Field Artillery

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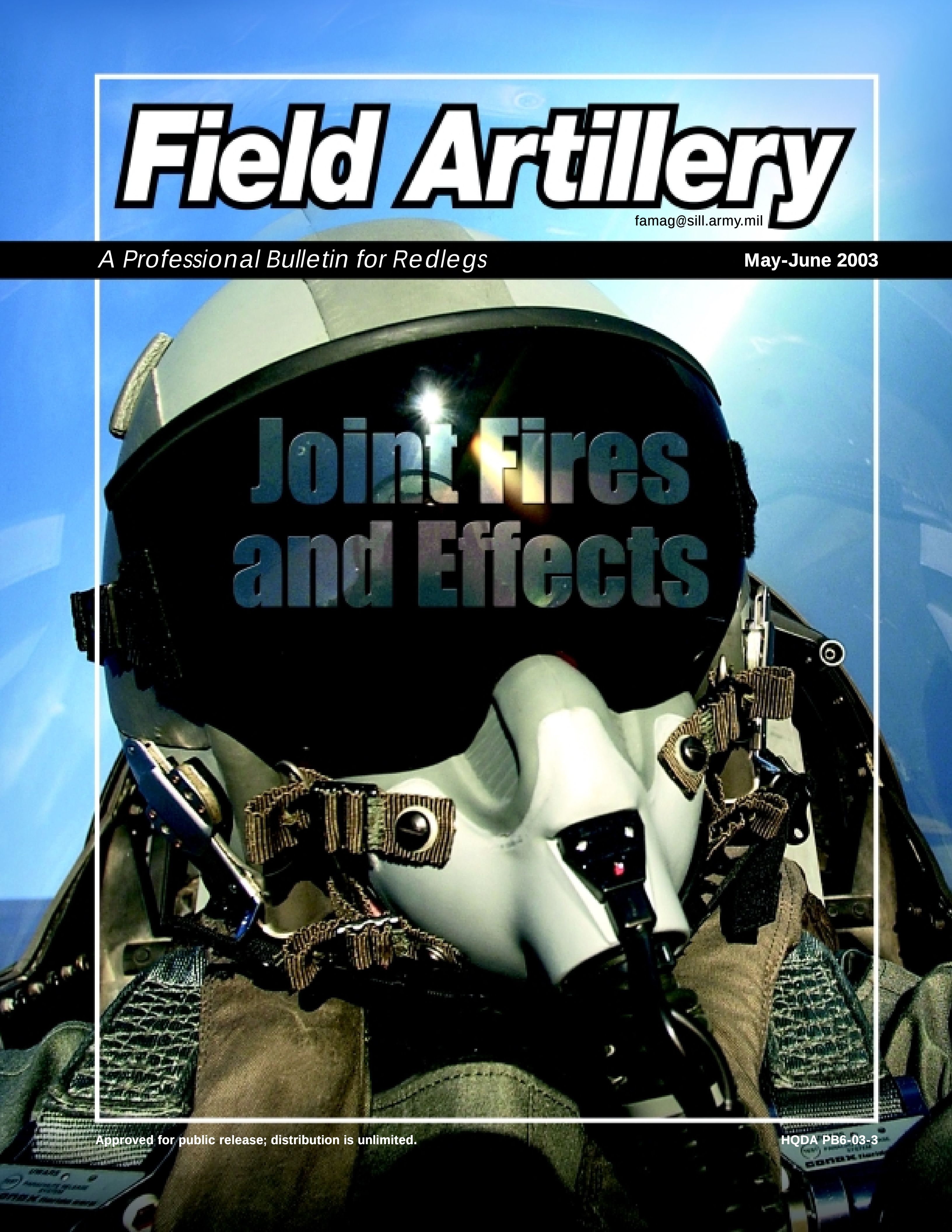
A Professional Bulletin for Redlegs

May-June 2003



Joint Fires and Effects

HQDA PB6-03-3

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ARTICLES: Joint Fires and Effects

ARTICLES: Feature

DEPARTMENTS

PURPOSE: (as stated in the first ***Field Artillery Journal*** in 1911): *To publish a journal for disseminating professional knowledge and furnishing information as to the Field Artillery's progress, development and best use in campaign; to cultivate, with the other arms, a common understanding of the power and limitations of each; to foster a feeling of interdependence among the different arms and of hearty cooperation by all; and to promote understanding between the regular and militia forces by a closer bond; all of which objects are worthy and contribute to the good of our country.*

OFFICIAL DISTRIBUTION: US Army and Marine Corps Active and Reserve Components FA units: seven copies to corps artillery, division artillery, brigade and regimental headquarters; 13 copies to battalions; and seven copies to separate batteries or detachments. In addition, other Department of Defense or government agencies that work with Field Artillery or fire support personnel, issues, material, doctrine, training, organization or equipment may request a limited number of free copies of the magazine. These include, but are not limited to, other coordination and support units, training centers and branch schools, recruiting commands, readiness groups, libraries and education centers, program/project managers, military arsenals and laboratories, state adjutant generals, liaison officers, military academies, ROTCs, major command headquarters, military attaches and public affairs offices.

PAID SUBSCRIPTIONS: Those ineligible for Official Distribution may subscribe through the US Field Artillery Association, P.O. Box 33027, Fort Sill, OK 73503-0027 or usfaa@sirinet.net. Telephone numbers are (580) 355-4677 or FAX (580) 355-8745 (no DSN). Dues are $20 per year to US and APO addresses. The international rate is $55 for a one-year subscription.

SUBMISSIONS: Mail to Editor, ***Field Artillery***, P.O. Box 33311, Fort Sill, OK 73503-0311. Telephone numbers are DSN 639-5121/6806 or commercial (580) 442-5121/6806 or FAX 7773 with DSN or commercial prefixes. Email is famag@sill.army.mil. Material is subject to edit by the ***Field Artillery*** staff.

ADDRESS CHANGES: ***Field Artillery*** (ISSN 0899-2525) (USPS 309-010) is published bimonthly. Periodicals postage is paid by the Department of the Army at Lawton, OK 73501 and an additional mailing post office. POSTMASTER: send address changes to ***Field Artillery***, P.O. Box 33311, Fort Sill, OK 73503-0311.

Redleg Hotline
(Organization, Material, Doctrine and Training)
DSN 639-4020 or (580) 442-4020 (24-Hours)

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Fires in Operation Iraqi Freedom

Field Artillery soldiers, once again, have demonstrated in combat their professionalism, the destructive capabilities of their equipment and the importance of the FA to the combined arms team and joint force. We all should be immensely proud of what Army and Marine Field Artillery units have contributed to achieving victory in Operation Iraqi Freedom.

Field Artillerymen truly have performed magnificently. They have fielded and employed new systems; trained their units into cohesive lethal teams; demonstrated the flexibility of FA organizations; and, while adapting to changing situations, developed the tactics, techniques and procedures (TTP) that resulted in overwhelming firepower and ultimate success on the battlefield.

Combined Arms/Joint Fires. These Artillerymen have demonstrated conclusively that "the FA has not walked away from the close fight" and fires do enable maneuver. Further, Operation Iraqi Freedom has shown that the call-for-fire is something all soldiers should be able to do, cannons produce destructive effects, Artillery fires do protect the force, digital command and control is effective, sensor-fused munitions have a role, FA fires make an enormous difference in urban operations, suppression is essential and special purpose fires, such as obscuration, are significant enablers for maneuver forces.

Once again, our multiple-launch rocket systems (MLRS) combined with our Firefinder radars proved deadly in counterfire. The new high-mobility artillery rocket system (HIMARS) linked directly with Special Operations Forces formed a highly lethal sensor–shooter team, while the new M270A1 launcher improved responsiveness and reliability significantly. Operation Iraqi Freedom further demonstrated that the Army tactical missile system (ATACMS) is a critical operational capability, extended range is a decisive factor in preparing the battlefield and operational fires are essential to set the conditions for maneuver success and to support the joint force commander.

We also have seen that to achieve success in complex military operations, we need extensive training and complementary systems that enable true integration. We must train and develop the force during peacetime to synchronize fires with maneuver, coordinate the suppression of enemy air defenses (SEAD) with rotary- and fixed-wing aviation, and fully integrate joint fires and effects in combat.

Capturing History. Units engaged in Operation Iraqi Freedom have begun capturing the history their great soldiers and subordinate units have made. They also have begun to compile lessons learned from the operation. We will draw from their experiences to improve our doctrine, share TTPs that proved effective and improve shortcomings in our equipment and capabilities.

Many observers have begun to document interpretations of the war and draw conclusions. We will see think-tank papers and journalistic observations; we will see a joint lessons-learned process; and the Army, likewise, is undertaking a formal lessons-learned process, including documenting what soldiers and units accomplished in a written history of the conflict.

Many participants and observers already are commenting on two very significant aspects of Operation Iraqi Freedom: the application of joint capabilities and the importance of combined arms teams. Success was achieved at the lower tactical level because of the competence and bravery of our soldiers and Marines and their leaders. The land force achieved success because it employed the complementary capabilities of the combined arms team. Success at the operational level can be attributed to improvements in the integration of joint capabilities.

Our ability to successfully integrate land-based and joint fires is clearly important today and will become increasingly more important to our armed forces' ability to conduct warfare in the future.

The Chairman of the Joint Chiefs of Staff addressed this point recently when he said, "Joint warfighting is the key to greater things on the battlefield. For the most part, the equipment used to conquer Iraq is equipment we've had for years. The difference is how well integrated all of the capabilities of the services are. All you have to do is look back at the Gulf War. There we were basically in a deconfliction mode between the various capabilities the services bring to the table. Here we're in the mode of integrating them and applying the effects on the battlefield."

Continuing to Improve. We certainly have progressed in fighting joint capabilities, but our processes for creating integrated warfighting concepts and joint capabilities that truly complement one another are still being developed. We must establish the programs and capabilities that will enable us to train individuals, commanders and staffs at the brigade level and above and train our formations to truly integrate fires and effects on the battlefield.

The Joint Forces Command (JFCOM) is now leading training, experimentation and doctrine development for the Armed Services of the United States, and our Training and Doctrine Command (TRADOC) will become the Army's service component to JFCOM for that purpose. Fort Sill, as the TRADOC proponent for fires, must become increasingly involved in the joint process, particularly in the application of firepower.

Field Artillerymen must be experts in the proper integration and application of fires. We must train our soldiers and junior leaders to apply joint fires at the lowest tactical level. Our fires and effects coordinators at the brigade, division and corps levels must be fully capable of coordinating and integrating joint fires. We also must provide officers assigned to joint staffs the skills and tools they need to achieve the seamless integration of joint fires and effects.

We all are incredibly proud of what Field Artillerymen have achieved in Operation Iraqi Freedom as a critical element of the joint and combined arms team. They were *magnificent.*

The joint nature of future warfare demands we learn from what they have done and continue to improve on our ability to fully integrate joint fires and effects.

JCAS in Operation Anaconda-It's Not All Bad News

Colonel Neuenswander, an A-10 pilot (El Cid), *was the Deputy Commander of the 332d Air Expeditionary Group (AEG) at Al Jaber Air Base, Kuwait, from July 2001 to July 2002; the 332d AEG flew fighter sorties in Afghanistan for Operation Enduring Freedom, including Operation Anaconda. In March 2002, he led the A-10 detachment that deployed forward into Afghanistan in support of Operation Anaconda and then redeployed that unit to Bagram Air Base where he became the first AEG Commander in Afghanistan. Colonel Neuenswander flew A-10 sorties as a Forward Air Control (Airborne) (FAC(A)) in support of Operation Anaconda.*

Editor

Since the first articles concerning Operation Anaconda "hit the street" in *Field Artillery* [September-October 2002], virtually every aspect of what went wrong in that operation has been discussed. Very little attention has been given to those things that went right—and many did.

I believe it is important to acknowledge what our soldiers, sailors, airmen and Marines accomplished with respect to close air support (CAS) during and after Operation Anaconda. In that regard, I address some of the points made in the article "JCAS in Afghanistan: Fixing the Tower of Babel" [by Lieutenant Colonel John M. Jansen, et al] published in the March-April edition and what must be done in the future to ensure joint CAS (JCAS) best contributes to the fight.

Tactical Chaos Due to Inadequate Operational Planning. In the article, the authors gave a great description of the fog and friction of war that existed over the battlefield during the first several nights of the operation. The A-10 the Hornet almost collided with on the night of 5 March 2002 was under my command, and I was as unhappy as the Hornet pilot was about the chaos over the battlefield.

Most of the problems the authors discussed were tactical-level execution problems caused by an absence of planning at the operational level. The operational-level command and control mechanism that should have prevented most of this chaos is the theater air control system/Army air-ground system, also known as the TACS/AAGS. This is a joint system made up of Army and Air Force organizations.

For a variety of reasons, only parts of the system were operational when the shooting started on 2 March. There was little capability built into the system to handle high-volume, extremely close air support, and there was rampant confusion about CAS and time-sensitive targeting (TST). The bottom line is that there was a lack of shared information and joint planning before the operation.

Some significant complaints the "Tower of Babel" authors raised were no mission briefings, no idea where friendly forces were, no area of operations check-in briefings and updates, TACPs [tactical air control parties] arguing over who was to get the CAS, not enough contact points (CPs) for holding and deconfliction, and lack of deconfliction of CAS assets in the target area. All these issues could have been solved by planning for and setting up a healthy air support operations center (ASOC) within radio range of the Shah-e-Kot Valley. The ASOC is the US Air Force control element that resides at the senior Army headquarters and is a critical part of the TACS/AAGS system.

Immediately after Anaconda, the Combined Forces Air Component Commander (CFACC) directed a theater-wide CAS emergency conference where we took a hard look at command and control and discussed the very high target approval levels and centralized execution that posed restrictions on flight leaders in the air. These restrictions were manageable when we were engaging targets sporadically in the weeks before Anaconda, but they proved inadequate when we unexpectedly transitioned to two weeks of high-intensity CAS and TST operations. These issues were addressed at the CFACC's CAS conference and forwarded to the Combined Air Operations Center (CAOC) where they eventually made their way into the [air tasking order (ATO)] special instructions (SPINS) for follow-on Operation Enduring Freedom operations.

Talk-Ons and Nine-Line Briefings. I take a different perspective than the "Tower of Babel" authors on their claims that CAS talk-ons are relatively easy and should have been done more often and that the TACPs should not have abbreviated their nine-line CAS briefings. I did a number of talk-ons in Afghanistan and found Afghanistan to be the most challenging place I have ever done CAS, even though I had a God's eye view from my A-10.

The repetitive terrain east of the Shah-e-Kot valley is devoid of roads and significant cultural features. There are several different valleys that run east from the Shah-e-Kot, and only one of them has what could be called a river in it. (During Anaconda, the Army referred to these valleys as "Rat Lines.")

Talk-ons were made even more difficult for the TACPs because many of them were collocated with the units they supported at the bottom of the valley with limited line-of-sight due to terrain. In an effort to get the aircraft overhead so they could ease pilot target acquisition, the TACPs got in the habit of abbreviating the standard CAS nine-line, which is acceptable under *Joint Publication 3-09.3 [Joint Tactics, Techniques and Procedures for Close Air Support]*. Unfortunately, when a TACP abbreviates a nine-line and briefs the first three lines as "N/A," the CAS platform has no initial point (IP), heading or distance to reference. The CAS platform proceeds directly to the target and holds overhead until the terminal controller can talk his eyes or systems on it. If there is more than one terminal controller in the target area, the result is aircraft have to do their best not to hit each other.

I do not blame the controllers for calling the first three lines "N/A" nor can I fault them for not having enough CPs to deconflict the inbound fighters. These points are published in the ATO and are created by the collective TACS/AAGS system—another planning issue. When the terminal controllers did pass the first three lines of the nine-line briefing, the CAS platforms had no IP or CP and, thus, no airspace to hold in that belonged just to that flight. The lack of these holding points caused deconfliction problems as several different terminal controllers called their CAS platforms overhead to attack separate targets.

The initial deconfliction problem should have been the job of the ASOC and the CAOC, not the TACP on the battlefield.

Dedicated Frequencies for Terminal Controllers. My final disagreement with the "Tower of Babel" article was the recommendation that all terminal controllers have their own working frequency for CAS. The Shah-e-Kot valley was roughly nine kilometers long and five kilometers wide. Inside that valley, the US Air Force had 37 TACPs—that's almost one TACP per square kilometer. The article's suggestion that each TACP have its own dedicated control frequency and (or) IP/CP is not realistic.

In one instance, there were six CAS operations simultaneously saving the lives of our troops on the valley floor. Had all six of these flights been on different frequencies, I am certain there would have been a mid-air collision between CAS strikers.

The recommended solution to prevent this possibility is that no CAS platform be allowed in the CAS area without being on a common frequency to deconflict aircraft and munitions.

Anaconda Successes. The "Tower of Babel" article provided an accurate description of the first three nights of the Anaconda operation. It clearly demonstrates how a lack of joint planning with all service component players resulted in substantial command and control problems.

What the article misses, from the CAS perspective, is the positive aspect of how virtually every aircraft in theater came to the aid of our soldiers in the Shah-e-Kot Valley. In addition, by the night of 6 March, the CFACC built an expedient command and control system, solving many of the JCAS problems by the fourth day of the operation.

To avoid Anaconda being written off as a complete failure, it is important to recognize and capture the many positive actions that occurred during that operation.

Anaconda was arguably successful due to the frantic work of many tireless airmen who pulled together a tactical air control system on the fly. Prior to the kickoff of Operation Anaconda, the senior Air Support Operations Group (ASOG) commander realized that Combined Joint Task Force-Mountain did not have an adequate ASOC assigned at the CJTF/HQ. This ASOG commander immediately begged, borrowed and stole every available air liaison officer (ALO) and enlisted terminal air controller (ETAC) in theater and set up a small CAS cell at Bagram that later transitioned to a full-up ASOC. This foresight proved critical as the battle progressed, and despite the fact that a full-up TACS/AAGS system was overlooked by Operation Anaconda planners, the incredible efforts of these ALOs/ETACs provided huge benefits to the CJTF-Mountain commander, CAOC and CAS aircrews.

By 6 March, the FAC(A)s were in constant contact with the ALOs at Bagram and were taking off with current friendly and enemy positions plotted on their maps. At the same time, the CFACC ordered the ASOG commander, working with Air Expeditionary Wing (AEW) commanders at Al Jaber Air Base and Al Udied Air Base, Qatar, to devise a plan to put fighter aircrew members on board the joint surveillance and target attack radar system (JSTARS) aircraft to provide command and control as well as the deconfliction function usually performed by the airborne battlespace command and control center (ABCCC). This innovation was in place by 6 March and proved critical to the eventual success of the operation.

When senior air commanders in theater were called upon to provide high-intensity and high-volume CAS and TST to assist in Operation Anaconda, they "pulled out the stops." On the night of 3 March, the CFACC directed the A-10 unit stationed at Al Jaber to move five jets to a classified forward location. This unit launched the first A-10s 12 hours after notification, and the unit was in place from more than 1,400 miles away with its first operational capability 27 hours after notification.

The A-10s conducted CAS and FAC(A) missions and at times performed the ABCCC and airborne warning and control system (AWACS) missions. These aircraft provided a large portion of the TACS/AAGS architecture and significantly aided in target area deconfliction, target acquisition, command and control, and terminal control of CAS platforms.

In their role as CAS fighters, these A-10s were responsible for the destruction of a significant number of enemy targets. This included the total destruction of a large enemy counterattack on 5 March. At one point during Anaconda, the pilots and maintainers of the 74th Expeditionary Fighter Squadron (EFS) provided 21 continuous hours of FAC(A)/CAS coverage over the target area with only four aircraft.

As soon as the runway at Bagram Air Base was repaired and allowed full-length operations, this A-10 unit moved to Bagram to support CJTF-Mountain and served as the backbone for a new AEG. This group, and later wing, was initially manned and supported by the 332d AEG out of Kuwait. The CFACC took a number of key personnel already in theater "out of hide" to build this unit until these positions could be backfilled from the states.

The feat of moving an A-10 unit 1,400 miles in one ATO day is a testimony to the US Air Force's combat logisticians, Director of Mobility Forces and 332d AEG. Hundreds of professionals in the Mobility Forces truly made this operation possible.

Our airlift and tanker forces reacted to a real-time combat need with little or no notice and did what needed to be done. Whether it was airlifting Apaches from Fort Campbell, Kentucky, in less than 72 hours or flying C-17s into austere locations, these folks showed why they are critical to our success in modern warfare.

Many of the logistical lessons learned as a result of moving the 74 EFS twice in two weeks to two different austere bases are now being taught in the US Air Force's Advanced Maintenance and Munitions Officer's Course at Nellis AFB, Nevada.

The US Marine Corps TF-58 commander also played a significant role in Anaconda. On 3 March when intense fire rendered five of the seven AH-64s combat ineffective, USMC TF-58 received a request for support. The 13th Marine Expeditionary Unit (Special Operations Capable) squadron commander was first notified of a possible deployment early on Sunday, 3 March. He was given the "Execute" order by mid-day and deployed five AH-1W Super Cobras and three CH-53E Super Stallions the next day. Less than 40 hours after receiving the initial warning order, all five Cobras and two of the three CH-53Es had arrived at Bagram Airfield more than 700 nautical miles away.

On 6 March, AH-1 Super Cobras and carrier-based AV-8s flew CAS missions in direct support of Operation Anaconda with no losses—another case of incredible combat logistics linked with operations and one for the record books.

On 4 March, many heroes appeared during the battle on Roberts Ridge following the shoot down of a Special Forces helicopter north of the Shah-e-Kot Valley. Not since Vietnam had Air Force fighters flown repeated, sustained, low-altitude, danger-close CAS attack—inside 100 meters from friendly troops. Two F-15Es and two F-16s provided CAS coverage for more than four hours, ultimately breaking the back of the al Qaeda resistance on the high ground overlooking the helicopter.

US Air Force rescue units flying HH-60 helicopters pulled around-the-clock alert during the battle, rescuing a number of wounded troops at night under the most adverse conditions. Their crews' superb training and equipment made them the aircrews of choice to evacuate many of the wounded, and they performed brilliantly.

On the ground, US Air Force terminal controllers assigned to units of the 10th Mountain and 101st [Air Assault] Divisions got their trials-by-fire as they called in CAS, often while under attack. These terminal air controllers (including a number of USAF combat controllers) performed heroically as did the pararescue men assigned to a number of the teams involved in combat.

On 5 March, members of the 74 EFS (A-10s) in conjunction with the 332d AEG, elements of the 18th ASOG and the CAOC devised a kill-box deconfliction plan to manage the skies over the Shah-e-Kot Valley. The CAOC accepted this plan as written and published it in the daily SPINS for the 6 March ATO. This flexibility enabled the A-10, F-14 and F-16 FAC(A)s to control the airspace with much less fear of confliction problems. By 7 March, the new kill-box plan was fully in effect.

This kill-box plan was critical due to some of the issues mentioned in the "Tower of Babel" article. The initial Anaconda plan did not anticipate the need for high-intensity CAS. Yet, almost immediately after the battle began, pinned down ground units needed CAS and lots of it. Accordingly, the CAOC contacted carrier- and land-based fighters as well as bombers and initiated a maximum effort to both destroy enemy forces and enable our surface forces.

AEGs at Al Jaber, Al Udied and Diego Garcia tripled the number of jets available with less than 24 hours' notice. Carrier-based fighters did the same. The massive number of aircraft available to the CFACC for CAS by 5 March overwhelmed the original airspace deconfliction plan. The new kill-box plan was implemented quickly, proved flexible and worked well.

This summary of JCAS in Operation Anaconda is not close to being all-inclusive of the magnificent air attack efforts conducted. This operation was as close to a maximum effort as many of us will ever see.

When our Army and Air Force brethren were being assaulted on the ground, airmen did everything they could to help them. For these efforts during the two weeks of Anaconda, Air Force members—in the air and on the ground—were awarded two posthumous Air Force Crosses, 12 Silver Stars and 52 Distinguished Flying Crosses. There are hundreds of positive lessons from Anaconda.

On the Air Force side, Task Force Enduring Look took thousands of hours of interviews and is still in the process of providing observations and lessons from Air Force participation in Operation Enduring Freedom.

Joint CAS Training. After leaving the Operation Enduring Freedom in the Afghani Theater, I assumed command of the US Air Force Air Ground Operations School (AGOS) at Nellis AFB. This school was moved to Nellis in 1997 specifically to maximize CAS training between the Air Force and Army, primarily at the National Training Center (NTC) [Fort Irwin, California].

AGOS teaches the Joint Firepower Course (JFC) for the Air Force and Army and runs the CAS portion of the NTC and Joint Readiness Training Center (JRTC) [Fort Polk, Louisiana]. At AGOS we are committed to improving CAS operations and work hand-in-hand with the Army and USMC to design optimal processes and procedures to execute this toughest of all joint missions.

To that end, we are attempting to increase the amount of CAS play and its impact at both the JRTC and NTC, so our young officers do not take the wrong lessons away from these major training events. Recent visits of AGOS members to Forts Leavenworth [Kansas], Campbell, Rucker [Alabama], and Sill [Oklahoma] have been very productive.

Those of us in the air-to-ground business are doing all we can to ensure we train for CAS at every opportunity. With this training, we will build the trust needed to make CAS as effective as possible.

