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Fires

Optimizing Fires

Creating synergies with leaner force structure

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A Terminal High Altitude Area Defense (THAAD) interceptor is launched from a THAAD battery located on Wake Island, during Flight Test Operational-02 Event 2a. During the test, the THAAD system successfully intercepted two air-launched ballistic missile targets. (U.S. Missile Defense Agency)

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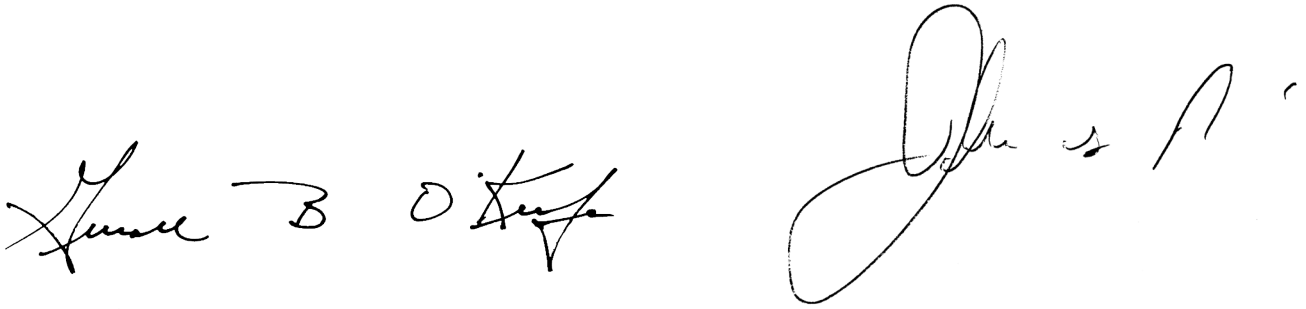

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Purpose

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

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A Forward Observer from the 82nd Airborne Division Artillery finds a target during the Division Artillery Readiness Training (DART) on Fort Bragg, N.C. The DART is used to gauge how well trained and equipped its artillery Soldiers are for operations worldwide. (Sgt. David Greeson, 49th Public Affairs Detachment)

A Look at Excellence

By Monica Wood

U.S. Army Training and Doctrine Command was born of innovation and agility, and quickly adapts to shifting world, national and institutional situations, in both peace and war. TRADOC's adaptive character and culture ensures the Army remains the Nation's "force of decisive action."

TRADOC oversees 32 Army schools organized under eight Centers of Excellence, each focused on a separate area of expertise within the Army. These centers train over 500,000 Soldiers and service members each year.

Here's the high points from some of these centers with "A Look at Excellence.'

Fires Center of Excellence

Hundreds of people from all over the world converged on Fort Sill May 2-4 for the annual Fires Conference. More than 60 vendors were on post to showcase everything from radar technology to missile defense. Fort Sill played host to speakers from around the globe who gave presentations and held breakout sessions on topics such as the importance of partnerships with our military allies and the value of Fires to the Army Operating Concept.

The theme was "Fighting Fires: Enabling Maneuver." It focused on development and integration for the air defense artillery and field artillery.

Lt. Gen. Patrick Donahue, U.S. Armed Forces Command deputy commanding general, said from an Army-wide standpoint, Fort Sill is important to the future success of the military as a whole.

"Fort Sill has a major role to play in the overall combined arms fight that

Attendees of the 2016 Fires Conference visit the vendor tent between presentations, May 3, 2016, at Fort Sill, Okla. (Monica Wood)

Soldiers view the outdoor displays for the Patriot, Terminal High Altitude Air Defense and other systems, while attending the 2016 Fires Conference. (Monica Wood)

we have whenever we go and the innovation we are seeing here is remarkable. It is helping us improve the quality of our Fires force in our Army," said Donahue.

Lt. Col. JP Maddaloni, Fires Center of Excellence Outreach director, said the electric Fires range on post is a perfect example of the technological advancements that are being showcased at this year's conference.

"We've had the opportunity to demonstrate a lot of capability on that range and in April we hosted our most recent Maneuvers and Fires Integration Exercise, which were Fort Sill's first experiments using electronic warfare weapons, including two lasers and a railgun. I am looking forward to seeing that range used in the future," Maddaloni said.

This year's attendees came from several countries, including Singapore and the United Kingdom. Four hundred people attended the conference in person, another 100 or more joined online to hear the speeches.

Aviation Center of Excellence

New turbine engine to restore helicopter lift capability

Degraded lift capability is especially problematic in areas where high-altitude, high-temperature flights are required, including nearly half of Afghanistan, said Maj. Gen. William Gayler.

Gayler, U.S. Army Aviation Center of Excellence and Fort Rucker commander, spoke at the Army Aviation Association of America-sponsored 2016 Army Aviation Mission Solution Summit in Atlanta, April 29 and 30.

Using the UH-60 Black Hawk helicopter as an example, Gayler said an average of 78 pounds per year have been added annually — for all the right reasons. That includes increased protective gear, ammunition and new technologies. Over the years, those increases have totaled about a ton-and-a-quarter.

"All of that weight affects speed, lift, range, maneuverability and the amount of stuff that can be carried," he said.

Years ago, four Black Hawks could move a platoon, he pointed out. Now, it takes eight or nine and by 2020 — assuming the linear weight increases continue at the current rate — it will take 15 to 20, he said.

That decrease in capability severely limits options for ground commanders, he said. Besides that, it increases risk, and fuel consumption goes

way up as well. "We've got to fix that," Gayler said.

Steffanie Easter, Army Acquisition, Logistics and Technology principal deputy assistant secretary, said "We're giving up options for our warfighters by not being able to give them the power they need."

ITEP key to restoring power

The Improved Turbine Engine Program, or ITEP, is a completely new engine that will likely replace those currently in the AH-64 Apache and Black Hawk helicopters, according to Gayler.

"It will return a lot of that lost capability. ITEP is critical," he said. "We must get it right to buy back maneuverability."

Easter said ITEP is the solution for improved mobility, range and payload capacity of the current fleet.

ITEP will replace the 1970s-era T700 family of engines for the Black Hawk and Apache fleet, she said.

"It's going to provide over 3,000 shaft horsepower, which is a great increase over the current 1,900 to 2,000 hp. The ITEP design will also decrease the amount of maintenance required."

Brig. Gen. Erik Peterson, U.S. Special Operations Aviation Command commander, said his Soldiers are excited about ITEP as well, but their emphasis in on the maneuverability aspect of what it promises, and somewhat less on range and payload.

That may mean special operations will get its own variant, but cost would be an important deciding factor, he said, meaning they might go with what the Army gets.

Brig. Gen. Bob Marion, Aviation program executive officer, said ITEP is a big deal for the Army and it will be resident in about 85 percent of its platforms.

"It also has potential for Future Vertical Lift, or FVL, if not the motor then pieces of the technology," he said.

FVL's engineering and manufacturing development doesn't begin until fiscal year 2024 with the first aircraft test in FY26.

Marion said fielding ITEP is still years away.

"We're going after milestone A this quarter. We'll be looking to award two contracts and down-select two vendors."

ITEP not enough

Gayler said that while ITEP will meet near-term demands for increasing power, long-term solutions are needed.

The CH-47 Chinook helicopter was brought into the fleet in 1964, he said. Its scheduled departure from the Army is 2064.

"That's 100 years on that airframe. It's similar with the Apache and Black Hawk. These are gaps. It's what keeps me up at night."

He added, "I don't want my grandchildren flying the same aircraft my father flew."

Cyber Center of Excellence

The Army is pushing forward with a new program effort and accompanying documents that take the concept of cyber situational awareness to a new level — a level that improves maneuverability in cyberspace.

Cyber situational understanding is supplanting situational awareness not only as the latest cyber buzzword, but as standard operating procedure for conducting offensive cyber operations (OCO) and defensive cyber operations (DCO) across the Defense Department Information Network (DoDIN).

"The reason for the shift is twofold," said Portia Crowe, Army Program Executive Office for Command, Control and Communications-Tactical director of cyber operations and chief information officer. "Awareness and understanding mean two different things. Awareness is 'I have knowledge of that.' Understanding is more than that — it's 'I have an awareness of what's going on, the mission and the impact, but I'm also understanding how to make better decisions.' So it's more, 'What do I know and what am I going to do about it?' "

To support the broader operational shift, the service is preparing to stand up a new PEO-C3T initiative also backing situational understanding.

Tactical Network Operations Management is an emerging program effort to evaluate and implement holistic tactical network assessment and understanding. Initial requests for information from industry already have been issued this year, and both the findings and the program will support emerging requirements in cyber situational understanding, according to PEO-C3T spokesman Paul Mehney.

Army officials also are working on new documents to help get the necessary tools, Crowe said.

"There is a joint cyber situational requirements document already, so we're using that as the foundation to improve situational understanding and the OCO, DCO and DoDIN environment better," she said.

The new document is part of higher-level Army efforts between Training and Doctrine Command and the Cyber Center of Excellence to better align ongoing warfighter challenges, where cyber situational understanding is a top priority, Crowe added.

With the cyber-focused warfighter challenges and the new doctrine, leaders including TRADOC Commander Gen. David Perkins and Army Cyber Center of Excellence Commander Maj. Gen. Stephen Fogarty wanted to get on the same page in terms of issues like lexicon. They also wanted to push forward the requirements faster, Crowe said.

"I think part of that challenge is we want to see everything and we want to know everything, from the DoDIN across OCO and DCO. Understanding pushes it a little bit further," Crowe said. "When we go to get funding we have to tie the requests to requirements, and this gives us a stronger case to say, 'This is number one, this is what they're asking for the in the field, this is what we have to do.' Everybody's putting a lot of emphasis on cyber, but we have to put it in the right place — they're positioning us to do that."

Sustainment Center of Excellence

Being responsive to the nation's warfighters requires an innovative approach to adapting missile systems to "fit the fight" and a line of communication that keeps industry and academia involved in the Army's modernization process, according to a leading Department of the Army senior executive service member.

Speaking at the Missile Systems Symposium April 19 hosted at the Von Braun Center in Huntsville, Ala., by the Redstone-Huntsville Chapter of the Association of the U.S. Army, Barry Pike, Missiles and Space program executive, said forums like the symposium are important to keeping government partners aware of changing requirements for Army equipment to meet evolving national threats and world situations.

Pike said the fiscal year 2016 is a milestone year for four of the Program Executive Office's (PEO) major programs. While the Integrated Battlefield Command System and the Indirect Fire Protection capability will undergo program review, two new projects – the Lower Tier Missile Defense Sensor (the Patriot sensor replacement) and the Long Range Precision Fire system – will begin development.

Even in a time of declining budgets, Pike said there remains a lot of interest in new programs and major upgrades in missile systems managed by the PEO for Missiles and Space.

Reviewing the PEOs budget portfolio, Pike said investment was at its lowest in fiscal year 2015, with the PEO budget of $2.8 billion. That budget increased to $3.4 billion in fiscal year 2016 and is set to grow to $4.5 billion in fiscal year 2017. A healthy PEO, Pike said, has about $2 billion a year for procurement and $2 billion a year for research, development, test and evaluation.

In fiscal year 13, 14 and 15, budgets were less because the "Army was getting smaller and it was recommended to buy less materiel in terms of procurement. But this year and next, procurement accounts are going back up … We need quality and reliability in our systems. We've realized the Army needs to ramp up in terms of our munitions procurement," Pike said.

Development, Test and Evaluation funds are needed to foster, build and develop new programs that will replace aging systems.

"We need to replace capability that over decades has served us well," Pike said. "We are fighting the obsolescence battle."

Unlike helicopters and unmanned aircraft, the missile portfolio is primarily an "inside the Army" portfolio with little commercial opportunity.

"There is no commercial marketplace for missiles," Pike said. "With lots of things the Army buys there is a commercial marketplace, a commercial technology that is applicable. Missiles are really a unique piece of business. If you don't have a perpetual investment in science and engineering; and research, development, test and evaluation, then you are in a death spiral."

Pike said it took the Army "decades to create the industrial base that can deliver a system with overmatch capability" and it's important to maintain that industrial base along with relationships with such partners as the Aviation and Missile Research, Development and Engineering Center and the Missile Defense Agency so that innovation can be turned into "real materiel we can turn over to our warfighters."

Reviewing a history of missile innovation, Pike referred to three offset cycles -- the first, in the 1950s, focused on tactical nuclear deterrence (Redstone, Pershing, Lance TOW and other missiles); the second, in the 1970s, was aimed at precision-guided munitions; and the third, in the 1980s and still today, has produced the Big 5 weapon systems (AH-64 Apache Helicopter, UH-60 Black Hawk Helicopter, M1 Abrams Tank, M2 Bradley Fighting Vehicle and MIM-104 Patriot Missile System) and continues with robotics, lasers and other technologies.

"The innovation piece has been very engaged in the missiles of the Big 5 systems," Pike said. "It's up to our creativity and ingenuity to be a factor in stabilizing the world again.

"Nothing is forever. Our enemies are figuring out and finding ways to combat our systems. That is perpetual, and that's why we are always moving and fielding new things. We have to figure out how to use existing things in ways or how to integrate existing things in different ways. We have to find new purpose for technology."

Hellfire missiles integrated on unmanned aircraft systems and HIMARS (High Mobility Artillery Rocket System) shooting the AMRAAM (Advanced Medium-Range Air-to-Air Missiles) are examples of applying existing technology in new ways. The PEO is working to apply existing sensors, shooters, and command and control systems for new purposes and new threats.

In an era of tight budgets, "We have to fight tough so we go with what we've got and if we go with what we've got, we've got to get the most out of it," Pike said. "We've got to take existing material and apply it to different platforms in new ways."

The Integrated Air and Missile Defense Command System offers a good solution to integrating different missiles, sensors and launchers. Taking elements such as Counter-Rocket, Artillery and Mortar systems and Terminal High Altitude Area Defense systems and putting them together to create a system of systems for the future, Pike said.

