during a weeklong field exercise. One platoon was equipped with solar panels, while the other was not. The result was a three-gallon reduction in fuel usage per vehicle during static operations over two days. The vehicles with solar panels did not have to run their engines to power their howitzers, and the FDC with two panels attached, did not require external power for their operations. *Boldsteel* now had buy-in for the idea. It was time to contact the manufacturer of the solar panels, PowerFilm Inc., in order to create an integrated vehicle prototype.

I contacted the PowerFilm Military Business Operations director, Wesley White. He was extremely helpful and receptive to the idea of creating an integrated vehicle mounted solar solution. After scheduling several teleconferences with the DIVARTY Operations officer, deputy commander, and engineers at PowerFilm, we formed a plan to debut the prototype system during our upcoming division artillery mass exercise.

The integrated vehicle mounted system consists of a 220-watt flexible solar panel attached to the tarp of the M1152 HMMWV by Velcro and clips. The wiring for the system runs down the inside of the tarp to the vehicle battery compartment, where it is wired into the charge controller and battery assembly. Further testing during a five-day field exercise proved the panel was capable of maintaining sustained static operations without the need for starting the vehicle engine, or using external power to charge the M119A3 howitzer. The panel has remained in place on the vehicle through multiple field problems without fail or reduction in charging capability.

Solar panels integrated into vehicle tarps provide several immediate and long-term benefits:

1. Vehicles with integrated solar panels do not drain power and need to be jump started in cold weather, or after long periods of storage in the motor pool, eliminating the need to buy expensive batteries. At $250 per battery the cost savings are immediate.
2. With modifications to the motor pool infrastructure, vehicles, while parked-can be tied into the power grid, providing power to garrison infrastructure to offset energy usage.
3. Solar panel usage for power in austere environments overseas amounts to thousands of dollars in fuel savings per day, quickly recouping the initial cost of investment.

The next phase of the solar project is focusing on the use of a charging system to replace the Tesla charging system, frequently used on M777A2 howitzers for maintaining their charge during extended static operations and air assault raids. This system is useful, but cumbersome and not well suited to air assault operations. The solution is to attach a large foldable panel that can be carried in an assault pack and employed after landing at the objective. The Soldier carrying the panel will be able to throw the panel on the ground next to the howitzer and plug it in during occupation, providing a full charge for sustained digital operations however long or short the duration of the mission.

Dynamic and innovative solutions have been a hallmark of the United States military, giving us overmatch in a constantly evolving battlefield. The ability to sustain combat operations without the need for enormous amounts of fuel will help sustain this edge going into the future. The quicker and more widely we integrate these technologies, the quicker we will see the return on investment into the future of the Army and the environment we are leaving to our progeny. We have reached the tipping point, and must move to adopt innovation now.

Moving forward, *Boldsteel Battery* and 101st DIVARTY will continue to lead the way in innovative uses for renewable technology. If you have any questions or would like to integrate this technology into your formation please contact me at Michael.s.wentz.mil@mail.mil.

Capt. Michael Wentz is the B Battery, 2nd Battalion, 32nd Field Artillery Regiment commander.

Deep Fires in a distributed battlefield

Video by Jason Miller, National Training Center Public Affairs Office

U.S. Army Soldiers with A Battery, 2nd Battaion, 20th Field Artillery Battalion conducted a unique crucible readiness training exercise at the National Training Center, by providing rocket artillery support to the 2nd *Black Jack* Armored Brigade Combat Team, 1st Cavalry Division meanwhile processing fire missions over 1,000 miles away from Fort Sill, Okla.

"This is an opportunity for our battalion level tactical operations centers (TOC) to train in a distributed battlefield," said Col. Nate Cook, 75th Field Artillery Brigade commander. "We have the opportunity now to stand the TOCs up from long distances and validate that we can do it from distances such as Oklahoma to California. We need to do that because it's not unrealistic that we would fight that way, we're currently fighting that way in the Middle East."

Conducting operations in a distributed battlefield is revolutionizing readiness training and hosting it at the National Training Center is crucial to validate the battalion's ability to execute fire missions over large distances.

"We can train our battalions at Fort Sill to a certain degree, but we can't replicate that division headquarters, the brigade combat team operations, as well as that world-class opposing force, anywhere close to what is done at the National Training Center," said Cook.

"Intel drives Fires; Fires drives Maneuver."
Maj. Gen. James Rainey, 3rd Infantry Division commanding general

Fighting Fires with Fires

The synchronization of two headquarters

By 75th Field Artillery Brigade and 3rd Infantry Division Artillery

Soldiers fire a High Mobility Artillery Rocket System during Warfighter Exercise 17-01. (Courtesy photo)

The purpose of this article is to capture the lessons learned through a review of how two artillery headquarters planned, prepared, rehearsed and synchronized operations in a decisive action fight. This article also shares best practices on how they supported 3rd Infantry Division's scheme of maneuver during Warfighter Exercise 17-01.

The 3rd Infantry Division commander presented a clear vision for defeating a near-peer enemy during planning for Warfighter Exercise (WFX) 17-01. First, develop the intel to find the enemy and determine his course of action; second, integrate and synchronize Fires to destroy the enemy; third, develop the maneuver plan to ensure Fires are positioned forward. His vision demanded the division stay enemy-focused while maintaining the initiative with Fires. Among the commanding general's imperatives was clear guidance for Fires – neutralize the enemy's integrated Fires command and win the counterfire fight. WFX 17-01 held at Fort Stewart, Ga. from Oct. 4-12, 2016 provided the opportunity for 3rd ID and several functional and multi-functional brigades to exercise mission command while employing the division's combat power against a near-peer, free-thinking opposing force. Seventy-Fifth Field Artillery Brigade stationed at Fort Sill, Okla. was among those functional brigades and operated as the division's counterfire headquarters while reinforcing Fires to 3rd Infantry Division Artillery.

Third ID DIVARTY and 75th Field Artillery Brigade developed a clear understanding of the division commander's intent for Fires beforehand during an extensive command post exercise that first tested the CG's vision. The brigade commanders and their staffs spent the months leading up to the WFX deliberately wargaming the processes used to synchronize the Fires effort, ensuring the timely delivery of rocket and missile Fires against the Operational Strategic Command 2 commander's fire support systems and other high payoff targets within Area of Operation (AO) Marne.

Field artillery seminar

Prior to execution of WFX 17-01, 3rd ID DIVARTY, 75th FA and the Division Fire Support Element (DIV FSE) conducted a formal Fires seminar at Fort Stewart, Ga. The reinforcing Fires relationship between the two brigade-sized field artillery headquarters had not been executed in the past 15 years and required a clear definition of roles and responsibilities to ensure the division maximized Fires forward in the decisive action scenario. The multi-day Fires seminar provided an opportunity to discuss and establish roles, responsibilities, processes and systems which enabled synchronization of efforts across the Fires warfighting function. Warfighting function representatives from both brigade headquarters discussed a wide range of topics including field artillery organization for combat, command support relationships, Force Field Artillery (FFA) Headquarters and Counterfire (CF) Headquarters responsibilities, the 3rd ID CG's intent for Fires, airspace management, battle rhythms, reporting procedures, command post operations (locations, redundancy, movement considerations) and liaison officer (LNO) requirements. Building upon discussions between the staffs prior to the Fires seminar, the event solidified a way forward, significantly influencing future planning and execution for both command teams. By the end of the seminar, 3rd ID DIVARTY and 75th FA gained a shared understanding of how each organization would operate and formed working relationships that proved vital as the organizations moved forward with the planning and execution of WFX 17-01.

One of the most important outputs the Fires seminar produced was LNO duties and responsibilities for the WFX. Each brigade exchanged two experienced warrant officers to serve on day and night shifts within the sister unit's command posts as well as an LNO

team to work within the division's forward command post. Each LNO was equipped with a Command Post of the Future workstation, a Non-classified Internet Protocol Router computer and a Secure Voice over Internet Protocol telephone in order to accomplish their assigned duties. Third ID DIVARTY LNOs to the 75th FA BDE served as sensor managers, ensuring Q-37 radars were positioned to acquire incoming enemy artillery and transmit the data to both brigade headquarters. They also played a vital role in 75th FA's targeting meeting which was responsible for planning radar locations for the upcoming 24-hour intervals. In addition to the LNOs, 75th FA tasked personnel from their organic rocket battalions to serve as LNOs to 3rd ID DIVARTY. The rocket battalion LNOs served as subject matter experts in the employment of rocket and missile Fires in the DIVARTY command post; that lacked adequate leaders who had experience providing mission command of organic rocket artillery. The battalion LNOs also provided a direct link between 3rd ID DIVARTY and their units, and they helped to disseminate orders and receive information from their battalions that were attached to 3rd ID DIVARTY.

Command post exercise

Third ID DIVARTY and 75th FA communicated and worked through a series of tactical processes prior to the Fires seminar during the 3rd Infantry Division's Command Post Exercise (CPX) III. CPX III served as an opportunity to identify processes required to plan and execute a divisional fight while building key relationships between the two organizations. Third ID DIVARTY served as the FFA HQs providing deep surface Fires with two attached Multiple Launch Rocket System (MLRS) battalions from 75th FA. Seventy-fifth's participation consisted of providing observer, coach/trainers, conventional force LNOs and a small fire control team. Although the scenario and some of the command support relationships differed, this initial collaboration formed the basis for many of the systems used during WFX 17-01, particularly the targeting process and fire mission processing. The observations gained from the CPX largely informed the Fires seminar and focused efforts on potential points of friction during planning and execution, such as, FA organization for combat and command support relationships. These observations, further refined during the Fires Forum, leveled expectations and postured both organizations to effectively transition into the military decision making process (MDMP).

MDMP

Third ID DIVARTY Headquarters and 75th Field Artillery Brigade Headquarters initiated simultaneous MDMPs in conjunction with the 3rd Infantry Division staff upon receipt of the Combined Joint Forces Land Component Command tactical order. They synchronized FA operations of five general support rocket battalions, two direct support (DS) Paladin battalions, one DS battalion of M777s, one DS composite battalion of M777s and M119s, and six Q-37 radars, all within the 3rd ID area of operation. The DIVARTY, as the FFA HQs, owned development of the FA organization for combat, positioning and movement of all artillery, the scheme of Fires, survivability moves, security and re-supply. The 75th FA sent its chief of plans and a targeting warrant officer to Fort Stewart in order to actively participate in the 3rd ID and 3rd ID DIVARTY MDMP processes and rehearsals while 75th FA BDE simultaneously conducted MDMP at Fort Sill. These two planners served in a vital capacity to ensure the synchronization of the Fires warfighting function and the employment of the 75th FA to "win the counterfire fight" for the division. Additionally, these planners provided recommendations and courses of action about the FA organization for combat, positioning of Q-37 radars and rocket batteries, and required security of those elements.