The Joint Firepower Course always has emphasized joint planning as the key to CAS success. Anaconda has reemphasized this point and demonstrated the real-world consequences of not enough joint planning prior to operations anticipating CAS.

The real lesson of Anaconda is about modern joint warfare—we have to ensure the air component is included in the planning of ground operations and vice versa…only then can we achieve the synergy of both.

COL Matthew D. Neuenswander, USAF
Commandant, USAF AGOS
Nellis AFB, NV

Commo Systems Lack the Human Element

The following three letters are responses to the article "Why Can't Joe Get the Lead Out?" by Colonel Gary H. Cheek and the letter-to-the-editor "Artillery—Never Leave Home Without It (And Don't Forget the 'Dumb' Rounds)" by Lieutenant Colonel (Retired) John M. Perkins, Infantry, in the January-February edition.

Editor

Back to the Future

I was involved in the Crusader program from 1991 until its cancellation last year. I watched Louisiana Maneuvers, Army After Next, Army XXI, digitization, etc., come and go. I sat in hours of briefings and watched millions of dollars spent trying to fit this cannon system into each new "paradigm," and I could never understand why nobody "Got it."

I participated in innumerable discussions about the esoterica of precision and accuracy, cannons versus rockets, counterfire, target sets, fractional damage—you name it. And while Crusader always provided incredible battlefield results no matter the scenario, none of us ever got it quite right.

So, I was astounded when I read the letter from LTC Jenkins and the article by COL Cheek. The juxtaposition of those two pieces in one issue was brilliant and provided me a crystal clear vision of why we, collectively, got it all wrong about what is so important about cannon fire support.

COL Cheek was perfect in his description of what is really missing from the heart of cannon artillery direct support [DS]. You can't automate emotion, you can't automate urgency, you can't automate dealing with the incredibly rapid and unpredictable environment of the DS mission (if that is an acceptable term) in close combat. Can you imagine an FO's [forward observer's] having to look down to use his fingers on a keypad while watching a bad guy move in on his position at night, in the rain, with gloves on, etc.?

LTC Perkins hit it dead-on when he described the situations he and his FOs repeatedly found themselves in. He especially got it right when he talked about the kinds of responses he expected and got from his Redlegs who performed the DS mission and talked to FOs and, as necessary, directly to the maneuver soldier.

What he wanted and got, what Audie Murphy wanted and got, what Dragon 6 and Lieutenant Dewitt wanted and got was pretty profound: cannon artillery fires—on time, on target—that always were adjusted because things changed. And each got those fires from somebody he knew.

Everybody can play in the fire support game when things are planned, set and clear—ground-, air- and sea-based fires. But I firmly believe that the dynamics of the close fight have not changed, that only one "Bad Boy" can play when things get close and tough and mean and nasty. That is, or it used to be, cannon artillery responding to an FO who sits in the same foxhole with his infantry brothers.

If the articles I have read over these past several years were any indication, I'd bet we'd be hard pressed to find an active duty infantryman who loves his Cannoneers like LTC Perkins does, and that's, in Perkins' words, "*criminal*" and, it's our fault.

If we can't restore that love by providing the human element to ensure the foot soldier gets the steel he needs, we might as well move Block House Signal Mountain to Huntsville.

LTC(R) David V. Crowell, FA
Minneapolis, MN

Digital Commo Tools Not Fielded

Colonel Gary H. Cheek's article spoke to a subject that pained me during my time as a battalion FDO [fire direction officer] in an active duty battalion charged with direct support [DS] of a light infantry brigade and, more recently, during my time as the battalion FDO for a National Guard general support [GS] unit. That subject is "artillery digital communication systems."

COL Cheek's article was the most courageous and brutally honest critique of any subject I've read in your magazine.

COL Cheek is correct when he states that the human element of fire support has been lost during the implementation of digital systems. And his written words echo the private thoughts of the officers and NCOs charged with making current artillery digital systems work.

Advancement in the name of digital "progress" has done little to improve the overall performance of the Field Artillery. More often than not, these systems only have served to unnecessarily complicate our branch's mission.

The essence of this article is not that digital communications are an inappropriate priority for the Field Artillery. Certainly, digital communications between battalion and battery FDCs [fire direction centers] greatly speeds the processing of fire missions. And safety during missions is greatly improved by digital communications between the battery FDC and individual howitzer sections (so the chief of section can visually verify fire commands)—despite the fact that the gun display unit [GDU] is an unreliable system ripe for replacement by a more modern version.

Digital communications technology has the potential to greatly improve the capabilities of the artillery, but the systems that have been fielded so far do not deliver the connectivity required.

This trend is continuing. The infamous "red gumball" displayed by the AFATDS [advanced FA tactical data system] has stopped far more fire missions in training than any simulated enemy action.

It takes several days of setup for us to establish connectivity between disparate digital systems during a division or corps Warfighter exercise, and the Battle Simulation Center where Warfighter exercises are conducted is a much less primitive environment than the field.

The design of these systems has equally stressed all potential nodes in the fire support network in the names of "flexibility" and "oversight." However, when digital systems are designed, emphasis should be placed on the sensor and shooter. This all-or-none approach incorporated into systems like AFATDS has sacrificed simplicity and reliability.

COL Cheek is dead-on in his assessment. Current digital systems fail to deliver reliable connectivity and are too complex for soldiers to gain proficiency on, particularly our time-constrained Reserve Component artillery units.

What we need is a system that is easy to set up (fewer, more compact and reliable components), simple to operate (the "Burger King" approach), operates on a simple network that prioritizes the sensor and shooter and doesn't require extensive training to troubleshoot.

Computerized artillery systems have revolutionized our pursuit of accurate fires. However, the communications systems our branch uses have failed to make fires any more responsive.

"Going digital" has been stressed down to the officers and NCOs at the battery level. But our junior officers and NCOs cannot meet digital connectivity expectations with the tools they have been given to do the job.

CPT Brett A. Saffell, INARNG
Commander, B/2-150 FA

You're *Darn Tootin'!*

I am a computer operator in F Battery, 7th Field Artillery, 25th Infantry Division [Light] Artillery at Schofield Barracks, Hawaii, and I just finished the article "Why Can't Joe Get the Lead Out?" I have been thinking about this same thing for a long time, but every time I said anything similar, everybody seemed to look at me like I was nuts and just afraid of change. I got the look that said, "Deal with it—you *have* to learn AFATDS."

And, I am actually in favor of automated and digital communications—to a point.

I recently finished a JRTC [Joint Readiness Training Center, Fort Polk, Louisiana] rotation, and there were so many problems with this system, starting at the battalion level, that I often wondered if soldiers on the other end of this training exercise were "dying" because we could not get our act together.

Every mission should be sent as quickly as possible, and I don't think the soldiers being rushed or attacked by an enemy who greatly outnumbers them care about our attack guidance, loss of digital communications or the four or five cells the mission has to go through in order to get to me or my big heavy M198 howitzers that have to shift onto the target. All they want to hear is "Shot" and "Splash."

I can honestly say that other than the live-fire portion of this last rotation, I did not talk to a forward observer. If I did receive a voice mission, it was only from battalion because digital went down again and battalion finally broke down and sent the mission by voice. This mission, of course, was probably too late because battalion had spent so much time trying to send it digitally! Thus, we end up in a vicious cycle.

When the FDC [fire direction center] receives a fire mission digitally, the sense of urgency is the same as for any other mission. We get it out as fast as possible and remind the guns they need to hurry. The computer operator has his finger on the mouse button ready to send, "Shot." The RTO [radio-telephone operator] holds his hand microphone and gets ready to send voice "Shot" because the digital "Shot" only goes through about half the time. The chart operator begins to put the round on his target grid, and finally the HTU [handheld terminal unit] operator opens up his subs field looking for more missions.

As you see, the process is automatic, almost robotic. There is no feeling, understanding or urgency because we don't know the soldier or soldiers on the other end, and we certainly don't know the situation. Receive the mission…process it…*Boom*…wait for correction—that is all there is to it.

But when you hear a soldier on the other end saying, "We need those rounds *now*, Over," then you know that what you are doing is for the good of your fellow soldiers in combat. You know you are shooting at a force trying to kill your brothers, and you feel a certain bond and great sense of relief when you can hear that same voice come on the radio again and adjust the fire.

That is what artillery is all about. We are not about computers, radios and radars. We are about timely, accurate fires.

If I had my way, I would chuck that big white box out the window, hook up the LCU [lightweight computer unit] with the BCS [battery computer system] in it and process the mission. I wouldn't have to worry about AFATDS' "gumballs," attack criteria, lockups (which happen quite often and only at the most inconvenient times) and OPFAC [operational facility] reconfiguration messages.

Give me two charts, a radio and a well-trained FDO [fire direction officer], and I promise accurate, timely fires in support of any unit.

SGT Marshall S. Poland
Computer Operator, F/7 FA
25th IN Division, Schofield Barracks, HI

40th Div Arty Has Woman Commander

In July 2002, Lieutenant Colonel (Promotable) (LTC) Jane M. Anderholt took command of the 40th Infantry Division (Mechanized) Artillery of the California Army National Guard (CAARNG). She likely is the first woman to command a division artillery or even a brigade-level FA unit in the Total Army.

In her previous two assignments, she served as the 40th Div Arty Executive Officer (XO) and Commander of the 40th Rear Operations Center in the CAARNG. Other command and staff positions include serving as XO for the Forward Support Battalion, Assistant Fire Support Coordinator (AFSCOORD), Div Arty S2 and Commander of the Div Arty Headquarters and Headquarters Battery, all in the 40th Division. In Lance missile units while on active duty, LTC Anderholt was the S2 for the 3d Battalion, 79th Field Artillery (3-79 FA) in Germany and a Firing Platoon Leader in 6-33 FA at Fort Sill Oklahoma. She was appointed to the CAARNG in 1990.

LTC Anderholt also served in the Field Artillery School, Fort Sill in the Weapons Department, teaching the Lance Officer's Course and the PreCommand Course. It was during this tour that she received her Force Modernization functional area. She was involved in the Lance conversion to the multiple-launch rocket system (MLRS), among other modernization projects.

She holds an MBA from Oklahoma City University and is a graduate of the Command and General Staff College, Fort Leavenworth, Kansas.

Effects-Based Operations for Joint Warfighters

By Lieutenant Colonel Allen W. Batschelet

Meeting the demands of an ever-changing strategic context requires the US military develop forces capable of achieving what Joint Vision 2020 describes as "Full Spectrum Dominance."[1] Building effective military forces for 2020 demands joint integration—intellectually, operationally, organizationally, doctrinally and technically.[2] For full spectrum dominance, we must use joint integrated effects to maximum advantage in military operations: effects-based operations.

Current discussions of effects-based operations involve various definitions and descriptions of the concept. According to the US Joint Forces Command (JFCOM) J9, effects-based operations is "a process for obtaining a desired strategic outcome or effect on the enemy through the synergistic and cumulative application of the full range of military and non-military capabilities at all levels of conflict." Furthermore, an "effect" is the physical, functional or psychological outcome, event or consequence that results from specific military or non-military actions.[3]

The defining elements in the J9 description include emphasis on effects-based operations as a *process*, beginning with developing knowledge of the adversary (viewed as a complex adaptive system), the environment and US capabilities. Knowledge of the enemy enables the commander to determine the effects he needs to achieve to convince or compel the enemy to change his behavior.

The commander's intent plays a central, critical role in this determination and in explicitly linking tactical actions to operational objectives and desired strategic outcomes. Execution of the plan follows; the task then is to use all applicable and available capabilities, including diplomatic, information, military and economic.

A study done by the Institute for Defense Analyses in Alexandria, Virginia, offers a second interpretation of effects-based operations. (See a representative model in Figure 1.) It begins by arguing that effects-based operations rest on an explicit linking of actions to desired strategic outcomes. It is thus about *producing desired futures*.

Moreover, effects-based thinking must undergird the concept by focusing on

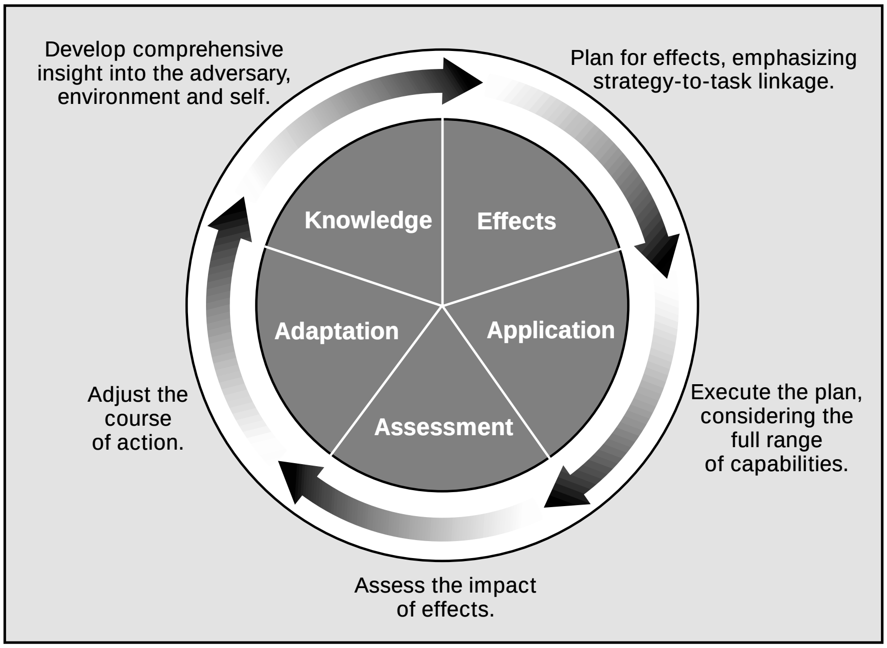
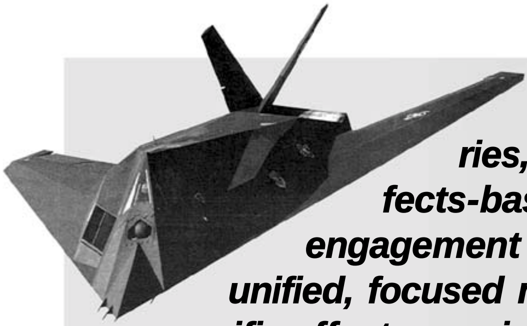


Figure 1: Effects-Based Operations Cycle. (Taken from "Effects-Based Operations: Change in the Nature of Warfare" by Brigadier General David A. Deptula, USAF, Arlington, VA, 2001, Page iii.)



"Given the predominant ideas in these theories, one might produce the following definition: 'Effects-based operations represent the identification and engagement of an enemy's vulnerabilities and strengths in a unified, focused manner and uses all available assets to produce specific effects consistent with the commander's intent.'"

the entire continuum (peace, pre-conflict, conflict and post-conflict) and not just on conflict.[4] Understanding how to think in this manner enables effects-based operations.

This study also emphasizes the need to understand and model an adversary as a complex, adaptive system driven by complex human interactions rather than just collections of physical targets. Therefore, one should be able to focus operations more coherently.[5]

Of note, this study places great importance on communications among decision makers at the strategic, operational and tactical levels and underlines the criticality of the commander's intent for ensuring focused efforts and effects.[6] Finally, this work says those engaging in effects-based operations must continuously adapt plans, rules and assumptions to existing reality—in other words, effects-based thinking and operations help the commander "fight the enemy and not the plan."

Given the predominant ideas in these theories, one might produce the following definition: "Effects-based operations represent the identification and engagement of an enemy's vulnerabilities and strengths in a unified, focused manner and uses all available assets to produce specific effects consistent with the commander's intent." Potentially then, the concept of effects-based operations can serve as a common conceptual denominator or language for executing joint operations in a unified, holistic approach.

Historical and Theoretical Perspective. History provides many examples of theorists arguing for and commanders planning and executing military operations focused on outcomes—in essence, effects-based operations. In fact, one can reach back to antiquity to see that classical theorists advocated the efficacy of combining all elements of power to compel an enemy to do one's will and achieve one's aims. Sun Tzu, the classical Chinese theorist, emphasized the use of force as a last resort: "those skilled in war subdue the enemy's army without battle" and "the best policy in war is to take a state intact."[7]

Carl von Clausewitz, the Prussian theorist, focused on the primacy of military means and the physical destruction of the opponent's forces as the best way to achieve desired ends. However, Clausewitz explicitly recognizes the importance of using all the elements of power, not just military force, to create desired outcomes.

In a discussion of how to disrupt the alliances of an enemy, he argued, "But there is another way. It is possible to increase the likelihood of success without defeating the enemy's forces. I refer to operations that have direct political repercussions, that are designed in the first place to disrupt the opposing alliance or to paralyze it, that gain us new allies, favorably affect the political scene, etc. If such operations are possible it is obvious that they can greatly improve our prospects and that they can form a much shorter route to the goal than the destruction of the opposing armies."[8]

One recent example describes the potential efficacy of effects-based operations. Evidence of effects-based thinking and operations show up clearly in the planning and execution of the Gulf War in 1990-1991, primarily in the use of air power. General H. Norman Schwarzkopf, Commander-in-Chief of US Central Command, developed a four-phased operation to achieve President George Bush's objectives.

A portion of his commander's intent stated: "We will initially attack into the Iraqi homeland using air power to decapitate his leadership, command and control, and eliminate his ability to reinforce Iraqi ground forces in Kuwait and Southern Iraq. We will then gain undisputed air superiority over Kuwait so that we can subsequently and selectively attack Iraqi ground forces with air power in order to reduce his combat power and destroy reinforcing units."[9]

Clearly, the commander's intent reflected a view of the enemy as a system and the effects desired against that system. According to the planners of the strategic air operation, they employed an effects-based approach toward achieving the stated objectives. Apparently, air planners continually thought through how they could best employ force against enemy systems so every tactical strike contributed toward achieving a desired effect on the system.

A good example of this approach comes from the attack of Iraqi air defense sector operations centers. Initially, air planners determined that destruction of the facilities would require eight F-117s to deliver four 2,000-pound bombs against each of the hardened underground facilities. However, planners argued that to achieve the effect desired, the facilities had only to be rendered inoperative. Therefore, complete destruction was not necessary; forcing the operators to abandon the facility and cease operations would achieve the desired effect.

In this case, effects-based thinking and operations produced the most efficient and effective way to employ force, achieve the commander's intent and increase flexibility and responsiveness by freeing up scarce assets for use elsewhere. One can see, therefore, that effects-based thinking and operations are nothing new.

Much of the current discussions on effects-based operations appear to center mostly on discussions of air power. One must ask why it is that many of the leading writers and thinkers regarding effects-based operations seem to be primarily airmen? The answer is found in the Army's familiarity with the concept that was institutionalized in AirLand Battle doctrine and the most current joint operations manual *Joint Publication 3.0, Doctrine for Joint Operations.*

AirLand Battle doctrine evolved from the mid-to-late 1970s to the early 1980s. It culminated in the publication of the Army's *FM 100-5, Operations* in 1982 and in a revised version in 1986. Experiential observations and thinking about modern combat by senior field commanders in the 1970s, including General Donn Starry, moved the process of doctrine development from the central battle to the integrated battlefield to the extended battlefield and finally to AirLand Battle.

General Glenn K. Otis described AirLand Battle doctrine in *Military Review* just before its official publication: "AirLand Battle is now the doctrine of the United States Army. It states that the battle against the second echelon forces is equal in importance to the fight with the forces at the front. Thus, the traditional concern of the ground commander with the close-in fight at the forward line of own troops (FLOT) is now inseparable from the deep attack against the enemy follow-on forces. To be able to fight these simultaneous battles, all of the armed services must work in close cooperation and harmony with each other. If we are to find, to delay, to disrupt and kill the enemy force, we will need the combined efforts of the Air-Army team."[10]

Thus, AirLand Battle contains the key components of effects-based thinking and operations. Further examination of the doctrine reveals a methodology that enables the idea of creating and achieving desired effects: target value analysis.

The target value analysis process is an adjunct to the Army's current military decision-making process (MDMP), a single, established and proven analytical process for solving problems. The purpose of the process is to produce an integrated, coordinated and detailed operational plan. This process was the cornerstone methodology for the practical application of AirLand Battle and remains so, as "the estimate process" found in Joint Publication 3.0.[11]

Joint doctrine describes targeting as the analysis of enemy situations relative to the mission, objectives and capabilities at the commander's disposal to identify and nominate specific vulnerabilities that, if exploited, will accomplish the commander's purpose through delaying, disrupting, disabling or destroying critical enemy forces or resources.[12] In turn, target value analysis offers the commander the means to identify effects criteria, prioritize the engagement of targets and plan for contingencies based on the enemy's likely adaptations when his operation fails; it also enables the estimate of friendly unit capabilities.[13]

As a methodology, target value analysis helps determine assets critical to the enemy commander's likely strategy. Furthermore, it examines and anticipates the enemy's critical nodes and potential decision points and suggests what might happen if the enemy commander's plan fails and what actions make up his failure options. Evaluation of the potential and likely enemy strategies identifies critical enemy functions and determines where and when the commander can selectively apply and maximize his combat power against the enemy to achieve desired effects.

Additionally, the process seeks to identify specific enemy activities or events that confirm or deny potential enemy strategies, thereby enabling the assessment of friendly desired effects and, ultimately as necessary, adapting friendly actions.[14] The *decide, detect, deliver* and *assess* (D^{3}A) targeting methodology serves as familiar shorthand for targeting and target value analysis.[15] (See Figure 2.)

If, as the Institute for Defense Analyses study proposes, effects-based operations identify and engage an enemy's vulnerabilities and strengths in a unified focused manner using all available assets to produce a specific effect consistent with the commander's intent, then this concept should look very familiar. Certainly it is not new to practitioners of AirLand Battle.

Because this is the case, the Army is singularly well-suited to lead the debate on effects-based operations and may have a fleeting opportunity to shape the conceptual foundation for implementation of Joint Vision 2020.

Conceptual Implications. Most of the Army's recent conceptual work on effects-based operations originates from the Training and Doctrine Command's (TRADOC's) Depth and Simultaneous Attack Battle Lab at Fort Sill, Oklahoma. The technological developments and maturation of the idea of effects-based operations spurred Fort Sill to look for ways to increase the effectiveness of fires.

One of the emerging concepts, the fires and effects coordination cell (FECC) focuses more on organizational changes designed to employ fires (lethal and nonlethal) to create effects efficiently and successfully. The first Stryker Brigade Combat Team (SBCT) at Fort Lewis, Washington, is testing this organizational design.

Naturally, the Battle Lab's core competency is thinking about the employment of fires with a complementary professional expertise in targeting and target value analysis processes. And because fire supporters have shaped the nature of the Army's discussion of effects-based operations, the result has been a narrower interpretation of the concept as compared to the current analysis.

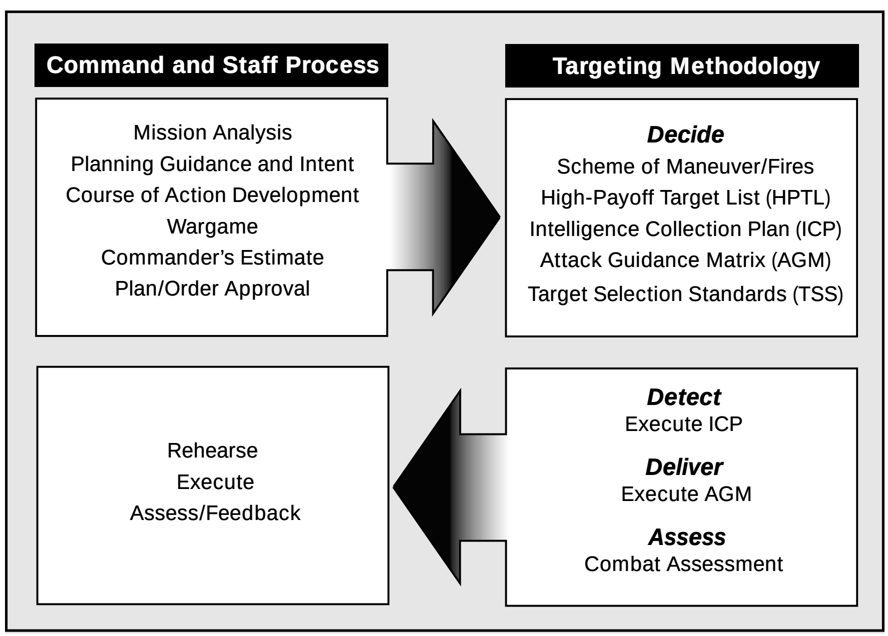


Figure 2: The Command and Staff Process and Targeting Methodology (Target Value Analysis). These Army processes fulfill the requirements for effects-based operations: "Identify and engage the enemy's vulnerabilities and strengths in a unified, focused manner, using all available assets to produce specific effects consistent with the commander's intent."

“More so than current Army doctrine, effects-based operations require commanders and staffs to link tactical actions to operational objectives and desired strategic effects.”

Many in the joint community perceive the Army’s position on effects-based operations as limited to discussions of creating effects solely with fires. Nothing could be further from the truth.

Because the Army adopted effects-based operations and codified the concept in its AirLand Battle doctrine, the idea and current debate appears to many in the Army as the “same candy bar—different wrapper.” There are however, some critical differences between effects-based operations and AirLand Battle’s target value analysis methodologies.