"We will always be able to overmatch downrange against the threats … But we have to modernize at an affordable pace. We need modular missiles that can use different controls and different warheads. Hellfire is a good example of that. That system has continued to reinvent itself with different platforms, different warheads and guidance systems."

To respond to the complex world threat, you have to be "adaptable and have modularity. You have to set yourself up for options with a main line stream of modernization," Pike said. "Modularity provides real solutions because you don't know how the threat will present itself. It's how we can make sure we are in a position to be responsive."

A Look at Excellence used information from articles written by Kelsey Powell, Amber Corrin and David Vergun respectively.

Soldiers carry cables during an emplacement drill. Post training assessments indicate an increase in crews' ability to self-regulate important mental approaches to performance, as well as respond appropriately to setbacks during training and evaluation. (CW2 John Roeder/U.S. Army)

Sports psychology enhances Patriot crew member performance

By Lt. Col. Glenn Henke, Adam Skoranski and McKenzie Rath

In early 2015, 1st Battalion, 43rd Air Defense Artillery *Cobra Strike Battalion* incorporated performance training with the goal of attacking common concerns faced by air defense operations of the past.

Army personnel systems routinely build young Patriot battalions populated by inexperienced crews. This occurs as new Soldiers arrive and experienced noncommissioned officers and lieutenants depart for new assignments after a deployment. The prevalence of crew turnover forces leaders to build crews with limited-to-no experience. This impedes mastery of the challenging air battles that characterize Patriot training operations.

In order to mitigate the relative lack of experience, the *Cobra Strike Battalion* integrated performance experts into the Patriot gunnery program. These professionals support the Comprehensive Soldier and Family Fitness (CSF2) program, and are trained in the same sport psychology techniques professional athletes have used for decades. The battalion's leaders built this plan based on previous work by a battery from a sister battalion.

Performance psychology

Performance experts, formally titled master resilience trainer-performance experts (MRT-PEs), have advanced degrees in sport or performance psychology or other related fields. The set of skills the MRT-PEs have is derived from more than 40 years of sport psychology research and is tailored to optimize performance for soldiering tasks and MOS-specific training benchmarks.

The graphs represent the performance outcomes and byproducts of integrating performance techniques with

leaders (train the coach format) vs. historical company averages for a one station unit training brigade at Fort Benning, Ga.

At first glance, Patriot Engagement Control Station (ECS) crews are ideally suited for performance training based on the mentally taxing nature of these operations. Specifically, crews are required to perform at a very high cognitive level, often under extreme stress and rapidly changing environments. Several attempts to incorporate CSF2 instruction into Patriot gunnery training were made over the past five years. However, due to a lack of a long-term training plan, leader buy-in from the top down, CSF2 MRT-PE availability, and follow-up training, earlier attempts were considered worthwhile, but lacked opportunities to take traction.

While units and Soldiers generally perceived these gains as positive, command lacked statistical data to make any ready conclusions on the efficacy of this training methodology.

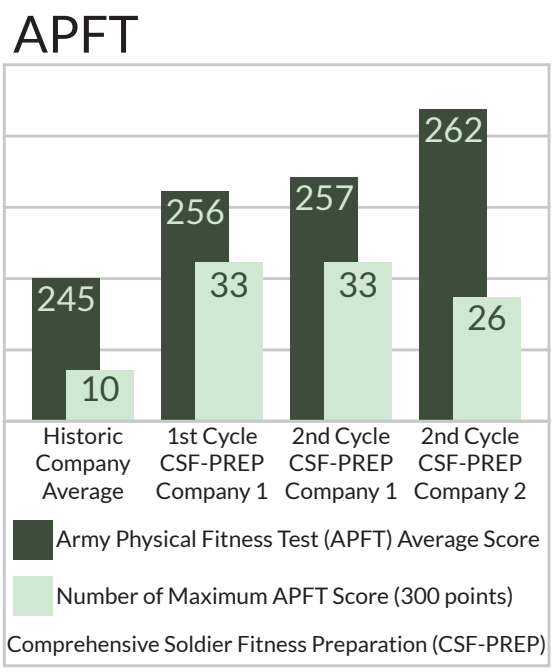
In the fall of 2013, Capt. Joshua Urness, D Battery, 2nd Battalion, 43rd ADA, integrated MRT-PEs from the Fort Bliss CSF2 Training Center. Urness attempted to change the way training and skill acquisition had been previously conducted within the traditional Patriot learning systems. He created a learner-based environment, where ECS crews completed a two-week train-up on the Patriot system basics with practice, thanks to the Fires Center Capabilities Development and Integration Directorate located on Fort Bliss. The inclusion of MRT-PEs began in the early stages of training in order to accelerate the development of expertise and deliberate application for inexperienced air defense crew members.

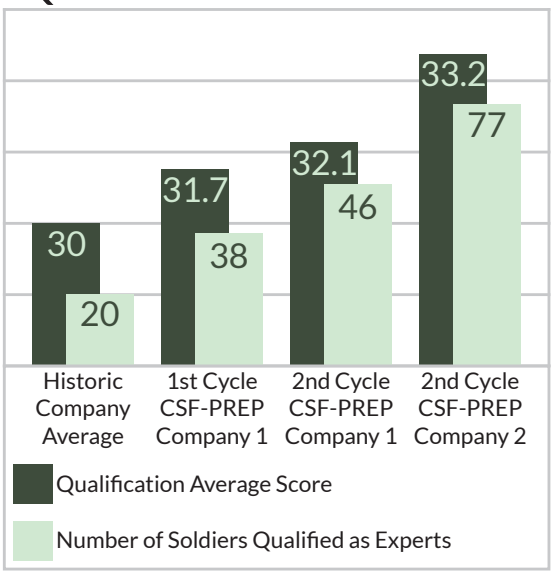
Following initial performance training, which provided crews with a baseline knowledge of mental skills techniques, MRT-PEs regularly attended field training exercises with D/2-43rd ADA to ensure air defense Soldiers were effectively applying the mental techniques. Several follow-up education sessions were conducted to further enhance the performances of the Soldiers, and fine-tune the specific mental skills used during air battle operations.

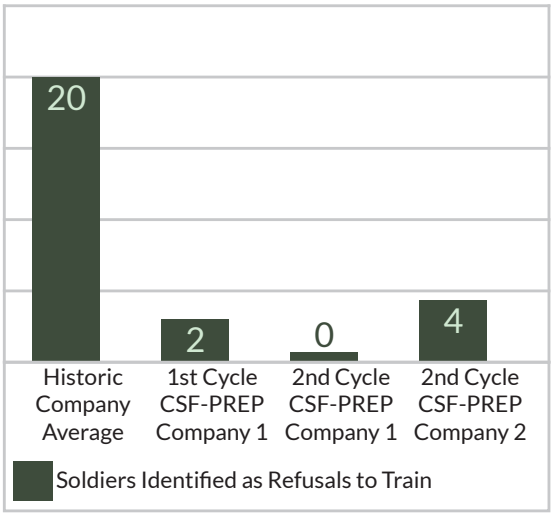
During the battalion's Mission Rehearsal Exercise (MRE) in the summer of 2014, external evaluators noticed D Battery crews were more proficient than most of the other crews in the battalion, even though they had roughly the same level of experience and the same amount of training time. Evaluators also noted the Soldier's ability to regulate their emotions and energy levels following high stress air battles.

One of these evaluators was Capt. Sheiloh Carlos who became the D/1-43rd ADA commander. Carlos intended to replicate Urness's training plan. He briefed the battalion leadership, who directed the integration of MRT-PEs and performance techniques into the battalion's train-up.

The figures show the performance outcomes and byproducts of integrating performance techniques with leaders (train the coach format) vs. historical company averages for one station unit training (OSUT) brigade at Fort Benning, Ga. (Graphic by Rick Paape, information provided by the U.S. Army Comprehensive Soldier and Family Fitness Program)







Cobra Strike performance training integration

The battalion train-up began in January 2015 during initial gunnery table training. Soldiers completed an academically intensive, three-day block of mental skills training. They went through a challenging course that combined physical exercise with mental tests designed to mimic the stress they would feel while deployed. The three-days that followed focused on application of mental skills to aid air battle operations throughout the next phase of the Soldiers' training.

MRT-PEs first introduced Soldiers to the basics of brain development and growth, to gain an understanding of the importance of continuous implementation of the mental skills. Following that, instruction focused on developing motivation, attention control and energy management. Soldiers also learned mental skills to enhance their confidence levels, imagine themselves performing successfully and hone their ability to maintain focus in high-stress environments. Other valuable mental techniques instructed were skills aimed to help Soldiers maintain and regulate energy levels over longer periods of time, perform at a moment's notice and maintain composure during air battles.

The trainers chose these specific mental skills and techniques for the ECS crews due to the nature of each crew member's specific role. Crew members learned the proper timing of mental skill application. Upon completion of the three-day training, Soldiers executed a similar challenge course to the initial challenge course, enabling them to implement the mental techniques they just learned.

Shortly after the three-day training, commanders from C and D batteries noticed benefits from the performance training with ECS crews. They recognized the potential benefit of having their launcher crews attend a similar mental skills training. The responsibilities of a launcher crew are different from that of an ECS crew, but still require a high level of performance. To be successful, launcher crews must accomplish tasks in a specific and timely manner, while remaining mentally agile in the midst of extreme circumstances. C and D launcher crews received similar education that was adapted to enhance their specific responsibilities in an air battle.

Embedded training

Following the initial block of performance training, MRT-PEs observed and provided feedback on the application of mental skills with in-the-moment training when necessary during 1-43rd ADA's gunnery training and evaluations. On-site training was a crucial aspect of the eventual success of the long-term training plan for a number of reasons. MRT-PEs were able to note how crew members applied the mental skills to their actual air battle operations. Crew members and MRT-PEs conducted after action reviews following air battles, highlighting crews' mental mistakes, and whether they were able to make the adjustment in the moment. MRT-PEs and crew members talked through a potential solution before the next air battle, during which crew members immediately put the skill into play. A similar procedure took place over the six months and served to solidify the

Cobra Strike Soldiers, from 1st Battalion, 43rd Air Defense Artillery successfully engage a target during a live-fire exercise. The 1-43 ADA's integration of performance training paid off, with the entire battalion certifying all deploying crews in less than 72 hours during the mission rehearsal exercise. (CW2 John Roeder/U.S. Army)

A Patriot Engagement Control Station crew conducts the Challenge Course under the supervision of the Master Resilience Trainer-Performance Experts. (CW2 John Roeder, U.S. Army)

skills and make their application as automatic as possible.

Another benefit of on-site training was that it allowed MRT-PEs the chance to see how leaders of each crew coached the mental skills during air battle operations. For example, many crews took a few moments before each air battle to execute a routine to prepare them for air battle readiness. The readiness routine often incorporated short imagery sessions, cue words to direct attention, and contingency plans to respond to a variety of air battle situations. Crews benefited from having a plan for how to approach their performance, often guided by the tactical control officer or an informal leader in the van.

Results

The battalion's first opportunity to test the crews came during the Standardized Patriot Evaluation and Reporting (SPEAR) exercise. The purpose of the SPEAR exercise is to evaluate a battalion's gunnery program through externally evaluated crew assessments to ensure battalion evaluators are assessing crews correctly. However, in 2014 the 32nd Army Air and Missile Defense Command changed the SPEAR program to happen approximately 60-90 days into the train-up instead of at the end of the train-up, as was the tradition. As a result, most crews had less than 60 days together. Additionally, this change made previous SPEAR results an inaccurate benchmark for the MRT-PEs to measure against.

Despite the crews' inexperience, evaluators from sister battalions noted the crews were atypically calm during the high pressure evaluation. Evaluators also commented on the crews' ability to remain focused and on task while fighting each air battle. Crew members were diligent about taking the initiative to conduct a crew-focused AAR after completing each air battle. Soldiers were honest in their feedback with each other and worked through plans of action, as a crew, for each subsequent air battle. Evaluators commented on this desire to improve shown by 1-43rd ADA and pointed to their mindset and approach to the evaluation as the reason they seemed to remain calm and more in control than previous battalions. An unexpected by-product of the mental skills training was an overall increase in crew cohesion during the SPEAR, also noted consistently by external evaluators.

Mission rehearsal exercise

Throughout the spring, the MRT-PEs and the *Cobra Strike* crews continued working together. Following the SPEAR, the battalion sent crews forward to Central Command to embed with 2-43rd ADA crews for two weeks. Upon return, the batteries deployed to the field for final gunnery training prior to battalion-level evaluations at the beginning of May.

The final test came with the mission rehearsal exercise in June. The first part of the exercise consisted of intensive operational readiness evaluations

of each site crew, evaluating their ability to execute their wartime mission as a battery. The battalion's integration of performance training paid off, with the entire battalion certifying all deploying crews in less than 72 hours, the best result within the brigade in several years.

Assessment

The battalion evaluation team and MRT-PEs assessed crew members in a number of ways throughout the training plan. Because the mental skills training plan was developed to directly improve performance across air battle operations, MRT-PEs and battalion leadership needed to develop ways to show these effects. The first line of assessment came during the initial three-day block of education. Prior to receiving any mental skills education, Soldiers completed a large pre-survey comprised of multiple validated performance measures: the sport confidence inventory, the test of performance strategies, the mental skills valuation scale, the personal views survey-III revised, the Connor-Davidson Resilience Scale, and a measure of unit cohesion. Sections from each validated measure were combined to create the survey.

Instructors also measured Soldiers on their self-reported abilities across a range of areas that could potentially contribute to improved performance. The initial survey was administered at the conclusion of the six-month training plan. Results showed increases in crew resilience, ability to regulate self-talk and the Sport Confidence Inventory, which measured across a physical, cognitive, and resilience domain.

Results of the surveys indicated an increase in crews' ability to self-regulate important mental approaches to performance, as well as respond appropriately to setbacks during training and evaluation. The results of the Connor-Davidson Resilience Scale match with the behavioral effects noticed by external evaluators during the SPEAR and MRE evaluations.