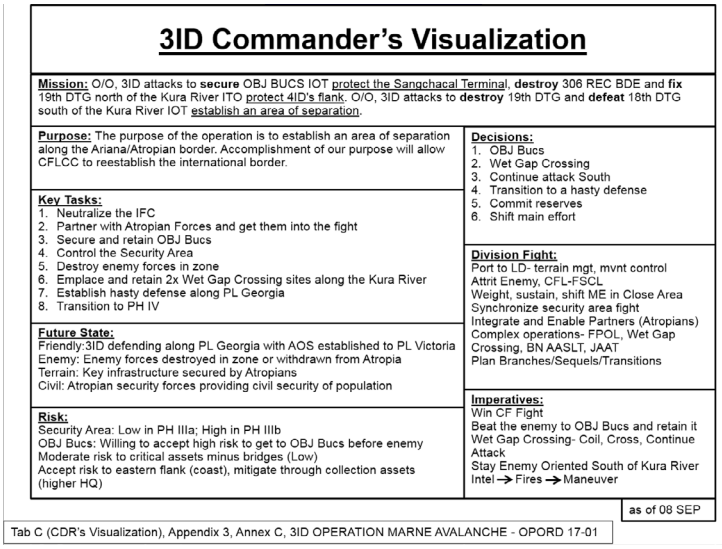


Figure 1. The 3rd Infantry Division commanders Warfighting Exercise 17-01 visualization. (Courtesy illustration)

The planners from the two artillery brigades tackled organization for combat first. As III Corps' habitual FFA HQs, the 75th FA contains four MLRS battalions, one High Mobility Artillery Rocket System (HIMARS) battalion, a support battalion, a signal company and a target acquisition platoon. By comparison, 3rd ID DIVARTY does not have organic rocket and missile systems, but instead possesses a headquarters element that provides mission command of attached assets, particularly rocket battalions when task organized. During mission analysis, the brigade staffs in conjunction with the 3rd ID staff detached one MLRS battalion and one HIMARS battalion from 75th FA and attached them to 3rd ID DIVARTY. This command relationship enabled the division FFA HQs to provide responsive surface Fires between the coordinated fire line (CFL) and the fire support coordinating line (FSCL). The Division FFA HQs assigned 75th FA BDE the role of the division's CF Headquarters, responsible for providing timely proactive and reactive counterfire between the CFL and FSCL. This task organization provided the division commander with three MLRS battalions conducting counterfire and two battalions conducting deliberate and dynamic Fires in support of the division's deep fight. Additionally, the 75th FA had operational control of all six Q-37 radars within AO Marne in order to help synchronize the counterfire fight.

Upon the division's course of action approval, the DIV FSE, 3rd ID DIVARTY, and 75th FA BDE planners had a clear understanding of Marne 6's intent. His visualization (Exhibit 1) of the overall fight described that intelligence drives the employment of Fires and Fires drives maneuver. This gave FA units the understanding of how to position assets to effectively employ Fires in support of the fight. Maj. Gen. James Rainey's visualization included key tasks directing the two brigades to neutralize the enemy's integrated Fires command and to win the division's counterfire fight. With a clear understanding of the commander Fires-focused

Purpose: Synchronize FA BDE and DIVARTY operations over the next 24 hours and confirm COP. In addition, confirm conditions for FFA HQ & CF HQs transfer; posture subordinate commands for future operations

Inputs:
POF
Slant
MLRS Locations

Operations over the next 24 HRS (BDE and DIVARTY S3s)
- Planned Missions
- Planned Movements
- Contingencies

Current UBL
- CSR/RSR
- Projected Resupply/ Confirm Triggers

Radar Coverage
- Planned movements

Any decision points
Any shortfalls
FFA HQ TOA Conditions Check Status
- Shoot, move, communicate

CF TOA Conditions Checklist
- Shoot, move, communicate

Outputs:
Synchronized COP
Confirm TOA of responsibilities status and or time required to meet TOA
Any Decision Point recommendations

Chair: BDE XO/S3
Co-Facilitators: FUOPS/OPS Majors
*BDE CDR attendance upon recommendations

Frequency: Daily
Duration: 1300-1325
Location: CPOF Briefing Room
Means: CPOF/Ventrillo

Attendees: BDE and DIVARTY XOs/S3s;; Primary Staff Officers and Special Staff (BDE CDR as required)

Key Tasks:
- Synch operations over the next 24 HRs
- Identify assets available/shortfalls/risks
- TOA status

Figure 2. Force Field Artillery Headquarters/Counterfire Headquarters synchronization meeting.

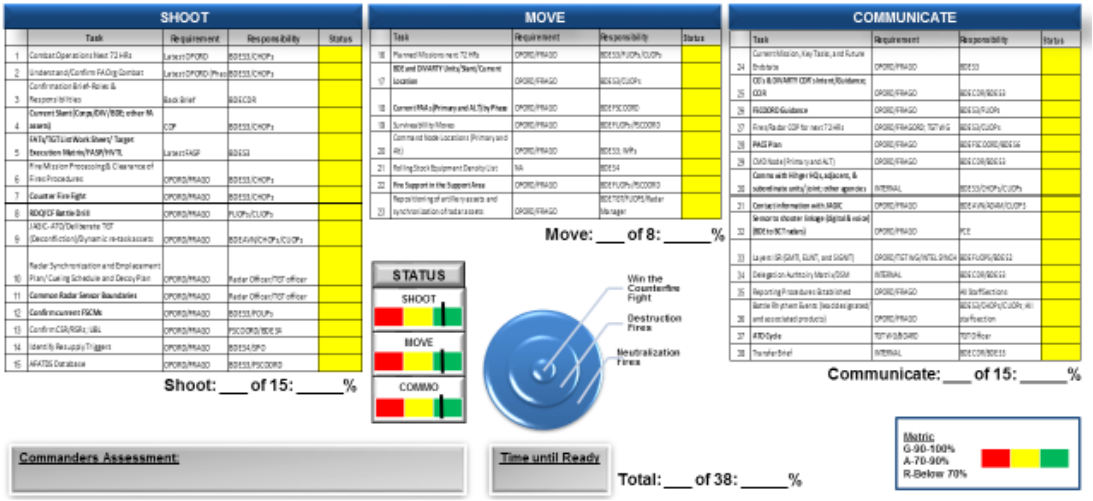


Figure 3. The Counterfire Headquarters transition checklist. (Courtesy illustration)

mindset, the planners from both DIVARTY and 75th FA continued working with the remainder of their staffs to develop each brigade's Field Artillery Support Plan (FASP). Third ID DIVARTY and 75th FA produced separate, but synchronized FASPs that focused on their assigned and attached units to describe how the subordinate artillery battalions would shoot, move, and communicate in order to support the overall 3rd ID scheme of maneuver while supporting the 3rd ID commander's intent. The two staffs remained in constant communication throughout FASP development and as a result, Fires detection and delivery assets were postured and movements synchronized to ensure the Fires warfighting function achieved the CG's intent, placing Fires forward in order to provide responsive Fires capable of shaping the deep fight while providing coverage between the division's CFL and the corps' FSCL.

Rehearsals

Third ID executed a series of rehearsals prior to execution. The 75th FA and 3rd ID DIVARTY maintained an active role in the recon and surveillance, fire support, combined arms, sustainment, security area and wet gap crossing rehearsals. The 75th FA, 3rd ID DIVARTY, and DIV FSE planners briefed the employment plan for their respective organizations, synchronizing the Fires warfighting function across division scheme of maneuver, to ensure artillery units could deliver Fires against known or suspected enemy positions throughout AO Marne. The detailed integration into every division-level rehearsal proved critical in identifying potential gaps in the division's plan, allowing for further refinement as the division moved closer to execution.

A separate battle rhythm event was required to ensure both organizations remained synchronized throughout execution. The two headquarters developed a daily Fires synchronization meeting (Exhibit 2) in order to confirm planned targets, positioning of rocket batteries and target acquisition radars, current and future Fires support control measures (FSCMs) and airspace control measures (ACMs), as well as proposed changes to command support relationships. This battle rhythm event supplemented the division commander's update assessment (CUA) and provided an informal way of exchanging information and confirming the composition and disposition of all fire support assets within the 3rd ID AO. The brigade XOs, S-3s, and key staff primaries from each organization attended the normally 30-minute meeting conducted via SIPR VOIP.

Col. Todd Wasmund, 3rd ID DIVARTY commander, and Col. Nathan Cook, 75th FA commander, emphasized that each brigade headquarters be prepared to assume mission command for both FFA and CF HQs in the event either command post was compromised or destroyed. In order to accomplish this key task, each brigade staff developed a checklist (Exhibits 3 and 4) to ensure a shared understanding of current and future operations, combat slant, communications status, etc., existed at all times within both organizations. While these products were not fully tested, the exercise provided the opportunity for each organization to think through required tasks associated with the transfer of command and support roles.

Execution

Many systems and processes aided the two field artillery headquarters in meeting the CG's intent for Fires. A shared understanding of the division commander's priorities provided the foundation for these systems. While this foundation was laid during the planning and preparation phases, it was the daily refinement and reinforcement in the CUA that focused all participants in the deliberate and dynamic targeting process during execution. The most effective systems were the joint targeting process and near-real time predictive analysis targeting.

The joint targeting process is a cycle that begins with review of the joint forces commander's priorities. The process allows for bottom up refinement through

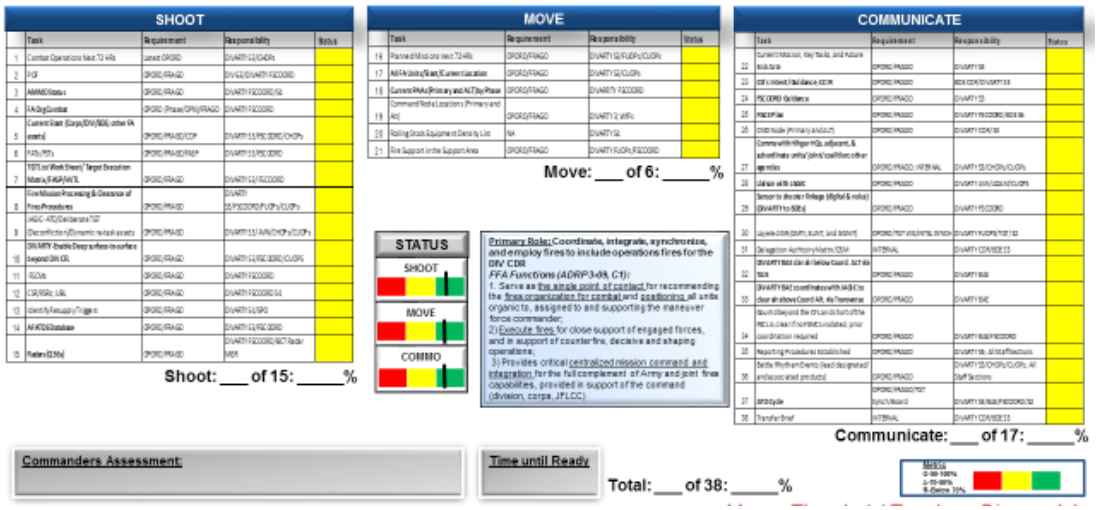


Figure 4. Force Field Artillery Headquarters transition checklist. (Courtesy illustration)