Like AirLand Battle doctrine and the enabling methodology of target value analysis, effects-based operations causes practitioners to think in terms of desired outcomes and the importance of using all available assets. The concept of effects-based operations differs in that it places more emphasis on understanding the enemy and determining the linkages between cause and effect. It also demands a greater capability to assess and adapt to the vagaries and unknowns of warfare.

Thus, effects-based operations, as a concept, is a refining and broadening evolution of Army doctrine. It offers the potential for improving the Army’s ability to achieve desired effects through a more holistic and systematic approach to planning, executing and assessing the results of military actions across the entire spectrum of conflict.

Effects-based operations lend themselves to a broader application—one that encompasses more than just military operations. Such operations incorporate all the applicable elements of national power for a given situation—diplomatic, economic, military and information—and are relevant across the full spectrum of operations.

More so than current Army doctrine, effects-based operations require commanders and staffs to link tactical actions to operational objectives and desired strategic effects. The interrelated focus at every level of command achieves the desired effects commensurate with the commander’s intent.

The strengths of effects-based operations include predicting, controlling and achieving desired effects and understanding that, that goal is not always achievable. Acknowledging this reality leads to the requirement for adaptation in planning and decision-making. The requirement to adapt and seize opportunity relies on a thorough understanding of the commander’s intent and leader’s ability to make decisive and sound decisions that will achieve the desired effect without creating unwanted or unpredicted second- and third-order effects.

However, it is not enough to say US forces will operate in an effects-based way. Commanders and staffs must think in an effects-based fashion if they are to operate successfully. It may no longer suffice to tolerate a subordinate’s cursory understanding of the commander’s intent two levels up. Leaders everywhere along the chain of command must have a clear understanding of national security and campaign objectives and at least a basic understanding of those actions necessary to create effects that cumulatively result in the desired end state.

Moreover, commanders must develop and subordinates understand clear measures of success that explain why the operations will work (planned actions, causal linkages and desired effects). This requirement and a thorough understanding of the commander’s intent provide the two elements that will enable subordinates to exercise initiative and seize fleeting opportunities.

Most would agree that this emphasis on adaptation is a great strength of effects-based operations. But it also exposes a critical vulnerability. The viability of effects-based operations becomes questionable if commanders fail to provide subordinates clear intent or measures of success.

Moreover, commanders must trust and have confidence in their subordinates’ abilities to exercise initiative and operate within the intent. If commanders become overly concerned with the need to control second- and third-order effects, the potential exists for them to “reach into the turret” and personally direct operations, negating the advantages of effects-based operations.

Decisions and actions taken by General Tommy Franks, Commander, US Central Command, during the opening stages of Operation Iraqi Freedom, provides an excellent example of effects-based thinking and operations. During a 22 March press conference, General Franks described actions he initiated to attack, as he described it, an “emerging target.” Information regarding the location of Iraqi President Saddam Hussein had reached President Bush and General Franks on the afternoon/evening of 19 March.

While President Bush considered options, General Franks, demonstrating a clear understanding of the commander’s intent and anticipating potential orders, directed two F-117s into the air, each carrying two 2,000-pound bombs. No better example exists of effects-based thinking and actions.

General Franks’ decision to launch the F-117s anticipated President Bush’s order to strike, but more importantly, his actions envisioned a desired future informed by the President’s stated intent of removing the Iraqi regime from power. Without General Franks’ flexibility of thought and willingness to adapt his plans, President Bush would not have had the opportunity to order the attack, as the target, Saddam Hussein, reportedly would have departed the known location in a matter of hours.

Moreover, Franks’ decision reflected an acknowledgement of and accepted the risk associated with executing a mission not planned for the current air tasking order (ATO). Normal, expected and necessary planning for suppression of air defenses would not be possible. In short, General Franks demanded the immediate adaptation of the current plan with its accepted, attendant risks in an attempt to achieve the commander’s intent in one quick, decisive strike.

At the time of this writing, the outcome remains in doubt. What is not in doubt, however, is General Franks’ effects-based approach to planning and executing operations. His actions reflect his background as a fire supporter, a professional, accomplished in the Army's AirLand Battle and full spectrum dominance operations doctrine. In turn, this anecdote describes a soldier who knows the importance and necessity of seeing the desired future and creating conditions necessary to achieve the commander's intent.

Practical Implications. The differences found in the evolution, refinement and broadening of current doctrine and the conceptual dynamics of effects-based operations will have practical implications for changes in joint cultural, organizations and leader training. Implementing effects-based operations as a concept described in this article will provide challenges, all of which are surmountable.

Cultural Challenges. Implementing effects-based operations in the Army should prove relatively easy. However, leading the transition to effects-based operations in the joint community is likely to be problematic and will require cultural changes within each of the services. Changing the culture will take many years as leaders and staffs become familiar with the concept and effects-based thinking becomes inculcated in service and joint educational programs and institutions.

While I have proposed a definition of the effects-based concept, it is apparent that an agreed upon definition that is incorporated into service and joint doctrine is necessary before the methodology can be of use. Almost as important as agreeing on a definition is the need to establish a common language.

The Army has an extensive but not always well-understood language to define effects. A familiar example involves the use of the terms "disrupt," "delay," "limit" and "destroy" that are so nebulous as to be of little use.[16] These terms have primarily served to describe effects associated with the kinetic attack of a specific target. Moreover, their intended use is to guide those involved in fire support operations.

In this context, effects-based operations take on a narrow definition of the effects of fires in support of maneuver. This limited viewpoint fails to address other areas where effects are important, such as the effects created by maneuver.

On the other hand, the view that associates effects-based operations as achieving effects without fires or maneuver fails to address the concept in the holistic manner in which its value rests. A key step in implementing any effects-based concept, then, would be to get the services and joint community to agree on usage of the relevant terms.

Organizational Challenges. Of most importance is the need to field organizations with a physical makeup that enables commanders and their staffs to cooperate in dynamic and orchestrated ways. Instead of having linked but separate centers for intelligence, operations, logistics and information operations (among others), the Army needs a combined operations center of generalist operators and functional area specialists, including intelligence analysts and technical equipment operators.

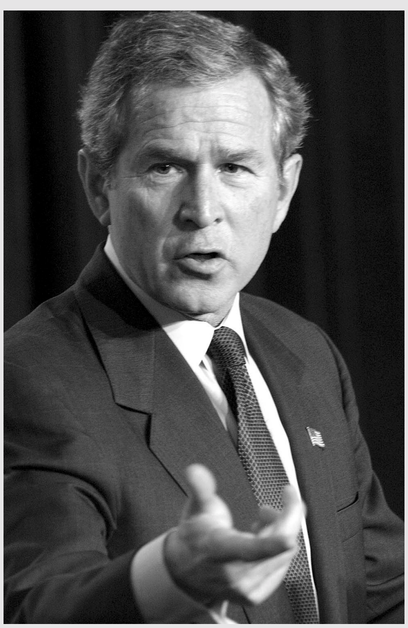
This team of experts who are aware of the desired effects, linkages between objectives and the commander's intent would understand the "why" of changes in policy goals that inevitably occur during operations. More importantly, they could adapt to the new realities, given the shared knowledge and cooperation derived from the proposed organization. In this instance, the Army is well on its way toward the proposed command and control organization.

Having experimented with command and control issues connected to digitization and Force XXI, the Army has moved forward in innovative and varied ways, including conducting tests with effects coordination cells (ECCs) and deep operations coordination cells (DOCCs). Supporting these organizational initiatives are those programs involving the Army battle command system (ABCS), which provides digital communications among strategic, operational and tactical headquarters down to the individual soldier/weapon system level. This point is critical to the successful use of effects-based operations because of the cyclic, nested nature of the concept.

Determining correct organizational design by itself is a necessary condition for enabling effects-based operations and so too is the requirement to develop leaders with the broad background needed to apply the concept.

Leader Training Challenges. For reasons other than developing proficiency in effects-based operations, the Army has initiated a new approach to conducting initial-entry officer training, the basic officer leader course (BOLC) with a pilot at Fort Benning, Georgia. Designed to expose every Army officer to basic warfighting fundamentals, this training could provide an institutional "start point" for developing effects-based operations as a common conceptual denominator, a way of thinking for the Army's future leaders.

The holistic, nested and integrated nature of effects-based operations places a premium on leaders who understand the big picture and the potential impact their decisions could have on achieving desired effects. Coupled with increased



While President Bush considered options, General Franks demonstrated a clear understanding of the commander's intent and anticipated potential orders to strike the emerging target of Saddam Hussein.

Coalition Forces Land Component Command (CFLCC) War Room integrating fires and effects during Operation Iraqi Freedom, March 2003. *(Photo by SFC David K. Dismukes, CFLCC-PAO)*

emphasis on rapid adaptation, leaders of the future will have to think in new ways that are more comprehensive. They must have the confidence to deal with uncertainty, the willingness to bridge gaps with thinking, the desire to take insightful calculated risks and the ability to visualize an abstract battlespace and think in nonlinear dynamic ways, incorporating multiple perspectives. This effects-base thinking is *no* small challenge.

The conceptual thinking skills required by practitioners of effects-based operations will change the way the Army develops and trains leaders. The Army's current approach to leader training focuses too much on *process* to the detriment of *outcome*. Battle drills, situational lane training and rote teaching of the military MDMP all contribute to the development of leaders who are able to apply proven, but limited responses to battlefield realities.

Faced with complex challenges, leaders often resort to executing conditioned, practiced battle drills with little regard to current realities. This technique offers predictability of response, which is an important component for success at the tactical level, but one that is increasingly less useful in operational and strategic level decision-making. Incorporating an effects-based approach to operations calls into question the future utility of the "battle drill," approach even at the tactical level of decision-making.

Effects-based operations demand the Army develop leaders capable of conceptual thinking. Leaders must be able to admit what they do not know, recognize patterns, spend more time in problem identification and determination and, ultimately, be adaptable. Educating leaders with these skills requires a shift in the emphasis in their training away from process to outcome.

Leaders of tomorrow employing effects-based operations must train in environments that center on the student, not the instructor, in situations where complexity is maintained, not removed. Checklists and process will remain important, but the focus must be on outcomes instead of getting the procedures right.

Of course, there is no substitute for leaders having a complete knowledge of the art and science of military operations. Implementation of effects-based operations will expand the requirement for leaders to develop and maintain a minimum competency in areas previously deemed outside the prevue of military leaders.

USS Theodore Roosevelt in the Mediterranean Sea (20 March 2003). To fight simultaneous battles, the armed services must work in close cooperation and harmony. *(Photographer's Mate Airman Todd M. Flint)*

If not expertise, for example, proficiency in domestic and international politics, culture, diplomacy and economics will prove critical to the successful application of effects-based operations. Leaders rightly will focus on being experts in the realm of military art and science, but they also must develop a depth of knowledge in other elements of power.

Developing future leaders with the right specific and general skills to use effects-based operations must begin from the moment they enter the service. The broader education requirements demanded by this concept are achievable if they are instilled in leaders beginning with their initial entry into service.

Implementation Recommendations. The Army has an unparalleled understanding of effects-based operations. Of all the services, it is best suited to "show the way" in the development of the concept as a joint common conceptual denominator. This will require moving forward on two fronts simultaneously: one joint and the other service-specific.

Define Effects-Based Operations and Terminology. First, the joint community and the services must agree on a common definition of effects-based operations. Realizing the potential of the concept requires the Army to expand what is a "fires centric" notion of effects into a more comprehensive definition, such as the one suggested. This should be a relatively simple task, given the Army's desire to focus on creating effects with all means available.

Hampering the debate over effects-based operations is the ambiguity of the language in the many descriptions of the concept, each of which employs unique descriptions and terms of refer-

The Army is uniquely suited to take the lead in the further development of the effects-based operations concept through a collaborative effort involving all services.

ence. Before going forward, the services must reach consensus in defining effects-based terminology. Without a clear understanding provided by jointly codified terms of reference, development of the concept may deteriorate into service-centric views, ultimately negating the unifying potential of effects-based operations. Approved definitions and language will provide the means to expand and begin the institutionalization of effects-based operations.

Establish a Joint Professional Military Education Strategy (JPMES). Effects-based operations places a premium on leaders with specific expertise in military art and science and a working knowledge of the characteristics of the other elements of national power. Necessarily, practitioners of the methodology will use conceptual thinking focused by internalized and well-understood guidance in the form of the commander's intent. Institutionalizing the training and education of leaders must begin at the outset of their careers and continue for the duration.

The same must be true for each service. For the Army, BOLC is the place to start. However, service-specific training and education alone will not suffice.

If the concept is to serve as common to the joint community, it also must be taught as part of a JPME strategy.

Design Effects-Based Organizations. Leaders, educated to employ effects-based operations, must have facilities and communications networks that enable their skills. Here too, each service must design field organizations to take advantage of the inherent potential of the concept.

The Army's FECC is a step in the right direction. While currently narrow in focus, the idea brings together operators, intelligence analysts as well as system technicians to employ lethal and nonlethal fires more efficiently and successfully. Easily expandable, this idea provides a start point for the creation of a more all-inclusive organization designed to orchestrate all effects, not just fires.

The bilateral command and control relationship of battlefield coordination detachments (BCDs) that the Army resources in cooperation with the Air Force could serve as a start point to expand the concept to joint task force organizational design. This proven command and control organization that was designed to synchronize and integrate fires, air power and ground maneuver-effects is expansible. And, given the evident interest shown by the Army and Air Force, effects-based operations could serve as a platform for the joint development of the concept as well as needed experimentation.

As with any new idea, testing and proving the theory through experimentation, practice and limited application is a perquisite to specific service and joint adoption. JFCOM already has begun experiments that include looking at effects-based operations.

Beyond this initiative, separate service experimentation must occur. In the Army's case, many venues and organizations exist that could conduct experiments with effects-based operations. TRADOC should task a specific battle lab with the lead—logically, the Battle Lab at Fort Sill.

Clearly, effects-based operations are not new. The renewed interest in the idea provides an opportunity to expand effects-based operations to the joint community.

The Army is uniquely suited to take the lead in the further development of the effects-based operations concept through a collaborative effort involving all services. Championed by the Army, the concept of effects-based operations may provide the enabling idea needed to achieve the goals of joint intellectual, operational, organizational, doctrinal and technical integration set out in Joint Vision 2020.

Lieutenant Colonel (Promotable) Allen W. Batschelet is an Action Officer in the J3 Operations Directorate, Deputy Directorate for Information Operations on the Joint Staff at the Pentagon. Prior to that, he was a student at the War College at Carlisle Barracks, Pennsylvania, and Commander of the 3d Battalion, 82d Field Artillery, 1st Cavalry Division, Fort Hood, Texas. He also commanded A Battery, 3d Battalion, 82d Field Artillery, 1st Cavalry Division, Fort Hood, Texas, during Operations Desert Shield and Storm in the Persian Gulf and A Battery, 21st Field Artillery following those operations. In 1996, he deployed as the S3 and then Executive Officer of the 1st Battalion, 7th Field Artillery, 1st Infantry Division (Mechanized) out of Germany in support of Operations Joint Endeavor and Joint Guard in Bosnia-Herzegovina. He holds a Master of Military Arts and Science (MMAS) from the Command and General Staff College and an MMAS from the School of Advanced Military Studies, both at Fort Leavenworth, Kansas, and a Master of Strategic Arts from the War College.

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2. Ibid., 2.
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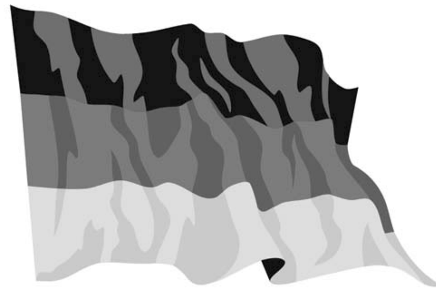
Artillery in the Future German Army Structure

By Colonel Heinrich Fischer, Chief of German Artillery

The German Army is downsizing and restructuring and with it, its artillery. Although the German Artillery is downsizing this year, it also is restructuring in the process—increasing its deployable reaction forces and reorganizing to be more effective against the modern threat across the full spectrum of military operations.

The German Artillery is designing the force to decrease mobilization requirements for medium- to large-scaled contingencies by drawing on reaction forces throughout the artillery. This and the modular concept of force development are allowing the German artillery to tailor force packages to support military operations from stability and support operations (SASO) to very large-scaled conflicts. The artillery's organizational design increases force flexibility and the speed with which the German Army can react to military crises.



This article outlines the mission, organization and equipment plus the operational capabilities of the restructured German Artillery. It should be noted that the German Artillery does not have towed or "light" howitzers—only 155-mm self-propelled howitzers: the PzH 2000 and M109A3G.

Artillery Mission. The German Artillery will continue to perform traditional missions in the future army structure, including conducting surveillance, target acquisition (TA) and reconnaissance (STAR) as well as providing fire support for the combined arms mechanized battle. It also will provide selected assets for SASO, as required.

To accomplish these missions, the German Artillery is using the integrated artillery system. This is an integrated, coordinated artillery system of command and control (C^2), STAR and weapons assets interconnected by a central operational forces' C^2 system. The artillery command, control, communications, computer and intelligence (C^4I) system is Adler. It ensures synergistic effects, contributes to the maneuver commander's battlefield assessment and enhances operational effectiveness.

"With the introduction of the PzH 2000 howitzer, the German Artillery has made a decisive step toward modernizing its cannon artillery."

To accomplish its missions, the German artillery must have wide-ranging capabilities. (See Figure 1.) It must be able to conduct TA and destroy targets in real-time out to 40 kilometers. The artillery must be able to reconnoiter target areas of interest (TAIs) out to a range of 70 kilometers, in particular command posts (CPs), long-range artillery assets, reserves and follow-on forces; then in near real-time, it must be able to engage and attrite the enemy to achieve friendly force superiority in quantity and quality. It also must be able to reconnoiter high-value targets (HVTs), such as C^2 facilities, reserves and logistical installations, out to 150 kilometers and engage them, disrupting the enemy's operations.

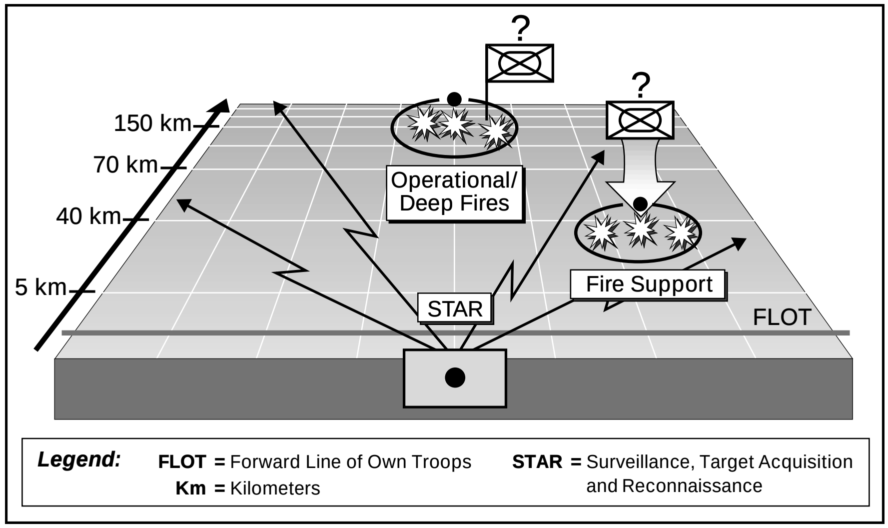


Figure 1: Missions of the Artillery in the Future German Army Structure

Reorganization. In restructuring the German Army, the artillery will be downsized from approximately 18,600 to about 10,700 soldiers. However, the size of the current 3,000-man deployable reaction artillery will rise to 4,400 soldiers. This increase orients the German Field Artillery branch toward modern operational realities.

The restructuring began in the summer of 2002. Seven artillery battalions and one drone battery will be deactivated by the end of this year. The majority of the restructuring efforts will occur in late 2003.

After the restructuring is completed, the German Army will have 17 active artillery battalions. They differ from each only in the number of reaction, augmentation and reserve forces assigned. The reaction forces (*Reaktionskräfte*) respond rapidly to crises; they are operationally deployable and are active duty professional artillerymen. The augmentation forces (*Verstärkungskräfte*) are conscript-heavy.

The reserve forces round out the formations. Each reserve battalion usually only has one active soldier and a few civilians for maintenance, supply and accountability and to support mobilization of the reservists who would fill the battalion's ranks in times of crisis. The reserve battalion uses its sister active battalion's equipment for training.

Artillery Brigade 100. The divisional artillery of the previous structure is concentrated in Artillery Brigade 100 under the command of the German Army Combat Support Arms Command (*Heerestruppenkommando*). (See the Artillery Brigade 100 in Figure 2.)

The Combat Support Arms Command is commanded by a two-star general and, in addition to the Artillery Brigade 100, includes a nuclear, biological and chemical brigade and an air defense brigade plus two logistical brigades. It provides modular slices for deploying German brigades and divisions to supplement their organic combat support/combat service support assets.

Artillery Brigade 100 began activating in July 2002. What Figure 2 does not show is that the brigade also includes nine reserve artillery battalions (two TA, two rocket and five self-propelled artillery battalions) in addition to the six active battalions shown.

Figure 2 shows the new TA battalions. Until now, STAR assets have been in independent batteries in the TA/self-propelled artillery battalions (or the TA/towed artillery battalions, when the German Artillery had towed artillery).

During peacetime, the TA battalion will have a headquarters and supply battery; one TA battery with the Cobra counterbattery radar, sound ranging and a meteorological (Met) section; one or

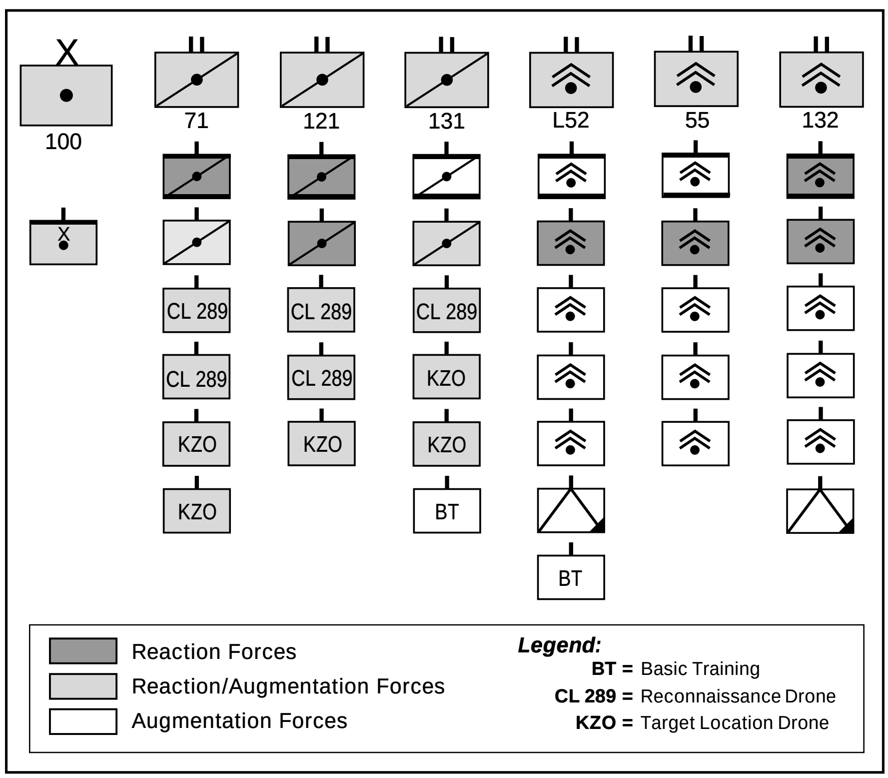


Figure 2: Artillery Brigade 100. In addition to these six battalions, the brigade will have reserve battalions: two target acquisition (TA), two rocket and five self-propelled artillery battalions.

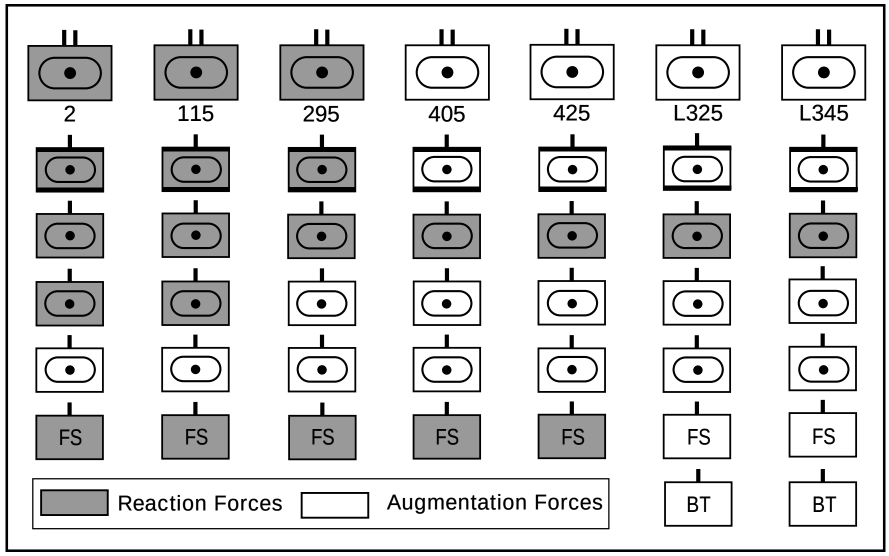


Figure 3: The Self-Propelled PzH 2000 Artillery Battalion. Each battalion has 24 155-mm PzH 2000 howitzers. Included for the first time are fire support (FS) batteries.

two CL 289 reconnaissance drone batteries; and two KZO target location drone batteries.