MRT-PEs and battalion leadership relied on feedback at different intervals throughout the training from battery commanders and test control officers to gain an understanding of what interventions were working, what needed adjusting and what skills were being used more than others. The conversations were a crucial component for the effectiveness of the training plan.

At the completion of the mental skills training plan, MRT-PEs interviewed each battalion evaluation team member that worked closely with 1-43rd ADA throughout their training calendar. MRT-PEs chose these evaluators to gain an outsider's perspective of the behavioral and performance changes of 1-43rd ADA compared to other battalions they have evaluated. Most of the evaluators were aware of the mental skills training program, but not trained in the actual skills. Evaluator comments included:

- "The strategy I probably saw most was attention control. They were able to stay on top of everything and stay relaxed when things got tough."
- "They never ran from failure. They took it and used it to improve."
- "Having a plan and effective communication skills helped them as well."
- "They felt and knew they were going to pass before the air battle began."
- "The solution many times is not in a book, but they were able to stay calm and think clearly in the middle of an air battle or measures of effectiveness."

Lessons learned and recommendations

1. **Integrate early.** The battalion's success came in part because of the deliberate planning months before the train-up began. Discussions with the MRT-PEs started 3-4 months prior to actual training. The initial education workshop was absolutely essential for every crew member.
2. **Train the leaders first, especially the battalion evaluators.** In addition to the crews themselves, battery commanders, first sergeants and those evaluating the crews must be trained in performance skills and techniques in order to understand how the crews are thinking and reinforce the training. The *Cobra Strike Battalion* did not train the evaluation team until after the SPEAR, and the dominant AAR comment was they wished they received the training earlier. This would have also given them a common understanding of the crews' application of mental skills.
3. **Focus on specific skills.** The battalion learned a breadth of mental skills, but over time, narrowed the training focus to the skills of deliberate breathing, attention control during stressful events and the creation of pre-performance routines to facilitate consistent performance.
4. **Assessment.** Continuous assessment informed development of the mental skills training plan. Soldiers completed an initial survey comprised of multiple validated performance measurements, and followed up with the same survey at the conclusion of the training. MRT-PEs also relied on feedback from crew members and commanders to gauge the progress of the training and if adjustments needed to be made.

Conclusion

Integrating performance training into traditional Patriot training provides crew members with a considerable advantage, as proven by the Soldiers of the *Cobra Strike Battalion*. Mental skills training does not replace fundamental training doctrine. The performance skills have been implemented for decades by professional athletes and can improve Patriot crew proficiency if they are deliberately integrated into the training plan. Leader education and buy-in is paramount, as expected for any Army operation. Formalizing mental skills training into doctrine is the next step in creating sustainable results that can be replicated across the Patriot force.

Lt. Col. Glenn Henke commands the 1st Battalion, 43rd Air Defense Artillery Regiment at Fort Bliss, Texas.

Adam Skoranski is a Master Resilience Trainer-Performance Expert with the Army's Comprehensive Soldier and Family Fitness program.

McKenzie Rath is a psychology consultant at the Comprehensive Soldier and Family Fitness Center.

Optimizing Fires by optimizing time

By Capt. Colin Marcum

Soldiers, assigned to 173rd Airborne Brigade, conduct sling-load operations with UH-60 helicopters from 1st Air Cavalry Brigade, 1st Cavalry Division, as a part of an artillery raid during Exercise Allied Spirit IV at 7th Army JMTC's Joint Multinational Readiness Center in Hohenfels, Germany, Jan. 26, 2016. (Staff Sgt. Opal Vaughn/U.S. Army)

The theme of this issue of the Fires Bulletin is finding methods to enhance the "Fires platform" through "training, doctrine and leader development." The categories of Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel and Facilities (DOTMLPF) help shape the Army's understanding of what is required by our combatant commanders for their operational readiness. When the theme asks for ways we can enhance Fires through "training, doctrine and leader development" they are looking to Fires organizations for bottom-up suggestions, arguably, the only categories of DOTMLPF we can effectively impact at the tactical level.

What meaningful influence can we provide at the tactical level to improve the Fires warfighting function? As our community tackles the question, the answer assuredly will not produce a revolution in military affairs, but an all-encompassing impact can still be made. We can optimize Fires through our optimization of time, the most valuable asset provided to us by our organizations.

A recent Marine Corps Times article entitled "Marine infantry officer: Blowing off orders has become a troubling norm" discussed a significant issue facing all the services in this day and age; lack of time. There is never enough space on the calendar to accomplish the mission essential task list (METL), as well as meet all the other readiness requirements leveled upon our leaders. The article made the valid point that organizational inspections shouldn't require weeks to prepare if we are meeting the standard consistently, but this is rarely the case when requirements start piling up. As leaders we tend to focus on only satisfying the requirements that are on the higher echelon's radar. Everything else falls by the wayside.

Command maintenance, Army Regulation (AR) 350-1 mandatory training requirements, METL training, field exercises, military occupational specialty (MOS)-based qualifications and certifications, driver's training, professional military education (PME), medical, financial and family readiness and a plethora of meetings and briefings that need to be prepared, presented and evaluated lead to a significant number of unit requirements that need to be planned, scheduled, resourced and tasked. The sheer number of things that need to be tracked can be overwhelming, and the possibility of safety standdowns due to unforeseen accidents in other units or legal issues with one of your own Soldiers can derail a carefully-laid and comprehensive training calendar.

A training calendar gets exponentially more difficult to manage the more that calendar is occupied with required activities. When every hour is occupied with something to do, any time-based change in one activity results in having to change others. Much like in a rush-hour subway car in New York City, if one person wants to move, they will have

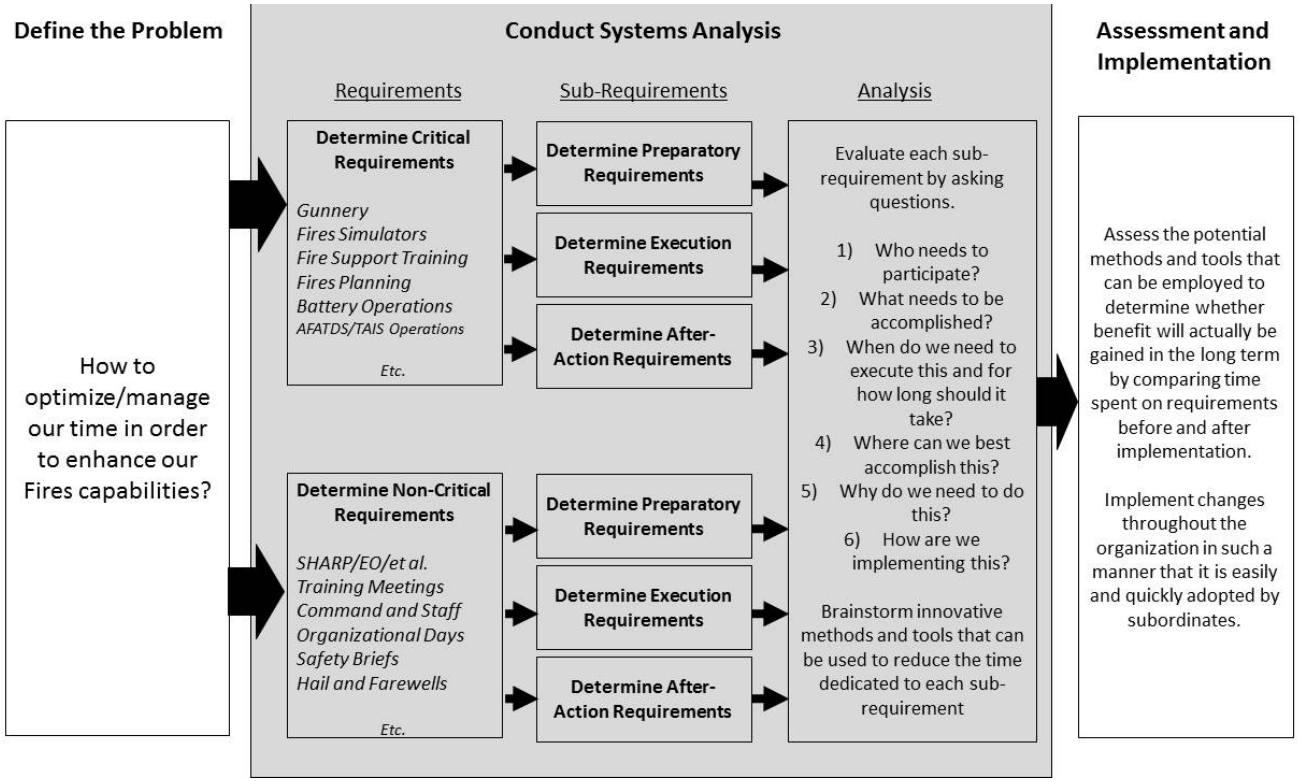


Figure 1. This illustration depicts a workflow for system analysis. (Cpt. Colin Marcum/U.S. Army)

to force others to move around them to accommodate; same with a jam-packed training calendar. As more space is filled there is less space to maneuver activities efficiently.

Since we cannot voluntarily relieve ourselves of these requirements then we need to instead manage them through our optimization of the time we have available with our Soldiers. The goal of optimizing the Fires platform can in part be related to the time we dedicate to our organizations to train in our METL and branch competencies. As a result, the more time we can dedicate to that training will invariably assist in our desired goal. The conflict is in still providing the time necessary to accomplish all the additional requirements while providing the preponderance of the time allocated to tasks that directly support the Fires warfighting function.

*Note: From now on tasks and activities that directly lead to enhancing Fires capabilities (e.g. Fires planning; field artillery/air defense artillery gunnery; Advanced Field Artillery Tactical Data System/Tactical Airspace Integration System operations; target working groups; Fires simulators, etc.) will be referred to as "critical requirements," and all additional requirements that don't directly lead to enhancing Fires, but are still important to operational readiness (e.g. Sexual Harassment/Assault Response and Prevention; Equal Opportunity; Threat Awareness and Reporting Program; urinalysis; briefings; inventories/inspections, etc.) will be referred to simply as "non-critical requirements."

In order to solve the problem of time we need to conduct a systems analysis of our organizations to determine how to effectively organize our training in such a manner that we only allocate the amount of time necessary to meet non-critical requirements while providing as much time as possible to the execution of critical requirements.

System analysis of an organization

Robert Stein, a former consultant to the U.S. Government and defense industry and who was critical in the development of the would-be Patriot Advanced TBM Capability (PAC) 1 & 2, provides a good industry definition for a systems analysis, "understanding and addressing the impact on the whole of issues related to each of the constituent parts or phenomenologies." What this means in relation to our discussion, is that the sum of an organization's activities is not just the execution of a requirement. Yes, there are briefs, gunneries, certifications, qualifications, SHARP training, and FRG meetings, but there is also the time people take to prepare for those events.

The execution of a gunnery event does not just encompass rolling out to the field and conducting your respective FA/ADA tables for section, platoon, battery and battalion qualifications. It includes months of preparation for training and resourcing followed by after-action assessments and capturing lessons learned for future gunneries. Similarly, the execution of a briefing is not simply the gathering of respective staff sections and talking through one's slide to the commander, but the days of gathering necessary information to make informed decisions to the boss, as well as an hour or so of updating slide-based metrics. This is what is meant when we say that an organization is more than the sum of its requirements … it is never just a gunnery or a briefing.

Define the problem

Using inductive reasoning, we know every critical and non-critical requirement we undertake takes time to execute, but there is also a preparatory and subsequent period that takes time

away from supporting other efforts. If we want to enhance our Fires capabilities internally we need to dedicate more time to training those critical requirements. We still have to execute our non-critical requirements that don't directly enhance Fires, because they are both necessary for operational readiness, as well as dictated by the Army. Therefore, the problem we are trying to solve in this system analysis is how do we manage our time to dedicate most of our effort to the execution of critical requirements while dedicating the least amount of time to both the pre/post-execution of critical requirements and the support of non-critical requirements? With a well-defined question we have begun the first step toward an effective systems analysis.

Determine requirements

The next step in this process would be to determine every critical and non-critical requirement that your organization will execute. Some of these will be easy to identify immediately. For many of your critical requirements your activities that directly support your organization's METL can be considered as such, and the Army Mandatory Training Requirements within AR 350-1 cover many of your non-critical requirements. It will be up to the commander and the staff to identify and categorize the remainder. The various training, command and staff and family readiness group meetings are of course not mentioned in AR 350-1, but are nonetheless non-critical requirements that you will have to undertake. Does the informative staff ride to a historical battlefield that employed artillery help enhance Fires through professional development of Fires leaders, or does the commander classify it as another non-critical requirement that doesn't enhance Fires?

Determine subrequirements

Every requirement that is undertaken is inherently made up of three phases: Preparatory, execution and after-action.

Preparatory requirements are those actions necessary for the successful execution of a particular activity. Prior to the execution of a gunnery there is planning to conduct, resources to request, land and ammo to reserve and preliminary training to direct so the gunnery can take place. Prior to the execution of a meeting, there are people that need to be informed, slides that need to be collected and updated and facilities that have to be set up. Failure to conduct a preparatory activity well, or at all, puts at risk the successful execution of a critical or non-critical requirement; like the gunnery or the FRG meeting.

Execution requirements are those actions that directly result in a successful or failed attempt to meet a critical or non-critical requirement. For a gunnery, the deployment of vehicles and personnel, establishment of an assembly area, drawing ammo, refueling operations, conduct of gunnery tables, tear-down of an assembly area and the redeployment back to garrison are all requirements necessary to execute that gunnery. For a meeting, the seating of the people in the room, providing necessary handouts, briefing of slides, and gathering requests for information (RFI) are required for successful execution. Failure to conduct these actions will result in failing to meet the intent of the critical or non-critical requirement, and therefore an operational failure for the organization.