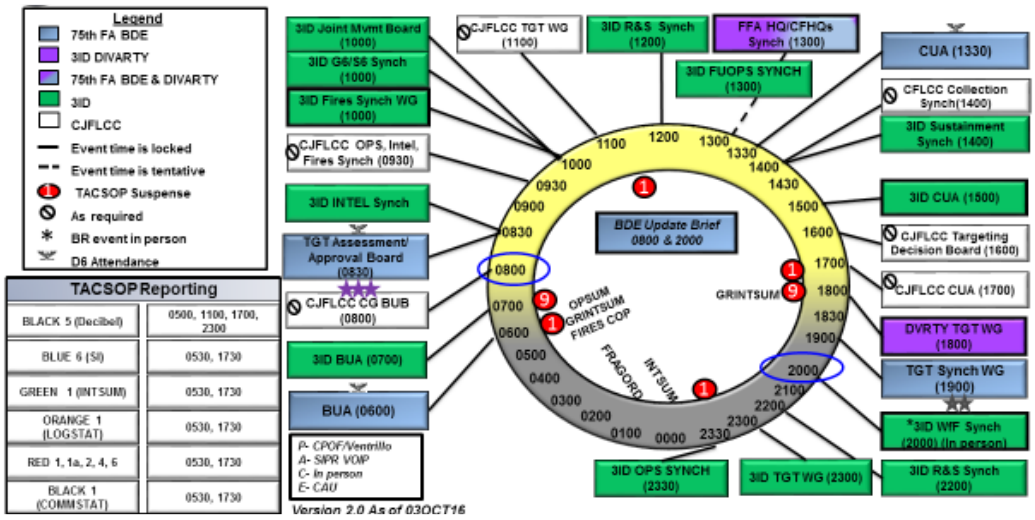


Figure 5. Warfighting Exercise 17-01 battle rhythm. (Courtesy illustration)

target nominations for the air tasking order (ATO) and attack guidance matrix (AGM), and assesses the effectiveness of the ATO and AGM daily to ensure synergy, driving the subsequent days targeting processes (Exhibit 5). One essential component of this iterative process during WFX 17-01 was the daily input from the FFA and CF HQs. Beginning with the nested division and brigade named areas of interest (NAIs) and tactical areas of interest (TAIs), the FFA and CF HQs further developed the call for fire zones (CFFZs) where enemy indirect Fires and fire support systems were most likely to be located over the next 24, 48, 72, and 96 hour intervals. Third ID's scheme of maneuver was a north-to-south attack. The 75th FA linked two planned position areas for artillery (PAAs) north of each CFFZ. Two daily corridors were developed as ACMs to allow for friendly counterfire within a four minute response time into the planned CFFZ. The ACM would activate in conjunction with the ATO date, limited in dimension to the maximum ordinance of the rocket fired, and measure approximately four kilometers in width to allow for the greatest sharing of the division and the Joint Forces Air Component Command airspace above the coordinating altitude.

Seventy-fifth FA positioned the Q-37s to cover the division's entire AO from the forward line of troops to the FSCL. The CF HQ provided near full and continuous coverage, although limited by the challenging terrain and shortened cueing cycles based on the significant enemy threat. Common sensor boundaries with the CF HQ's Q-37s and the BCT's Q-36 radars synchronized the overall counterfire fight and further reduced gaps of coverage. This effort was headed by the 3rd ID DIVARTY LNO to the 75th FA and nested within the FASP.

The approved ATO, ACMs, and FSCMs greatly aided 75th FA when the enemy medium and long range indirect fire systems were inside of the predicted CFFZs. Counterfire response times were solely based on fire mission processing limitations. However, especially in the first 24 hours, the vast amount of enemy indirect Fires between the CFL and the FSCL originated outside of the CFFZs. Each fire mission without an active ACM linking the launcher's PAA to the CFFZ required the airspace based on the rocket trajectory be deconflicted with the JFACC to provide reasonable safety to the aircrews above the coordinating altitude. Third ID streamlined the deconfliction below the coordinating altitude by delegating this task to the air defense and airspace management (ADAM) cells within the FFA and CF HQs. ADAM cell Tactical Airspace Integration System (TAIS) operators used this air common operating picture as a reference and digitally confirmed over Transverse the divisional airspace deconfliction with the combat aviation brigade (CAB) and tactical unmanned aerial systems with the BCTs.

While fire mission processing, deconfliction of airspace below the coordinating altitude, and ground clearance took less than four minutes, the average counterfire mission was over 22 minutes during the first 12 hours of the WFX. This was due to the high volume of missions coming from both the FFA and CF fire control elements and ADAM cells into a single coordinating cell at division, the joint air ground integration cell (JAGIC). Upon receipt of a fire mission, the JAGIC would begin the deconfliction process with the JFACC. During the first 12 hours, fire missions were deconflicted in order of receipt by the JAGIC. By the time the aircrews were diverted to a safe area and the fire missions executed, there was little or no effect on the enemy forces. Two major changes were identified and quickly implemented that improved the processing time over the next 24 hours.

The first change was the full implementation of the division commander's targeting priority for the deep fight and counterfire fight. During the

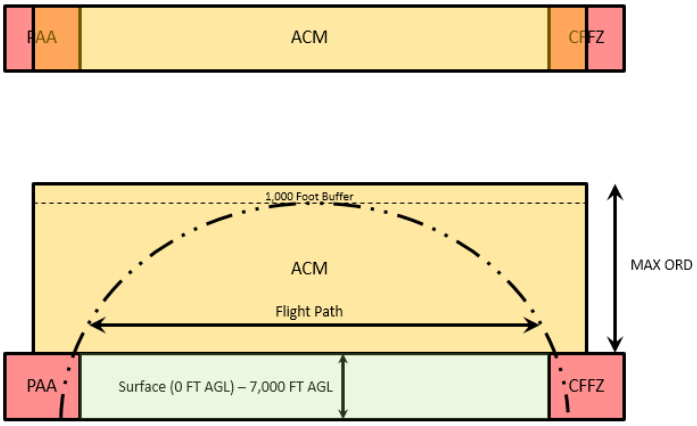


Figure 6. Airspace coordination measure example. (Courtesy illustration)

first division commander's warfighting function sync following the opening of Phase III operations, the division commander directed his staff to enable the deep surface Fires fight by prioritizing the targeting of specific enemy weapon systems. The 75th FA started with the CFFZs, which were based on intel analysis of the enemy courses of action and enemy order of battle to identify likely areas these specific systems would fire from. During fire mission processing, an intel analyst on the current operations floor would confirm the system firing and enemy organization it belonged to through the Joint Automated Deep Operations Coordination System (JADOCS). Once confirmed, the ADAM cell informed the JAGIC who then placed the fire mission at the top of the deconfliction priority list. This alone reduced the counterfire time by 10 minutes. Once the JAGIC confirmed the airspace was deconflicted, the 75th FA fired the initial rockets and left the mission open for reattack. The subsequent fire missions were processed to that location within four minutes, achieving overwhelming effects on the enemy systems. A similar effect on deep Fires was noticeable within the FFA HQs dynamic fight. Division G2 prioritized UAS collection efforts on those NAIs where the enemy's most lethal artillery elements were templated. The focused collection effort resulted in sustained Fires originated by the field artillery intelligence officer at division.

The second change implemented was the introduction of a condensed targeting cycle within the CF HQ. The fire control officer (FCO), brigade aviation officer (BAO), the brigade counterfire officer (CFO) and an intel analyst developed a two-hour battle rhythm event. The targeting cycle began with the pattern analysis provided by the playback feature of the JADOCS. For approximately 15 minutes, the four staff members discussed enemy tactics, techniques, and procedures; the enemy scheme of maneuver and decision points; movement rates for both enemy and friendly artillery; ranges for enemy and friendly systems; and forecasted where these enemy elements were most likely to be in 90 minutes. This became the new refined CFFZ. The FCO ensured this information was built into the Advanced Field Artillery Tactical Data System while the CFO shared the information with the 3rd ID DIVARTY LNO for sensor management and communication with the FFA HQs. The intel analyst shared the information with both the S2 section and the targeting officer. The BAO developed ACMs, which linked a friendly PAA to the new CFFZ and ensured this was built into the TAIS (Exhibit 6). At the completion of the 15-minute working group, the BAO contacted the JAGIC to proactively deconflict the airspace to begin firing counterfire missions 75 minutes from that point, leaving it open for an additional 30 minutes to assess effectiveness. At the 36-hour mark of the operation, the combination of the JAGIC processing the deconfliction of airspace based on the commander's priorities and introducing an abridged targeting cycle reduced the firing time of the first rocket to seven minutes and subsequent rounds in that area to under four minutes.

Keys to success

The success of Fires during WFX 17-01 can be attributed to several factors. Clear guidance for Fires from the division commander throughout preparation, planning and execution assured unity of effort across the Fires WfF. Early integration of both staffs of the FFA HQs and FAB served to solidify lines of communication and processes that leveled expectations between the two organizations and clearly defined roles and responsibilities of each HQs. Parallel planning with division ensured that the field artillery support plans were thoroughly nested with the division commander's intent for Fires. Detailed integration during division rehearsals ensured that the Fires plans were synchronized with maneuver. Reducing the time between targeting cycles at the CF HQs and a shared understanding of the division commander's targeting priorities helped to dramatically reduce both acquisition and attack of deep targets and counterfire times and increase the effectiveness of the mission. The two staffs' preparation and mental agility combined with the 3rd ID DIVARTY and 75th FA commanders' commitment to synchronize their efforts are reasons why the artillery remains the undisputed *King of Battle*.

The Soldiers in 3rd Infantry Division Artillery and 75th Field Artillery Brigade stand together after the final after action review. (Courtesy photo)

Capt. Daniel Allison (center), fire support officer for 4th Squadron, 10th Cavalry Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, joins a joint terminal attack controller assigned to the unit and a Polish 10th Armored Cavalry Brigade soldier at an observation point for mortar firing during the squadron's Mortar Training and Evaluation Program exercise at Sweitoszow training area, Poland, Feb. 9, 2017. (2nd Lt. Micayla Westendorf/3rd ABCT, 4th ID)

The lost art of observation planning

By Lt. Col. Jack Crabtree, Lt. Col. Jonathan A. Shine, Capt. George L. Cass

As observed at the National Training Center, fire support officers (FSOs) at all echelons struggle to get observers in position to observe planned targets. This results in planned targets that are tied to fire support tasks not being serviced or maneuver delayed by Fires. Unlike the effort maneuver commanders take finding a useable assault by fire or support by fire position, they put less thought into the observers' location and their ability to observe and adjust Fires. They think either the FSO will figure it out or the actual observer will move to a location they can observe from. The contributing factors are commanders and FSOs not planning the location of observation posts (OPs) to service targets, not understanding the capabilities and limitations of fire support teams (FISTs) and forward observers and commanders not selecting an appropriate fire support team control option.

Inadequate Fires planning starts soon after receipt of mission. FSOs often do not articulate directed brigade combat team (BCT) or battalion (BN) fire support responsibilities during mission analysis. They also fail to describe how those fire support tasks support the higher headquarters' concept of operation. Both enable clarity of nesting plans at echelon. This shortcoming limits the commander's and staff's understanding of the higher headquarters scheme of Fires, to include the observer plan.

The observer plan is further impaired by FSOs not incorporating the observer into the scheme of maneuver during course of action (COA) development, prior to COA analysis. The FSO's time is typically consumed by placing targets on a map with little thought to who, how or when the observer will be in place to observe targets and triggers. Maneuver battalion and brigade operations officers (S3s) and executive officers (XOs) do not require the FSO to attend the wargame armed with this information. They just want to see the fire support overlay with targets on it. This typically results in the FSO draw-

ing OPs on the operational graphics during or after COA analysis and sometimes not at all. No thought is applied to how the observer is going to get there, how long it will take, effects of limited visibility on optics and other critical factors. The result is positioning and timing of occupation of OPs that are not synchronized with the maneuver plan and the overall consequence is Fires not synchronized to facilitate maneuver.