The primary German Artillery weapon system to lay minefields and provide deep fires is in the rocket battalion: the medium artillery rocket system (MARS), which is the same multiple-launch rocket system (MLRS) used in the US artillery. In addition to the headquarters and supply battery, each rocket battalion will have three augmentation force firing batteries and one reaction force firing battery.

When the reaction force is task organized for a contingency, each rocket battalion will have three reaction force firing batteries for a total of 24 MARS launchers. In the near future, two of the three reaction force rocket battalions will receive one attack drone battery.

The future German Army will have five mechanized divisions. In peacetime, each division will have two or three active mechanized brigades with an organic self-propelled artillery battalion, much as it has today. When deploying, a division will include a division artillery regiment formed from the Artillery Brigade 100 structure to consolidate the division's FA assets and provide command and control over them.

Self-Propelled Artillery Battalions. These eleven active self-propelled artillery battalions generally will be organized the same as they are today. The difference will be in the number of reaction and augmentation batteries assigned. Each battalion will have three firing batteries with a total of 24 M109 or PzH 2000 howitzers. (See Figures 3 and 4.)

A new element in the brigade-level self-propelled artillery battalion will be the fire support battery, which includes the fire support teams, battlefield surveillance radar teams and artillery observer. The goal of this new unit is to improve the training of the brigade's artillery fire support elements and optimize cooperation with maneuver units, both during training exercises and in military operations.

Force Tailoring. With this battery organization, the German Artillery will have force tailoring options. Nearly all the artillery battalions will consist of a mixture of deployable reaction and augmentation forces. Using the modular principle, the German Artillery will be able to provide the force structure required for the different operations without mobilization: small-, medium- and large-scaled operations. Forces only would be required to mobilize for very large-scaled military operations.

For small-scaled military operations, artillery units would not be dedicated to the task force or higher headquarters executing the mission. If required, the artillery will provide elements with specific capabilities for evacuation operations, force protection against terrorist threats or humanitarian assistance operations—perhaps in the form of surveillance and reconnaissance assets.

For medium-scaled operations, artillery formations would be tailored for the mission. (See Figure 5.) Each artillery task force would have the appropriate STAR and weapons systems connected by Adler to form the integrated artillery system. A good example of artillery forces tailored for a medium-scaled operation is the current German Kosovo Force (KFOR).

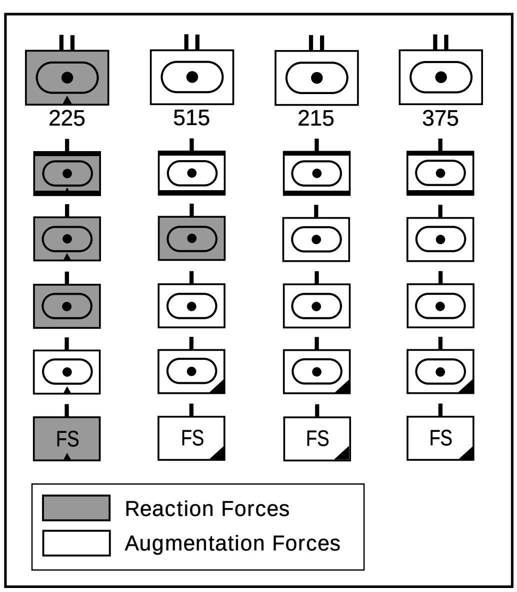


Figure 4: The Self-Propelled M109 Artillery Battalion

For large-scaled operations, an artillery regiment would be formed from reaction forces. (See Figure 6.) The regiment would include one TA battalion, one rocket battalion with 24 MARS and a self-propelled artillery battalion with 24 howitzers from the Artillery Brigade 100 plus the three artillery battalions with 24 self-propelled howitzers in each of the three mechanized brigades. Thus a reinforced mechanized division can be activated in support of a large-scaled operation without mobilization. It would have an integrated artillery system and be well balanced to accomplish the mission.

For a very large-scaled military operation, the mechanized divisions would form after mobilization. In each division, all the reserve TA, rocket and self-propelled artillery battalions of Artillery Brigade 100 as well as the three self-propelled artillery battalions of the three reserve mechanized brigades would be augmented with personnel.

Eventually each mechanized division would have an artillery regiment with a headquarters and headquarters battery, a TA battalion, a rocket battalion and a self-propelled artillery battalion. Each of the divisional mechanized brigades would have its artillery battalion. Thus af-

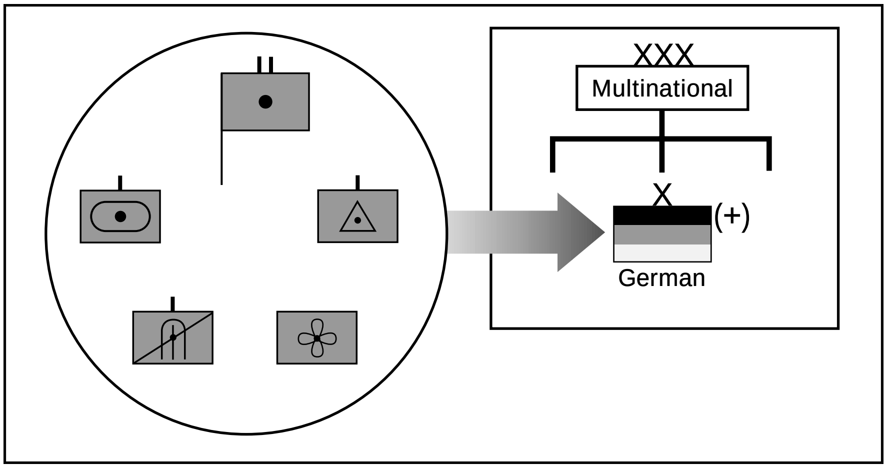


Figure 5: Artillery Force Package for Medium-Scaled Military Operations

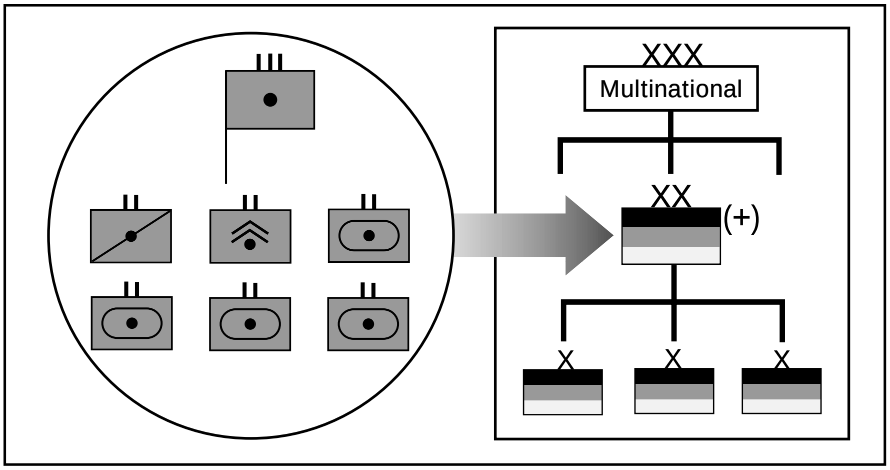


Figure 6: Artillery Force Package for Large-Scaled Operations

ter mobilization, the integrated artillery system would be available in all divisions.

Restructured Force Capabilities. With the enhancement or addition of selected equipment in the artillery system-of-systems, the German Artillery will upgrade its overall capabilities.

Command and Control. The artillery is one of the few German Army branches to have the digital capabilities found in the Adler system. Adler connects C^2 elements, STAR assets and weapons platforms digitally, ensuring the flow of situation and target data, fire missions, fire orders and target effects is reliable and expeditious.

Adler will connect the artillery to the army integrated system, the future German Army command, control and intelligence system. This will ensure a rapid information exchange with the maneuver commanders' headquarters and other branches as well as allied units.

Because future operations will be multinational, interoperability with other nations' C^4 systems is essential. The US, France, United Kingdom, Italy and Germany are in the Artillery Systems Cooperation Activities (ASCA) program to establish and improve the interface between their national artillery C^4 systems. By adjusting Adler developments over the next few years, the German Artillery will be able to interoperate effectively with its partners.

Development of the second Adler will begin in mid-2003. The new Adler upgrade software program will interconnect with the German Army C^2I System.

STAR. The artillery must be able to provide targeting data around the clock and under all weather conditions rapidly enough to engage targets responsively.

Artillery observers with the M113 armored forward observation vehicles closely cooperate with the maneuver units. They receive the calls-for-fire (CFF), forward them to higher level and coordinate the artillery fires in the immediate surroundings of the maneuver forces.

An armored artillery observer vehicle and a lightly armored vehicle will replace the M113s in the near future. This will improve the flexibility and rapid deployment of artillery observers, enhancing artillery support for maneuver.

The Abra battlefield surveillance radar acquires moving targets beyond the range of the artillery observer—out to a range of 38 kilometers. This provides the mechanized commander situational awareness and helps protect the force by preventing surprise attacks. The radar covers open flanks and locates moving targets, both on the ground and in the low-level airspace, day and night, and under all weather conditions.

The Bur ground surveillance radar is being developed with France and will replace Abra, starting in 2008.

As a passive TA system, the German Artillery uses the 064 PC sound-ranging system that can locate artillery and

The Cobra counterbattery radar is a trilateral project: France, the United Kingdom and Germany mortars firing out to a range of 15 kilometers. The system's performance is being enhanced by an automated data analysis capability and its integration into Adler. This year, four systems are being retrofitted; another two will follow at a later date.

The development of the Cobra counterbattery radar is a trilateral project: France, the United Kingdom and Germany. It will be able to locate and classify cannons, mortars and, for the first time, rocket artillery out to a range of 40 kilometers. From mid-2003 until 2006, a total of 12 systems will be fielded.

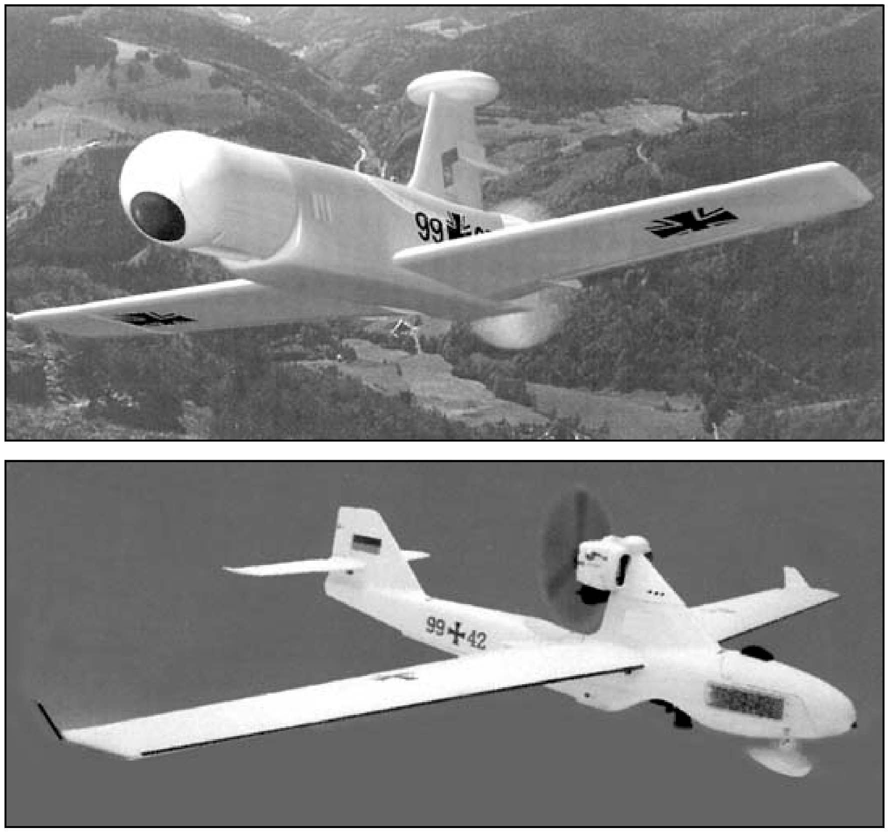
The pre-programmed flight of the CL 289 reconnaissance drone provides precise situational awareness, targeting data and battlefield damage assessment (BDA) out to a range of 170 kilometers. The drone is being upgraded: extending the flight path, which will allow for an increased number of sensor legs as well as the use of radar sensors. These upgrades will be implemented from 2007 to 2011 and will significantly improve the drone's reconnaissance performance.

The new KZO drone for target location will expand German Army TA capabilities. This system will enable situational awareness, targeting and BDA out to a range of 65 kilometers, day and night. The operator will have the option of diverting the pre-programmed flight path of the airborne system to track an acquired target of opportunity until the target is successful engaged. The German Artillery will buy six systems between 2004 and 2007.

Luna, the unmanned airborne close-range reconnaissance system, will be integrated into a platoon of the KZO battery. As an experimental system, the Luna X2000 has been included in the family of reconnaissance assets. After the system is tested and adjusted, it will be used at the brigade level for close-range reconnaissance.

In the initial procurement, the German Army will buy a total of three Luna systems in 2003 and 2004, one of them for the German Special Operations Division. The future German Army structure will require 13 more systems.

The artillery meteorological platoons are integrated into the artillery brigade. They are fully mobile and equipped with the Atmas atmospherical ranging and evaluation system and an upper-wind radar system. They provide the integrated artillery system and other users Met messages.



The KZO drone for target location is shown on top and below is the Luna unmanned airborne close range reconnaissance system.

In order to provide accurate Met data with improved time and space validity and to optimize the Met data's use, a global positioning system (GPS)-based radio sensor system will replace Atmas, starting in 2005. This will give the artillery Met section a passive ranging capability and eliminate the need for an upper-wind radar, which is an active emitter.

Additionally, the German Artillery will introduce a Met model that will be able to extrapolate weather data differing horizontally and vertically in a defined area in the force's area of responsibility (AOR). This model will be able to provide Met data for not only target and reconnaissance areas, but the entire AOR as well.

Current STAR assets can cover only part of the brigade and divisional AORs. Only after new or upgraded systems are fielded will it be possible to meet all the STAR requirements of the German Army artillery. Most urgent is the improvement of the artillery observer equipment. It plays a key role in fire support in cooperation with maneuver units.

Artillery Weapons and Munitions. Even after 35 years of service, the M109A3G howitzer will continue in four active and eight reserve battalions. The M109s underwent a service life extension program (SLEP), upgrading their vehicle power packs and installing an improved shell magazine and additional aids for shell handling inside the howitzer to relieve the crew.

With the introduction of the PzH 2000 howitzer, the German Artillery has made a decisive step toward modernizing its cannon artillery. The German Army already has fielded 185 PzH 2000s. Seven artillery battalions have this new system.

The PzH 2000 has a range of 30 kilometers or out to 38 kilometers using extended-range ammunition. It has fire direction equipment on board and includes a semi-automatic loading process with a 60-round magazine on board. Within 30 seconds of occupation, it can fire three rounds in less than 10 seconds and has a sustained rate-of-fire of 10 rounds per minute.

MARS has ballistic bomblet and mine-emplacement projectiles available. Bomblet rockets can engage soft and semi-hard area targets out to a range of approximately 30 kilometers.

Mine rockets emplace antitank mines with variable-time fuzes that cause the mines to self destruct in three to 96 hours (basically the same as the German

Engineer minelayers emplace and similar to the US family of scatterable mines). Emplacing these mines, the Germany Artillery can interdict approaching enemy armored formations out to 38 kilometers.

There are plans for 84 MARS, as an initial lot, to receive an improved fire control system and azimuth and elevation drives. This will improve MARS' responsiveness, flexibility of operations and logistical supportability.

The German Army has plans for two attack drone batteries to engage hard and semi-hard targets out to 150 kilometers—such as armored vehicles, logistical facilities, helicopters in assembly areas or operational reserves.

Germany, France and Italy are developing the tri-national fiber optical guided missile (TRIFOM). TRIFOM is characterized by pinpoint accuracy, visual target identification with the ability to shift to another target and air transportability. With a range of at least 60 kilometers, it will be suitable for offensive fire in support of medium-scaled conflicts as well as provide intelligence for peace support missions. The experimental program will conclude with a 30-kilometer flight test this year. The fielding date has not yet been decided.

Artillery influences battle mainly through the effects of its munitions. The effects of the entire German Artillery suite of munitions need improving. Starting in 2003, the artillery is buying infrared (IR) smoke shells to blind enemy IR and thermal imaging devices. A new fragmentation shell, the HE Mod 2000, will provide significantly improved fragmentation effects and deeper penetration into infrastructure targets.

An important step is the current procurement of the precision sensor-fuzed munition for the artillery (SMArt). SMArt will be able to destroy semi-hard and hard targets responsively and precisely under all weather and operational conditions. Because SMArt is so effective, it will reduce the logistical burden as compared to conventional munitions. With its ability to attack targets precisely, SMArt also will minimize collateral damage.

In the area of rocket artillery munitions, the guided MLRS rocket (GMLRS) is being developed in cooperation with the US, United Kingdom, France and Italy. Using GMLRS, launchers will be able to engage targets

The medium artillery rocket system (MARS) is the same multiple-launch rocket system (MLRS) used in the US artillery.

to a range of 60 kilometers precisely, requiring fewer rockets. It will have improved accuracy and a modular design, the latter to incorporate upgrades as technology allows. The German Artillery will begin fielding the GMLRS in 2007. (For more information on the GMLRS, see the article "Transformation—Bringing Precision to MLRS Rockets" by Lieutenant Colonel Jeffrey L. Froysland in the March-April edition.)

The German Artillery's current weapons platforms meet minimum range requirements, especially in terms of offensive fires. The M109, for instance, can range only 60 percent of the brigade AOR depth. With the fielding of the PzH 2000, this coverage rises to 80 percent.

With MARS, the divisional AOR only is 50-percent covered. With the upgrade of the MARS launcher, the fielding of GMLRS and the introduction of an attack drone, the German Artillery will be able to provide offensive fires across the entire divisional AOR.

The German Artillery systems achieve enough indirect fire effects against soft and semi-hard targets using the improved high-explosive and bomblet munitions fielded for cannon and rocket artillery. But with the fielding of SMArt, it will be possible to engage semi-hard and hard point targets with minimal collateral damage.

However, these platforms and munitions do not meet all the precision and range requirements for mechanized operations—especially those operations at the lower end of the spectrum of conflict. On the one hand, the artillery must maintain its ability to engage area targets. On the other, it must have the long-range, precision to engage HVTs without causing collateral damage. Both an attack drone and TRIFOM will fill this capability gap.

Conclusion. In its new structure, the German Artillery will have the strength, organization and sustain-ability to support the future German Army in the full spectrum of military operations. By concentrating STAR assets at the battalion level in peacetime, the German Artillery can tailor mission-oriented "recce packages" of efficient systems and qualified teams. Particularly in peacekeeping operations, these essential intelligence and reconnaissance instruments can provide maneuver and national commanders the right information for military decision making.

We in the German Artillery have identified our capability gaps in forward observers, weapons range and standoff, individual target engagement and precision as well as weapon systems for light and medium forces. These gaps will be closed in the medium to long term. Results from experimental projects are emerging and beginning to shape solutions.

But the quality of a branch is not determined only by its organization and equipment. It relies most notably upon well trained, highly motivated and professional leaders and soldiers. We Gunners meet these challenges daily.

With leaders and soldiers, STAR and weapons assets all interconnected via Adler to form the integrated artillery system, the German Artillery today is comparable to any allied artillery and will continue to be so in the future.

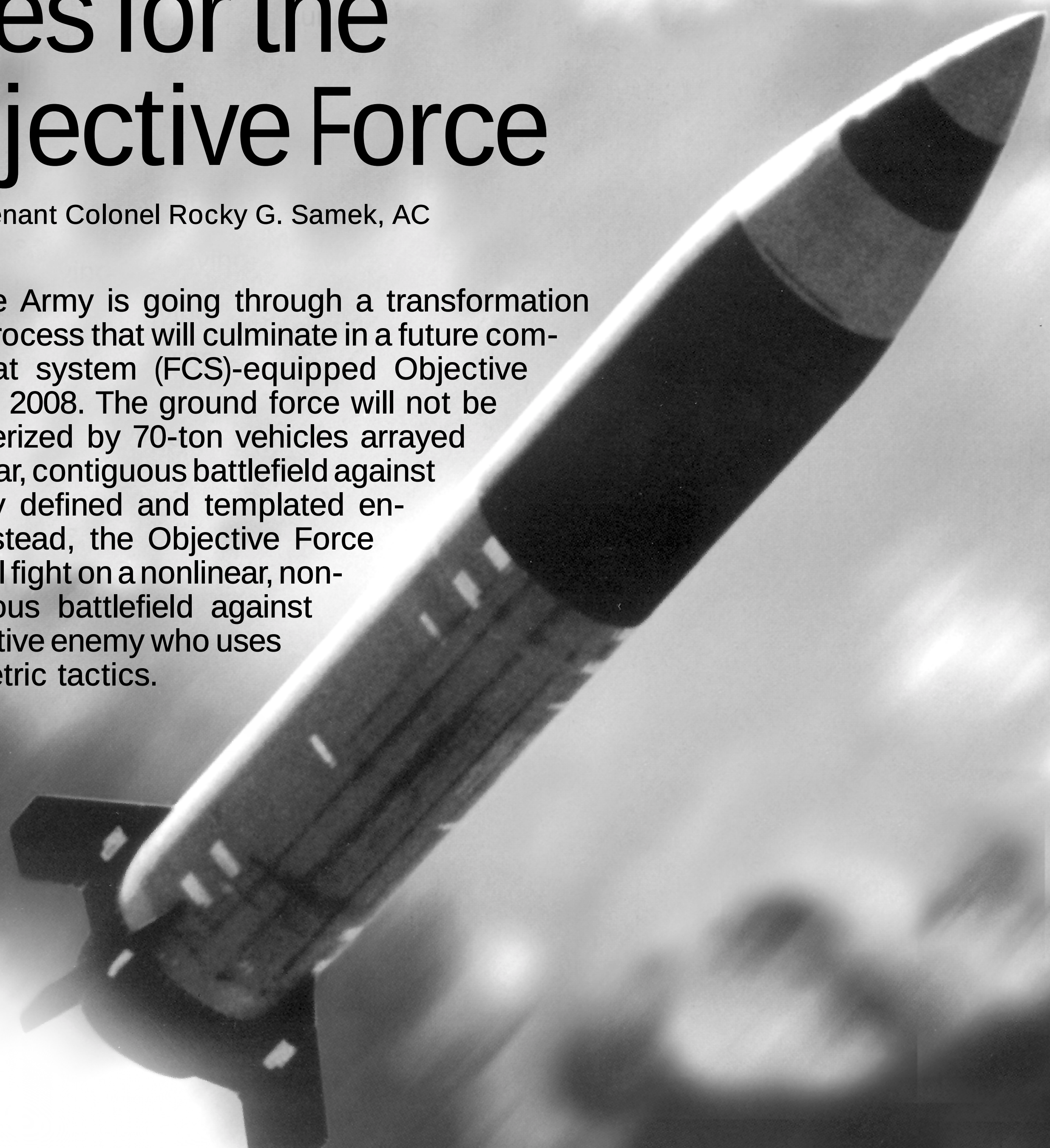
Colonel (Promotable) Heinrich Fischer is the Chief of the German Artillery and Commandant of the German Army Artillery Center and School at Idar Oberstein. Among his other assignments, he was the G3 Operations for the II German-US Bi-National Corps in Ulm; Branch Chief of the Federal Ministry of Defense of the German Army Staff in Bonn; Deputy Commander and Chief of Staff of the German Army Contingent Stabilization Forces (SFOR) in Bosnia-Herzegovina; and Executive Officer to the Assistant Chief of Staff for Resources in the Supreme Headquarters Allied Powers Europe (SHAPE) in Belgium. He commanded Artillery Regiment 7 in Dülmen and Self-Propelled Artillery Battalion 45 at Göttingen. He also is a graduate of the German and Canadian Armed Forces Staff Colleges in Hamburg and Toronto, respectively. Colonel Fischer began his career as a conscript and then attended Reserve Officer Candidate School.

ATACMS

Fires for the Objective Force

By Lieutenant Colonel Rocky G. Samek, AC

The Army is going through a transformation process that will culminate in a future combat system (FCS)-equipped Objective Force in 2008. The ground force will not be characterized by 70-ton vehicles arrayed on a linear, contiguous battlefield against a clearly defined and templated enemy. Instead, the Objective Force often will fight on a nonlinear, noncontiguous battlefield against an adaptive enemy who uses asymmetric tactics.



The tactical and operational levels of war will become blurred as operations become more network-centric and information previously reserved for corps and higher levels will become readily available at much lower levels. The extended area of operations (AO) in which the Objective Force will operate and the increased emphasis on precision munitions will force the employment of Army tactical missile system (ATACMS) munitions at levels lower than in the past.