After-action requirements are simply those activities we conduct post-execution in order to either capture lessons learned or as a preparation for another execution requirement. These would include conducting an after-action review (AAR), answering RFIs, or executing recovery operations in the motor pool. Some are vital for the continued success of the organization (i.e. RFIs) while others simply improve the organization for the better (i.e. AARs). Once you have identified and captured all the sub-requirements the next step is to begin the analysis portion of this aptly named systems analysis.

Analyze subrequirements

The final element of the systems analysis, before implementation, is where we identify possible courses of actions in order to solve for our defined problem. This is by far the more subjective portion of this process, and as a result, regardless of what the desired end state of the analysis is, most likely there will not be a definitive answer; only logical, well-defined opinions.

To get that opinion we analyze the issues by using a series of questions to determine how that sub-requirement fits into the bigger picture, and, in the case of our defined problem of optimizing time, that bigger picture is based on the expenditure of time for the organization. We know the main unit of measure we will be using is time-based, and therefore should display the value of a requirement in the form of time spent supporting it in hours. Furthermore, in order to improve the whole of the organization, we will be more specific in our measurement, and instead of just focusing on the number of hours it takes to accomplish a requirement we will instead determine the accumulated man hours (MH) for everyone involved to truly determine the total effort required to support it.

When we ask the questions for this defined problem the goal is to determine those MH dedicated to every significant activity involved. When we have determined the MH cost of each sub-requirement then we can effectively evaluate where to make changes to reduce those costs that save the organization the most MH, which will then make our training calendar more flexible to change and provide more time to dedicate to the execution of critical requirements that enhance our Fires capabilities. The following are some questions you may ask in order to help you determine the total effort that requirement needs to be successful:

1. Who needs to participate?
2. What needs to be accomplished?
3. When do we need to execute this and for how long?
4. Where can we best accomplish this?
5. Why do we need to do this?
6. How are we implementing this?

Once the questions are asked you can begin simultaneously determining new and innovative methods and tools for reducing the overall MH cost for those requirements. As these questions are posed you think to yourself, "How can I improve this?" Gathering advice from others within your organization

Staff Sgt. Bill Fenton guides the members of F Platoon, 2nd Battalion, 14th Marine Regiment, as they load a M142 High Mobility Rocket Artillery System onto a KC-130J Super Hercules aircraft during Balikatan 16 (BK16) at Clark Air Base, Philippines, April 6, 2016. BK16 was an annual bilateral training exercise between the U.S. armed forces and Philippines forces intended to promote cooperation and contribute to regional stability and security. (Tech. Sgt. Araceli Alarcon/ U.S. Air Force)

will be beneficial in determining possible solutions. The following are example solutions to the previous six questions in a fictional scenario of trying to reduce the time dedicated to a weekly battle rhythm briefing:

1. A weekly one-hour meeting that before had 30 personnel attend, but through a systems analysis you assess that you can achieve the same intent with only 10 personnel then you effectively cut down the total, per week, time requirement of 30 MH to 10 MH; a weekly savings of 20 MH for the organization. This is the most direct benefit we can see, but as we dig into it we can save even more time in specific areas.
2. During this meeting you need to be synchronized six weeks out and verify the current status of equipment readiness. You used to brief personnel readiness, but determined because that was covered in another meeting you don't have to cover it again at this weekly brief. Therefore your organization only needs to update and brief slides that require your planned training calendar out to training week six, and slides that cover all your equipment.
3. With the aforementioned changes you can effectively cut the slide update time (per person) from 0.5 MH (30 min) to 0.2 MH (12 min), and reduce the total briefing time from 1 MH to 0.5 MH since personnel readiness does take a significant amount of time. Using the original 30 personnel if only 10 updated slides (10 x 0.5 = 5 MH) and all had to attend (30 x 1 – 30 MH) then the total original time would cost the organization approximately 35 MH to execute this briefing. With the reduced number of attendees and reduced time required to update (10 x 0.2 = 2 MH) and attend (10 x 0.5 = 5 MH) you have reduced the total MH requirement from 35 MH to seven MH; saving 28 MH for your organization.
4. Before the meeting used to be held at a location that was in your building out of convenience. You could arrive there immediately but the other 29 personnel had

to travel 10 minutes to get to that location. You assess that if you moved the location of the brief to a facility closer to the others it would cut down their travel time to two minutes, and you would have to travel 10 minutes to get there. So originally 29 personnel had to travel 10 minutes (0.16 MH) to get to your location for a total of (29 x 0.16 = 4.6 MH), but now only nine people need to travel two minutes (0.03 MH) for total of (9 x 0.03 = 0.27 MH), and you would have to travel an additional 0.16 MH for accumulative 0.43 MH. By changing personnel and travel time you have saved your organization approximately 4.17 MH.

5. You understand the importance of holding this meeting to synchronize the efforts of your organization and verify the status of your equipment in order to get people to correct any deficiencies. Had you questioned the purpose of having this activity you may have been perfectly justified in foregoing it all together; therefore saving all those MH, but it is a requirement you feel is needed so it remains.
6. You generally provide this brief in the form of a PowerPoint presentation printed out in hard-copy form and through a projector. You assess that you don't need to provide hard copies for this brief, and instead will stick to just the digital slides. You no longer have to spend .5 MH printing off all the slides, organizing them and distributing them to everyone. You also used to spend about 12 minutes (0.2 MH) preparing your laptop and projector, but the new location already has a projector mounting from the ceiling, cutting your setup time down to six minutes (0.1 MH). So that provides a difference of 0.7 MH down to 0.1 MH, a difference of 0.6 MH which saves you 36 minutes of your own personal time just preparing for this briefing.

If you add everything up you come to an original time of 40.6 MH, a reduced time of 7.53 MH, and a total savings of 33.07 MH for your organization. Now let's assume this briefing was for a battery element, and those original 30 personnel encompassed everyone (E6 and above) which is the bulk of the leadership for this battery. You determined that only the commander, first sergeant, executive officer, platoon leaders, platoon sergeants and the orderly room noncommissioned officer were the 10 personnel required. If you had an organization whose duty day (not including physical training) was from 9 a.m. to 5 p.m. (8 hours) then the total dedicated MH for work per week for your 30 leaders would be (30 x 8 x 5 = 1200 MH) per week. That original 40.6 MH requirement, therefore, represents about 3.3 percent of your leaders time per week dedicated just to this one briefing. With the new reduced time of 7.53 MH you are only dedicating 0.6 percent of your weekly leaders' MHs to this brief. By using a systems analysis for this one requirement you have begun to chip away at the total effort dedicated to non-critical requirements.

Assessment and implementation

Now that we have determined methods to reduce our MH requirements while still achieving our desired intent we need to assess whether the change can be accomplished. Changes are difficult to pull off in large organizations like the Army, because in some cases it isn't just your organization that will need to change. If you discovered a tool that can replace the standard PowerPoint presentation with a more effective program then internally you may be able to save time and effort, however, externally you will probably still need to present similar information to others using the older systems.

An example of this is how our brigade Fires cell utilized the Strategic Management System (SMS), a web-based Army-contracted performance measuring tool, to track metrics and conduct its weekly synchronization meetings. Previously we employed a PowerPoint briefing format that covered Fire support vehicle and equipment statuses, individual and crew qualifications and certifications and their individual training calendars. Every week manual updates had to be applied to the PowerPoint for every metric and calendars had

Soldiers with A Battery, 6th Battalion, 52nd Air Defense Artillery, perform guided missile transporter training as part of the unit's Iron Forge field exercise, Seosan Air Base. In addition to maintaining the unit's air and missile defense proficiencies, a mock reporter was embedded to train Soldiers to properly address the media. (Pfc. Yoseup Kim, KATUSA)

Figure 2. The Strategic Management System allows automation when updating metrics. (Cpt. Colin Marcum/U.S. Army)

to be adjusted as the weeks progressed and training changed. In total, each battalion fire support officer (FSO) had to spend about an hour of their time, or one of their assistant's, to sit down, apply these updates, and email them to me. I would then collect the slides, consolidate them into a single briefing, and update our own metrics and calendars for this presentation; which took two hours. With four battalion FSOs and myself, the combined preparatory requirements for this brief took upwards of six MH per week, not including printing handouts for all attendees. This changed with SMS.

As shown in Figure 2, SMS allowed us to automate most of the processes used to update metrics. Vehicle statuses, equipment on hand and fully mission capable (FMC), crew manning, certifications, and qualifications were now updated through a serious of simple questions that the battalion FSOs have to answer. "Is the battalion fire support element's M1068 FMC?" "How many personnel are assigned to the battalion FSE?" "Has the C Company Bradley Fire Support Team crew qualified on their vehicle?" All of these are simple questions that require a Yes/No response or require a numerical input of some type; see first image in Figure 2. The metrics are then directly linked to a dashboard that has all the information laid out in a manner easily interpretable to the person reading it. In Figure 2 the second image shows the layout of an organization's equipment with on-hand numbers and color coded metrics. In the third image the layout of all training and manning metrics displayed as a color coded status. These colors and numbers can change weekly based on what the battalion FSO has inputted into those questions during those weekly metric updates.

However, as of right now, we are the only organization to be utilizing SMS as a means to track tactical level metrics. Though the Under Secretary of the Army has recently published a memorandum calling for all organizations to utilize SMS as their sole performance measuring tool, it will take time for it to permeate through the Army. As a result, we still have to convert our metrics into pre-existing Excel and PowerPoint formats until the day comes (if it ever does) when SMS is utilized by everyone else. Regardless, it has saved us significant time during the week. Each battalion FSO only spends 2-5 minutes updating metrics, and for me only about one minute. I don't have to consolidate slides since Dashboards are updated from SMS in real-time, and can be presented with a projector straight from a computer with a NIPR connection. (If required, SMS briefing books; which are a collection of dashboards for a particular presentation, can be saved in other formats; like PDF, PowerPoint or Excel in case you need to provide a presentation without a NIPR connection available). Even though the initial investment setting up the SMS metric questions, layouts and updater privileges took upwards of 20 MH of my time at the beginning, now that it is fully operational it saves the organization 23.6 MH per month just preparing for this weekly briefing.

This is what is meant when you need to assess whether it is practical to implement a change. It needs to be feasible within your organization. SMS worked for us because it was only replacing an internal briefing format, and didn't necessarily impact higher/external organizations. When more organizations implement SMS we will be able to provide metrics using a system/format that was already established, but at the very least we have optimized our own time implementing it internally.

When an assessment is deemed to be practical then all that is required is to determine the most effective means to

Soldiers from C Company, 1st Battalion, 244th Aviation, Oklahoma U.S. Army National Guard, conduct sling load training during their drill weekend Jan. 9-10, 2016 using a UH-60 Black Hawk helicopter. (Sgt. Peter Wycoff/Oklahoma U.S. National Guard)

implement that change. In some cases this requires a slow transition that changes components of a previous tool or method so that it is easier for everyone to adopt, and in other cases it will require a quick transition in order for its value to be immediately seen.

In either situation the biggest roadblock to any change will be others. If you determine there is value in a new tool or method and it can help your organization optimize time then you have to sell that concept to everyone else. In the Fires community we are no strangers to being proponents of our branches and convincing the rest of the force the value we provide; same is to be said when changing the way an organization operates. A superior, peer or subordinate may not like change because it can disrupt the established rhythm, but when using a systems analysis to optimize time arguing the time saved for everyone involved may compel them to listen.

When implemented, the following step is the redistribution of time in order to support critical requirements. Less time dedicated to a Tuesday morning meeting can mean more time dedicated to Tuesday afternoon training. Consolidating the time you save where you can will mean more time allotted for training in those critical requirements, and if consolidation is not an option then you simply have more white space for your organization to finish up other requirements, if not relax their operational tempo.

Conclusion

Utilizing a systems analysis to determine how best to optimize an organization's time to focus that organization's efforts on critical requirements is one method for optimizing the Fires platform. By cutting down time dedicated to non-critical requirements, as well as those preparatory and after-action requirements necessary for critical requirements, then logically more time will be available for the execution of critical requirements.

While an individual article cannot encompass the entire breadth that should be dedicated to fully understanding how a systems analysis can be used to optimize time, I feel it may have done its work in piquing other's interests to see how they can implement it in their organizations. "Perspectives on Defense Systems Analysis" by William Delaney provides numerous examples on how systems analyses have been utilized for strategic level initiative, and many of their scenarios can be translated over to tactical level employment; if you have an open-mind.

Optimizing Fires must first come from a suitable amount of training to employ those Fires on the battlefield, however, great leaps in technological development and organizational concepts to support Fires will be for naught if there is no time dedicated to training our Soldiers in how to operate and execute those new systems and methods. Therefore, time is a valuable asset to an organization, and it would be a wise course of action to determine exactly how that time is being utilized and reinvest it appropriately.

Cpt. Colin B. Marcum is currently assigned to the 2nd Armored Brigade Combat Team, 1st Armored Division, as the assistant brigade fire support officer.

A General Atomics employee performs maintenance on a railgun during the Maneuver Fires Integration Experiment 2016. (Monica Guthrie/ Fort Sill Tribune)

Army experiments on providing 'unlimited magazine' to 2025 Soldiers

By Monica Guthrie

FORT SILL, Okla. — A swarm of experts from across the nation assembled at Fort Sill for a two-week experiment trying out systems with the potential to provide service members with unlimited weapons capabilities. The event, called Maneuver Fires Integrated Experiment, spanned April 11-22 and demonstrated two types of weaponry - one using lasers and the other using electricity-propelled projectiles to acquire and destroy targets.

According to John Haithcock, Fires Battle Lab director, counter-unmanned aerial vehicle missions are the current capability gap and the focus of the weapons experiment. By conducting the experiments early in the development process, Haithcock said developers could incorporate the insights of service members who would use the equipment and report on how to improve the interfaces. Also, the event brought out not only future technologies but current technologies that may be used together. The result is an integrated weapon system with command and control sensors that can do multiple missions, he said.

"As opposed to having three pieces of equipment, we can use some of this new technology and integrate it into a single vehicle," said Haithcock.