Fire support capabilities, limitations

FSOs at echelon do not explain the capabilities and limitations of employing FISTs and FOs to support the servicing of planned targets. This is one of our primary responsibilities to our commanders. Fire Support Tables I-VI from Training Circular 3-09.8 Field Artillery Gunnery provide the framework for all field artillery units to qualify their fire supporters. Joint forward observer qualification standards are another framework. Inherent to these training models is that the FIST or FO is in an observation post. Currently there are no qualification standards for FIST and FO elements located in a formation that is conducting movement and maneuver. With this understanding, FIST and FO employment is best utilized when we occupy an OP on elevated terrain observing targets within the range of the capability of our fire support system. Battalion and company commanders/S3s must understand these factors or they will likely fail to service the targets assigned to them by brigade. During the military decision making process, they should require their FSO to brief capabilities and limitations of all mounted and dismounted OP's. The combat power for fire support they should brief reflects capabilities and limitations of mounted versus dismounted OPs, range capabilities of Fire Support Sensor System (FS3)/ Long Range Advanced Scout Surveillance System (LRAS), Lightweight Laser Designator Rangefinder (LLDR)/vector, or map, compass and binoculars. They also need to understand the effect of day versus night and periods of limited visibility on all those systems. FSOs need to understand and communicate these capabilities and limitations to maneuver leaders so they understand the purpose behind planning and occupying observation posts.

When fire supporters consolidated into field artillery battalions, the most significant reason was to ensure they receive the best training possible in their primary duties. FA battalion commanders are responsible for ensuring maneuver battalion commanders receive highly trained fire support elements back as they transition to collective training for company and above. However, FISTs are trained on very specific tasks that are not always integrated into maneuver training. A training gap that has become evident at the National Training Center is that commanders fail to integrate fire supporters' occupation of OPs into maneuver training at home station. It becomes especially apparent during the brigade live fire at NTC. Observers are more timely and accurate when they are in an elevated position and stationary. During the offense, one of two scenarios occurs; 1. The FSO, due to the order or implied requirement that the FSO remain with the commander, moves behind the company or battalion commander and he or she is unable to observe or communicate the trigger or the target while moving due to the positioning of the commander. 2. The FSO maneuvers to their OP, but because the timing of the movement to their OP was not planned or synchronized with the maneuver plan, it takes much longer than the commander visualized. This results in executing the plan without Fires, or else the maneuver elements remain stationary for a long period of time and are subject to enemy Fires and desynchronizing the brigade plan. This could be attributed to live fire exercises at home station, where routinely the field artillery and mortar impact areas are offset from the platoon, company or battalion maneuver live fire area. This requires the observer to occupy an OP that is nowhere near where they are training. Many times observers move straight to their OP as maneuver is setting up the range and remain there for the duration of live fire training without requiring OP occupation to be synchronized. FSOs do not maneuver with the company or battalion due to the location of the OP and designated impact areas. The other scenario is having the FSO move with the maneuver element and call the tactical trigger, but the OP observing the offset impact area makes all the fire support adjustments. Training this way prevents us from having a clear understanding of how long it will take FSOs and observers to occupy positions where they can effectively do their job, and to maintain communications that facilitate responsive Fires.

Commander's guidance to fire support officers

Maneuver commanders know they owe their staff and subordinates a description of their visualization of the battle. If they intend to fight an unfair fight weighted with responsive Fires, they need to focus some energy on the Fires warfighting function. Specific to the FSO, commanders should clearly identify the decisive point of the operation. They should then be able to expect the FSO to develop a plan to mass Fires at that time and location, including detailed observation planning. Commanders should demand their FSO backbrief them on this plan, explaining how Fires enable success at the decisive point. They should direct the FSO to report back with a pre-battle conditions check on the Fires warfighting function prior to the line of departure. This should include the Fires combat power, a running estimate of FIST capabilities including digital communications status, confirmation that current fire support coordinating measures have been pushed out to every subordinate,

Observation Planning 6-Step Technique from Army Technical Publication 3-09.42

For this purpose, the 6-step observation planning technique retains flexibility at the lowest level to position observers. Using top down planning, bottom up refinement to position observers optimizes and synchronizes observer positioning across the brigade combat team. Detecting and assessing the effects of fires is critical.

The 6-step technique provides a methodical approach to produce refined, executable, integrated, and synchronized observation plans. This observation planning technique also provides the observer and commander with data necessary to rapidly adapt that plan during execution if a planned observation post is determined to be unsuitable after using a line of sight and risk estimate diagram.

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

Battalion Fire Support Platoon from Army Technical Publication 3-09.43

Consolidate fire support teams (FISTs) at the battalion level to maximize the battalion commander's ability to influence the battle at a critical time and place.

Company/troop commanders may retain access to fire support expertise in the planning process while the FISTs are centralized at the battalion level for execution.

primary communications have been checked with every sensor and shooter in the Fires technical rehearsal (ideally from the OP where they will call the targets, if conditions allow), which targets were rehearsed and if any of the triggers were refined based on the outcome of the rehearsal. If something is not right, the FSO must understand that he or she owes the commander the information to make a risk decision on whether to fight degraded, change the plan, or take more time to fix problems. One simple check is for commanders to ask how long a particular target took to process during the Fires rehearsal: averages for recent combat training center rotations are around 11 minutes, so if the FSO briefs something significantly different, the commander may need to investigate further to ensure the rehearsal was adequate to ensure responsive Fires.

Observation planning

Many FSOs do not create a detailed observation plan that shows primary and alternate observer locations to support battalion and brigade targets and triggers. This results in maneuver waiting on fire supporters to get observers in position to observe targets that are essential to the battalion/brigade scheme of maneuver. Doctrine currently for fire support planning is covered in Army Techniques Publication (ATP) 3-09.30 Techniques of Observed Fire and ATP 3-09.42 Fire Support for the Brigade Combat Team. ATP 3-09.30 has nothing about observation planning at battalion level. It only provides on the procedure for occupying an OP (security, location, communication, targeting head, observation and position). Commanders should rely on FIST and FOs to occupy OPs on dominant terrain that can overwatch a wide area. Security posture is determined by the commander, but a mounted OP consists of at least one Bradley fire support team or fire support vehicle and a dismounted OP consists of at least two FOs. Commanders must assume the risk of those Soldiers occupying dominant terrain independently to gain a tactical advantage over the enemy.

ATP 3-09.42 provides the six-step technique for observation planning. It prescribes that at the BCT Fires cell, planners establish OPs to support the servicing of any BCT-directed target. This allows for top-down planned targets that require bottom-up refinement during parallel planning at battalion and company level. Often times BCT Fires planners will assign primary and alternate observers on the fire support task matrix with the assumption that subordinate units will plan OPs in support of the targets. Routinely, BN FSOs assign targets in the same manner with the assumption that company FSOs in conjunction with company commanders will incorporate it in their scheme of maneuver. What ends up happening is no echelon plans the occupation of OPs to synchronize establishment with target triggers. In many cases, FISTs and FOs are in maneuver formations requiring cover and concealment and unable to observe targets. This contradicts the way we train FISTs and FOs in occupying an OP on dominant terrain and gives the observers the same aspect angle as the maneuver element.

The six-step technique for observation planning is a forcing function for subordinate units to analyze the target and OP planned by BN/BDE and submit refinements. Company commanders often plan under constrained timelines and focus on what battalion tasks them to do. When the S3 includes, in tasks to subordinate units, the requirement to emplace an OP in order to observe battalion targets, the commander is now required to follow the order or submit a refinement. This also makes it a consideration briefed in operation orders, backbriefs, and the BN combined arms rehearsal. They submit refinements to targets, triggers, and OP locations so that they are incorporated in battalion and company schemes of maneuver.

FSOs at all echelons should plan OPs that can service each planned target they determine as essential to facilitating FSTs to support scheme of maneuver. They should consider risk estimate distances or minimum safe distances of munitions planned for the target, line of sight analysis and capabilities available. They should plan each OP location considering whether it is a mounted OP with FS3/LRAS, dismounted OP with LLDR/vector, or map, compass, and M22 binoculars. FSOs need to be familiar with the capability of these systems and the experience of the FOs that are utilizing them. When a planned target does not have a feasible location to set an OP, they need to be honest brokers with their maneuver commanders and notify them of the constraints in observing targets.

"Commanders are the most important participants in the operations process. While staffs perform essential functions that amplify the effectiveness of operations, commanders drive the operations process through understanding, visualizing, describing, directing, leading, and assessing operations." Army Doctrine Publication 5-0.

Many maneuver commanders provide mediocre guidance for fire support. This limits the FSOs ability to develop a scheme of Fires and included observer plan. It also reduces the staff's ability to synchronize fire support guidance with the maneuver plan.

If commanders provide a similar level of guidance they provide for the movement and maneuver warfighting function, observers will be more successful and Fires more responsive. Commanders should consider issuing guidance for the observer plan addressing the following areas:

- Daylight vs. limited visibility movement and occupation.
- Mounted vs. dismounted movement and occupation.
- "No later than" for establishment of Ops.
- Prioritization for special equipment such as digital Fires capability and optics observing critical targets or triggers.
- Additional assets the commander is willing to commit to serve as observers such as squads, snipers or scouts.
- Requirements for observation redundancy of triggers and targets.
- Fire support team control options.
- Tactical risk the commander is willing to assume with the observer plan (compromise, time, equipment, redundancy, etc).

Fire support team control option

Another significant concept in doctrine that is not routinely discussed is the fire support team control option referenced in ATP 3-09.30. When asked about control options, most fire supporters know about centralized versus decentralized control options for calling for fire directly or through an intermedi-

ary to a surface-to-surface weapon system. However, the ATP also provides options on how to employ the fire support platoon for planning and execution. The three control options are fire support platoon, company/troop FIST, and squad forward observer. Each have their own benefits and drawbacks.

The first control option is consolidated fire support platoon, which centralizes the fire support platoon for planning and employment of FISTs and FOs to streamline tasking from the battalion commander. The FISTs can still be available to their company commanders during troop leading procedures, but the BN FSO plans their OPs and targets with the focus on battalion scheme of maneuver. This utilizes the fire support platoon in a way similar to the way BCTs used combat observation lasing teams. It allows for the FSO, as delegated by the BN commander, to control the platoon and have it focus on massing fires at the BN commander's decisive point. This option is advantageous when an operation lacks detail in battalion and company schemes of maneuver. For instance; in the defense, when a BN has two companies occupying battle positions set to fire into the same engagement area, less detail is required with the company scheme of maneuver. This control option will allow for the fire support platoon to provide redundant observation from different OPs to service BN or BCT targets. Another scenario is when the BN is the shaping operation for a BCT combined arms breach. The battalion is tasked to occupy support by fire positions to provide suppression on the enemy Battle positions in support of the breach force advance to the breach site. Again, this is not detailed at the company level. The BN commander can centralize the employment of FISTs and FOs to ensure that his battalion suppresses and obscures at the BCT commander's decisive point. The battalion staff can feasibly plan the OPs and specify in position ready to observe times that facilitate observation of suppression and obscuration Fires in support of the breach force.

U.S. Army 2nd Lt. Connor Cabrey, fire support officer assigned to Battle Company, 2nd Battalion, 503rd Infantry Regiment, 173rd Airborne Brigade, and Slovenian 2nd Lt. Gregor Lisjak, platoon leader assigned to 1st Platoon, 2nd Company, 10th Infantry Regiment discuss the employment of mortars during a Section Live Fire Exercise, Nov. 9, 2016. (2nd Lt. Winston Boldt/U.S. Army)

Fire support planning definition from Army Technical Publication 3-09.30

Fire support planning is accomplished using targeting and the running estimate. Fire support planning includes developing integrated fire plans (target lists, fire support execution/fire support task matrix, scheme of Fires, and overlays) and determining forward observer control options that support the commander's scheme of maneuver.