In the Objective Force, ATACMS no longer will be solely a corps deep (operational) fires asset—it also will be employed at the close combat (tactical) level. Future ATACMS munitions will have increased range and accuracy, maximizing lethality and minimizing collateral damage. This article discusses the evolutionary application and increasing importance of ATACMS fires to the Objective Force.

Combat History. The first ATACMS missile fired in anger was on 18 January 1991 against an SA-2 surface-to-surface missile site located 30 kilometers inside Kuwait. Although Lieutenant Colonel (now Major General) Michael D. Maples' 6th Battalion, 27th Field Artillery that fired the ATACMS was on the road when it received the mission, the battalion took a mere 13 minutes to fire the missile. The Block I missile's payload (950 submunitions) dispensed directly over the target area with catastrophic effects. By the end of Desert Storm, 32 ATACMS Block I missiles had been launched against targets ranging from missile sites to command and control (C^2) nodes.

Combat-proven, ATACMS munitions have been integral assets available to commanders for more than a decade albeit usually reserved as operational fires by the corps commander. Operational fires attack targets whose destruction or neutralization would be significant to the success of a campaign or major operation.

The Objective Force will continue to use ATACMS for deeper targets but also for close combat.

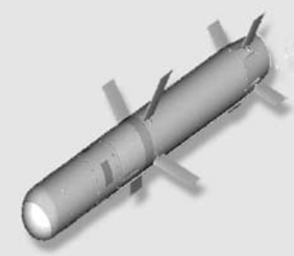
Units of Action (UAs). To accomplish the full-spectrum operations today (offense, defense, stability and support), the Army draws upon nine ground combat formations: Special Forces groups, Ranger regiment, airborne infantry, light infantry, Stryker brigade, mechanized infantry, armor, armored cavalry and air assault formations. In the future, UAs of the FCS-equipped Objective Force will account for the mission sets of all but the Special Forces, airborne and Ranger combat formations.

Focused on engagements, UAs will be highly tailorable, full-spectrum, brigade-sized combined-arms units with organic capabilities that optimize strategic responsiveness and battlespace dominance. Although the UA will have the responsiveness and deployability to achieve a 96-hour deployment goal, it is being designed with the durability, endurance and stamina to fight battles and engagements for the duration of a campaign, focused on decisive points and centers of gravity. UAs normally will fight under the command and control of a UE.

The organic artillery fires for each UA will consist of a non-line-of-sight (NLOS) battalion. The NLOS battalion will provide the UA destructive, protective/suppressive and special purpose fires. The current construct of this battalion consists of NLOS cannons; NLOS launch systems (NLOS-LS) with precision attack munitions (PAMs) and loiter attack munitions (LAMs) (Figure 1); unmanned aerial vehicles (UAVs); and multi-mission radars (MMRs) (see Figure 2 on Page 22).

PAM Properties

- 55 Inches Long
- 7 Inches in Diameter
- Weighs 100 Pounds
- Speed of 270 Meters per Second (m/s) Sprint and 150 m/s Terminal
- Range of 500 Meters to 40 Kilometers*



PAM Characteristics

- Fire and Forget- With a 270-meter diameter footprint, will have an uncooled infrared and semi-active laser (SAL) seeker to locate and engage targets autonomously or engage them cooperatively with external laser anointing.
- Jam-Resistant Digital Targeting- Global position system (GPS) and inertial navigation system (INS) will enable precision attack of stationary and moving targets.
- Flexible Lethality- Will have a shape-charge warhead with frag-wrap for soft and hard targets.
- Not Platform-Dependent- Will be able to be launched vertically from a container/launch unit (C/LU) on the ground or in an unmanned vehicle.

LAM Properties

- 55 Inches Long
- 7 Inches in Diameter
- Weighs 100 Pounds
- Speed of 200 m/s cruising and up to 70 kilometers-plus per minute loitering.*
- Flight Altitude: 200 to 225 Meters Above Ground Level

LAM Characteristics

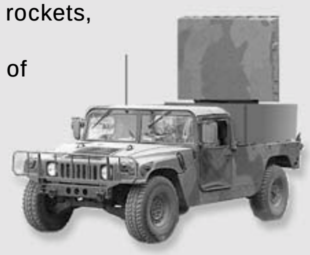
- High-Capability Seeker- Will have a light amplification for detection and range (LADAR) seeker that has automatic target recognition (ATR) to identify/locate targets and provide high/low resolution images (150-/500-meter footprints) for battle damage assessment (BDA).
- Common Jam-Resistant Digital Targeting- Will have GPS/INS for accurate search and target location; data link will provide targeting coordinates and BDA and allow in-flight missile re-tasking.
- Flexible Lethality- Will have a smaller shape-charge warhead with frag-wrap for light armored and soft targets.
- Common Vertical Launch Compatibility- Will have a booster rocket and mini-turbo jet motor to allow launch from the same C/LU as PAM.

*Threshold Capability

Figure 1: Precision Attack Munition (PAM) and Loiter Attack Munition (LAM). PAM and LAM will be fired from the non-line-of-sight launch system (NLOS-LS).

Counterfire Mission: Detect, locate and classify rockets, cannons and mortars.

- Minimum Range of 1 Kilometer and Maximum of 30 Kilometers
- Azimuth of 1600 mils (Fixed)
- Track 100 In-Flight Projectiles, Providing Hostile Impact Prediction
- Location Accuracy of 0.3 Percent of Range



Air Defense Fire Control Mission: Track and identify fixed- and rotary-wing aircraft, unmanned aerial vehicles (UAVs) and cruise missiles, providing precise targeting data.

- Range of 15 Kilometers
- Azimuth of 1600 mils (Fixed)
- Track 50 Targets Simultaneously
- Location Accuracy of Targets within 15 Meters at 10 Kilometers

Air Defense Surveillance Mission: Track and identify fixed- and rotary-wing aircraft, UAVs and cruise missiles, providing long-range, 360-degree surveillance.

- Azimuth of 360 Degrees
- Elevation of 28 Degrees
- Minimum Range of 1 Kilometer and Maximum of 100 Kilometers
- Track Targets at 360 Degrees at an Elevation of - 10 to +55 Degrees
- Tracking Accuracy of 200 Meters

Air Traffic Control Mission:* Track and identify fixed- and rotary-wing aircraft, UAVs and cruise missiles, providing air traffic controllers airspace deconfliction information.

*Has the same azimuth, elevation, etc., specifications as for the Air Defense Surveillance Mission.

Figure 2: Multi-Mission Radar (MMR). The MMR will be part of the NLOS cannon battalion.

The NLOS battalion will have increased capabilities over the traditional direct support (DS) FA battalion. Specifically, PAM and LAM from the NLOS-LS will be able to range armored vehicles at 60 kilometers and light armored vehicles at 100 kilometers.

However, the NLOS battalion will lack the longer-range artillery necessary to support the UA with fires across the full range of target sets. Much like an armor or infantry brigade of today, if a UA requires additional support, it will have to get that support from its higher headquarters: the UE.

Unit of Employment. The UE will be a highly tailorable, higher-level organization that integrates and synchronizes Army, joint and multinational forces for full-spectrum operations at the higher tactical and operational levels of war. UEs will employ multiple UAs to achieve tactical decision.

It is at the UE level where one finds the first system capable of firing ATACMS, the high-mobility artillery rocket system (HIMARS). (See Figure 3.)

HIMARS will provide the UA longer range shaping and counterstrike fires. It will fire ATACMS munitions that will range out to 145 to 300 kilometers with several precision missiles and minimize collateral damage. (See Figure 4.)

Why is ATACMS so important to the Objective Force? The close, deep and rear operational framework of AirLand Battle fighting doctrine may be of limited utility as we look to future contemporary operational environments (COEs). The nonlinear, non-contiguous nature of many operations characterized by increased AOs for the Objective Force will blur the distinction between tactical and operational fires based on range or battlefield construct. The UA most likely will have an AO radius in excess of 75 kilometers with its UE's AO radius likely to be up to 250 kilometers.

In the Objective Force construct that has lightly armored FCS platforms weighing less than 20 tons, combat fires must achieve greater destruction at extended distances to reduce the heavy reliance on maneuver or the direct fire fight to achieve a decisive outcome. The objective of tactical/close combat fires is to destroy or neutralize enemy forces, suppress enemy fires and disrupt enemy movement with the FCS force from a greater distance than ever before. Close combat fires involve lethal and nonlethal effects to be decisive.

It is easily conceivable that the UE will need ATACMS fires to range the enemy, helping to ensure the UA avoids the direct fight, wherever possible. Furthermore, ATACMS will give the UE commander flexibility in the application of fires that are readily available and precise.

Flexibility. To be relevant, fires must move combat power (lethal effects) throughout the battlefield with the weapons platform (launcher) displacing fewer times. Range provides the commander greater flexibility.

In distributed operations, the range of a weapon system cannot be thought of in terms of straight-line perpendicularity to the forward line-of-own troops (FLOT). The Army must be able to shift and apply combat power rapidly anywhere within an AO.

Fires and maneuver are complementary elements. Each can create battlefield conditions that enhance the application of the other. Fires can suppress and destroy enemy forces and restrict the enemy's ability to counter friendly actions, thereby, setting the stage for successful maneuver operations. Units can use maneuver to dislocate enemy units where fires can achieve maximum effectiveness and efficiency.

- Minimum Range of 10 Kilometers and Maximum of 300 Kilometers
- Rate-of-Fire of 1 Rocket or Missile Every 8 Seconds
- Caliber of the Multiple-Launch Rocket System (MLRS) Family of Munitions (MFOM)
- Reload in Less than 8 Minutes
- Fire All Current and Planned MFOM, Including Guided MLRS, ATACMS Block IA and Quick-Reaction Unitary Missile

- Respond from Hide Point to Firing Point to Reloading Point in Less Than 14 Minutes
- Deploy on 1 C-130 Aircraft Sortie, Including Rocket/Missile Pod
- Accuracy is Munition-Dependent

Figure 3: High-Mobility Artillery Rocket System (HIMARS). HIMARS will be part of the unit of employment (UE).

Block I and IA (Current)

- Target Set: Air Defense, Logistical Sites, Command and Control Nodes, Radars and Helicopter Staging Areas
- Block I Characteristics: Inertial Guidance, 25- to 165-Kilometer Range and 950 Anti-Personnel/Anti-Materiel Submunitions
- Block IA Characteristics: GPS-Aided, 70- to 300-Kilometer Range and 300 Anti-Personnel/Anti-Materiel Submunitions

Block II (Limited Fielding Ongoing)

- Target Set: Moving Armored Combat Vehicle Formations
- Characteristics: GPS-Aided, 35- to 145-Kilometer Range and 13 Submunitions

Quick-Reaction Unitary (Limited Fielding Ongoing)

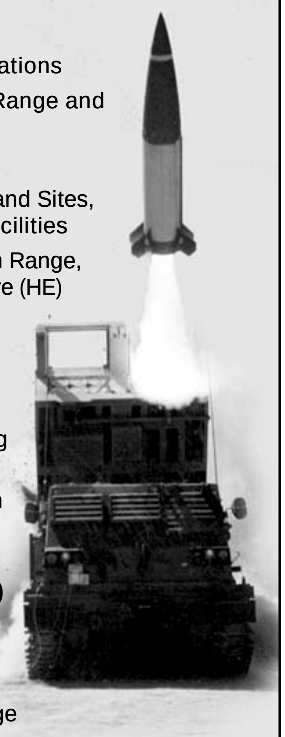
- Target Set: Buildings, Bunkers, Underground Command Sites, and Petroleum, Oil and Lubricant (POL) Storage Facilities
- Characteristics: GPS-Aided, 270-Kilometer Maximum Range, Point-Detonating Fuze and 500-Pound High-Explosive (HE) Warhead

Unitary ATACMS* (Unfunded)

- Target Set: Buildings, Bunkers, Underground Command Sites, POL Storage Facilities, Logistical Sites, Radars, Air Defense Sites, Helicopter Staging Areas, Lightly Armored Vehicle Formations, etc.
- Characteristics: GPS-Aided, 300-Kilometer Maximum Range, Multi-Mode Fuze (Delayed and Point-/Air-Detonating) and a 500-Pound HE Warhead

ATACMS Penetrator (Development Begins in FY04)

- Target Set: Hard and Deeply Buried Targets in Constrained Environments
- Characteristics: GPS-Aided, 500-Pound Warhead with Design Optimized for Reduced Collateral Damage



*Although the specifications are similar to the quick-reaction unitary munition, the unitary ATACMS' multi-mode fuze will increase the span of the target set and effects significantly.

Figure 4: ATACMS Munitions

One without the other lessens the chances of success. Combined, they make destroying larger enemy forces feasible and enhance the protection of friendly forces. ATACMS munitions clearly will have the increased range required to move combat power and, thus, achieve synergistic effects throughout the Objective Force AO.

Availability. Ground-based fires are arguably more readily available than any other type. In bad weather, aircraft are grounded and ships seek deep water to avoid beaching. In fact, during Operation Allied Force (Kosovo 1999), of the 6,766 sorties planned, 3,766 (55 percent) were flown because only 21 of the 78 days had good enough weather. Also, aircraft experience some limitations in darkness.

In addition, faced with strong enemy air capabilities, the Air Force's number one priority is to establish air superiority while the Navy's priority is to protect the fleet. At the same time, the ground force commander likely will be facing that same strong enemy and need availability of fires.

Asymmetric threats in built-up areas will dictate the use of immediately responsive and continuously available fires in all types of terrain and weather against time-sensitive targets without fear of collateral damage. ATACMS missiles will provide those fires in all weather and under all conditions.

Precision Munitions. The imperatives to decrease collateral damage, reduce the logistical footprint and increase per-round effectiveness are all driving the use of precision munitions. During Desert Storm, only seven percent of the munitions available were precision. In Operation Iraqi Freedom, at least at the beginning of the campaign, more than 70 percent of the available munitions have been precision. Of note, in the first five days of ground operations in Iraq, US forces have fired 126 ATACMS.

The employment of munitions in the proximity of friendly forces or non-combatant populations demands increased accuracy—a clear requirement for ATACMS munitions.

ATACMS Close Combat Enablers. Several new capabilities are enabling the use of ATACMS in close combat.

Enhanced Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C^4ISR). Networked command and control systems will give commanders at all levels access to intelligence and targeting information never before imagined (Figure 5 on Page 24). The networked system will be responsive, decentralized and agile and support lethal as well as nonlethal fires and effects. It will give the commander access to the warfighter information tactical network (WIN-T) with near real-time information providing a common operating picture (COP) for situational awareness at all levels and precise, timely targeting. Subscribers will enter and exit a net seamlessly as the need for timely, accurate and effective fires stretches across service, organizational and geographical boundaries.

Access to sensor suites—both organic and external, ground-based and airborne—will allow commanders increased influence at every organizational level. Information from organic, Army, joint, theater and national sensors will give commanders the ability to influence the battle within timelines never before achievable.

Advanced technologies, such as those used to achieve the COP, will allow commanders to leverage intelligence, tactical intuition and experience from multiple levels and attack enemy weaknesses at a time and place of their choosing. The lengthy deep operations coordination cell (DOCC) process of clearing fires associated with ATACMS missiles will be replaced by transparent, rapid networked fires functions. This will enable ATACMS to attack in near real-time—time-of-flight of the missile.

GPS Technologies. The incorporation of global-positioning system (GPS)-aided munitions lends itself to missiles supporting the close fight on the nonlinear battlefield of the future. The onboard guidance package will deliver a munition to well within required accuracies to limit collateral damage. ATACMS munitions will have a number of variants that will afford Army commanders an organic capability to affect the close combat fight.

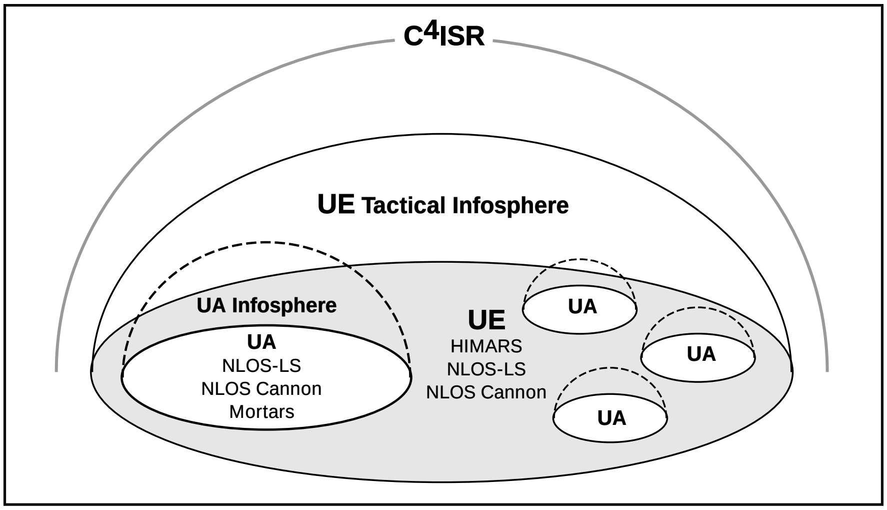


Figure 5: Networked Fires. All relevant sensors and shooters are linked through command, control, communications, computers, intelligence, surveillance and reconnaissance (C^4ISR). The units of action (UAs) and their unit of employment (UE) will receive near real-time information from organic, Army, joint, theater and national sensors, both ground-based and airborne, expanding their capabilities significantly.

Improved Sensors. An enabler to fires accuracy is the suite of sensors available today and the reduced target-location errors (TLEs) they bring to the battlefield. It will no longer be feasible to saturate an area with area munitions when one precision-guided missile will suffice. Future commanders at every level will have access to national, theater and UE-level sensors. Tactical exploitation of national capability (TENCAP), Rivet Joint, joint surveillance and target attack radar system (JSTARS), U2-R, Phoenix battlefield sensor system (PBSS), etc., and organic UAVs ultimately will provide intelligence to all commanders.

The Phoenix is the next-generation radar replacing the Q-37 Firefinder. It will have a range of four to 200 kilometers, an azimuth of 1,600 mils (fixed), hostile impact prediction and location accuracy up to 0.25 percent of its range plus be able to track 50 in-flight projectiles simultaneously.

Sensor "fusion" will combine sensors to address sensor weaknesses in the Objective Force. The result will be a more refined target location and better effects on target. Sensors will be linked directly via the network and enhanced battle command system to shooters or, occasionally, in direct sensor-to-shooter links to further reduce engagement timelines for time-sensitive or fleeting targets.

Fires featuring ATACMS munitions have long shaped the battlefield, and their contributions to increased force effectiveness are undeniable. As it is with current forces, ATACMS will remain a critical combat power munition of the Objective Force, regardless of the organizational and material structure.

Given the capabilities of the developing ATACMS munitions and the UE's 250-kilometer non-contiguous, nonlinear battlespace, ATACMS will be effective when other UA or UE munitions can't range the target or air assets can't respond fast enough or in all weather conditions.

ATACMS also will include increased accuracy for missile fires in close combat. However the Army first will have to break the "mental paradigm" that ATACMS is only for deep (operational) fires. Clearly, the Objective Force will need ATACMS in relatively close proximity to troops in contact.

Lieutenant Colonel Rocky G. Samek, Acquisition Corps (AC), is the Assistant Training and Doctrine Command (TRADOC) System Manager for Rocket and Missile Systems (TSM RAMS), Fort Sill, Oklahoma. He began his AC assignments in 1994, and since then, has served as the Assistant Project Manager (PM) for Program Integration of the 2.75-Inch Rocket at Rock Island, Illinois, and Test Officer at Yuma Proving Ground, Arizona, conducting firing tests on direct and indirect fire weapons ranging from 60-mm mortars to the 203-mm 8-inch howitzer. He was the Commander of B Battery, 2d Battalion, 80th Field Artillery in the FA Training Center (FATC) at Fort Sill and the G3 Mobilization Officer, also in the FATC. He holds a Master of Science in Materiel Acquisition from Florida Institute of Technology and is a graduate of the Command and General Staff College, Fort Leavenworth, Kansas.

Joint Center for Lessons Learned (JCLL)

This is a branch of the Doctrine Division in the Joint Warfighting Center (JWFC) of the Joint Forces Command (JFCOM) in Suffolk, Virginia. Its primary purpose is to collect and analyze joint after-action reports from exercises, operations and experimentation to identify and disseminate positive and negative trends, issues and lessons to improve joint force capabilities through doctrine, organization, training, materiel, leader development, personnel and facilities enablers.

The center produces special reports; maintains a lessons learned database and help desk; hosts the Worldwide Lessons Learned Conference and Configuration Management Boards; supports the Joint Staff Remedial Action program, joint training, real-world operations and joint doctrine development; identifies software requirements; and develops system improvements. It also produces the "Joint Center for Lessons Learned Quarterly Bulletin" that addresses current lessons-learned trends. To view an electronic copy of the bulletin or subscribe, go to the center's home page at http://www.jwfc.jfcom.mil/dodnato/jcll/ and click on "Registered Users."

You can access the joint database on the secure Internet protocol net (SIPRNET) website at www.jcll.jwfc.jfcom.smil.mil. This also is the website for submitting lessons learned to JCLL.

If you have questions, contact the Chief of the JCLL Branch Mike Barker at DSN: 668-7270 or commercial: 757-686-7270 or email him at barker@jwfc.jfcom.mil.

From *A Common Perspective*
JWFC Doctrine Division's Newsletter
Volume 10, No. 1, April 2002

FCS 20-TON CANNON IN 2008

Fact or Fiction?

By Major Charles J. Emerson, Jr., AC

> ***"In peace the cry is for mobility, in war for the weight of shell."***
>
> **Field Marshal Lord Alanbrooke**
> Commandant, British Artillery School
> *Artillery 2000*, Arms and Armour Press, 1990

In the 1920s while reviewing the artillery developments of World War I, Lord Alanbrooke lamented the competing demands of artillery mobility and lethality. He drew upon the artillery lessons from the preceding war and the earlier Boer War: artillery had to be mobile enough to support transient targets and armored forces yet have enough firepower to destroy hardened targets. Britain was unsure of how to proceed with modernizing its forces.

The chance for a new war on the European continent seemed remote amid the debate of how best to achieve artillery support. As a consequence, the modernization of artillery forces was allowed to languish, and the British were found to be ill-prepared at the start of World War II.

Today's Army faces a similar period of modernization. We know the lessons of the past, and we have a vision for the future. The path to the vision is articulated in the Objective Force. The Objective Force White Paper dated 8 December 2002, and the Army's Vision for 2020 are being realized through the future combat system (FCS) program.

We cannot allow ourselves to be similarly complacent as the British were before World War II. Only by wavering in our commitment can we prevent success.

Originally described as a compilation of capabilities that were fulfilled through an array of systems, the FCS program has coalesced into a family of manned and unmanned vehicles joined through a comprehensive command, control, communications, computers, intelligence, surveillance and reconnaissance (C^4ISR) network. With common mobility and survivability characteristics, the manned FCS variants will be 50 to 70 percent lighter than comparable systems in our inventory today yet exceed the collective capabilities of today's warfighting systems and require a significantly smaller logistical tail.

The FCS cannon, one of the 20-ton class FCS family of vehicles, will provide responsive fires in support of combined arms battalions (CABs) and their subordinate units as part of the Objective Force. The FCS cannon used to be called the non-line-of-sight (NLOS) FCS. The first FCS cannon unit to be equipped is scheduled for 2008.

Is the FCS cannon a "Crusader replacement"? It is incorrect to assume that the FCS cannon is being developed solely as a response to the termination of Crusader. Indirect fires are a basic capability of the Objective Force, and thus, a platform that delivers them is integral to any plans for the development of the FCS family of systems.

However, Crusader's termination did create a unique opportunity to initiate the development of the FCS cannon. With the funds freed up from Crusader's termination, the Department of Defense ordered the Army to accelerate the development of several artillery modernization programs already in existence. Additionally, the Army was ordered to initiate an Objective Force indirect fire concept technology demonstration (CTD) and transfer relevant Crusader technology to the demonstration and other transformational programs. It is this CTD and transfer of Crusader technology that makes fielding the FCS cannon possible by 2008.

The CTD began 7 August 2002 and has two main objectives: Develop a materiel solution for the FCS cannon and develop technologies and common materiel solutions for use by the FCS cannon and the entire family of FCS manned ground vehicles.

The ambitiously low-weight goal of the FCS family of systems brings up a question essential to the development of the Objective Force indirect fire capability. Can a modern automated artillery piece (FCS cannon) be created under 20-tons? And what use can the technologies matured under Crusader (itself a 40-ton platform) provide a system that must be under 20-tons to achieve the deployability standard of the Objective Force?

The weight of a combat vehicle is in large measure determined by the mission it is designed to perform. Other factors, such as crew size, volume under armor and means of protection also play a role. In short, the FCS cannon is a very different vehicle than Crusader and represents the capability of the latest technologies combined with a ruthless examination of FCS cannon requirements, requirements that reflect how the FCS cannon will fight. (See the figure on Page 26.)

How will the FCS cannon fight? The FCS cannon will allow options to fight in fundamentally different ways than today's artillery systems. Networked fires enable these options. Rather than a centralized pathway for fires requests with many decision points, the operations of the FCS cannon will be characterized by multiple direct links from individual sensors to FCS cannons or pairs of FCS cannons. These decentralized communications pathways will greatly increase responsiveness to calls-for-fires.