Unlimited laser weapons

Unmanned aerial vehicles, commonly called drones, provide reconnaissance and weapon capabilities. It's relatively low cost makes them a prev-

alent force multiplier for military units. According to Lt. Col. Jeff Erts, Fires Battle Lab experiment and war-games chief, drones have become an increasing threat around the world where friendly forces are encountering them. The operators of those drones are able to report locations of friendly troops and call in large barrages of enemy fire as a result.

"We don't currently have anything to take those down," said Erts. "So we're really working to put something in the field that can destroy these before they have a chance to report on our Soldiers' locations."

The first weapon demonstrated was a compact laser weapons system able to either be transported on its own vehicle or as an augmentation of currently used equipment. For the demonstration, a 2-kilowatt laser was mounted on a Stryker armored vehicle. The system's beam controller was mounted to the top of the vehicle while the laser itself, the power and coolant, was integrated into the interior of the Stryker. Nearby was a 10-kilowatt laser, on an independent vehicle.

The lasers have the ability to melt away plastic and burn through metal, damaging drones to the point they can no longer remain airborne or their reconnaissance abilities are damaged.

"The lasers are able to perform regardless of weather, however poor weather can degrade the performance. Still, the carcasses of multiple destroyed drones, some shot by the laser through rain, are testament to the power and ability of the lasers," said Adam Aberle, Space and Missile Defense Command and Army Forces Strategic Command Technical Center High Energy Laser Mobile Demonstrator program manager.

Operators pick a point on the target and sensors in the beam are able to "see" and lock on to the target, auto tracking. The laser produces little noise and is invisible to the eye.

"You can have an effect and nobody knows what happened," said Aberle.

Perhaps the biggest feature is the weapon's ability to save military money in terms of ammunition currently needed to provide security against unmanned aerial vehicles. According to Erts the current method to combat aerial targets is to use expensive equipment. For the military to engage in counter

Robert Taylor, who was involved with the payload and design at General Atomics, explains how the power system is set up in a modular format, meaning if one is lost, the others can be manipulated to pick up the slack, during the Maneuver Fires Integrated Experiment, at Fort Sill, Okla., April 21. (Monica Gutherie/Fort Sill Tribune)

drone missions with current technology would be financially inefficient. Instead the lasers will be able to fulfill the role.

"If an intercontinental ballistic missile is coming, if any ballistic missile is coming, to a very high priority target then absolutely, shoot a million dollar missile at it," said Erts. "However, when you have conceivably hundreds of small inexpensive targets coming at you, we don't have enough of those missiles to engage them. With as low cost as (drones) are, the enemy can keep throwing those at us. So we need a system, something that doesn't cost a lot to shoot. Literally a laser is just the cost of the gas it takes to run the generator, to generate the power to shoot again, and again and again."

A common theme throughout the experiment was the ability of the laser to operate an effective counter mission on as little as a few gallons of fuel. Dexter Henson, Boeing communications manager, explained that so long as the lasers have enough coolant and fuel, they are able to participate in continual enemy engagement.

"The compact laser system provides, what we like to describe as, an infinite magazine," said Henson. "What it allows us to do is to assist the Soldiers who are dealing with these types of threats. Basically all it takes is the amount of fuel that you can fill in a coffee can."

Eliminating accelerants

A few yards south of the laser experimentation, members of General Atomics ready their own prototype for a demonstration. Their weapon, a railgun, uses electricity to generate the propelling force for a round, and also uses a round without accelerants, eliminating any potential source for an explosion either prior to, or after, firing the weapon.

"Without a propellant the logistic questions are simplified," said Robert Taylor, who was involved with the payload and design. "You can't make an (improvised explosive device) out of any part of the projectile."

An unmanned aerial vehicle, held by a U.S. Army Space and Missile Defense Command employee, displays the damage caused by a compact laser weapons system during the Maneuver Fires Integrated Experiment 2016.(Monica Guthrie/Fort Sill Tribune)

Instead, the weapon uses speed as its method to deliver damage. The railgun has the ability to travel six times the speed of sound. Taylor said there is potential for tremendous lethality at that range.

The railgun operates using bus bars where electricity flows up one bar, across an arm and back down the other bar, returning to the power supply. The electricity is up to 1.7 million amps and the curvature of the path creates the electromagnetic source to accelerate the projectile, said Taylor.

"It does not need (an accelerant)," said Taylor. "It's moving six times the speed of sound. If you had an explosive charge, the fragments off of that would be moving slower (than the propellant)."

An interesting difference between the railgun and a traditional weapon is the shape of the barrel. Because the weapon does not use any accelerants, there is no need for the weapon to be round (and seal the propellant gas), so the barrel of the railgun is square. In addition, a separate capacitor stores the energy in a system whose technology is more than a decade old, said Taylor. It is four times more energy dense, meaning operators can get the same power from a box a quarter of the size. In addition the power system is set up in a modular format, meaning if one is lost, the others can be manipulated to pick up the slack. The result is a piece of equipment that is more tolerant of battle-field damage. Its modular style makes it flexible for work and replacement, said Taylor.

As the projectile leaves the weapon, a lower portion separates from the body as the protective continues. One will be destroyed immediately, said Taylor, and the other will go to the side. Because of the speed, the projectile itself requires a heat resistant nose, typically made of tungsten. The weapon's speed and lack of explosive allows the user to reduce the amount of collateral damage. Its precision makes it multi-functional for aerial targets as well as ground targets such as buildings or antennas. Its speed gives it the potential ability to intercept long-range targets.

"You'll have to watch the muzzle flash and then quickly shift your gaze to the target," said Taylor. "If you wait to hear the gun, it's over. You will not see the effects on the target. And don't blink."

EDITOR'S NOTE: This information is being provided for informational purposes only, and neither does nor intends to imply an endorsement and does not necessarily represent the views of the Department of Defense, the Army or any other government components.

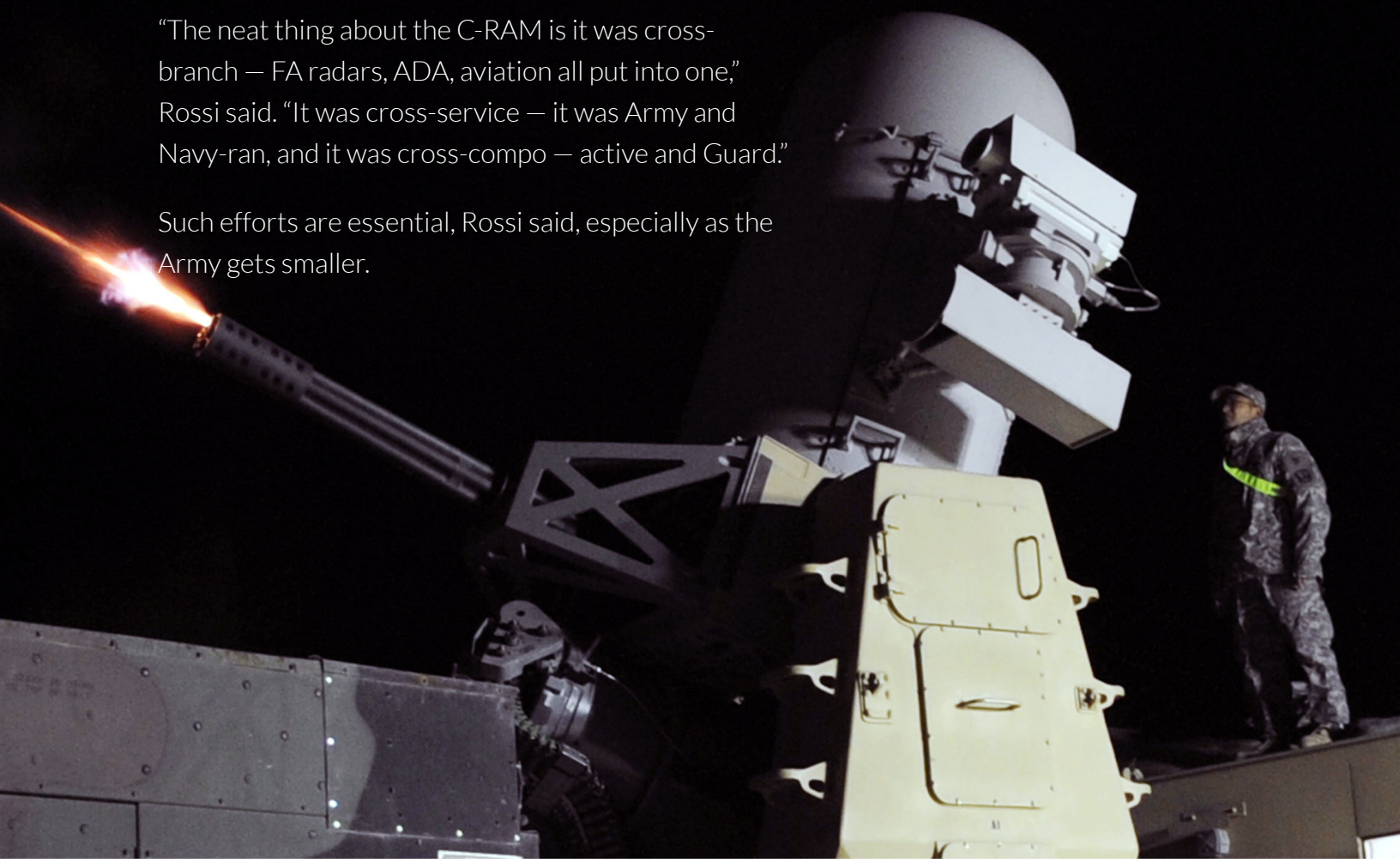
A projectile, traveling at six times the speed of sound, leaves the muzzle of a railgun April 19 on a Fort Sill training area during the Maneuver FIres Integration Experiment 2016. (Monica Wood)

Short-range air defense back in demand

By Gary Sheftick

"The neat thing about the C-RAM is it was cross-branch — FA radars, ADA, aviation all put into one," Rossi said. "It was cross-service — it was Army and Navy-ran, and it was cross-compo — active and Guard."

Such efforts are essential, Rossi said, especially as the Army gets smaller.



A Counter-Rocket, Artillery, Missile gun fires flares during a weapons test at Joint Base Balad, Iraq, Jan. 31, 2010. C-RAM has the ability to fire up to 4,500 rounds per minute to protect the base against incoming projectiles. (Senior Airman Brittany Bateman/U.S. Air Force)

WASHINGTON (Army News Service, Feb. 12, 2016) — The Army is looking at placing more short-range air-defense capabilities in brigade combat teams (BCT).

For more than two decades, the Army has neglected the short-range threat and focused instead on missiles, said Maj. Gen. John Rossi, Fires Center of Excellence and Fort Sill commanding general, Oklahoma. He was part of a panel discussion, Feb. 11, at a day-long Association of the U.S. Army-sponsored Hot Topics forum on Air and Missile Defense.

Desert Storm, 25 years ago, brought the Patriot missile defense systems into prominence, Rossi said.

"As we made Patriot better and we focused on it, in essence the air defense community migrated to what became a point-defense branch, a missile defense branch," Rossi said.

No 'a' in missile defense

"We took the 'A' out of air and missile defense in many ways," he said. "We didn't think we really needed to focus on it."

SHORAD or Short-Range Air Defense battalions were deactivated. "We took all short-range air defense out of the architecture as we focused on missile defense," Rossi said, adding "that's caught up to us."

Now the proliferation of small, unmanned aircraft is forcing commanders to reassess the need for SHORAD capabilities to combat low-altitude threats.

"We've got to find a game changer," Rossi said, alluding to the need to find more affordable and lethal air-defense systems.

Dr. David Markowitz, Army G 3/5/7 assistant deputy chief of staff for operations; Maj. Gen. John Rossi, Fires Center of Excellence and Fort Sill commanding general; and retired Maj. Gen. Francis Mahon, a defense consultant, participated in a panel discussion on the defeat of air and missile threats, Feb. 11, 2015, at the Association of the U.S. Army headquarters, in Arlington, Va. (David Vergun/U.S. Army)

"We have to change the scenario or change the equation so it's more costly to attack than to defend," he said. "We've got to build to the future."

CMIN experimentation

The Counter-Unmanned Aircraft Systems Mobile Integrated capability, or CMIN, is among systems being researched for the future.

"We already demonstrated this a year ago at Fort Bliss and we're going back again now for the [Network Integration Evaluation] in the spring," Rossi said.

CMIN uses a Q-50 radar to find incoming UAS, he said. The AN/TPQ-50 counter-fire radar was developed by the field artillery community to detect incoming rounds and calculate their trajectory.

Once radar spots the UAS and they are identified, then CMIN has both non-lethal and kinetic tools to stop them, Rossi said.

Other innovations being researched to boost air defense include new sensors and a hypervelocity gun.

The hypervelocity gun weapons system uses a 155 mm projectile in an air defense mode, Rossi said.

It's a good example of what he called "cross-domain expansion," merging field artillery and air defense artillery platforms.

Cross domain expansion

Cross-domain expansion uses existing platforms in new ways, Rossi said, and is an important part of the Army Operating Concept.

A battle-tested example of this is the C-RAM, he said. C-RAM stands for Counter Rocket, Artillery and Mortar system. It was adapted from the Navy Phalanx weapons system and was sent to Iraq for the protection of large forward operating bases such as Camp Victory and Joint Base Balad.

"The neat thing about the C-RAM is it was cross-branch — FA radars, ADA, aviation all put into one," Rossi said. "It was cross-service — it was Army and Navy-ran, and it was cross-compo — active and Guard."

Such efforts are essential, Rossi said, especially as the Army gets smaller.

Rossi is not advocating more force structure to bolster air-defense capability in BCTs.

"What we're not going to do is bring back the SHORAD battalion and lay that on top of a BCT," he said. He explained that making a brigade larger would just detract from its expeditionary nature.

What he advocates instead is "multi-functional convergence" or merging select branch attributes.

"It can't be just ADA systems inside the portfolio of air defenders to solve this in isolation," he said.