The second control option is company/troop FISTs decentralized to companies for planning and execution. This is the default and most often used control option because it is inherent in the concept of Mission Command, where we rely on decentralized execution by subordinate leaders. This control option is ideal for operations that require detailed integration of Fires in the company scheme of maneuver. As an example, in offensive operations with multiple company objectives, Fires need to be synchronized with company schemes of maneuver to ensure Fires are massed at the company commanders' decisive points. Also, when an urban center is the battalion objective, utilizing this control option assists the isolation force in having an observation plan focused outside the urban center, and the fixing force having an observation plan inside the urban center.

The third control option is squad forward observer. This is the least preferred method, but locates an FO in every squad-size element. This option is not recommended because it splits up the FO team and diminishes their ability to conduct dual independent checks. It also requires a higher degree of training for individual FOs than most units are able to achieve.

The examples given are not a rule, but are considerations that maneuver commanders and FSOs at echelon should discuss from BCT down to Company. Fire support control options that are recommended should be tied to each COA during COA analysis.

A recommendation is for BCT FSOs to host a brigade fire support leader professional development class with focused discussion on observation planning and fire support team control options. Attendees would be BDE and BN commanders, XOs, S3s, FSOs, and company commanders and FSOs. BN FSOs can do the same thing for a maneuver battalion, but so much can be learned from developing shared understanding amongst the leaders across a BCT. It is up to the fire supporters to advise their maneuver commanders in the options available, providing different ways to approach operations. (For training materials to facilitate this discussion, please contact the author.)

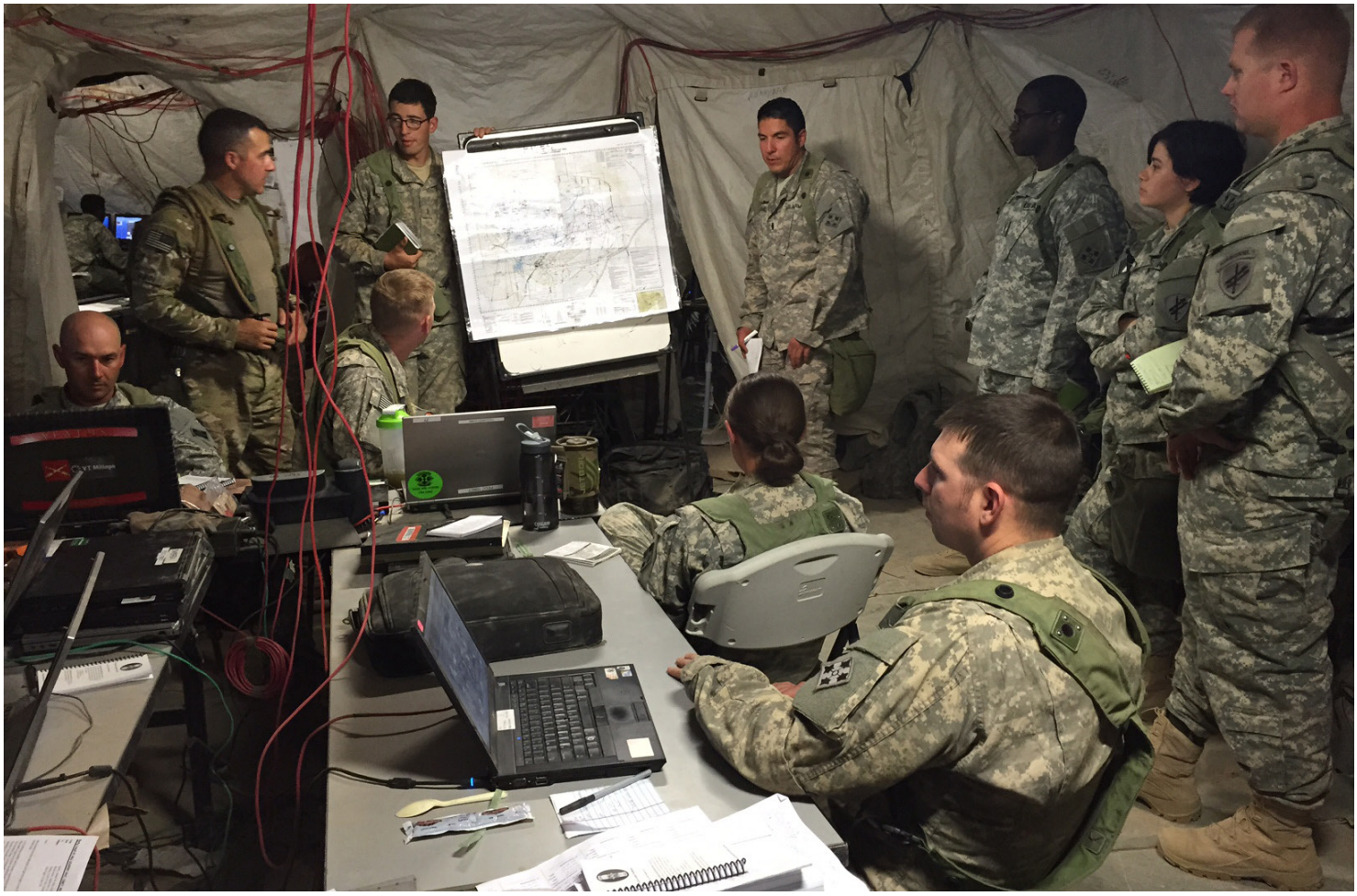
Gen. Dwight D. Eisenhower once said, "The speed, accuracy and devastating power of American artillery won confidence and admiration from the troops it supported and inspired fear and respect in their enemy." Fire Supporters can win that confidence within their formations by ensuring they develop shared understanding with commanders on the capabilities and limitations of the fire support system and utilizing doctrine as a tool to plan and execute in a manner that provides speed, accuracy, and devastating effects.

Lt. Col. Jack Crabtree is an infantry officer that serves as a National Training Center Combined Arms Battalion senior trainer.

Lt. Col. Jonathan Shine is a field artillery officer serving as a National Training Center senior fire support trainer.

Capt. George Cass is a field artillery officer that serves as a National Training Center Combined Arms Battalion fire support trainer.

A U.K. artillery support non-commissioned officer and a U.S. fires support officer discuss the desired impact area during a joint firing exercise near Bemowo Piskie Poland April 20. The exercise, meant to ensure proper weapons function and test joint fire control and reporting in the battle group, marks the first time the unit has fired its artillery weapons since arriving in Poland. (Staff Sgt. Zackary Cowher/U.S. Army)



Soldiers of the 1st Stryker Brigade Combat Team, 4th Infantry Division brief the collection plan during a targeting working group. (Courtesy photo)

Collection management at the National Training Center

By Chief Warrant Officer 2 Aziz Smith and Chief Warrant Officer 3 Ferman Barnes

In brigade combat team (BCT) decisive action (DA) operations, many collection managers provide limited intelligence to operations because they lack the school training or experience in DA.

Developing the intelligence collection synchronization matrix (ICSM), named area of interest (NAI) overlay, intelligence collection matrix (ICM) and synchronizing the proper assets in time and space extends beyond the experience of most collection managers. Limited experience creates intelligence gaps and missed opportunities.

The duties and responsibilities outlined in Army Techniques Publication 2-19.4, Brigade Combat Team Intelligence Techniques, can be unrealistic at the National Training Center, given the many time constraints. Often, collection managers skip steps when developing an intelligence, surveillance and reconnaissance (ISR) plan to save time. Skipping steps during ISR planning forces the unit to spend additional time modifying the ISR plan during course of action (COA) development and COA analysis or wargame. Briefing the ICSM and NAI overlay without creating an information collection matrix (ICM) has become the norm. Based on recent NTC observer-coach/trainer (OC/T) observations, a well-developed ISR plan begins with daily synchronization with all warfighting functions, capability representatives and enablers.

Collection manager

As BCTs begin operations at NTC, many quickly recognize the many challenges associated with assigning the correct individual to the brigade collection manager position. The first hurdle for most brigades is appointing a school trained information collection planner (Q7 additional skill identifier). Considering the collection manager is not a modified table of organization and equipment position at the brigade level, this position is often filled by an individual of limited experience.

It is essential for collection managers to understand the Army's two core competencies – DA and the requirement to conduct both simultaneously. These two competencies will allow BCTs to defeat or destroy an enemy, seize or occupy key terrain, protect or secure critical assets and populations, and prevent the enemy from gaining a position

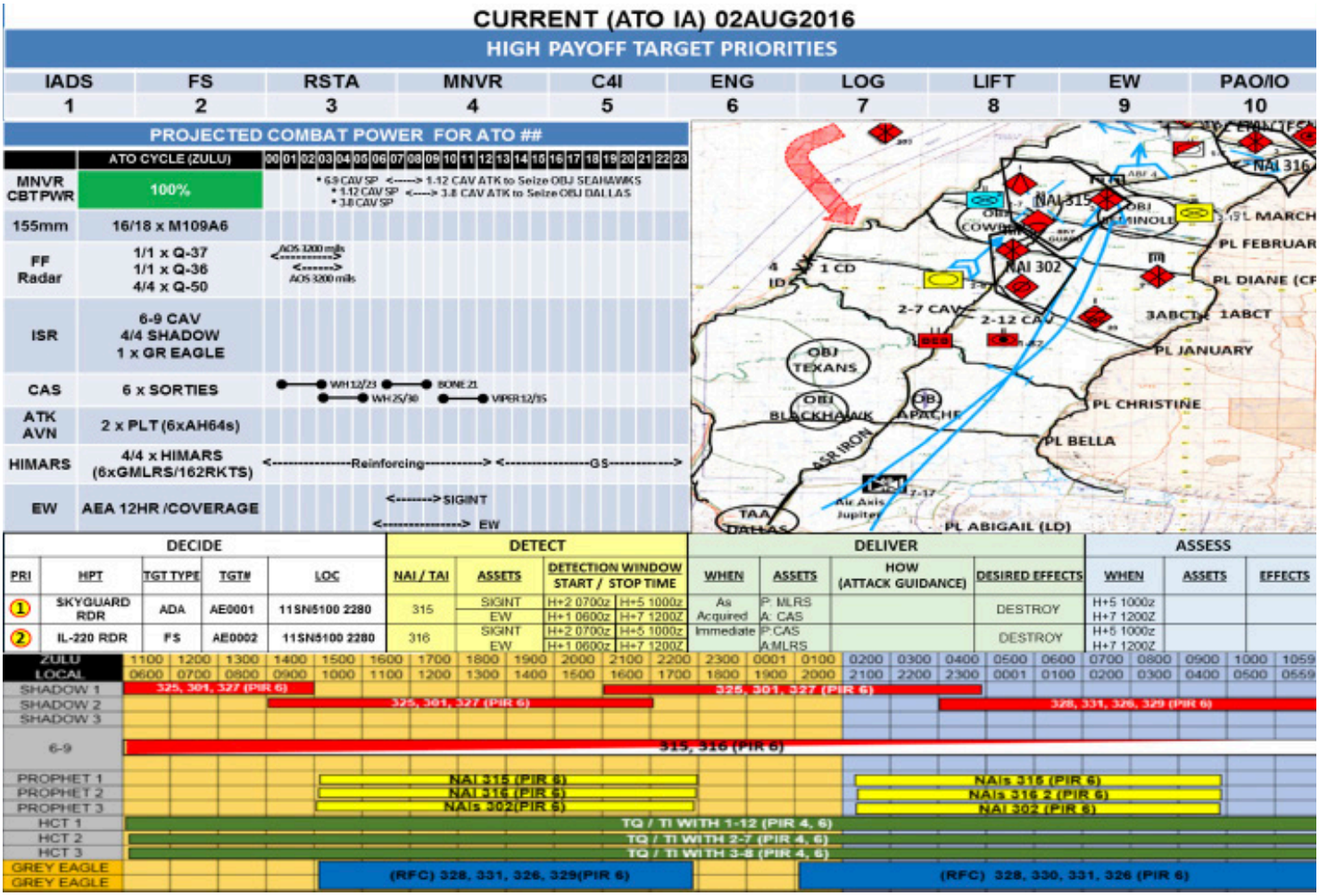


Figure 1. The Target Synchonization Matrix (A Way) dated Aug. 2, 2016. (Courtesy illustraton)

of advantage (Army Doctrine Publication 3-0). This is achieved through a well-developed battle rhythm and daily synchronization meetings with all warfighters and enablers.