FCS cannons will operate in close proximity to maneuver forces rather than in their own platoon and battery position areas. Because FCS cannons will have common mobility with the other FCS variants (50 kilometers per hour cross-country), they will execute mobility battle drills normally the province of maneuver forces. This will increase the FCS cannons' survivability and allow them to support the CABs better.

Because the FCS cannons will be able to resupply/rearm at a much greater speed, resupply will occur during battle lulls rather than as part of a longer tactical move. Additionally resupply will be in the vicinity of the cannon rather than in a resupply area to the rear.

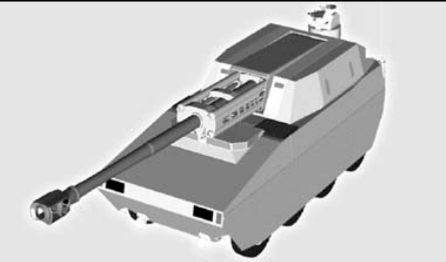
In the Objective Force fires will support maneuver, but the converse is also true: maneuver will support fires. The seamless transitions of shifting support from one to the other during operations will put unrelenting pressure on the enemy. The goal will be to create multiple dilemmas for the enemy commander.

A typical combat day for the FCS cannon would call for a mix of its capabilities: a large burst of fire missions interspersed with rapid resupply in position immediately followed by a long tactical maneuver. Cannon crewman will be much more battle-focused than today's artillerymen.

What Crusader technologies are relevant? Not all technologies slated to be used for a 40-ton platform apply to the development of a 20-ton cannon on a FCS chassis common to a family of vehicles. But many do.

Ammunition Handling System. This system was at the heart of Crusader's ability to provide responsive fires. Consisting of storage magazines, robotic transfer equipment and the software control routines to use them, the ammunition handling system is required if the FCS cannon is to achieve rates-of-fire similar to Crusader. Reliable and comparatively lightweight for its capabilities, the ammunition handling system will be incorporated into the FCS cannon with some minimum changes due to differences in platform layout and resupply methods.

In conjunction with a weight optimized cannon tube, this system will allow the FCS cannon to achieve a rate-of-fire of six to ten rounds per minute that is equal to or better than the best systems in the world today and will be able to maintain that rate-of-fire for the duration of the engagement. The effect of this integration of automated ammunition handling and cannon technologies means that fires will be impacting exactly where needed "on-demand" throughout the battle.



Maximum Range: 30 to 40 kilometers
Minimum Range: 3 to 4 kilometers
Rate-of-Fire: 6 to 10 Rounds per Minute
Caliber: Undefined
Resupply: Complete in 5 to 12 Minutes
Payload: 24 to 48 Rounds
Munitions: All Current and Developmental Munitions of its Caliber
Responsiveness: Emplaced within 15 to 20 Seconds and Moving 20 to 30 Seconds
Cross-Country Speed: Greater than 50 Miles Per Hour
Deployability: C-130 Aircraft

Deployable on C-130 with FCS cannon, crew, equipment, three-quarters of a tank of fuel and a fighting load of ammunition and be capable of self defense upon arrival. The FCS cannon will have a basic armor package, but the optional armor package is not included in this requirement.

Future Combat System (FCS) Cannon Requirements

Projectile Tracking System (PTS). PTS is a method for dramatically improving the accuracy of munitions fired from the cannon. Consisting of a narrow beam radar and detector, it tracks projectiles and compares "should hit" to "did hit" target location before the round completes its trajectory. With this information, the cannon continually adjusts the firing solution to achieve an optimum aim point in every firing mission. This adjustment occurs round to round and dramatically improves the efficacy of the cannon's fires.

When combined with improved sensors for targeting and modern munitions, PTS will ensure precision effects even at the extreme edge of the cannon's range. PTS is a mature technology that does not add significantly to the weight of the cannon.

Resupply. One of the major concerns of any artillery piece is the amount of time it takes to resupply. Throughout the world, all artillery pieces are resupplied by hand in a time-consuming, manpower-intensive exercise.

In the US, a Paladin crew loads its howitzer at the rate of a round per minute, making a standard resupply last the bulk of an hour. This "man-in-the-loop" aspect of resupply vastly increases the time it takes to resupply when the conditions are less than ideal: at night, while wearing mission-oriented protective posture (MOPP) gear or in extreme cold weather gear or wet/icy conditions.

Crusader would have used a dedicated resupply vehicle that quickly and automatically rearmed the howitzer through an armored boom. Feeding the vehicle one round at a time, the crew would have remained safe under armor yet could have disengaged the resupply operation in seconds if threatened.

Because of the extensive ammunition handling and storage requirements unique to the vehicle being rearmed, this method of resupply would not be feasible for the FCS cannon or other variants in the FCS family of systems. Instead, the FCS cannon will feature a resupply mechanism using preloaded magazines to quickly bring a cannon with depleted stocks back to its full load.

This ammunition magazine is envisioned to be common across the family of FCS vehicles. Line-of-sight (LOS), beyond-line-of-sight (BLOS) and mortars will use the same magazines with ammunition specific to each vehicle.

The FCS cannon will be able to completely rearm in less than 12 minutes. Additionally, it will do this through automation with fewer soldiers who are protected inside their respective systems. Resupply of fuel and water will be similarly automated, potentially in conjunction with rearming ammunition. These resupply systems will be similar to those used across the FCS family of systems, drastically reducing the load on the logistical chain.

The FCS cannon will not have a unique resupply vehicle dedicated to its support. The FCS program is coordinating with Training and Doctrine Command (TRADOC) proponents and industry to create the requirements for a future tactical truck system (FTTS) that will be a resupply vehicle common throughout the FCS-equipped force.

Crew Cockpit. Crusader spent much of its effort on optimizing the interfaces and operating areas of the crew. This resulted in a cockpit for the crew that facilitated the tactical employment of the howitzer in sustained operations. The abilities of the cockpit are largely independent of the type of ground combat vehicle it is located in; so this technology is ripe for transfer across the FCS variants.

The FCS cannon will be enabled by advances in the application of fires. Integrated into the battlefield command system (BCS) software, networked fires will exploit technological advances and combine them with new concepts in controlling fires. This will enable the force to link a target with a shooter in real-time, dynamically adjust fires allocations, and assess and reassess target status and damage while reducing the chances of fratricide or collateral damage. The results of networked fires will be the best pairing of effects and targets at the right time in support of the commander.

Survivability. The force that Crusader was originally envisioned to support is substantially different than the Objective Force. In order to pace Abrams tanks and Bradley fighting vehicles, Crusader used similar armored packages to achieve a comparable level of protection.

The light and deployable FCS systems preclude the kind of "brute force" armor approach that Crusader incorporated. Nevertheless, several of the advanced materials and capabilities integrated into the Crusader late in the program to achieve a 40-ton deployability weight are likely to be included in FCS. These advanced capabilities will play a big part in the FCS family of vehicles' achieving C-130 deployability and remaining survivable.

Additionally, the layout of the FCS cannon will be significantly smaller than Crusader. This reduces the internal volume and the requirement for heavy protective armor. These and other technological advances are at the core of achieving a platform weight of under 20 tons.

Despite the lesser weight, incorporating the latest survivability advances makes the FCS cannon more survivable than the 40-ton Crusader. Giving up weight does not mean giving up protection.

Other Technologies. Several other technologies matured under the Crusader program will migrate into FCS. These include the laser ignition system for the propellant, embedded training, drive-by-wire technologies and a real-time common operating system for the manned ground vehicle system.

Because Crusader was the first major ground vehicle that featured all-electric drive assemblies (as opposed to using hydraulics like other ground vehicles), FCS will benefit from power generation and control systems that were optimized for Crusader.

Manufacturing large titanium assemblies is an extremely difficult process, but that capability was matured under the Crusader program. FCS is expected to use several titanium assemblies and will benefit from this maturity.

Crusader's band track, a one-piece reinforced rubber track, has great potential for use in the FCS family of vehicles. Potentially, it will make vehicles lighter than comparative wheeled systems.

Additionally, several of the development systems and procedures (practices, software tools, simulations, virtual environments) that were in place for the Crusader program are being used in the development of FCS.

The impact of these Crusader technologies on the development of the FCS cannon cannot be overstated. Because the design team has all the tools at hand, they can develop the FCS cannon on the shortened timeline.

What characteristics will FCS cannon have in common with the FCS family of systems? In many ways, the operation of the FCS cannon will resemble the operations of all other FCS manned ground vehicles. Common features across the FCS family of systems will include access to the BCS; planning, training and communications software; maintenance parts and procedures; water generation; common resupply implementation; and other capabilities.

Using a common chassis, the FCS cannon will have the advanced mobility and survivability of the FCS. The chassis will boast a suspension capable of smoothly traversing rough terrain at speeds of greater than 50 kilometers per hour. For the first time in recent history, the cannon will enjoy the same mobility as the supported force.

The common chassis will feature reduced fuel consumption. Through a combination of engine and hybrid electric advancements, the FCS will be able to travel hundreds of kilometers on its on-board fuel capacity.

The commonality of the manned ground vehicles combined with the automation of the resupply functions for ammunition and fuel will enable the FCS to have a significantly smaller supply tail.

What will the FCS cannon's caliber be? Currently, there are a number of analyses and experiments being conducted in support of the Objective Force development. The initial analyses for the CTD demonstrated that both 105-mm and 155-mm caliber systems are feasible designs for the FCS cannon. Additionally, the mobility system could be tracked or wheeled. The CTD will culminate in a firing demonstrator, and the Field Artillery Center, Fort Sill, Oklahoma, has recommended the demonstrator be a 155-mm band-tracked vehicle.

This does not mean that, that is the final decision on caliber or chassis design. The final decision rests on analyses due to be completed later this year and on the best overall technical approach to achieve the FCS.

The 20-ton FCS cannon will provide the Army a strategically deployable, tactically mobile, networked, responsive, precision strike NLOS weapons platform to deal with the uncertainties of future battlefields. Given the requirements of the system and the maturity of technologies at hand, it is a *fact* that the FCS cannon can be fielded in 2008.

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PFED, LWTFDS and GDU-R:
You Want Tactical Handhelds? We've Got Tactical Handhelds!

By Paul C. Manz, Jeffrey L. Weiss and Captain John A. Landmesser, ARNG

The revolution of information technology continues at a rapid pace, and the needs and expectations of the commercial consumer have grown in kind. The same demands logically have carried over to warfighters and, correspondingly, have generated greater technological and program challenges for the materiel development community.

Within this context, the effects systems acquisition professionals under the Project Manager for Intelligence and Effects (PM IE), Fort Monmouth, New Jersey, have been working on a fast-track family of new tactical handheld digital devices that will improve the capabilities of our light and early entry troops dramatically and lay the foundation for the next generation of weapon systems. Several of these palm-sized devices are for forward observation and ballistic calculations.

In spring 2000, the PM identified a replacement for the aging handheld terminal unit (HTU) that no longer would be available or supported under the Army's Common Hardware/Software II contract. During the past several years, the Army had fielded the HTU to meet the lightweight forward-entry device (LFED) requirement. Although this newer replacement called the ruggedized handheld computer (RHC) could meet many customer requirements, its form, weight, power consumption and unit cost made it only marginally desirable for dismounted warriors.

The Effects Systems Office at Fort Monmouth decided to take advantage of fast-paced commercial market de-

A Forward Observer using his Rangefinder Binoculars and Tactical Handheld PFED

Photo by Jeffrey L. Weiss, PM IE

velopments to find solutions for dismounted users. The PM garnered multi-service support and engaged the faculty of the US Military Academy (USMA) at West Point, New York, to conduct a 45-day non-parochial market survey. USMA reviewed the latest commercial-off-the-shelf handheld personal digital assistants in 2000 based on common and mission-essential tactical requirements.

Fire Support Handhelds. While the hardware systems examined during the survey were not mature enough to meet all requirements, the PM initiated software coding for both a handheld dismounted forward observation system and a replacement for the backup computer system (BUCS) used in technical fire control ballistics. A year and a half after coding started, these beta version software packages were ready for developmental testing. During the same time, the commercial handheld market had gone through almost three technology refresh cycles resulting in hardware capable of running the beta version software.

Since an initial software demonstration in February 2002, the PM has worked with hardware and software vendors to produce a materiel solution that has exceeded customer expectations with an initial unit cost that suggests a "throwaway" logistical support strategy. The hardware platform, which contains one of the latest unmodified commercial Windows CE-based 400 MHz motherboards, is the baseline for the PM's three ruggedized handheld products: the pocket-sized FED (PFED), the lightweight technical fire direction system (LWTFDS) and the gun display unit-replacement (GDU-R). The Army and Marine Corps have memorandums of agreement to co-manage the accelerated acquisition of these devices.

PFED. The AN/PSG-10 PFED is the closest of the three tactical handheld devices to materiel release, beginning in the Fourth Quarter of FY03. The PFED is joint-capable and uses hardware independent C++ software code with an intuitive graphical user interface.

It measures 5.75 inches x 3.5 inches x 1.5 inches and weighs 1.2 to 2.9 pounds, depending on the battery configuration. The weight of the PFED is a significant improvement over the weight of AN/PSG-9 LFED and the AN/PSG-7 FED, which weigh 8.3 and 11.4 pounds, respectively.

The PFED supports the sensor link protocol (SLP) and interfaces with current laser ranging systems, such as the Vector 4 and 21 and the digital mini-eyesafe laser infrared observation set (MELIOS). The PFED also interfaces with either an external precision lightweight global positioning system (GPS) receiver (PLGR) or the new internal GPS card-based products being acquired for joint GPS systems to accurately calculate target position location, direction and speed.

The PFED uses standard two-way tactical communications and messaging, including the military standard (MIL-STD) 188-220 protocols with either tactical fire direction system (TACFIRE) or variable message format (VMF) messages. This allows the PFED to interoperate with the advanced Field Artillery tactical data system (AFATDS) and legacy fire support command and control systems.

Although a "bluetooth" untethered remote handheld device has been developed to replicate data with a junction box wired to existing forward observer (FO) equipment, the first fielded configuration will be cabled to the laser rangefinder (LRF). Bluetooth allows a device to wirelessly transmit for short ranges to other devices, allowing it to serve multiple purposes; bluetooth is the industry standard for wireless personal area networks (WPANs).

Once fielded with a bluetooth enabled LRF, the bluetooth handheld FO devices will transmit and receive in the industrial, scientific and medical (ISM) frequency band available globally with frequency hopping to avoid electromagnetic interference. Connections will be point-to-point or multi-point. The devices will transmit encrypted data at a rate of one megabit per second over a maximum range of 10 meters.

Once all the peripheral devices are enabled by bluetooth, the need for wires and junction boxes will be eliminated.

LWTFDS. The LWTFDS uses the same PFED hardware and weighs 1.2 to 2.9 pounds, depending on the battery configuration. Eventually, it will replace the battery computer system (BCS) hosted on the lightweight computer unit (LCU) and the BCS light hosted on the HTU, which weighs 31 and 8.3 pounds, respectively.

The initial product offering was split into two software build releases to allow for an expedited urgent materiel release to cannon artillery users. The initial software release will replace the obsolete BUCS and perform ballistics calculations using the NATO Artillery Ballistics Kernel (NABK). This software can provide a second independent check for AFATDS technical fire control or be used as a stand-alone early entry device.

PFED shows its versatility in snow and rain
Photos by Jeffrey L. Weiss, PM IE

LWTFDS will be a stand-alone device with no communication capablities. LWTFDS also will support FA computational safety procedures.

LWTFDS will be released starting in 2004. Subsequent releases of LWTFDS will allow it to interoperate with the GDU, GDU-R and Paladin.

GDU-R. The GDU-R is another Army and Marine co-managed product that will replace the obsolete and unsupportable GDU. The GDU-R will leverage the hardware and software solutions of the PFED and LWTFDS development efforts.

The GDU-R will use hardware-independent C++ software code with a more intuitive graphical user interface. It will support GDU communications and data protocols and interoperate with AFATDS, LWTFDS and BCS.

Future releases of the GDU-R will use a bluetooth network of connected devices for wireless operations at the howitzer, eliminating the time-consuming setup required to dig and bury cables around the gun. GDU-R will support the gunner's reference card and section chief's report.

Similar to the rationale used on the LWTFDS, the initial GDU-R fielding will be split into two software builds to expedite release of a core capability to cannon units lacking GDU spares. The initial release is projected for 2004.

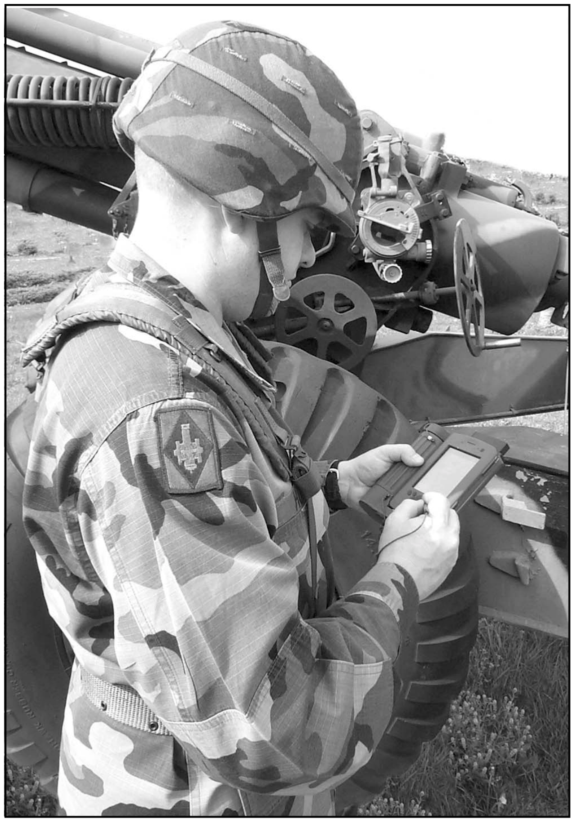
Without LWTFDS or the GDU, these units would be forced to use manual gunnery techniques. Subsequent releases will support the Excalibur munition and muzzle-velocity sensor (MVS).

The GDU-R will serve as an interim solution for towed artillery digitization (TAD) on the joint lightweight 155-mm howitzer.

Handheld Challenges. Effects system professionals encountered several technical and program hurdles along the fast-track acquisition of its new family of ruggedized handheld devices.

Security and Information Assurance. Some of the biggest challenges are security and information assurance of wireless data exchange in the handheld tactical device environment. Wireless handheld devices can pose potential security risks based on their increased computing power, large quantity of software applications and various data-exchange capabilities with other handheld devices. Information assurance concerns range from those about hardware and software applications to the underlying operating systems.

Information assurance security officers (IASO) in gaining units must ensure the risk mitigation procedures outlined in the Security Features User's Guide and the security policies in the System Security Architecture Report are enforced.



The LWTFDS hand held device. *Photo by Jeffrey L. Weiss, PM IE*

The data in the PM's family of wireless handheld products will be encrypted and require a password to authenticate the user. The products will come with an anti-virus application to scan data files both in resident memory on the wireless handheld device and on any external connected memory cards. The commercial, off-the-shelf suite of security tools selected by PM IE will support predefined administrative settings to automatically enforce many security features and policies.

Bluetooth provides a lower risk of detection over the larger radio frequency (RF) footprint and eliminates the need for cables in the dismounted devices. These are the result of its low transmission power and increased band availability in the ISM band while using frequency-hopping spread-spectrum technology.

Bluetooth also uses a challenge-response protocol to authenticate other devices. The family of ruggedized handheld devices will reject connections from devices not specifically bonded during device setup.

Bluetooth data is encrypted using a "shared" key between devices. In addition, all the devices will use an "unshared" key to protect all data stored on the device.

Finally, all PM IE wireless solutions will have a cabled configuration when there is an electronic warfare (EW) threat or a host country policy prevents use of the ISM band.

Communications and Messaging. The communications protocols and VMF message parser are coded to permit reuse among the PM's suite of handheld devices with additional reuse opportunities throughout the Army as Windows CE devices come to fruition. The currently supported communications protocol is MIL-STD-188-220 that has been tested over all SINCGARS models and wire line.

The family of ruggedized pocket digital assistant (R-PDA) handheld tactical devices uses a personal computer memory card international association (PCMCIA) modem to connect to the radio, a modem that is used throughout the FA community. The projected fielding of Taclink 3000 with the supported protocols flashed into memory on the modem would eliminate a 35-second load time for the communication protocols. Because the Microsoft Pocket PC operating system on the handheld devices is designed for no boot time, these devices can temporarily power down and instantly power back up once the load time for the protocols is eliminated.

The NABK acts as a server for the LWTFDS application and, potentially, the GDU-R. A set of application program interfaces (APIs) encapsulates technical fire direction functionality to allow any user interface to consistently access and process information.

Different NATO countries have their own compiled versions of NABK. By correctly implementing the user interfaces with the NABK APIs, other NATO countries can benefit from LWTFDS and GDU-R applications by substituting their own dynamically linked NABK.

Software and Hardware Modularity. One hardware design consideration included component reuse across multiple systems. The modular approach was adopted, allowing the greatest flexibility from both reuse and field repairable perspectives. As the need for a different mission configuration presents itself, these ruggedized devices can be modified in the field to conform to the new mission. A removable external battery and a single/dual PCMCIA sleeve are among current changeable configurations.

Future configuration options include the addition of a PLGR-based GPS scheduled for fielding in late 2003 and an anti-spoofing module based on GPS in 2004. This modular approach permits a single ruggedized hardware design to fill requirements across a gamut of both commercial and military systems.

Conclusion. In December 2002, PM IE and the Training and Doctrine Command (TRADOC) System Manager for FA Tactical Data Systems (TSM FATDS), Fort Sill, Oklahoma, coordinated an airdrop test of handhelds using soldiers from the 82d Airborne Division, Fort Bragg, North Carolina. The test entailed placing ruggedized handheld tactical devices in a soldier's rucksack in both inside and outside pockets. The soldier then jumped with the device, which was tested after he hit the ground. In all cases, the ruggedized devices survived the jumps. These systems are undergoing environmental and operational testing within the context of an urgent materiel release process to ensure soldiers receive quality products in the fastest time possible.

The PM designed the software applications to run on both ruggedized and commercial devices to make them more cost-effective for lower priority Department of the Army master priority list (DAMPL) units. In addition, the software application technology building blocks contained in these systems can be reused, royalty-free, by follow-on Department of Defense hand-held development activities. The PM has already engaged in collaborative discussions on applying the capabilities and functions contained in its new family of handheld ruggedized devices to forward air controller (FAC) functions, mortar fire control and Special Operations non-line-of-sight (NLOS) missile planning/management.

The PM IE effects systems professionals are focused on the warfighters' need for lightweight devices with simple, intuitive human-computer interaction in its suite of handheld devices. While these initial products are an exciting start, there will be opportunities to improve the efficiency, accuracy and effectiveness of these devices to create a seamless integration of fire support assets from the FO to the howitzer crew.

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2003 Senior Fire Support Conference Dates Set

Planning is underway for the next Senior Fire Support Conference (SFSC) at the Field Artillery School, Fort Sill, Oklahoma, 22-24 October. Army and Marine FA commanders and their command sergeants major will meet 21 October before the main conference begins.

The 2003 Henry Knox and Alexander Hamilton Awards for the best active and Army National Guard (ARNG) batteries, respectively, will be presented during the conference. The 2002 Knox Best Battery Award winner was B Battery, 1st Battalion, 319th Field Artillery (B/1-319 FA), 82d Airborne Division, and the 2002 Hamilton Best Battery Award winner was B/1-147 FA, 147th FA Brigade, South Dakota ARNG. The deadline for awards submissions is 15 September.

For more details on the conference and the awards, go to the SFSC and FA Awards websites on the Fort Sill Home Page at sill-www.army.mil.