'Back into the dirt'

Air defenders need to work closely with everyone else in the maneuver force, said another member of the panel, Maj. Gen. Glenn Bramhall.

"I think we've lost just about a whole generation of knowledge base of how we work with the maneuver force," said Bramhall, 263rd Army Air and Missile Defense Command commander.

"One of the things we need to do is get back into the dirt -- get back into the maneuver forces and train their commanders on how do we integrate air defense, what does air defense offer ... "

Getting back into the dirt means integrating Air and Missile Defense units into National Training Center rotations, the AMD leaders said.

It also means getting back to the basics of old-fashioned training such as how to employ camouflage netting over tactical vehicles to keep them from being spotted by aircraft, said Dr. David Markowitz, G-3/5/7 assistant deputy chief of staff for operations.

Left and Right: Soldiers from 1st Battalion, 204th Air Defense Artillery, Mississippi U.S. Army National Guard, conduct air defense training at Oro Grande, N.M. (Courtesy photos)

Air defenders partner with National Guard units to strengthen Army's total force

By Capt. Clayton Richardson

The American people depend upon the Army to provide reliable land power to fight the nation's wars and defend U.S. interests at home and abroad. While the Army's active component (AC) plays the major role in providing readily available forces, the Army National Guard (ARNG) and the U.S. Army Reserve (USAR), which serve as the nation's reserve component (RC) forces, fulfill a critical role by supplying additional, sustaining forces for a variety of recurring missions.

Together, these AC and RC forces make up the Army's total force.

The Army Total Force Policy (ATFP), as currently implemented, strives to marshal the full capability of AC and RC units to provide the predictable, trained, manned and equipped forces necessary to meet the nation's needs.

To better integrate these AC and RC forces into a coherent total force, the U.S. Army's Forces Command (FORSCOM) seeks to leverage partnerships between AC and RC units for their mutual benefit. FORSCOM's Total Force Partnership Program (TFPP) spells out specific goals, guidelines and an overarching structure for making these mutually beneficial partnerships a reality.

Within the total force, several different types of partnerships exist. For instance, several partnerships exist between AC and RC brigade combat teams (BCTs), field artillery and air defense artillery brigades and aviation brigades. These units train together as opportunities present themselves and as resources allow.

The importance the Army places upon nurturing the total force through these enduring partnerships is highlighted by the recent development of the Army's Associated Units pilot program, slated for implementation in summer of fiscal year 2016. Unlike the TFPP, which does not require that partnered AC and RC units train together a specified number of days or execute certain prescribed tasks together, the Associated Units program does precisely that. Such partnerships allow for a common set of training standards, provide leader development opportunities and allow for frequent sharing of best practices. Moreover, major training exercises, such as combat training center rotations or warfighter exercises, when planned and executed together, pay off in multiple ways, not least of which is the ability of different units' staffs to communicate using a common language and common procedures. The efficiencies gained through these training partnerships benefit both the active and reserve components.

A third type of partnership exists between RC units that are manned and resourced to execute a specified mission set and partner AC units that are expressly designed to support these units' training. Headquartered at Rock Island Arsenal, Ill., First Army's AC units provide necessary pre-mobilization and post-mobilization training support to RC units. Essentially, First Army units enable partner RC units to sustain a higher state of readiness during the premobilization training cycle and to achieve full combat readiness much more quickly during post-mobilization training.

While numerous units across the Army work continually to implement the ATFP, one such unit with a highly unique and critically important mission is the 1st Battalion, 362nd Air Defense Artillery Regiment, a training support battalion assigned to the 157th Infantry Brigade, 1st Army, Division East. Headquartered at Camp Atterbury, Ind., the 1-362nd ADA Renegade Battalion partners with seven different ARNG Avenger battalions across five different states.



Left: Soldiers from 1st Battalion, 188th Air Defense Artillery, North Dakota U.S. Army National Guard, conduct air defense training at the armory in Fargo, N.D. Center: Soldiers from 1st Battalion, 204th Air Defense Artillery, Mississippi U.S. Army National Guard, conduct an Avenger live fire at Oro Grande, N.M. Right: Soldiers from 1st Battalion, 174th Air Defense Artillery, conduct the ALTP practical exercise with assistance from 1st Battalion, 362nd Air Defense Artillery. (Courtesy photos)

These Avenger battalions, located in Florida, Ohio, Mississippi, North Dakota and South Carolina, serve rotational tours within the national capital region (NCR) to provide continuous short-range air defense as part of an overarching integrated air defense system (IADS).

In the years since Sept. 11, 2001, the importance of air defense in support of homeland security within the NCR has become universally apparent, with national leaders vowing never again to allow an event of such magnitude to occur. Because of the critical importance of the NCR-IADS mission, the units 1-362nd ADA works with undergo a rigorous training and certification process that begins several months prior to mobilization.

"The Army National Guard units that we partner with must be the most qualified air defenders in the world," said Command Sgt. Maj. Phillip Stewart, 1-362nd ADA.

The Renegade Battalion's primary asset in its mission to train and certify NG Avenger battalions prior to assuming the NCR-IADS mission is its observer-coaches/trainers (OC/Ts). The battalion's OC/Ts, are senior noncommissioned officers and mid-career commissioned officers who are also air defense subject matter experts. They apply their years of experience to prepare NG units for their upcoming rotations at the nation's capital.

"Our highly skilled and motivated OC/Ts ensure that our partner units are ready to live up to the standard and are prepared to assume the NCR-IADS mission," said Stewart.

"As full-time professionals, we supply the experience and expertise that Soldiers in the reserve component may not have had as much of an opportunity to develop," said Staff Sgt. John Reich, 1-362nd ADA's Avenger master gunner and long-time trainer.

Prior to each rotation in support of the NCR-IADS mission, NG Avenger units must meet several certification requirements, most notably Exercise America's Shield and a culminating training event (CTE) prior to mission assumption.

"I know we wouldn't have been as proficient without what we learned from them," said Staff Sgt. Keith Hensley, an Ohio Army National Guard Avenger crewmember assigned to Cincinnati's 1st Battalion, 174th Air Defense Artillery Regiment.

When asked about his experience training with 1-362nd ADA he said "I finished CTE feeling a lot more confident in our abilities."

Preparing units for assuming the NCR-IADS mission, which supports Operation Noble Eagle, a homeland security-focused operation in support of federal, state and local agencies, represents 1-362nd ADA's primary mission. However, the battalion assists its partners in preparing for other missions as well.

"We strive to provide a significant value-added benefit to our partners in multiple ways, depending on the missions they've been assigned," said Lt. Col. Thomas Genter, 1-362nd ADA battalion commander.

With this goal in mind, the Renegade Battalion recently developed the Avenger Leader Training Program (ALTP), which is a two-day crash course in air defense tactics and planning for air defense leaders tasked to provide short-range air defense in support of maneuver units. The principal audience for the course comes from units tasked to provide air defense at an upcoming combat training center rotation, such as at Fort Irwin, California's National Training Center or Fort Polk, Louisiana's Joint Readiness Training Center.

"Providing air defense in support of maneuver forces is somewhat of a lost art," said Sgt. 1st Class Brian Giacobbe, 1-362nd ADA Avenger master gunner and OC/T team noncommissioned officer in charge. "Avenger units generally haven't performed this type of mission since before the Iraq War," he said.

1-362nd ADA presented the first-ever ALTP for 1-174th ADA in February 2016 in order to help them prepare for their upcoming NTC rotation slated for June this year. Just two months later, in August and September 2016, North Dakota's 1st Battalion, 188th Air Defense Artillery Regiment will conduct their own NTC rotation in support of an armored brigade combat team from Minnesota.

"We're going to do whatever we can to help our partner units," Genter said. "Regardless of whether it's at the NCR or at NTC, we're going to provide that training expertise to get them where they need to be. We really do train the best air defenders in the world."

Capt. Clayton Richardson currently serves as the observer, coach/trainer team chief for Bravo Team, 1st Battalion, 362nd Air Defense Artillery at Camp Atterbury, Ind.

Playing both sides

An artillery battery's lessons learned while being BLUFOR and OPFOR at NTC

By Capt. Timothy Lewin and Sgt. 1st Class John Grimes

Soldier in 2nd Battalion, 8th Field Artillery Regiment, man an M777A2 howitzer prior to a 'bait raid' mission. (Staff Sgt. John Shanahan/U.S. Army)

Field artillery must be able to present the enemy with multiple unsolvable dilemmas to allow joint forces to seize and retain the initiative and win in a complex environment. Moreover, they must do this with less force, leaner structures and operate within dynamic environments. This concept is tested by deploying a brigade combat team to either the National Training Center at Fort Irwin, Calif., the Joint Readiness Training Center at Fort Polk, La. or the Joint Multinational Readiness Center at Hohenfels, Germany.

What happens when you place a unit in a training center to serve on both sides, friendly and enemy?

In this unique situation a unit gets to experience unified land operations from multiple perspectives and truly understand how to solve the problem.

B Battery, 2nd Battalion, 8th Field Artillery Regiment (M777A2, towed) deployed in support of National Training Center Rotation 15-03 against the 11th Donovian Tactical Group in a decisive action rotation. A year later during NTC Rotation 16-03, the battery deployed in support of the 11th Donovian Division Tactical Group against the 2nd Stryker Brigade Combat Team, 7th Infantry Division from Fort Lewis, Wash. This time the battery represented the entirety of the 111th Brigade Tactical Group's field artillery assets in a similar decisive action rotation. Since both experiences took place within a year, the majority of the battery's core leadership had the unique opportunity to act as the United States friendly forces (BLUFOR) and opposing forces (OPFOR) during similar decisive action rotations. During each rotation the Soldiers learned how to ensure effective and efficient indirect fire support against an intricate enemy with less force.

Modern field artillery batteries must maximize the retention of combat

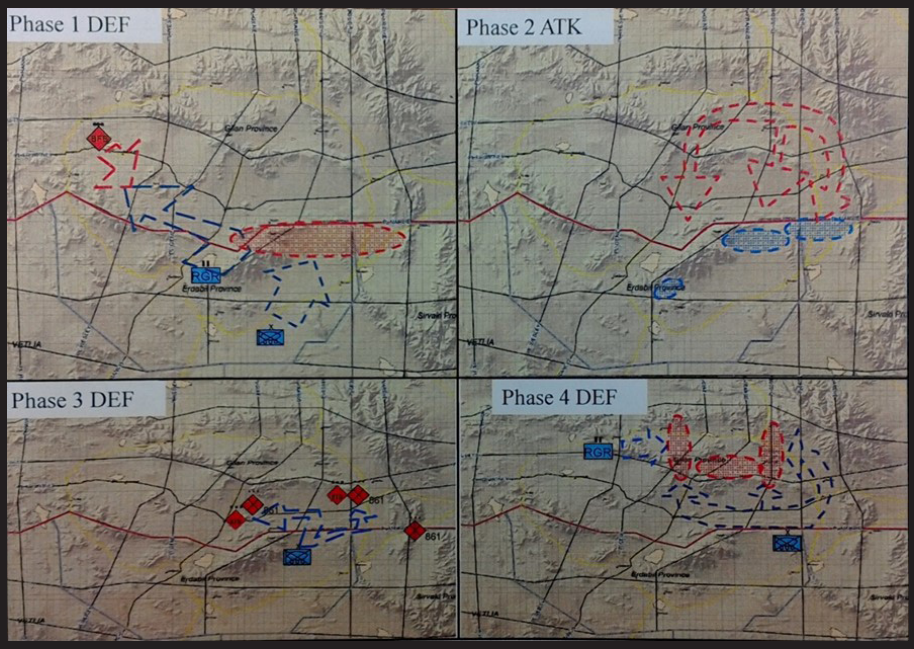
power during unified land operations against an elusive, equipped and equal enemy in a complex environment by performing tactics that ensure mobility and deception. The battery leadership determined in order to be successful, the unit must protect their combat power from high-level enablers. Examples include attack aviation, unmanned aerial vehicles (UAV) and specialized reconnaissance. They must also provide additional techniques against radar using innovative ways to win the counter-fire fight.

Survivability: Sustaining combat power through the whole fight

Field artillery is used to destroy, neutralize, suppress or obscure the enemy, degrade key facilities, screen movements and illuminate an area of operations. It is crucial for artillery units to stay in the fight at all costs. During NTC rotation 15-03, the battery took the most casualties when guns were stationary for too long. Even if the unit was not firing, the OPFOR obtained the unit's position with UAV or dismounted observers and produced counter-fire. With today's technology, the capability of the cannon battery is enhanced through the flexibility and survivability of the platoon-based organization.

The platoon fire direction centers (FDC) are equipped with the Advanced Field Artillery Tactical Data System (AFATDS) computer as the primary digital interface between the battalion tactical operations center and the howitzers. Batteries usually conduct moves in response to either friendly or enemy considerations. The three factors driving most unit movements are support to maneuver forces, timing and survival. A unit must be able to move to provide fire support to the supported force. Almost all field artillery tasks require the unit to reach a certain position or phase line to range the target. A unit may also be forced to move when a position becomes untenable due to counter-fire attack or natural obstacles.

When B Battery deployed to NTC 16-03, the leadership had to rethink the way they did survivability moves. The conventional tactic involved establishing survivability move criteria based on enemy analysis and friendly information. Triggers for survivability moves include the number of rounds fired in current location, duration of firing and time in position.



In this courtesy photo, the phases of the training rotation for B Battery, 2nd Battalion, 8th Field Artillery Regiment, are displayed. B Battery conducted four phases, three defensive phases and one offensive phase, during their rotation to the National Training Center (NTC) at Fort Irwin, Calif. (Courtesy Photo)

During the OPFOR rotation, the counter-fire threat and the presence of BLUFOR UAV forced the battery to keep the guns spread out and constantly moving. They only occupied when a call-for-fire was received and processed. Essentially, the battery fired every mission as an emergency mission. As soon as the gun line received an end-of-mission the guns would immediately displace and continue movement within the position area. The battery called this method "running guns" because the howitzers were constantly moving within their assigned position area, safe from the delay of BLUFOR indirect fire. This method proved very effective by observing the impacts of the BLUFOR's counter fire in the previous positions of the howitzers. By the time counter fire impacted, the guns were already two or three positions ahead waiting on another target.