The second hurdle BCTs need to overcome is utilizing the correct intelligence and operational products to develop a solid ISR plan. Field Manual 3-55 recommends that collection managers assist with the development of the following intelligence products –

- Enemy situation template
  - Depicts how, where, when enemy forces will fight
  - This will assist with developing specific intelligence requirements (SIR) and indictors
- Event template
  - Provides phase timelines for enemy maneuver forces
  - Critical for NAI development and aligning assets in time and space
- Intelligence running estimate
  - Forms the basis of facts and assumptions
  - Critical for future NAI development and ICM

The most significant observation identified from OC/Ts and replicated at higher headquarters was the limited connection between rotational enemy course of action and higher headquarters products. Lack of synchronization between the high payoff target list and ISR planning is just one example of this disconnect. A majority of the brigade collection managers will plan in a vacuum without integration of the rest of the staff. The lack of coordination with other warfighting functions force the collection manager to focus on what the enemy has done and not on what they will do. Lack of predictive analysis can force the current operations (CUOPs) team to fight the collection plan and not the enemy. OC/Ts continue to observe these challenges when units do not synchronize operations with the collection manager and when BCTs place too significant a workload on the collection manager.

One technique that is often effective is assigning multiple collection managers on day and night shifts. Adding multiple collection managers with adequate workstations enhances vertical and horizontal communication throughout the formation. Additionally, this will augment the intelligence officer and brigade all source warrant officer's ability to process, exploit and disseminate (PED) intelligence. With the addition of PED, maximum effort is applied to understanding the operational environment, support to warfighter functions and improved collection plan (Field Manual 3-55).

Targeting working group

The brigade targeting OC/T consistently observes challenges associated with optimal employment of intelligence enablers in synchronization with the targeting process. Target discrimination, target acquisition and target engagement are often desynchronized. Although the BCT executive officer directs, coordinates, supervises, and synchronizes the targeting work group and acts as the chair of the targeting effort, many collection managers lack the capability, experience and skills to provide valuable input.

Information collection doctrine is not prescriptive; however, it does advise collection managers to translate priority intelligence requirement (PIR) and SIR into indicators as it may influence the commander's selection of a course of action (Field Manual 3-55).

During the targeting working group, the BCT intelligence officer (S-2) and collection manager are responsible for bringing an in-depth understanding of the enemy and requirements of information collection to establish and support the BCT targeting priorities. The BCT S-2 provides possible enemy courses of action for deep fight considerations and a running estimate of predictive enemy actions for the next 24-72 hours. These courses of action must be depicted on an analog map containing NAI and TAI. OC/Ts routinely observe units lacking sufficient coordination and dialogue among the intelligence and Fires warfighting functions. The latest observations illustrate that cross-level planning amongst targeteers and the collection manager for information collection is vital.

The targeting working group produces requirements that are integrated into planning products and the unit's information collection plan. Likewise, possible threat locations, avenues of approach, infiltration routes, support areas, and areas of activity become NAIs and develop into TAIs as collection assets focus their efforts. In order to have a successful targeting effort, the information collection plan must seek to verify enemy activity in support of the targets we want to engage. It is vital for the information collection plan to provide observations to monitor decision points comprised of NAIs and TAIs in association with high payoff targets. Observations show the collection managers have become comfortable briefing the ICSM with no task and purpose or ISR plan linkage to PIRs, SIRs, or decision points. This lack of understanding and poor linkage to decision points limits intelligence for targeteers who must assign primary/alternate observers for targets. When the IC manager provides increased clarity and specific information in the collection brief, the targeting team can establish a dialogue that becomes critical to the targeting process. The targeting process has a desired end state focused on integration of target nominations in conjunction with target acquisition, target discrimination and engagement.

The inclusion of the IC matrix to the targeting synchronization matrix (TSM) is a valid technique to achieve success. The combined products create a shared understanding that allows operations and intelligence war fighting functions to visualize target priorities, detections, delivery methods and provide assessments on selected NAIs. A way to depict this product is through a "mini map" with NAIs, enemy objectives and projected combat power aligned with the air tasking orders cycle. This product helps the staff to visualize, predict and synchronize engagement of the enemy to shape the deep fight. Additionally, it enables radar zone and TAI development for successful dynamic targeting. This TSM is the primary output of the TWG and is transitioned to CUOPs for coordinated execution. An example is as follows:

The objective is to execute the targeting process to support both dynamic and deliberate targeting, and planning requirements within the military decision making pocess (MDMP). It is vital to ensure we transition the TSM to current operations at the conclusion of MDMP. The TSM facilitates recording specific information and associated changes for the distribution of results produced by any course of action approval/decision brief. As an added benefit, it can help units to identify NAIs and the indicators necessary to transition NAIs to TAIs during the targeting process. The NAI and TAI is a way for intelligence and Fires personnel to reference a common location of terrain on a map without having to pass grid data. Finally, once a NAI is confirmed by collection assets, it is then transitioned to a TAI to engage in accordance with the commander's targeting guidance.

Information collection planning

Regarding the ISR plan, collection managers should attend TWG knowing when and how they will execute:

- **Reconnaissance.** A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or adversary, or to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area. (Field Manual 3-55).
- **Security operations.** Those operations undertaken by a commander to provide the early and accurate warning of enemy operations, to provide the force being protected with time and maneuver space within which to react to the enemy and to develop the situation to allow the commander to effectively use the protected force (Field Manual 3-55).
- **Surveillance.** The systematic observation of aerospace, surface, or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means (Army Doctrine Publication 3-0).

OC/Ts have seen success when collection managers do not rely exclusively on aerial reconnaissance. The most effective recon elements are dismounted recon elements such as scouts. Given their ability to work day or night, in any weather condition, they should be employed as soon as possible. Ground reconnaissance scouts have the ability to see the ground objectively and determine how it will affect both enemy and friendly forces. When the ISR plan is developed correctly, dismounted reconnaissance can be used to cue additional assets or used as redundancy.

A frequent observation is the BCT's are hesitant to commit ground reconnaissance assets until the area is observed by unmanned aerial systems. This technique has not proved to be successful at NTC, especially during decisive action operations. In fact, rotational units that delayed the commitment of ground reconnaissance assets lost the initiative, were limited in their ability to provide maneuver time and space for main body elements, and had limited effect on the enemy's decision cycle.

Recommendations

Typically, junior lieutenants are assigned as the brigade collection manager. Most lieutenants have limited experience or familiarity with echelon above brigade (EAB) intelligence collection systems and their capabilities. Moreover, a majority of lieutenant collection managers have multiple responsibilities within the BCT. It is almost impossible to produce a quality ICSM, ICM, NAI overlay and attend the required staff meetings when there is only one or two (day and night) personnel assigned as the collection manager.

Department of the Army Pamphlet 600-3, Commissioned Officer Professional Development and Career Management, provides duty descriptions for who should be assigned as collection managers. It is recommended that senior intelligence warrant officer two with five or more years as a warrant fulfill the role as the brigade intelligence collection managers. Most warrants have served a minimum of five years enlisted with multiple duty assignments as intel-

Soldiers of the 1st Stryker Brigade Combat Team, 4th Infantry Division, secure a Stryker vehicle to a rail car with chains during rail load operations for deployment to the National Training Center at Fort Irwin, Calif., Aug. 26, 2015. NTC is a major training center for the United States military located in the Mojave Desert. (Sgt. William Howard/1st BCT, 4th ID)

ligence professionals providing them additional necessary experience and knowledge in intelligence collection operations. Their experience and ability to provide candid recommendations to commanders is a necessity in all BCTs.

If the brigade commander chooses to leave an officer as the collection manager, we recommend utilizing a senior captain, preferably a former battalion S2 or, better still, a former military intelligence company (MICO) commander. This officer should have at least served successfully as a battalion S2. This enables better understanding of organic intelligence equipment, capabilities and methods to effectively employ EAB assets. MICO commanders also have the maturity and skills to multitask, adhere to timelines and integrate with the BCT staff. The experience of MICO commanders usually reduces changes to products, which empowers the brigade commander, staff members and subordinates to receive critical information. If assigning a post-key development captain or post-MICO commander is not feasible, it is highly recommend the collection managers are school trained, additional skill identifier-Q7 qualified officers.

The volume and diversity of the collection manager role will continue to increase as the military continues to adapt to decisive action operations. Collection managers struggle to provide the necessary outputs and information to the BCT due to limited experience with combined arms maneuver and wide area security operations. With more detailed products in areas of ICSM, ICM and NAI overlay, the collection manager will provide an ISR plan that forces the enemy to be reactive or gives the BCT commander the ability to seize, exploit and retain initiative. The key is ensuring vertical and horizontal communication remains consistent. The assignment of the collection manager is vital. It is recommended that the BCT commander and primary staff provide overview on the selection of the collection manager. The collection manager must possess the ability to support the commander's decisions through shared understanding and the identification of the enemy's location and actions in time and space.

Overall, selecting the right collection manager facilitates our ability to take the lead in shaping the BCT commander's plan through collection and target integration and enable vital effects based on the commander's guidance. This allows the BCT to shape the deep fight while simultaneously supporting decision points for maneuver enhancement. Through the development of the collection manager, we can enable the BCT commander to provide an achievable endstate, key task, objectives based off validated assessments through desired effects while managing our limited resources.

Chief Warrant Officer 2 Aziz Smith is the National Training Center All Source trainer with 20 brigade combat team training rotations in this capacity. Smith has 17 years of experience at the tactical and strategic level as an infantrymen, intelligence analyst and all source technician.

Chief Warrant Officer 3 Ferman "Manny" Barnes is the National Training Center targeting training with 30 brigade combat team training rotations. Barnes has 18 years of tactical and strategic-level experience as a forward observer, battery commander, targeting officer and target acquisition trainer.