US Army Joint Munitions Command Stood Up

On 17 January, the Army celebrated the provisional stand up of the US Army Joint Munitions Command (JMC) at Rock Island Arsenal, Illinois, the site of the new command. It is the Department of the Defense's field operating agency for the "single manager for conventional munitions" mission. As such, the command manages the production, storage, issue and demilitarization of conventional ammunition for all US military services

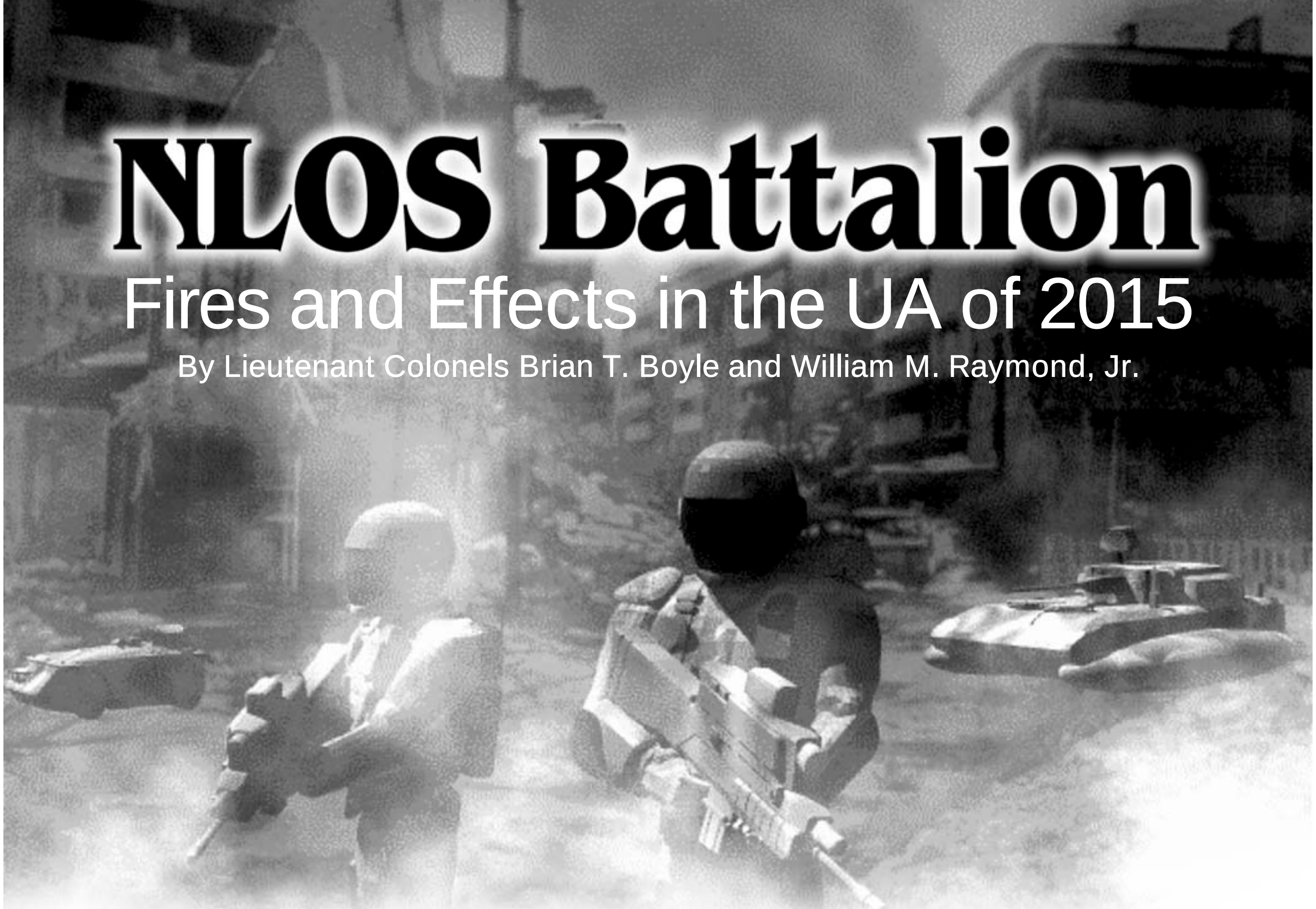
To meet the needs of the transformed fighting forces of the 21st century, JMC is developing and modernizing systems to provide theater and field commanders accurate, up-to-the minute information on the status of munitions. Through its Army Field Support Command (AFSC) component, JMC serves as a platform for projecting logistics power anywhere in the world. AFSC maintains prepositioned stocks of weapons and equipment stored at land-based sites around the world and aboard ships. AFSC also provides direct support to combat units deployed to the front lines and operates sites near forward areas, such as logistic support elements (LSEs).

Taken from the JMC News Release, 22 January 2003

NLOS Battalion

Fires and Effects in the UA of 2015

By Lieutenant Colonels Brian T. Boyle and William M. Raymond, Jr.



In October 1999, the Chief of Staff of the Army announced his plans to transform the Army into an Objective Force that would be more responsive, deployable, agile, versatile, lethal, survivable and sustainable. Figure 1 describes the transformational operational characteristics of the Objective Force maneuver unit of action (UA). Perhaps no better example of this transformation is the non-line-of-sight (NLOS) battalion that will be organic to this UA.

The NLOS battalion of 2015 will be nothing like the direct support (DS) battalion of current operating forces. It will transcend current and Stryker force DS artillery by applying a wider range of capabilities and being fully integrated with maneuver to conduct military operations across the conflict spectrum to achieve overmatch and decision. It will be organized with a mix of capabilities to make it more agile, lethal and survivable: extended range and enhanced targeting and counterstrike, precision and area cannon and missile effects.

Although the NLOS battalion will be smaller than today's DS battalion, it will have the lethality of today's division artillery. In large part, this lethality will be realized through advanced technologies applied to the UA's family of future combat systems (FCS).

The DS battalion today is challenged to attack high-payoff targets (HPTs) for the brigade commander while being responsive to the most dangerous targets that present themselves to maneuver companies and battalions that are not the main effort. Although Paladin is a capable cannon, it has a relatively slow rate-of-fire; in addition, it is the unit's main source of firepower.

The DS battalion lacks the mix of target acquisition (TA) systems and munitions to operate in the contemporary operational environment (COE). It must depend upon high-volume area munitions for lethality and has a limited suite of munitions: only Copperhead as a precision munition and smoke and illumination as nonlethal munitions.

Mechanized FA battalions are limited in their strategic deployability. Additionally, today's battalions do not have the fully integrated, digitized command and control system that will exist in 2015, known as "networked fires." (For more information about networked fires, see the sidebar "Networked Fires for the Objective Force" on Page 37.)

In short, the NLOS battalion will be able to provide fires with greater precision and more devastating target effects in close support while simultaneously supporting shaping and counterstrike operations.

This article describes how the Objective Force UA will fight, what the organization and capabilities of the NLOS battalion will be, what the battalion's command and support relationships will be and what warfighting tactics, techniques and procedures (TTPs) are emerging from recent experimentation and exercises. Last, we highlight some new responsibilities of the NLOS battalion's leaders and soldiers.

The UA Fight. The UA will fight unlike tactical forces of today. It will be the decisive element in the Objective Force that closes with and destroys the enemy in any operation against any level of threat in any environment. The UA will operate within a new tactical paradigm based on "quality of firsts": the ability to see first, understand first, act first and finish decisively.

Once the National Command Authority (NCA) decides to commit a UA, operations will begin in the motor pools at home station using the battle command system (BCS) on board the FCS. With access to the global information grid (GIG), the UA will receive intelligence about the area of impending operations. With a 75-kilometer operational radius, planners will use tools built into the BCS to focus on the precise information commanders need to develop plans and orders before deploying and en route to the theater of operations.

With respect to UA fires, the decision-making process will designate specific targets for attack. Experimentation has shown that not every HPT must be attacked to begin the disintegration of an enemy force. Commanders and fires and effects personnel rapidly will input the critical elements of the commander's scheme of fires into BCS. This process will be much more dynamic than it is today.

Concurrently, higher-level assets at the joint/unit of employment (UE) level above the UA will continue to add sensor information to provide more fidelity for subordinate planners and begin shaping the battlespace with fires and effects to allow the successful entrance of the UA(s). En route (via sea, air or ground) the UA will continue to modify and rehearse plans, allowing it to arrive in the area of operations (AO) ready to start engaging the enemy.

Upon arrival, the major difference between maneuver in the Objective Force and our current operating forces can best be described as maneuver's exercising "tactical patience." Capitalizing on the success of higher-level and organic sensors and fires, the UA will develop the situation out-of-contact.

Networked fires will link relevant sensors to shooters, enabling all levels to better receive effects when required. Done correctly, the combination of fires and maneuver will create the conditions for decisive operations. Close tactical assault no longer will be the only operation to achieve combat decision. If required, the UA will execute close combat, confident that the conditions will have been set for it to achieve decision rapidly with minimal risk to forces and equipment.

Engaging the enemy out-of-contact means the UA will be able to move with speed and agility, coming at the enemy in unexpected ways from unimproved aerial/sea ports of embarkation (A/SPOEs) and arriving at a position of advantage. From that position, the UA will use fires and effects to engage the enemy beyond the range of his weapons and use sensors and effects-producing platforms to set the conditions for follow-on engagements.

The purpose of the position of advantage is to present the enemy with a dilemma. He will be able to remain in place and be destroyed by fires and effects or move and be destroyed by maneuver forces assaulting at the time and place of their choosing and supported by fires.

Although not necessarily sequential, it is the combination of fires (precision and volume) and maneuver (with tacti-

Responsive/Deployable

- Deploy 96 hours after first liftoff on C-130 or advanced aircraft.
- Deploy from continental US (CONUS)/overseas to anywhere in the world using in-flight refueling to arrive in coherent combined arms increments and fight upon arrival.
- Project decisive power rapidly through multiple entry points by land/air/sea for immediate employment throughout the area of operations (AO).
- Be part of a continuouos cycle of UAs for sustained momentum into engagement areas.

Agile/Versatile

- Be a full-spectrum force that can transition from small-scale contingencies (SSC) to major combat operations (MCO).
- Conduct distributed, embedded full-spectrum mission planning and rehearsals.
- Master transitions from one tactical engagement to the next across any environment based on superior situational understanding by sharing data from the battle command system (BCS).
- Have a design that is tailorable, modular and capable of rapid task organizing; be mounted, dismounted and air assault-capable at the lowest unit levels.
- Have a combined arms framework, including air-ground integration at the battalion level and the ability to task organize at the company level, as needed.

Lethal

- Develop the situation organically out to a radius of 75 kilometers.
- Assure overmatch against enemy forces in all conditions and environments, firing first with an assured kill.
- Employ small units at the right time and place based on situational understanding.
- Employ precision networked Army and joint, interagency and multi-national (JIM) fires and effects.
- Provide mutual support from a distance using the active protection system (APS) and the network-enhanced BCS.
- Generate combat power from every element-all enhanced by shared information.

Survivable

- Have highly trained, competent and capable soldiers.
- Maintain situational awareness to allow movement around the enemy and impediments.
- Have the tools to understand and use terrain in the safest manner.
- Conduct route reconnaissance with sensors, manned and unmanned, at greatly increased speeds.
- Have a superior capability to detect the presence and disposition of mines.
- Have superior dash speeds and the ability to optimize cover and concealment.
- Have an inherently offensive orientation with speed and lethality.
- Employ low-observable technologies and camouflage.
- Have active and passive protection systems.
- Have armor protection over vital crew areas.
- Fire first with an assured kill.
- Provide more effective suppressive and obscuration fires.
- Provide mutual support from dispersed, distant overwatch positions.
- Be able to accept augmentation from unit of employment (UE) plug-ins-e.g., the high-mobility artillery rocket system (HIMARS), air defense artillery (ADA) and engineers.
- Have unmanned platforms perform high-risk functions.

Sustainable

- Deploy with three days' combat service support (CSS) for an MCO and seven days' CSS for a SSC.
- Have on-board water production.
- Have common structures, organizations, platforms and systems with more reliable components to reduce Class IX and maintenance requirements.
- Have the crew chief perform 80 percent of maintenance, requiring fewer repair personnel.
- Combine prognostic and diagnostic capabilities with plug-in modules to allow quicker maintenance with fewer components.
- Maximize precision fires to reduce the Class V demand for lethal effects.
- Track material in real-time via the network and employ just-in-time logistics to reduce the number of logistical bases and CSS command and control nodes.
- Have less equipment than current operating forces.
- Reduce fuel consumption at extended ranges.

Figure 1: Operational Characteristics of the Maneuver Unit of Action (UA)

cal assault, if required) that will make the enemy's dilemma so difficult. The cumulative effects of simultaneous, multi-dimensional operations will enable the UA to dominate an adversary by destroying, dislocating or disintegrating him and then transition to the next engagement.

NLOS Battalion Organization. For the battalion to fight as part of a UA, the NLOS battalion must have a unique design and increased capabilities.

At first glance, many may be disturbed by the reduced size of the NLOS battalion without considering its increased capabilities. The battalion will have 176 personnel organized into a headquarters and headquarters battery (HHB) and three NLOS batteries. Figure 2 depicts the command group that will include the command integration cell (CIC) with human resource (S1), sustainment (S4), signal and operations personnel. Figure 3 shows HHB, and Figure 4 on Page 36 shows a firing battery.

While technological innovations enable the reduction of some personnel in the UA, there are three main reasons why the NLOS battalion will be significantly smaller than the DS battalion of today: it will need fewer sustainment personnel for more reliable FCS systems, need a smaller number of crew/support personnel who use more automation and robotics, and have no fire support personnel.

Sustainment and Reliability. First, with the exception of a battalion sustainment officer and NCO (S4) and battery supply sergeants, there will be no sustainment or maintenance personnel in the NLOS battalion.

BCS will track the NLOS battalion's supply needs for the forward support battalion (FSB) to provide all classes of supply, maintenance and recovery directly or deliver a smaller artillery-specific portion to an NLOS battery that is part of a combined arms battalion (CAB). The latter would be through the CAB's sustainment replenishment operations (SROs).

The facts that the FCS family of vehicles will be more reliable and that the NLOS battalion (and UA) will have a fewer number and types of vehicles will reduce maintenance requirements.

Automation and Robotics. Second, enabled by significant improvements in automation and robotics, the NLOS battalion will operate more efficiently and at a different level of performance for certain tasks.

A few of these technology enablers are as follows.

• The FCS cannon in the NLOS battalion will have a crew of two. This compares with a Paladin crew of four and what would have been a Crusader crew of three. The crew will direct/operate the cannon from the cab and no longer handle ammunition or operate the cannon manually.

Because the cannon will be self-locating, it won't need conventional survey teams. However, there still will be a need for common grid throughout the battlespace. A future version of the improved position and azimuth determining system (IPADS) will be on command and control vehicles interspersed throughout the UA to provide initial control for common grid. The future IPADS will be a non–global positioning system (GPS) inertial survey system.

Because the FCS cannon will provide its own technical fire control and limited tactical fire direction for other cannons, there will be no need for battery fire direction centers (FDCs) and platoon and battery operations centers (POCs/BOCs). Additionally, the fires application of BCS will perform tactical fire direction and disseminate data throughout the network.

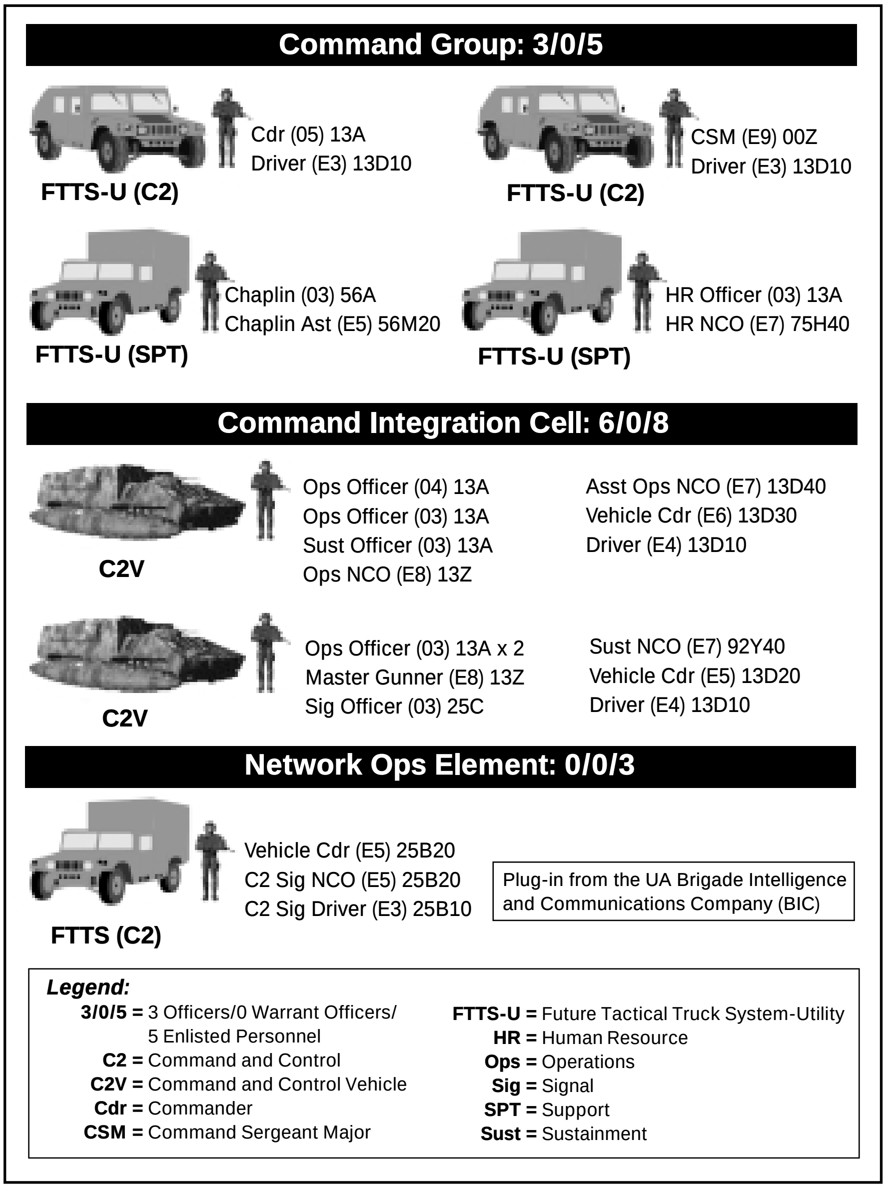


Figure 2: Non-Line-of-Sight (NLOS) Battalion Headquarters. The headquarters will be located in the vicinity of the unit of action (UA) headquarters. The entire battalion will have 176 personnel and 169 major pieces of equipment, including 60 NLOS launch system (NLOS-LS) container launch units that can fire 900 missiles, 18 future combat system (FCS) cannons, 24 Class III unmanned aerial vehicles (UAVs) and six multi-mission radars (MMRs).

• Enhanced automation via the BCS and networked fires will reduce the need for a large battalion staff. The counterfire responsibilities performed by the current cannon battalion tactical operations center (TOC) will migrate to the fires and effects cell (FEC) at the UA headquarters; the FEC routinely will have access to UE and joint capabilities.

• Profiler-like technology in the UA will allow the battalion to download meteorological data directly to its platforms to ensure accurate fires.

• The future tactical truck system-maneuver sustainment (FTTS-MS) robotics will allow one soldier to operate the vehicle. Every second vehicle will be able to operate as an unmanned vehicle controlled by a manned FTTS-MS, using its "robotic follower" capability.

Coordination of Fires. Third, no fire support personnel will be in the NLOS battalion. FEC personnel will be in the UA headquarters, and fires personnel will be assigned to the CABs, aviation detachment and maneuver companies.

However, these fires personnel will not perform the same duties as those in current forces. Using BCS, fewer fires personnel will be required to coordinate and synchronize all external and organic resources to execute fires. They also will execute special purpose fires, such as smoke, illumination, etc.

NLOS Battalion Capabilities. The NLOS battalion will have enhanced sensors, command and control systems, and weapons.

Sensors. There will be multiple layers of sensors in the UA. They will include humans, platforms, unmanned aerial vehicles (UAVs), robots and other sensors. The robotic sensors will be able to sense and then change its data into useable information on board.

All these systems will be linked to BCS via communications systems to provide the battalion leadership situational awareness to better integrate maneuver and fires after operations begin.

The NLOS battalion's sensor platoon will have two types of sensors: six multimission radars (MMRs) and 24 Class III UAVs.

The MMR's missions will include counterstrike, air defense surveillance, air defense fire control and air traffic control. (For a description of the MMR's missions, see Figure 2 on Page 22 of the article "ATACMS Fires for the Objective Force" by Lieutenant Colonel Rocky Samek in this edition.) Efforts are underway to determine if technology will allow the MMR to do all four missions concurrently.

With respect to the counterstrike mission, the MMR will have a range of 30 kilometers and be able to track 100 in-flight projectiles simultaneously in a 1600-mil sector. Compared to the Q-36 Firefinder radar, the MMR will be able to acquire targets nearly twice as far with twice the accuracy.

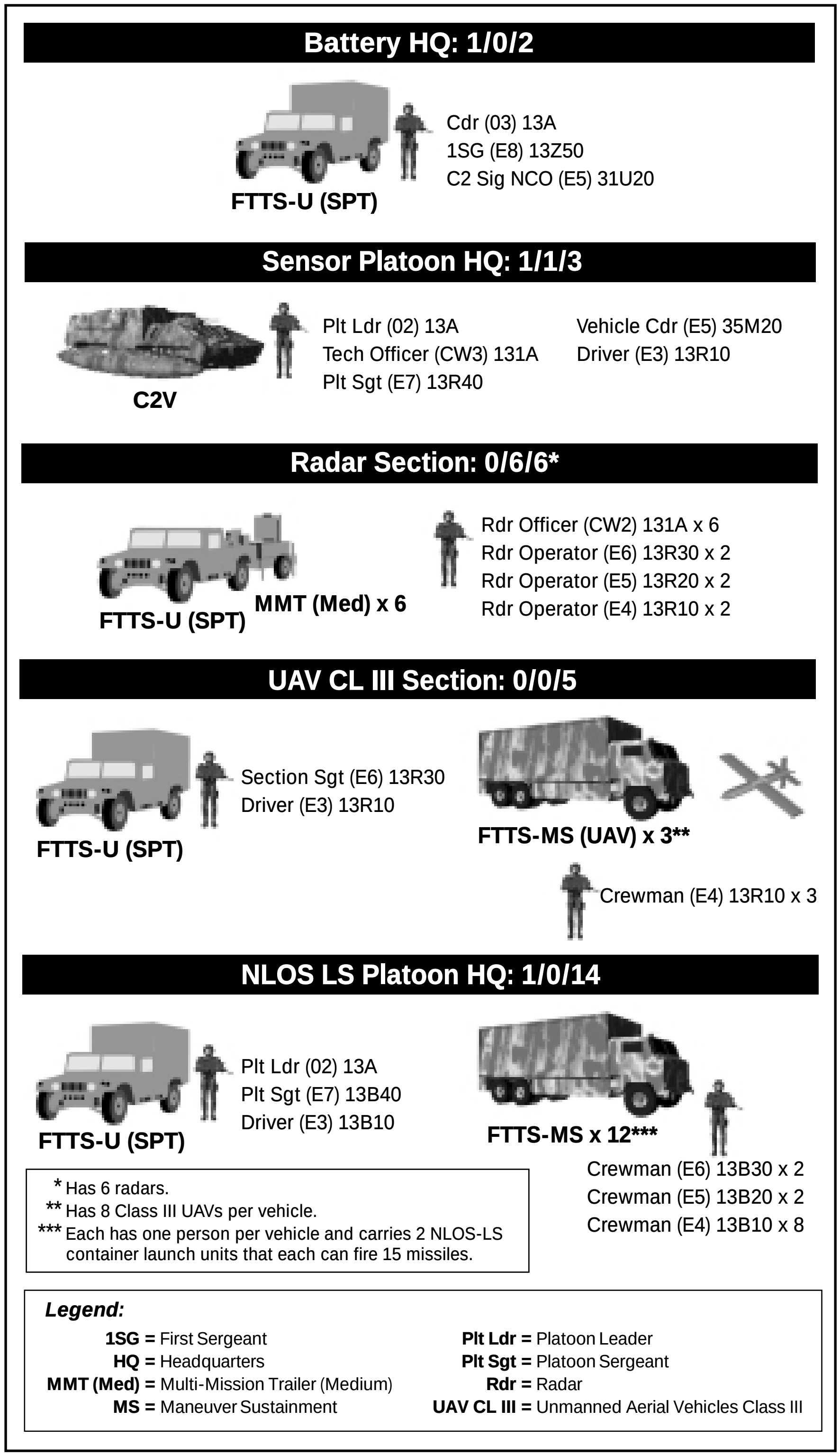


Figure 3: Headquarters and Headquarters Battery (HHB). Each HHB will have 62 personnel and 61 major pieces of equipment, including 24 NLOS-LS container launch units that can fire 360 missiles, 24 CL III UAVs and six radars. It will be located generally in the vicinity of the NLOS battalion headquarters. Elements of HHB may be pushed down to the NLOS batteries or employed at the UA level.

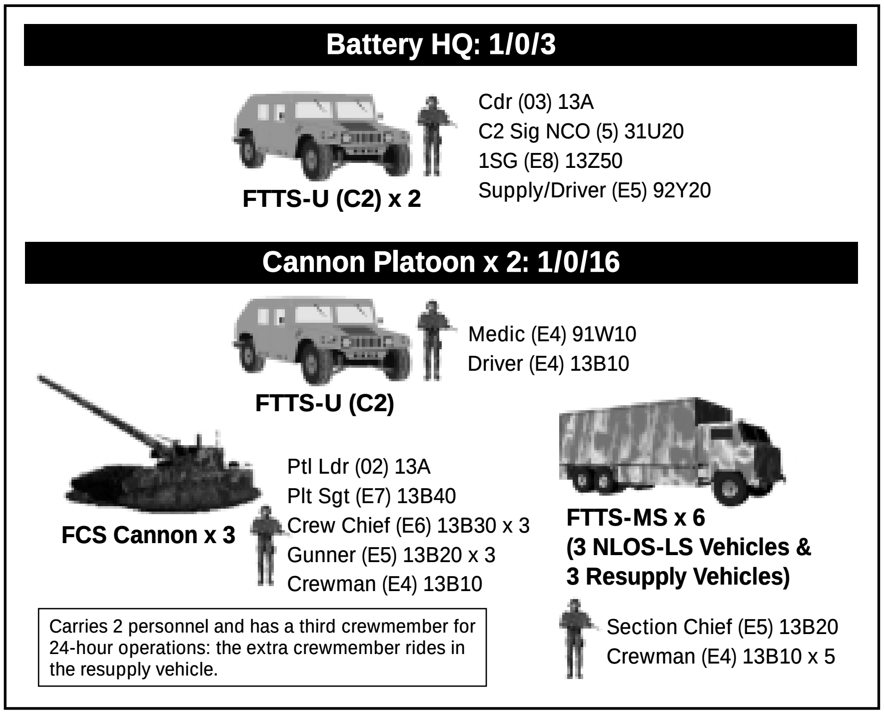


Figure 4: NLOS Battery x 3 Per NLOS Battalion. Each NLOS battery will have 38 personnel and 36 major pieces of equipment, including six FCS cannons, six NLOS-LS vehicles with 12 container launch units that can fire 180 missiles and six resupply vehicles. Each resupply vehicle will carry a combination of NLOS-LS and FCS cannon munitions and provide personnel for 24-hour operations.