Camouflage nets proved to be a highly effective technique against the enemy during decisive actions. In each rotation, the nets had their advantages and disadvantages. During the battery's support of the BLUFOR rotation, camouflage nets were used to conceal positions the firing unit occupied in large, open areas. During the battery's support to the OPFOR rotation, the BLUFOR constantly had aerial reconnaissance looking for the firing unit trying to conduct indirect fire. To counter this, the battery moved into a tall valley tucked in next to the mountains and draped camouflage nets over the trucks and howitzers. Coupled with the capabilities of the equipment and the terrain, the battery was able to stay hidden. Tall walls on either side of the valley made incoming indirect fire ineffective as the steep angles forced high-angle trajectories and forced aerial assets to be higher in altitude to observe the ground. As opposed to the BLUFOR mission, the battery was not in position ready to fire. Their primary objective was to stay as hidden as possible. If they received a fire mission, they would come out of the hide and execute the mission. This technique was only used when the number of fire missions expected from the maneuver were low and the commander desired to sustain the number of guns for the future fight. Implementing these methods drastically improved the effectiveness and the survival of the battery during the main part of the decisive action fights.

Tactics: Creating unsolvable dilemmas for the enemy

While deployed to NTC 16-03 as OPFOR, the battery experimented with new tactics previously unknown to the unit. A new tactic included provoking a counter-fire fight goaled towards discovering the enemy's indirect fire assets and using their own radar against them. The unit executed this by developing "bait raids." These bait raids consisted of having two firing platoons in position ready to fire while another firing platoon was in a running guns configuration. The running guns platoon would fire a mission at a previously identified high value target and then immediately displace to a subsequent position. BLUFOR radar would determine the point of origin for the running guns and attempt to counter fire on their now empty position. Friendly radar would acquire the firing unit location and send the counter-counter fire mission to one of the emplaced units.

Once fired, the emplaced firing platoon would displace. This procedure was continued multiple times with tremendous results. Once the desired effects were achieved, or the counter fire was getting effective, the units retrograded to their hide-sites.

As the fight progressed and each side learned more about one another, opportunities for deception increased. As the BLUFOR determined B Battery's tactics for concealment with the use of hide-sites and camouflage nets, the OPFOR was able to mislead their assumptions. The easiest way to do this was to establish camouflage nets over nothing. This simple trick would force the BLUFOR to waste valuable time and resources to determine the composition and disposition of the empty camouflage net. It also provided an avenue for the BLUFOR to think the battery had more combat power than they really had. This added to the force protection of the unit while the BLUFOR squandered key resources.

Creating problems for the enemy needed a centralized operations center with an active decision cycle. The battery solved this problem by consolidating both fire direction centers into a battery operations center (BOC). Since the BOC controlled all technical and tactical aspects of the field artillery battle, it presented itself as a high value target to the enemy. If the BOC was destroyed, the entirety of the field artillery unit would be useless, but it was assessed as prudent risk. The BOC was established as far away from the howitzers as possible, on the reverse slope, and occupied with-

Soldiers from B Battery, 2nd Battalion, 8th Field Artillery Regiment, execute a fire mission using an M777A2 as part of a running guns tactical maneuver. Staff Sgt. John Shanahan/U.S. Army)

in undesirable terrain. It turned out that this type of concealment allowed the BOC to stay stationary during all phases of the battle and allowed conditions to improve communications tremendously (taller antennas, troubleshooting, more range, etc.). This expanded the battery's area of operations and allowed bait raids and hide sites to be executed in new locations. The BOC continued to be a place where leaders could consolidate Fires related material, analyze the throughput and make informed decisions in order to best stay ahead of the enemy.

Mobility: Understanding limitations of each field artillery piece

Since the unit operated as a M777A2 battery, limitations of other platforms must be discussed in order to associate these lessons with other capabilities. Modern field artillery consists of three platforms in today's operational domain. They are the M109A6, M777A2 and the M119A3.

The Paladin M109A6 features improvements in the areas of survivability: reliability, availability and maintainability (RAM); responsiveness and terminal effects. The M109A6 is an armored, full-tracked howitzer carrying 39 rounds. It has the ability to fire 360 degrees by just moving a handle. One of the major advantages of the M109A6 is that it can quickly emplace and displace without dismounting any Soldiers. Strategically, this increases the survivability of the unit and the equipment by allowing the howitzer to quickly displace between missions, or if attacked by indirect fire, aircraft or ground forces. The Paladin is the biggest piece of field artillery and is hard to hide from the enemy. It is also severely restricted by terrain. Paladins are easiest to be placed in hide sites as described above.

The M777A2 replaced the M198 and is made with titanium to make it lighter and easier to maneuver on the ground and in the air. Some of the advances with the M777A2 are improved lethality and strategic deployment, increased tactical mobility and improved survivability with a decreased emplace and displace time. The M777A2 uses a digital system similar to the M109A6 to provide navigation, pointing and self-location allowing it to send rounds downrange faster when called upon. The M777A2 takes a seven-man crew to operate. Unlike the M109A6, Soldiers have to be out of the vehicle to operate it forcing them to dig fighting positions for security. This piece also takes longer to occupy and displace when conducting movements.

M119A3 is a recently fielded upgrade to the M119A2. The upgrades include software and hardware upgrades, global positioning system for navigation, digital gunner's display and digital communication between the fire direction center and the gun line. This allows the guns to receive missions faster.

The M119A3 is faster, lighter and easier to change azimuth of fire. The biggest downfall of the M119A3 is that it cannot range the same distance as the M109A6 and the M777A2. This piece is very similar to the M777A2 regarding the aforementioned tactics, but limited range does not allow for bait raids as effectively.

Exercising lessons learned

B Battery's experiences at the NTC as the BLUFOR in 2015 and as OPFOR in 2016 gave a unique insight on the advantages a field artillery unit can have by using mobility and deception during decisive actions.

By experimenting with tactics that increase survival of the field artillery, the battery can use less resources to achieve greater effects for a longer period of time. "Running guns" challenges current mindsets about the need to be in position ready to fire at all times. Mobility and rapid occupation can lead to great effects upon the enemy. At the same time, concealment for centralized operations centers is equally important. As near-peer enemies in complex environments deploy everything between manned air interdiction aircraft to small drones to detect friendly assets, high value assets must be concealed using camouflage and terrain.

The experience also showed field artillerymen can create unsolvable dilemmas for the enemy using radar systems and counter-fire tactics. "Bait raids" are useful tools to provoke a counter-fire fight while simultaneously engaging high-value targets and countering counter fire. These lessons learned were collected using the M777A2 platform. However, field artillerymen can use any of the three platforms with a combination of these tactics if there is an understanding of their capabilities and limitations.

Ultimately, mobility, deception and force sustainment are essential to using less force and achieving maximum results. Using these tactics, field artillery can degrade the enemy's ability to seize the initiative and assist joint forces in fighting and winning the nation's wars.

Capt. Timothy Lewin currently serves as the battery commander for B Battery, 2nd Battalion, 8th Field Artillery Regiment, 1st Stryker Brigade Combat Team, United States Army Alaska, Fort Wainwright, Alaska.

Sgt. 1st Class John Grimes currently serves as a platoon sergeant for B Battery, 2nd Battalion, 8th Field Artillery Regiment, 1st Stryker Brigade Combat Team, United States Army Alaska, Fort Wainwright, Alaska.

The tactical edge of Fires

Maneuver Fires Integration Experiment

By Capt. Jeffrey Jaramillo

The 5-kilowatt laser weapon, mounted to a Stryker vehicle, has the ability to destroy unmanned aerial systems and inbound artillery rounds using a network of sensors and was used on Fort Sill, Okla., during the Maneuver and Fires Integration Experiment 2016 (Rick Paape, Jr.).

Army experimentation mitigates risk to our warfighters and improves capabilities for the Army modular force by executing live, virtual and constructive experiments that produce actionable recommendations used to inform decision makers across doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy (DOTMLPF-P).

The Fires Center of Excellence along with Training and Doctrine Command's Army Capabilities Integration Center and other government organizations and industry partners, planned and executed the annual Maneuver Fires Integration Experiment (MFIX) April 11-22 at Fort Sill, Okla.

This experimentation helps the force maintain a proactive stance to recognize threat tactics and influence change so the Army doesn't have to react on the enemy's terms. By integrating air defense artillery and field artillery into the Fires warfighting functions, the efforts at Fort Sill lead Army experimentation, enabling the Fires force to understand the complex interactions between Army Fires, joint services and multinational partners.

A 5-kilowatt laser weapon system damages an the unmanned aerial system. (Capt. Jeff Jaramillo/U.S. Army)

MFIX was created to provide a repeatable, credible and validated venue for aggressive live prototype experimentation with current systems repurposed for other means, emerging technologies and concepts related to the Soldier and small units. MFIX also serves as a platform for risk mitigation to assess technology prior to going to Army Warfighting Assessments or Network Integration Evaluation events, and further provides operational DOTMLPF-P focused insights to support the Army's science and technology development efforts.

A challenge currently confronting the Army is the extensive use of unmanned aircraft systems (UAS) by nation states and non-state actors, with low, slow, small UAS garnering particular interest at the tactical edge. Proliferation of these platforms warrants an in-depth analysis of their capabilities and impacts on the battlefield. The potential to conduct reconnaissance, deliver nuclear, biological, chemical or conventional weapons with an UAS creates a significant, multi-faceted threat.

The FCoE serves as the U.S. Army's lead for counter-unmanned aerial system (CUAS) efforts; therefore, MFIX 2016 explored air-ground integration, CUAS, sensor management and precision Fires capabilities in order to inform the DOTMLPF-P process, identify future requirements and address capability gaps. Fires Battle Lab analysts collected data to answer learning demands in support of Army Warfighting Challenges 17, integrate Fires, and 18, deliver Fires. This experiment enables the FCoE to make informed decisions for support to the force in the execution of the CUAS fight at the brigade level and below, as well as facilitate better air-ground integration and precision Fires.

Among the Army's primary CUAS projects, and a first-time participant at MFIX, was the High Energy Laser Mobile Test Truck (HELMTT), an initiative pursued by the Army's Space and Missile Defense Command. The HELMTT is a truck-mounted laser weapon test platform designed to demonstrate the capability to shoot down enemy UAS, rockets, artillery and mortars. As presently configured, the HELMTT system consists of a Heavy Expanded Mobility Tactical Truck (HEMTT) vehicle platform with an enclosure containing the beam control, the 10 kilowatt High Energy Laser (HEL) and HEL subsystems. Future plans for the HELMTT include a 50 or 100 kilowatt HEL integrated into it.

Another CUAS option for smaller maneuver units is the 2-kilowatt Mobile Expeditionary High Energy Laser (MEHEL) mounted on a Stryker chassis. The MEHEL was showcased at MFIX as a proof-of-concept platform that combines the expeditionary and combat-proven capabilities of Stryker with a laser weapon system. It primarily consists of the General Dynamics - Land Systems Stryker Infantry Carrier Vehicle, and the Boeing Compact Laser Weapon System. The lethality of this technology was shown during the experimentation.

Fully integrated into the MFIX network, both laser weapon systems validated the ability to detect, identify and defeat hostile UAS and ground targets during multiple live laser engagements at Fort Sill's Thompson Hill Range Complex. These engagements were the first of their kind for Fort Sill and the Fires community. Also the proponent for electric Fires, the approval of the Electric Fires Range satisfies the ability for Fort Sill to demonstrate high energy lasers, microwave and railgun technologies. The tactics, techniques and procedures (TTPs) displayed a seamless handover between target acquisition systems and the weapon system. Moreover, numerous future efforts are focused on the ability to integrate fully high-power laser systems capable of defeating a wider range of aerial and ground threats with a low cost-per-shot defeat capability.

An other focus area of MFIX 2016 was demonstrating the capability of an electronic attack to defeat a low, slow, small UAS threat with non-kinetic means. The Joint Forcible Entry CUAS Kit is designed to provide a forcible-entry capability to support an electro-optical/infrared visual sensor, the Q-50 Multi Mission Radar (MMR) and the electronic warfare surrogate system. The pocket-sized Forward Entry Device Increment II science and technology version was coupled with the Q-50 MMR to receive slew commands to a potential target and display full motion video for visual identification.

MFIX also exercised a TTP under development by the Joint Fiber Laser Mission Engagement (J-FLaME) Joint Test (JT) to determine employment considerations of laser weapon systems in ground-to-ground, ground-to-air and air-to-ground engagements for all services. Chartered by the Office of the Secretary of Defense, Director of Operational Test and Evaluation and the Joint Test and Evaluation program office, J-FLaME JT was created to develop TTPs for the integration of high-energy lasers in support of joint operations.

Over the past year, the Fires Battle Lab and J-FLaME teams worked collaboratively to draft and refine TTPs for evaluation through multiple systems integration events and the final experiment. Through data analysis, warfighter input from MFIX and other field tests,

A 10-kilowatt laser weapon is mounted on a High-Engery Laser Mobility Tactical Truck. (Courtesy photo/U.S. Army Space and Missile Defense Command)

the J-FLaME team will examine their final TTP before publication to the joint community.

As a stand-alone demonstration, MFIX also introduced the General Atomics 3 mega joule Blitzer Electromagnetic Railgun, a first at Fort Sill. The Electromagnetic Systems Group of General Atomics is working to bring electromagnetic railgun technology to the Department of Defense for multiple missions including integrated air and missile defense, surface fire support and anti-surface warfare. The railgun delivers muzzle velocities up to twice those of conventional guns, resulting in shorter time to target and higher lethality at greater range. Railguns offer deeper magazines and lower cost per engagement compared with missiles of similar range. While at MFIX, the railgun successfully launched multiple projectiles at designated targets in the impact area.