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Field Manual 3-55 (Information Collection)

Army Techniques Publications 2-19.4 (Brigade Combat Team Intelligence Techniques)

Army Techniques Publications 2-01.3 (Intelligence Preparation of the Battlefield)

Army Techniques Publications 2-33.4 (Intelligence Analysis)

Army Doctrine Publication 3-0 (Unified Land Operations)

Field Manual 3-09 (Field Artillery Operations and Fire Support)

Army Techniques Publications 3-09.12 (Field Artillery Target Acquisition)

Army Techniques Publications 3-60 (Targeting)

Soldiers assigned to 4th Battalion, 23rd Infantry Regiment, 2nd Stryker Brigade Combat Team, 2nd Infantry Division communicate during a noncombatant evacuation operation in January, as part of Decisive Action Rotation 16-03 at the National Training Center, Fort Irwin, California. (Pfc. Kyle Edwards/Fort Irwin Operations Group)

Winning at the National Training Center

A fire support perspective

By Lt. Col. Timothy Mungie and Maj. Jason E. Turner

"No one gets my things! Don't ask for my guns, my helicopters, my fighter jets, my UAVs or my rockets. You get nothing. You fight with what you have and I'll fight with what I have."

Col. Jerry Turner
2nd Stryker Brigade Combat Team, 2nd Infantry Division commander

Top: Soldiers from the 2nd Stryker Brigade Combat Team, 2nd Infantry Division, prepare for rollout during a rotation at the National Training Center, Fort Irwin, Calif..(Spc. Randis Monroe/NTC Operations Group)
Bottom: Soldiers from A Company, 2nd Stryker Brigade Combat Team, 2nd Infantry Division, prepare for an air assault mission at the National Training Center, Fort Irwin, Calif.(Spc. Charles Probst, NTC Operations Group)

The brigade commander provided clear guidance to the 2nd Stryker Brigade Combat Team, 2nd Infantry Division Fires team as it prepared for National Training Center Rotation 16-06; "I want to be permissive to Fires and restrictive to aviation."

That was clear enough guidance for the brigade fire support officer (FSO) and the brigade fire support coordinator (FSCOORD) to go forward with how the fire supporters and field artillery could best support the SBCT.

Our task was to unify efforts across the brigade's warfighting functions (WfF) to achieve the commander's vision. The successful application of Fires and maneuver requires specific ingredients mixed at the right time to achieve the desired effect. The path to effectively shaping the close fight for maneuver battalions in a decisive action training environment (DATE) started with a sound fire support plan; continued through the application of the brigade's targeting process; required unity of effort between key brigade warfighting function leads; solidified by a detailed brigade fire support and intelligence surveillance and reconnaissance rehearsal, and required multiple repetitions of brigade-level exercises.

Fire support plan

The fire support plan is an amalgamation of lethal and non-lethal effects platforms, in time and space, to shape and win the brigade deep fight. Success in the brigade fight enables subordinate maneuver commanders to achieve favorable coefficient of forces and means (COFM) in decisive and supporting operations through effective synchronization and unity of effort. The fire support plan (FSP) nested with the field artillery support plan (FASP) are the brigade's tool to achieve this synchronization across all WfF and is the responsibility of the FSCOORD to produce.

Success then begins with a clear and shared understanding of the commander's vision and guidance.

The commander helps the staff understand his vision at deliberate gates in the military decision making process (MDMP). The first formal opportunity to provide guidance comes during mission analysis with the presentation of the commander's guidance worksheet. This tool proved to be invaluable. It created shared understanding of the commander's long-term end states which enabled the staff to develop running estimates needed for the brigade's targeting cycle.

Often WfF staff leads needed to create recommendations for the brigade commander's guidance worksheet because the specific verbage each WfF used is based on emerging doctrine and lessons identified during recent rotations or combat deployments. The commander's guidance worksheet is a conduit between the commander's visualization and targeting priorities for the brigade. This worksheet also provided the FSO with conversation starters between lethal and non-lethal effects planners.

This was the first opportunity for the FSO and FSCOORD to bring all targeting WfFs onto common terms of understanding. One good practice was to use joint doctrinal terms from the Joint Targeting Manual (JP 3-60). Combined with the commander's guidance worksheet, the brigade FSO was able to start the targeting process, which helped refine the FSP and FASP.

Finally, the collaboration between the field artillery battalion operations officer (S3) and the brigade FSO was vital to creating a FSP. The brigade FSO began collabora-

tive planning with the field artillery battalion staff from receipt of the mission through rehearsals. The brigade FSO and battalion S3 established scheduled meeting times over the CPOF system to collaborate on possible artillery areas, logistical lines of communications, observer locations, movement triggers and radar locations. The deliberate and dynamic communications enabled the battalion to provide the brigade commander with realistic expectations for the fire support plan as well as the field artillery support plan. The FSO to S3 relationship is vital to the success of the fire support plan.

Targeting

While the FSP was under development, targeting had been initiated, the fight was on, and targeting processes were underway. One key to developing a useful FSP is accurate target value analysis (TVA) in both the MDMP and during the targeting cycle. Whatever timeframe the MDMP or targeting cycle falls into, TVA cannot be undervalued. During the MDMP, the brigade intelligence section (S2) identified elements of enemy combat power by formation and function. It is the duty of the targeting team to evaluate the enemy's combat power, conduct TVA, and provide the commander with an initial estimate of the enemy's high value targets (HVT). During the targeting process, TVA is a battle rhythm event which cannot be overlooked. The brigade S2 provided predictive analysis of enemy courses of action which the targeting team used to synchronize assets in time and space. This predictive analysis also refined the FSP through doctrinal analysis of enemy practices.

The brigade's entire fight was synchronized and approved through the targeting process. The National Training Center uses a truncated timeline to simulate the stress of war. One successful practice was to keep our perspective in the same timeframe as our environment. We ran a 24-hour targeting cycle because it matched up with our higher headquarters air tasking order/air control order cycle. The targeteers came together every morning at 10:30 a.m. and conducted the brigade's targeting meeting. The brigade S3 or executive officer (XO) would chair the meeting while the brigade FSO drove the discussion. The brigade targeting warrant officer kept the meeting on track, ensuring the group's inputs and outputs achieved synchronization of effort for the next 24- and 48-hours' worth of events.

The targeting meeting acted as a daily wargame for the brigade fight. The S2 presented enemy courses of action for a 24- and 48-hour window based on predictive analysis and TVA. The S2 also provided analog overlays (depicting time and space) of enemy formations and functions. With these key points of data, the brigade targeting group war-gamed on how all assets the brigade possessed and requested could achieve the desired effects to shape the environment. The brigade FSO was the key leader in this meeting. The FSO ensured the decide, detect, deliver, and assess process achieved synchronization for the designated timeframes.

As the timeline went forward, the S2 identified HVTs while the FSO nominated high payoff targets, named areas of interest (NAIs), target areas of interest (TAIs), attack guidance matrix (AGM) and target selection standards (TSS) for lethal- and non-lethal artillery assets.

The inclusion of non-lethal assets in a DATE NTC rotation was just as important as the lethal assets. Years of counter-insurgency operations re-enforced the value of enablers to the maneuver fight. Electronic attack, offensive cyber operators, defensive cyber operators, and psychological operations teams all play a key role in offensive, defensive and stability operations. It is the FSO's duty to ensure every measure of combat power is considered when massing on the enemy, whether lethal or non-lethal.

During the targeting process, the brigade FSO presented targeting nominations with all enablers synchronized and intelligence and targeting collection efforts clearly defined to the brigade S3 or XO. The brigade S3 or XO approved the nominations, attack guidance, target selection standards and collection plan during the meeting. The key output was a synchronized plan for the brigade fight that required the approval of the commander through his nightly targeting decision board, which was nested within the brigade commander's update brief.

In this decision board (normally three slides on the CPOF), the targeting team updated the brigade commander on how the deep fight was progressing, identified targets for re-attack and new targets to attack and received approval/guidance. If the brigade commander approved the targeting recommendations, the brigade Fires cell published a consolidated HPT/AGM/TSS worksheet with its version number in a daily targeting fragmentary order. The targeting team collected the previous versions and destroyed them to avoid confusion. This was an important TTP used to maintain the current targeting picture.

This approved product was what the brigade fought off of for the next 24 hours. All the targets on this worksheet were pre-approved, engagements were streamlined and allocation of resources were clearly understood. This method provided shared understanding for decision-makers throughout the brigade tactical operations center and enabled rapid execution of dynamic and deliberate targeting. While the targeting process was continual and started during the MDMP, the FSP was the formal product produced by the FSCOORD which gave the force the initial plan approved by the commander. This plan, which had been refined through the MDMP and targeting, provided key leaders initial orders and guidance from the FSCOORD. Finally, the brigade targeting process, when executed and synchronized with the FSP, yielded the effects on enemy HPTs the maneuver needed to achieve the COFMs necessary to win the fight.

Unifying warfighting functions: The air picture

During the operations process, as well as targeting, it was critical for the brigade aviation officer (BAO) and the brigade FSO to create a digital and analog unified air picture (UAP). The UAP combined airspace coordination measures (ACM) and fire support coordination measures (FSCM) onto a single analog and digital map. The ability to manage ACMs and FSCMs is a point of either success or failure for many units at the NTC. The ability to manage these systems and maintain an accurate common operating picture enabled the Fires chain to provide accurate and timely Fires with both indirect, rotary-wing and fixed-wing platforms.

The UAP enabled one of the major training objectives for the brigade, conducting a coordinated attack using the joint air attack team (JAAT) method. The JAAT was a culminating event for the live fire that was hinged upon successful demonstration of ACM and FSCM management and the sustainment of a perpetual and accurate UAP. Without those two factors, the JAAT event was a go/no-go event. It was the direct responsibility of the BAO and the FSO to work out the details of the UAP and ensure both future and current operations elements understood the plan and were able to manage it as it unfolded.

A Mine-Clearing Line Charge, fired by Soldiers from C Company, 4th Battalion, 23rd Infantry Regiment, 2nd Stryker Brigade Combat Team, 2nd Infantry Division, explodes during a rotation at the National Training Center. Fort Irwin, Calif. (Spc. Randis Monroe/NTC Operations Group)

Leaders being at the point of friction during decisive points in the battle was a crucial element. The FSO and BAO must be on the current operations floor when the fight is on. Key warfighters were present to ensure effective execution during the JAAT, artillery live fire, or brigade's maneuver decisive operation. The FSO must be where the fight is controlled to enable flexibility, provide clarity to the FSCOORD, and ensure that all Fires efforts are executed in accordance with the commander's guidance.

Rehearsals are the final key to fire support success. Going over the fire support plan at every echelon ensured shared understanding from the sensor to the shooter. The brigade fire support rehearsal was conducted before the brigade combined arms rehearsal (CAR) so details of the plan were properly coordinated in time and space before demonstrating it to the entire brigade leadership. The rehearsal included the fire support tasks (FST) and field artillery tasks (FAT) as they fit into the maneuver mission. It was critical for the brigade S2, the brigade S3, and all brigade staff officers from both the future operations planners and the current operations executioners to see the plan together. This hand-off enabled the commander's vision to manifest on the battlefield.

The FSCOORD actively supervised the rehearsals to keep assets in time and space synchronized, while the FSO executed the actions.

The focus of the rehearsal was on the brigade echelon of fighting. Maneuver battalion FSOs kept their scope to the task, purpose, execution and assessments by key time block for their battalion mortar missions. Cavalry squadron fire supporters, who are the eyes for the brigade, briefed their observer plan in (target, trigger, location, delivery system, attack guidance and comm net) TTLODAC format.

Rule No. 1: always plan for human eyeballs as primary observers on all target areas of interest and against everything we intend to engage with indirect Fires.

The brigade's fight, in space, started at two-thirds max range of the maneuver's most devastating direct fire weapon system and went out to its largest supporting indirect fire weapon system. It synchronized the brigade's assets, intelligence collection, rotary wing, fixed wing, cyber warfare and all forms of indirect fire platforms over a map together. In time, the brigade's fight was focused to managing effects at the desired time to meet the commander's intent. There are three main tasks whose executions must be rehearsed: the observer plan and collection plan, fixed/rotary wing tasks, and indirect fire tasks. With these tasks rehearsed, the Fires team was prepared to engage in the brigade's CAR and demonstrate how the brigade's deep fight shapes the close fight.

As fire supporters, it is our duty to place proper target value analysis on the enemy, find them, affect them through lethal or non-lethal means, and assess the effects of our engagements. The fire support plan developed during the MDMP, exercised and refined during the habitual targeting process will enable the brigade to shape the close fight and win the deep fight. But only once all WfF have shared understanding of the plan and have rehearsed their roles.

Maj. Jason Turner is the 2nd Battalion, 17th Field Artillery operations officer. Turner has deployed four times in support of Operation Iraqi Freedom with 82nd Airborne Division and 10th Mountain Division. He also deployed in support of Operation Enduring Freedom with 10th Special Forces Group during his 18-year career. He holds a bachelor's degree from State University of New York at Cortland and masters' degrees from Mercy College and Maynooth University, Ireland.

Lt. Col. Timothy Mungie is the 2nd Battalion, 17th Field Artillery Regiment commander. Mungie deployed three times in support of Operation Iraqi Freedom with the 25TH Infantry Division during his 20-year career. He holds a bachelor's degree from San Diego State University and masters' degrees from Webster University and the Command and General Staff College.

Staff Sgt. Trevor Desrosier, an Avenger Master Gunner with 1st Battalion, 188the Air Defense Artillery, North Dakota Army National Guard, observes his team, Pvt. 1st Class Nicholas Bitz and Sgt. Douglas Eagon (firing), as they conduct a Stinger man-portable air-defense systems live-fire exercise at the National Training Center, Fort Irwin, Calif. (Courtesy photo)

Short-Range Air Defense returns to National Training Center

By Lt. Col. Thomas Genter and Capt. John Nastus

Since 2005, U.S. Army National Guard air defense artillery battalions have been called on to provide air defense protection for the National Capital Region. This mission relies on a static land-based air defense capability that, in part, uses the Army's Avenger Short-Range Air Defense (SHORAD) weapon system and Sentinel Radar. Despite the high operation tempo required for the NCR mission, National Guard ADA batteries also provide a counter unmanned aerial systems (C-UAS) capability at combat training centers (CTCs).

For a majority of the last 13 years, the absence of air defense units at the Joint Readiness Training Center and National Training Center can be attributed to preparation for counter-insurgency operations in Iraq and Afghanistan. However, the decisive action training environment scenarios now incorporated at the CTCs include remotely piloted vehicles to conduct reconnaissance, intelligence, surveillance and target acquisition activities. NTC Rotations 16-07 and 16-09, which occurred during the summer of 2016, included Avenger and Sentinel equipped air defense batteries from the Ohio and North Dakota Army National Guard. These rotations yielded many lessons beneficial for ADA officers and noncommissioned officers who are preparing for NTC/JRTC deployments.

The most important take-away from these rotations includes the requirement for air defense artillery officers to be extremely proficient in the military decision-making process (MDMP) and knowledge of how best to integrate ADA capabilities with maneuver forces. Proper planning and integration guarantees an Avenger battery's ability to detect, identify and defeat enemy unmanned aerial systems (UAS) by employing Avengers and Sentinels at the right time and place. A savvy battery commander or air defense and airspace management cell officer in charge (ADO), should use aerial intelligence preparation of the battlefield techniques found in Army Techniques Publication 3-01.16 (Air and Missile Defense Intelligence Preparation of the Battlefield), to inform and influence the brigade commander and staff on the enemy's aerial threat capabilities. The battery can create an effective defense design based on what effects the enemy intends to achieve on friendly force capabilities. Relevant data of real-world employment of UASs on the battlefield is readily available on the Internet and can be used to show the importance of air defense to the C-UAS fight. For example, in October of 2016, ISIS flew an explosive-laden drone into a Kurdish Peshmerga check-point,killing two Soldiers. This is very relevant for units deploying to Iraq and ties directly to the commander's No. 1 priority of protecting his force from unnecessary risks. At all cost avoid rambling about the number of enemy drones, types and sizes. Briefing threat raw data will likely put the most energetic staff officer to sleep, and loses credibility for the briefer. A shared understanding of threat capability and clear communication is critical to the planning process.

Throughout the planning process communication between the air defense and airspace management (ADAM) cell and ADA battery is very important when integrating ADA capabilities with the combined arms force. The current generation of Army leaders at the brigade level and below have not deployed or trained with air defense units.

If they have, more than likely, their experience of air defense was not favorable due to the lack of a credible rotary/fixed wing threat. The first task for the air defense artillery battery commander or ADO is to brief the brigade commander on the unit's capabilities and limitations – what does air defense bring to the fight? What can it do and not do? Where does it need to be located on the battlefield to be most effective? This will allow the brigade commander to visualize how to best employ air defense capabilities to protect high priority assets and synchronize air defense with maneuver operations. During an evolving operation, the battery's link to the brigade is the ADO. Clearly defined roles and responsibilities are integral to succeed in the fight.

The ADAM cell is responsible for conducting air and missile defense (AMD) planning and coordination for the maneuver commander. The ADAM cell officer in charge is a member of the brigade staff and is responsible for providing early warning of enemy air attacks to all the elements of the brigade combat team. The ADAM cell develops, displays and disseminates the third-dimensional common operating picture in the brigade command post to facilitate shared understanding of the brigade staff and subordinate commanders. The ADAM cell officer in charge is also responsible for developing and implementing procedures to minimize the potential for fratricide (Field Manual 3-01).

The ADA battery commander accomplishes his objectives by communicating with his subordinates to understand what is going on in the battle space. Engagement reports, weapon unit status, enemy activities and mission orders allow the ADA battery commander to direct, lead and assess his unit and their level of effectiveness. Communication between the ADA unit and the ADAM cell is the key to successful integration. The ADAM cell must be included and kept aware of every aspect of AMD related activities and should receive the same level of priority when communicating with the battery command post as the battery commander receives. Likewise, the ADAM cell must share information regarding the larger brigade fight with the battery commander and battery command post so the commander can direct his forces accordingly to ensure operations are synchronized.

The brigade operations staff (S3) is responsible for synchronizing operations and determines the level of effort and priority for enabler support to maneuver forces. A well informed brigade S3 is able to make decisions to adapt the plan to defeat the enemy air threat where and when it exists. As witnessed at NTC during both rotations, the ADA battery had never previously worked with the brigade combat team. A best practice to enhance integration is to co-locate the ADA battery command post with the brigade combat team command post. While it is not explicitly stated in Field Manual 3-01, co-locating the command posts facilitates information sharing that builds better situational awareness and rapport. In a fluid and dynamic environment, information exchange reduces friction points to allow the unit to rapidly modify the defense design.

Sgt. 1st Class Justin Daily, from the 1st Army, conducts a hotwash with Staff Sgt. Kathryn Duben of the 1st Battalion, 188th Air Defense Artillery, North Dakota Army National Guard at the National Training Center, Fort Irwin, Calif. (Courtesy photo)

Another best practice that must be completed early in the MDMP is the development of a well-defined critical asset list. Solicit input from other warfighting functions in order to establish a defended asset list – assets to be protected by air defense systems. Due to the initial absence of a defended asset list at NTC, the ADA battery commander was forced to cover a larger area than possible. As a result, there were some holes in coverage resulting in some critical command and control nodes being left vulnerable to observation by aerial platforms. As a result, enemy aerial platforms gathered information on troop movements and locations of friendly high-value assets (command post and firing battery locations). The enemy used this information to target high-value targets with artillery resulting in the destruction of critical friendly field artillery assets. These observations could have been prevented had critical assets been assigned air defense coverage. A further illustration of this was the movement of key command and control nodes throughout the battlefield. Since the brigade command post was not assigned air defense coverage, when it jumped there was no firing unit (Aveng-

Soldiers from 1st Battalion, 188th Air Defense Artillery, North Dakota Army National Guard, conduct a Stinger man-portable air-defense systems live-fire exercise at the National Training Center, Fort Irwin, Calif. (Courtesy photo)

er) to provide protection. When the tactical operation center moved to its new location, enemy aerial observation platforms detected the movement unopposed. Had an Avenger been assigned to the command post, it would have jumped with them, and essentially prevented the enemy from detecting the location of the brigade command post. Prevention of observation is where passive air defense measures come into play, and can be a game-changer on the battlefield.

There are two types of passive air defense: attack avoidance and damage limiting. In regards to NTC, it is important to employ both. The Avenger weapon system tends to stick out against the white sand backdrop of NTC. This makes cover and concealment a necessity for survivability. When properly camouflaged, the probability of an Avenger being hit diminishes to nearly zero because if it cannot be seen, it cannot be hit. When concealing yourself, follow the basic principles of site, discipline and construction. Choose a site that puts you in an advantageous position that eliminates any factors of recognition. In regards to discipline, it is the responsibility of every individual to avoid activities that would reveal the presence of personnel or equipment. If concealment is in short supply, measures that limit damage can be employed to avoid total loss of combat power. Dispersion is a critical technique that should be utilized at NTC at every opportunity. In order for ordnance to be effective, or in the case of NTC, simulated ordnance, it must score a direct hit. By dispersing your force in convoys and at jump sites, you reduce the lethality of any attack from red air. To assure your success, consult chapter 3 of Army Techniques Publication 3-01.8: "Techniques for Combined Arms for Air Defense," which will give a more thorough description of the concepts discussed above.

Countering air threats is a shared joint and combined arms responsibility. In order to successfully integrate and employ air defense capabilities with the maneuver force, the battery commander is responsible for providing an accurate depiction of the capabilities of air defense to maneuver force commanders. Its misuse can lead to catastrophic results that would otherwise be preventable. Careful preparation beforehand with attention to detail will ensure the success of the unit's rotation at a CTC.

Capt. John Nastus is the 1st Battalion, 362nd Air Defense Artillery (Training Support) observer coach/trainer team chief in Camp Atterbury, Ind.

Lt. Col. Thomas Genter is the 1st Battalion, 362nd Air Defense Artillery (Training Support) commander at Camp Atterbury, Ind.

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In the next issue of Fires

July-August 2017, Expanding cross domain Fires: The Fires force doesn't fight from land only. The field artillery and air defense artillery are integral parts of the multi-domain battle providing cross-domain Fires. Topics to be covered: supporting joint combined arms maneuver; leader development strategies supporting the expansion of cross domain Fires; the Army Targeting Center.

The deadline for submissions is June 1, 2017. Send your submissions to usarmy.sill.fcoe.mbx.fires-bulletin-mailbox@mail.mil or call (580)442-5121 for more information.

A heavy expanded mobility tactical truck pulls an electrical power plant system from the belly of a C-5 Super Galaxy, Jan. 26 at Osan Air Base, Republic of Korea. The addition of the inbound Patriot equipment will support 35th Air Defense Artillery Brigade as it conducts the largest Patriot modernization effort ever executed outside a depot facility. (Capt. Jonathon Daniell/35th ADA BDE)