The FCoE continues efforts to provide small units the ability to detect, identify and defeat hostile UAS at the tactical edge. With more than 30 systems and technologies in attendance, MFIX 2016 developed, evaluated and expanded integrated concepts and materiel capabilities to inform how Maneuver and Fires enhance tactical operations at the brigade level and below, retain current advantages over adversaries and accelerate investments on contested future capabilities in support of Force 2025 Maneuvers and beyond.

As a result, several of these technologies will be recommended for integration into the Army Warfighting Assessment, an event aimed at closing the capability gaps and putting innovative new technology into the hands of Soldiers for real-time operations.

Capt. Jeffrey Jaramillo is an Air Defense Artillery officer assigned to the Fires Battle Lab, Capabilities, Development and Integration Directorate, Fort Sill, Okla.

Kurt Pesch, General Dynamics Land Systems, sets up an M2 .50 caliber machine gun as part of a static display at the 2016 Fires Conference May 2 at Fort Sill, Okla. (Monica Wood)

Rage against the machine

A Marine reads coordinates to an aircraft flying overhead to accurately and effectively engage the targets scattered along the hillsides of Marine Corps Base Camp Pendleton, Calif., Jan. 13. 2016. The Marines are joint tactical attack controllers and joint fire observers who are responsible for directing Fires of artillery and aircraft. The Marines are with 1st Air Naval Gunfire Liaison Company, I Marine Expeditionary Force. (Lance Cpl. Timothy Valero/I Marine Expeditionary Force)

Why simulators fall short of live training

By 1st Lt. Jonathan Pucci

Mission command, the basic scheme of giving the "what" and not the "how" of a mission, is supposed to inform how the Marine Corps functions at every level. Readers of this article are probably familiar with mission command, but for clarity's sake let's remind ourselves that a mission command organization functions with superiors giving a desired end state, a specific task to be accomplished and facilitating execution via subordinates.

Subordinates must attack each task with a high degree of personal initiative and an eagerness to accept responsibility. This system makes some stiff demands on organizational culture because of the initiative and leadership required at all levels.

Many of the Marine Corps' techniques, procedures and norms related to decision-making and communication reflect the idea of mission command. The most profound (and basic) example of this is the operations order format: a scalable device for distributing intent and specific tasking statements. The precisely defined tactical terms (from Marine Corps Doctrinal Publication-1 App. C) ideally to be used in an operations order are meant to provide economy of language and clarity of intent rather than to restrict subordinates.

It is to our credit as an organization that mission command is identified so closely with our orders process, but mission command is also strongly reflected in the structure of our Training and Readiness (T&R) manuals. Each manual follows the basic model of specific subordinate tasks servicing a more general end-state (such as "Conduct Offensive Operations," "Conduct Tactical Fire Direction," etc.), and each task is phrased in its most stripped-down, reductive form. The conditions accompanying each task are at the barest lim-

it of necessity. This is true for tasks at least at the platoon-level and above.

The intent behind the bare-bones presentation of T&R tasks is freedom for the commander. With such permissively worded training tasks, the commander may train the unit according to his own best judgment, and not according to restrictive guidelines. Many of us have seen commanders take advantage of the freedom inherent in T&R phrasing in various creative ways, designing their own field evolutions around skeletons of T&R tasks. The challenge for unit leaders is to make all field evolutions yield the maximum in terms of T&R tasks accomplished. Ideally, units will be exposed to complex scenarios calling on multiple skillsets, and commanders will get a cognitive workout from analyzing what skills (and T&R tasks) are appropriate in conjunction with each other and when. Multiple battlefield functions will be executed simultaneously by multiple parties; the essence of integrated training.

This should hopefully put Marine Corps readers in mind of exercises like Integrated Training Exercise (ITX) or Steel Knight. It is not primarily because of their scale, but precisely because of their complexity and integration that these exercises represent the ideal of Marine Corps training. The importance of integrated training strongly implicates fire supporters. Real fire support

Lance Cpl. Mathew Weirick calls for fire support while conducting a security patrol during an Integrated Training Exercise on Marine Corps Air Ground Combat Center Twentynine Palms, Calif., July 19, 2015. (Courtesy photo)

training can only be accomplished at such complex exercises. It is in fact logical to assume that if a howitzer is firing on a military base, a minimum 6000 level training event is taking place. Because it is less than cost-efficient for artillery units to go to the field with anything smaller than an integrated platoon/battery.

Fire support training of any kind is inherently complex -- observers must occupy an observation post and establish communications; shooters must emplace at gun positions and sustain themselves, etc. The more assets available to a fire supporter, the more discernment required to prosecute targets with maximum efficiency and the better the training. However the complexity and cost of even single-shooter evolutions naturally disposes fire supporters to look for less coordination-heavy and time consuming ways to accomplish their T&R tasks. Simulators such as the Deployable Virtual Training Environment and the Supporting Arms Virtual Trainer are an obvious answer.

The benefits of these systems are obvious. Besides their low cost relative to field training, simulators allow the leader running the training to zero in on the minutiae of fire support control techniques and change scenarios at the blink of an eye. There is also something to be said for the attention-grabbing value of what is essentially a video game. There is no more efficient way to obtain quality training in the fundamentals of observation and controlling techniques (though not necessarily "Fire Support" writ large).

The drawbacks of such simulators are, in a word, the intangibles. The physicality of our work environment as observers becomes totally moot. Essential real-world concerns for the forward observer like gear-load out and competence with optics are completely removed from the equation. The most important loss is in the practice of integration. Integration with maneuver may be technically possible to train in computer simulators, but realism obviously suffers, probably to a degree that is prohibitive to good training. Significantly, vocal conversation tends to replace the constant struggle of maintaining radio communications in computer simulator training.

The fact that it is possible to remove all friction and still accomplish the majority of forward observers' T&R tasks in isolation from other units should give us pause. Besides common sense, the existence of exercises like ITX, and the priority that the Marine Corps puts thereon, is solid institutional proof that our preference should always be for maximally integrated training. Computer simulators, if they are seen as the ultimate fire support training tool, offer a way to defy our organizational ideal of integrated training while technically accomplishing many of our T&R tasks.

Obviously this problem would be solved if we, as fire supporters, moderated our use of simulators in training. However the ease of computer simulators, combined with the real (though limited) benefits that simulators offer, makes them downright seductive to task-saturated leadership charged with training observers.

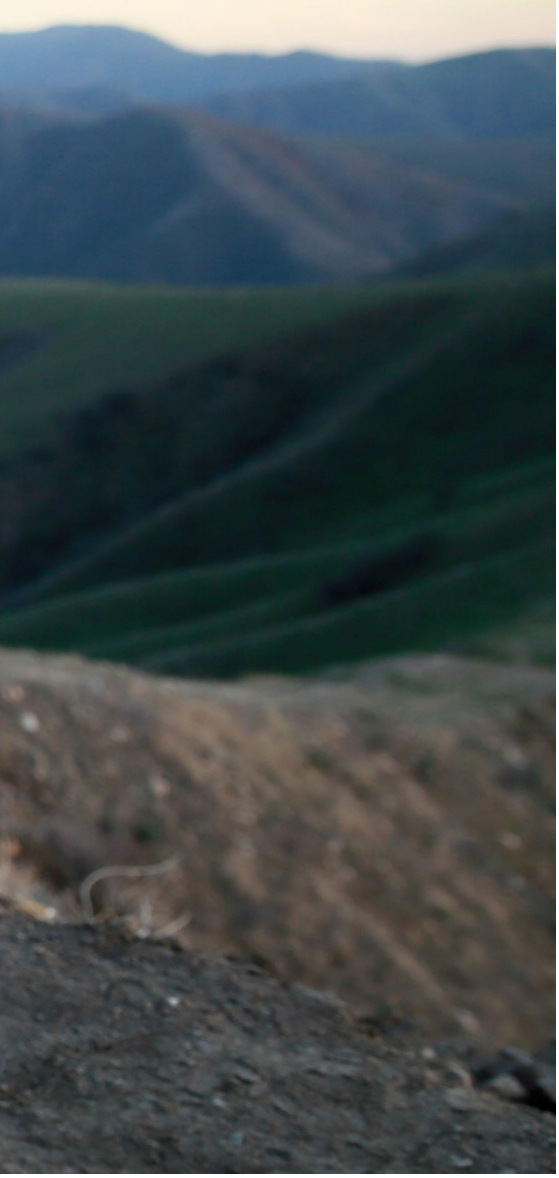
An overreliance on computer simulators for fire support training among 0861s (scout observers) and 0802s (artillery officers) is abetted by a set of assumptions and norms popular in the artillery community. I am articulating these assumptions based on opportunities I have had to watch fire supporters from all three active-duty Marine divi-

A joint fire observer watches the impact of an 81 mm mortar round to forward corrections needed to accurately hit a target during training on the hillsides of Marine Corps Base Camp Pendleton, Calif., Jan. 13, 2016. The JFOs work hand-in-hand with the joint tactical attack controllers to accurately and effectively strike targets with either artillery or aircraft. The Marines are with 1st Air Naval Gunfire Liaison Company, I Marine Expeditionary Force. (Lance Cpl. Timothy Valero/I Marine Expeditionary Force)

sions train, as well as numerous conversations on best practices with leadership from the same units. My claims are therefore anecdotal, but given the relatively small size of the artillery community in the Marine Corps, it is significant that these assumptions even seem dominant in all three active-duty divisions. The assumptions are that 1) Fire support training is ideally a static affair that takes place on "the hill" (a bizarre term whose very existence probably says more about our collective mindset than any article ever could) and 2) Fire support teams lose valuable training time if they chop to a supported maneuver unit too early in the training cycle. This is presumably because fire support training is best accomplished at the liaison shop of an artillery unit.

The first assumption, that fire support training is ideally static, can be refuted by looking to the practice of highly physical "notional" simulations such as those run by the Expeditionary Warfare Training Groups and many fire support leaders in the fleet. Such training calls for an energetic and assertive exercise controller who can be referred to for weapon impacts, effects, scenario paints, etc. Instead of the computer simulation training where all maneuver is notional, such real-world notional simulations can make the actual shooting of indirect-fire rounds the only notional element of the training. Such training can be fully integrated with maneuver units and real-world communications. It provides every "intangible" training benefit except for the freaks of chance that will periodically occur when dealing with a real indirect fire asset.

To the second assumption, that superior training for fire support teams is only available at the artillery units' liaison shop, we may reply that integrated training with supported maneuver units is the only way that observers can actually train as they fight. Liaison shops themselves obviously play an essential role in establishing and enforcing standards in artillery units, but a fire support team is task-organized with enough fire support expertise to be responsible for its own training. Retaining technical competency must be the shared responsibility of the fire support officer and fire support team noncommissioned officer, this duo should be more than capable of maintaining technical proficiency while maximizing



Marines fire their M240 machine gun while covering an advance on an objective at a training event during Integrated Training Exercise 2-15 at the Marine Corps Air Ground Combat Center in Twentynine Palms, Calif, Feb. 1, 2015. (Courtesy photo)

integration with supported maneuver forces, especially if their training plan can strike a balance between integration with maneuver and technical practice via computer simulations. Simply put, the benefits of integrated training with maneuver forces outweigh the losses sustained by leaving a parent artillery unit.

Benchmark T&R events and evaluations like ITX are not going away. The perennially high standard that major exercise control entities like Tactical Training Exercise Control Group have established in Fires at their supported exercises should have a liberating effect on those charged with developing training in the fleet: the gold-standard of Fires training will be available to most units periodically via ITX and similar exercises. The inevitability of large-scale, integrated, Fires-heavy exercises, plus the constant availability of computer simulations are both excellent hedges on the gamble represented by relying on notional simulations. Having little to lose by making notional simulations standard practice among fire supporters, we stand to gain increased flexibility - in order to meet a wealth of essential T&R tasks in a complex, friction-heavy exercise, we potentially need only communications gear and Fires-savvy exercise control.

Making fully notional fire support training a part of our collective training toolbox should start at the schoolhouse. Having established that designing and running such training is a valuable skill for fire support leaders, the follow-on Marine training at the Field Artillery Basic Officer Leadership Course should include practical application in designing and controlling notional training -- ideally to be integrated with the Fort Sill Marine Detachment Joint Forward Observer (JFO) Course. Treating notional exercise control as a skill, and zeroing in on notional factors that make such training worthwhile (time/space analysis, enemy maneuver, etc.) will go a long way towards disabusing junior leaders of the assumption that notional fire support training is somehow illegitimate or a less worthy way to train than computer simulations. Fire support leaders will be further empowered to integrate with supported maneuver units even without indirect fire assets and introduce their Marines to the intangibles of fire support that are impossible to access through computer simulation.

This is a fairly minor reconfiguration to how we approach fire support training, but the potential dividend will be increased freedom for commanders as they mix and match T&R tasks in training events. If fire supporters in the rifle company own the task of exercise control for notional fire support, we can offer the maximum level of integration among the combined arms at the company level for practically any field exercise -- nothing could be more conducive to building integrated Fires as a habit of thought.

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In the next issue of Fires

July-August 2016, Leveraging JIM: Pieces of the puzzle. This issue looks into how the Fires Soldier fights alongside sister services and allied forces to be effective throughout a theater. Soldiers execute joint training with Marines, Navy, and Air Force personnel to simulate battlefield environments and prepare for real-world threats. Stories will also look into how Soldiers work with allied forces to strengthen Joint, Interagency and Multinational relations and learn better ways to defend critical assets from air and missile threats in a hybrid war.

Airborne Artillerymen, from 1st Battalion, 319th Airborne Field Artillery Regiment, 82nd Airborne Division Artillery, sling load a M119A3 light howitzer to a CH-47 Chinook during their first battalion artillery readiness test in more than a decade on Fort Bragg, N.C. Over five days the Paratroopers' skills and resolve were put to the test conducting multiple complex fire missions during the day and night like the emergency fire mission, three-gun-raid, out of traverse mission and a 3-hour schedule of Fires. (Capt. Joe Bush/U.S. Army)

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