The 24 Class III UAVs in the sensor platoon will provide the NLOS battalion robust organic TA to facilitate preemptive counterstrike. The design calls for eight Class III UAVs in each of the platoon's three UAV vehicles that can be launched and recovered by one person.

The Class III UAV will provide targetable information during day and night and limited capability in adverse weather. It will operate at 2,000 feet above ground level (AGL) to locate, identify and designate targets at a slant range of six kilometers with a target location error (TLE) of 10 meters. The Class III UAV also will provide supplemental meteorological data to support NLOS battalion precision fires.

Currently, no fire support teams (FISTs) are in the design. The premise that a call-for-fire is the exclusive domain of Career Management Field (CMF) 13 Field Artillery will change largely because of the targeting capabilities resident in the FCS.

All Objective Force soldiers—land warriors—will be able to call for fires. The laser designators on land warrior systems and FCS vehicles and the enhanced sensor packages on the UAVs and the MMRs at the UA will provide the TLE for precise effects against targets. In addition, UE sensors and those at the joint interagency and multi-national (JIM) level above the UE will provide the TLE for precise effects.

Command and Control. The Objective Force's survivability is dependent upon shared situational awareness that will enable the "quality of firsts" and the force to win decisively. The Objective Force BCS will be the mechanism for integrating and synchronizing all battlefield functional areas.

The BCS will provide the scope and be the catalyst for transforming a staff-centered and planning-focused battle command system into one that is commander-centric and execution-focused. The fires and effects application of the BCS is networked fires.

Shooters. The NLOS battalion will have two of the three organic NLOS systems in the UA: FCS cannon and non-line-of-sight launcher system (NLOS-LS). (The third is the NLOS mortar.) Both the cannon and NLOS-LS will be able to fire a suite of lethal and nonlethal munitions at extended ranges as well as precision munitions for point and area targets.

The FCS cannon will have a range of 30 to 40 kilometers with a rate-of-fire of six to 10 rounds per minute. Automatic resupply will be by pre-loaded magazines to reload a cannon quickly. With its six high rate-of-fire FCS cannons and rapid resupply capability, the NLOS battery will have a throw weight that exceeds today's Paladin battalion.

The FCS cannon will be extremely accurate with probable errors (PEs) in range and deflection that are half those of Paladin. It will be able to receive and compute fire missions from all fielded and developmental TA sources and command and control systems.

Using on-board material handling equipment (MHE), the FCS cannon crew will be able to load and unload manually within five minutes while the crew remains under armor. When moving, the cannon will respond to a fire order, firing the first round within 20 seconds of the vehicle's stopping.

The FCS cannon will emplace in 15 to 20 seconds and displace in 20 to 30 seconds, which is less than half the time it takes Paladin, thus contributing to greater survivability. The howitzer will carry 30 to 48 complete rounds on board. It will compute its own firing data and provide limited tactical fire direction for the rest of the battery, when required. Finally, it will fire all current and planned lethal and nonlethal munitions.

The NLOS-LS will have an on-board technical fire control solution computer for individual munitions. It will have a loiter attack munition (LAM) capable of searching for and engaging soft-skinned targets to a range of 100 kilometers with 45 minutes of loitering time. It will have a range of 280 kilometers with no loitering time. These capabilities will allow the NLOS battalion to engage a wider set of targets at extended ranges.

NLOS-LS also will have a precision attack munition (PAM) capable of engaging armored and non-armored targets, moving or stationary, out to 60 kilometers. The system will include an on-board sensor to provide automatic target recognition (ATR). Its munitions will be able to accept in-flight updates (target type, location and velocity vector) from an observer or other sensors to attack moving targets and receive terminal guidance from an external source. Two men will be able to reload individual munitions in less than two minutes under tactical conditions. The system will tell the network its location within two meters after emplacing and powering up.

(For more information on the properties and characteristics of LAM and PAM, see Figure 1 on Page 21 of the article "ATACMS Fires for the Objective Force" in this edition.)

Objective Force soldiers will be able to fire NLOS-LS from tactical transport vehicles or from the ground. The system will have on-board anti-tampering devices to deny the enemy its use. It will be transportable via all helicopters and fixed-wing transport aircraft.

Each NLOS-LS will carry 15 munitions. With 60 NLOS-LS in the battalion, these 900 missiles represent a significant amount of precision firepower available to support the commander that is not present in today's DS battalion.

We are exploring a variety of additional munitions for NLOS systems. These include lethal munitions, such as air defense, artillery, intelligent munitions system (IMS) and nonlethal munitions, such as unattended ground sensors (UGS) and, conceivably, the full range of malodorants and vehicle disablers. (IMS is a mix of anti-personnel, anti-vehicular, and antitank munitions, each with integral targeting and engaging sensors that orient on and attack selected targets.)

The FCS cannon, NLOS-LS and all other Objective Force effects platforms will be linked by the BCS and enabled by networked fires to make the Objective Force significantly more lethal at greater ranges than current operating forces.

Command and Support Relationship. The NLOS battalion will be organic to the UA. This is due to the distributed nature of the battlefield that will require effects across a large, highly dispersed non-contiguous battlespace and the desire for combined arms training and deployment with fires integral to maneuver.

This is different than current operating forces and speaks to the changing nature of fires and effects for the Objective Force. Objective Force will focus on providing the desired effects by the most appropriate systems at the time and place of the commander's choosing. All echelons will be able to receive a variety of effects on demand. This demand requires fires to simultaneously support a number of echelons in a very dynamic manner.

The effects of fires will have little to do with who "owns" the system or who is part of the support relationship. The bottom line: every soldier or sensor acquiring a target in the Objective Force needs timely, accurate and effective fires and effects.

The NLOS Battalion Fight. The NLOS battalion will be responsive to the UA commander and be able to find and attack HPTs and most dangerous targets, conduct limited battle damage assessment (BDA) and reattack as needed. The UA commander will position the battalion to provide destructive, suppressive/protective and special purpose fires to best support the concept of the operations; the FEC will plan its fires and effects.

The battalion will be dynamically tailorable to support sensor-to-shooter teaming relationships with all relevant UA, UE and JIM sensors. Its firing platforms and sensor assets will be organized to fight as a fully integrated team with UA maneuver forces and routinely interact directly with troops in contact, mobile strike aviation systems and unmanned sensors.

Networked Fires for the Objective Force

The Objective Force will only have one network and one battle command system (BCS) for command and control. The fires and effects application of BCS will be networked fires. Networked fires will be a triad of relevant sensors, effects capabilities and battle command tools/communications capabilities available across the force.

All platforms and humans will be sensors in the unit of action (UA). The data points they will provide will be transmitted to various BCS interlinks throughout the UA via the network/communications systems. Through protocols, tools, automated support and a neural network, BCS will translate the often overwhelming amount of information into information useful for awareness of what friendly, enemy and unidentified personnel are doing on the battlefield. (A neural network is one that learns from itself intelligently via pattern recognition.)

Networked fires then will act on the data to select the best platform (lethal and/or nonlethal) to produce the desired effects on the enemy target from the soldier through the joint interagency multi-national (JIM) levels. By knowing the exact location of all elements on the battlefield, the UA will be able to use precise fires and effects at the time and place of its choosing against the target set that best supports the maneuver commander's intent.

The difference between networked fires and today's digital systems will be the dynamic nature of the human-computer interface. Commanders and their fires and effects personnel will be able to rapidly change guidance in the automated system using "user-friendly" voice or automated input means to react to an adaptive enemy. When the enemy's actions make the plan obsolete, the Objective Force will be able to adjust its plan dynamically to ensure mission success.

Further, networked fires will ensure a sensor can provide the accuracy for the target location error (TLE) needed for any effects platforms to attack a target. If a sensor cannot provide the TLE accuracy, the network will either choose a different sensor that can provide the required TLE or a different effects platform that needs less precise TLE to engage the target.

Networked fires also will track the use of munitions by systems and the resupply capability of the forward support battalion (FSB) and higher support agencies. It will consider these factors when selecting the best effects platform for targets, which should help mitigate often overwhelming Class V resupply problems.

Clearance of both ground and airspace will be much improved using networked fires. Knowing where all friendly ground forces are at all times will allow much more rapid responses to enemy targets. With an ability to track every flying platform (manned, munition and unmanned), the UA networked fires will be able to open up the airspace for use by munitions and unmanned/manned air and aviation units. Simply put, networked fires will enable rather than restrict the use of airspace by all combat elements.

In summary, networked fires will provide responsive fires with the most effective application of systems and munitions against most dangerous and high-payoff targets (HPTs) in the Objective Force.

NLOS-LS (both from the firing batteries and NLOS platoon in HHB) and the FCS cannons routinely will maneuver within two to four kilometers of CAB elements. This placement will be integral to the CABs to ensure all UA elements have access to NLOS battalion effects throughout the 75-kilometer radius of the UA AO.

FCS cannons normally will operate in pairs or platoons of three. Their interspersing with maneuver will provide protection and security to individual systems (both NLOS battalion assets and maneuver), using mutual support from a distance. When combined with MMRs (that also will be interspersed within CAB elements), the NLOS battalion will protect the entire force from enemy indirect fires.

The cannons' collocating with maneuver while still being commanded and controlled by the NLOS battalion will mitigate the effects of slowing to stop and fire, enhance the range of NLOS systems and allow massed effects from dispersed locations. While maneuver units may not necessarily be supported by fires and effects from its collocated NLOS platforms, they will receive fires from appropriate systems through networked fires.

The NLOS battalion will provide flexible and responsive fires to simultaneously engage multiple target sets on-demand while remaining fully integrated with maneuver. Generally, the on-board munitions mixture of FCS cannons will have more precision munitions than current operating forces; however, area fire munitions will continue to provide suppression and obscuration (high explosive and smoke) to allow CABs to achieve positional advantage.

The NLOS battalion will be equally adept at attacking both HPTs and the most dangerous targets, applying scaleable effects to account for the challenges of complex environments and rules of engagement (ROE). (Scaleable means that fires can be applied against targets in a measured, proportionate manner.) The NLOS battalion will have precision lethal and nonlethal munitions that will be able to attack targets with single, highly accurate shots that avoid collateral damage, do not violate the ROE and help avoid fratricide.

Although smaller, the NLOS battalion will be more agile—strategically deployable and rapidly tailorable to meet the requirements for a variety of missions. The NLOS battalion will be more lethal—the firepower from its three firing batteries (each with cannons and NLOS-LS) and the NLOS-LS platoon will exceed that of a present-day division artillery. And the NLOS battalion will be more survivable with its shared situational awareness and understanding via BCS and networked fires and the enhanced capabilities of the FCS cannon. These capabilities include faster emplacement and displacement times and the cannon's embedded active protection system.

Multi-Functional Leaders. In 2015, expectations of soldiers and leaders in the NLOS battalion will be greater because of the complexity of future operational environments. Soldiers and leaders must become more multi-functional and be comfortable with uncertainty and unpredictability. These soldiers will be trained to exercise judgment and take the initiative under stressful circumstances against a thinking enemy and be capable of learning and adapting to the demands of full-spectrum operations.

The following are three examples of the multi-functionality demands on leaders and soldiers in the NLOS battalion.

• The Military Occupational Specialty (MOS) 131A TA Radar Technician warrant officer will evolve into a sensor systems warrant who knows the MMR's missions and understands meteorological, UAV and Army airspace command and control (A^2C^2) operations. The seven warrant officers in the NLOS battalion will bring new personnel and capabilities that do not exist in today's heavy or light battalions.

• There will be one cannon/NLOS-LS MOS. This Cannoneer (13B) will not only be knowledgeable about the FCS cannon and FTTS-MS, but also be responsible for operating the NLOS-LS. MOS 13M will remain for high-mobility artillery rocket system (HIMARS) units at the UE level.

• The FCS cannon platoon leader and platoon sergeant will not only be leaders of their units like their counterparts today, but also fight the battle from their FCS cannons like their maneuver brethren.

These multi-functional leaders and soldiers will be challenged to command and control more technical systems that are widely dispersed in a larger AO. Clearly, our training and leader development programs will have to change to empower Objective Force leaders and soldiers to accomplish their missions.

Conclusion. Currently, the Combined Arms Center (CAC) at Fort Leavenworth, Kansas, is designing the UE echelonment of forces. Fort Sill is designing the FCS cannon battalion and HIMARS/NLOS-LS battalion that will support UE operations.

While much work remains on the transformation of our Army, the development of the NLOS battalion organic to the UA is well on its way. As the transformation continues, the NLOS battalion of the Objective Force is becoming a reality. Although the NLOS battalion is significantly smaller than today's DS battalion, it packs an unprecedented amount of firepower and capabilities that will enable the UA commander to be successful across the full spectrum of conflict.

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JOINT TRAINING CENTER for Indirect Fires Integration

A joint training center should be established at Fort Sill, Oklahoma, to provide instruction and training on the integration, coordination and application of the full range of joint indirect fires. The US armed forces need a center to train members of the joint fires team in individual skills as well as command and staff competencies related to the synchronous application of the effects of joint indirect fires.

While we recognize an increasing interdependence between the services, we do not have a joint training center that focuses on the integration of fires and effects. Instead, we rely on service component schools to inform on service capabilities and train component elements of the joint fires team. A joint training center would allow commanders and joint fires teams to work in a well-crafted simulated environment while providing the potential for live-fire outcomes. The Joint Training Center for Indirect Fires Integration would fill a long-standing training shortfall.

The concept of establishing this Joint Training Center for Indirect Fires Integration fully supports the Chairman of the Joint Chief's Joint Fires Initiative to promote horizontal coordination among forces and components.

Future Warfare and Joint Requirements. To achieve decisive outcomes in future warfare, the armed forces of the United States will execute coherent joint operations based primarily on the integrated application of firepower from each of the services. Multiple distributed operations will be conducted simultaneously to achieve an overwhelming synergistic effect.

The ability to successfully integrate the complementary indirect firepower capabilities of each service is essential to achieving decision. By achieving integration, a full kinetic pulse can be delivered by indirect fires in multiple dimensions against enemy critical vulnerabilities and centers of gravity. Fires will be maneuvered throughout the battlespace to continuously sustain pressure at all levels—strategic, operational and tactical—by applying the most appropriate indirect fire means.

To achieve the effective and timely application of all fires and effects, we require a cohesive joint fires planning and execution process. Because we require forces that are immediately employable, including staffs at every level, those forces must train on and rehearse the critical skills associated with fires and effects application.

Providing joint training will greatly enhance the ability of forces to locate and track targets, select and task the correct fires delivery systems, generate desired effects, assess results and reengage targets, as required.

Although advances in command and control capabilities have enabled the joint force to become more integrated, our command, control and communications systems, our targeting processes and the means by which we plan and execute fires are not yet fully integrated. We continue to organize and execute by service component rather than by functionally oriented headquarters.

Training Facility for Joint Fires. The US Army Field Artillery Center has begun a cooperative effort with the Institute for Creative Technologies (ICT), a government-funded university research facility associated with the University of Southern California, to create a joint fires and effects training capability. A training facility is being established at Fort Sill that will leverage ICT immersive training technologies to train the application of joint fires. It also will serve as a test bed for developing Objective Force training capabilities.

This facility will leverage revolutionary training technologies—virtual reality, artificial intelligence and simulations—with the potential to achieve live-fire outcomes. It will train personnel from all services to request and employ fires as universal observers; to develop staff capabilities to coordinate and synchronize fires; and to train observers in the application of joint effects in an urban environment.

The training system will replicate the visual and aural conditions of employing different lethal systems and combinations of systems against a wide array of enemy target sets. Scenarios will be developed to enable training across the full spectrum of operations in variable environments and conditions.

The facility will be able to train situations that present dilemmas, such as the presence of noncombatants on the battlefield, the potential for fratricide and the need to avoid collateral damage. The intent is to be able to train the application of any indirect fire capability from any service in any environment.

Using advanced virtual reality and simulation technology to create an experiential learning environment is an efficient and cost-effective supplement to large-scale military exercises. The integration skills developed by individuals and staffs can then be applied with greater effectiveness in other training environments, such as force-on-force joint training at our combat training centers (CTCs).

Our current training facilities replicate neither lethal and nonlethal fires realistically and effectively nor the full range of capabilities that our emerging doctrine directs. Our CTCs must continue to provide tough, realistic training scenarios for maneuver operations, but they must be able to better replicate the application and effects of the full range of joint and land-based indirect fires. We need to train as we intend to fight.

From the perspective of those who must integrate fires and effects, warfare is becoming increasingly complex and more reliant on joint indirect fires. The time has come to truly integrate the indirect fires capabilities of the services and, most especially, to train those who are engaged in integrating fires and effects.

The need for a Joint Training Center for Indirect Fires Integration is essential to our future.

MG Michael D. Maples
Chief of FA, Fort Sill, OK

Cannons in Early Entry Operations
Millennium Challenge 2002

By Lieutenant Colonel Steven A. Sliwa and Majors Robert O. Kirkland and Rodney L. Olson

During Millennium Challenge in the summer of 2002, a series of battles were fought at the National Training Center (NTC), Fort Irwin, California, using a combination of live and simulated forces. The first battle required the 2d Brigade of the 82d Airborne Division, along with its direct support (DS) artillery battalion, 2d Battalion, 319th Field Artillery (2-319 FA), to accomplish a forced-entry operation and seize a flight landing strip in a classified Mid-Eastern country. The airborne brigade successfully seized and expanded the lodgment area and began preparations for follow-on operations.

The joint task force (JTF) commander then ordered elements of the 3d Brigade, 2d Infantry Division, Stryker Brigade Combat Team (SBCT) to plan an early entry of forces to further expand and protect the airhead as well as prepare for follow-on operations. The SBCT tailored a force that consisted of a Stryker company, a 155-mm (M198) artillery battery and a Q-36 Firefinder radar from 1-37 FA and an antitank platoon to conduct air-land operations into the flight landing strip. The SBCT's follow-on mission was to secure a weapons of mass effects (WME) site.

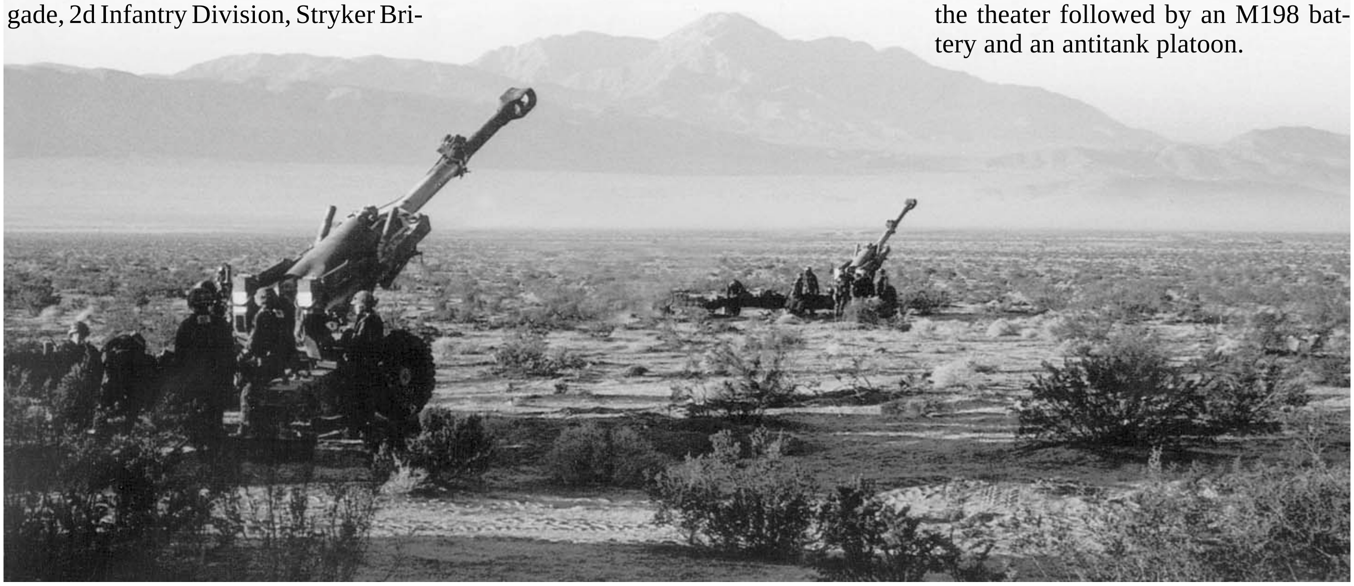
According to the organizational and operational (O&O) concept for the SBCT, the brigade must be organized, equipped and configured to meet a 96-hour deployment standard. At the operational level, it must be deployable intra-theater by C-130 (all end items and stocks must be C-130-transportable) to provide the joint force commander the flexibility to exploit emerging opportunities and hedge against uncertainty.

Early entry is spelled out in the O&O as an essential task that enhances the JTF commander's ability to shape the battlespace. Within this requirement, there are a myriad of fire support tasks, both specified and implied, that must be accomplished to ensure a successful operation.

The 82d Airborne Division Artillery out of Fort Bragg, North Carolina, over the years has developed fire support doctrine that covers forced-entry operations. It has provided an azimuth of who does what during this operation. However, there is little doctrinal guidance for follow-on forces spelling out many of the additional implied tasks the early entry force must accomplish and the coordination that must occur between the two elements.

This article explores the critical role of cannon artillery in early entry operations as it follows the forced-entry unit and provides insights into some key considerations and tactics, techniques and procedures (TTPs) to ensure success in this type of operation.

Early Entry Packages—The Importance of Cannon Fires. Based on the threat to the lodgment and impending follow-on mission, the 3d brigade staff concluded during its mission analysis that the firepower of an artillery battery and the detection capability of the Q-36 radar were required on the ground very early in the (notional) flow of the brigade's forces. (See Figure 1.) In fact, the Q-36 radar was the first to flow into the theater followed by an M198 battery and an antitank platoon.



Element	Unit	Pax	# Vehicles	C-130 Sorties	Cumulative Sorties
Q-36 Radar/1-37 FA	1-37 FA	6	3	1	1
A/1-37 FA (M198)	1-37 FA	61	20	9	10
Antitank Platoon	C/52 IN	12	4	6	16
Command Post 3/2	Bde	24	6	2	18
334 Sig Co Commo Node	334 Sig	8	3	1	19
A/1-14 Cav	1-14 Cav	90	20	27	46
Prophet 1/1-14 Cav	1-14 Cav	3	1	1	47
Prophet 2/1-14 Cav	1-14 Cav	3	1	1	48
Prophet 3/1-14 Cav	1-14 Cav	3	1	1	49
UAV 1, 2, 3	1-14 Cav	15	6	3	52

Legend:

Bde = Brigade **Co =** Company **IN =** Infantry **Prophet =** Signals Intercept System **Sig =** Signal
Cav = Cavalry **FA =** Field Artillery **Pax =** Passengers **UAV =** Unmanned Aerial Vehicle

Figure 1: Annex BB to Fragmentary Order (FRAGO) 8 to Operations Order (OPORD) 02-05. Note the Q-36 Firefinder radar was the first to flow into the theater followed by an M198 battery.

The challenge for the SBCT commander was to prioritize assets to employ the optimal mix of direct, indirect, target acquisition (TA) and reconnaissance (recce) assets to accomplish the mission. The SBCT commander has much to choose from when tailoring a force for early entry.

The SBCT has the mobility to expand the operational area and the firepower to conduct immediate follow-on missions. For example, the brigade has 146 Javelin (antitank) launchers in its infantry squads and reconnaissance, surveillance and TA (RSTA) troops; nine platoons of antitank guided missiles (ATGMs); a battalion of 12 M198 155-mm howitzers; one, each, Q-36 and Q-37 radar; and a myriad of other assets from the RSTA squadron (1-14 Cav). (Eventually, the ATGM will be replaced by the mobile gun system, a tank-like, light armored vehicle with a 105-mm gun.)

The RSTA squadron includes up to 18 sections of scouts (known as recce sections), three Shadow tactical unmanned aerial vehicles (TUAVs), ground surveillance radars and remote battlefield sensors, Prophet signals intelligence and electronic warfare (EW) system, and the Fox nuclear, biological and chemical (NBC) reconnaissance vehicle.

The threat at the NTC could employ both artillery and mortar fires against the lodgment area and had a mix of Soviet-era tanks, BMPs and limited air assets. The brigade commander's decision to bring his radar and cannon artillery battery into theater in the first few sorties of the operation is based on this threat.

The O&O makes clear that the brigade is vulnerable to casualties when targeted by enemy artillery. Accordingly, the SBCT's artillery, while still responsible for supporting fires, is focused on providing responsive, proactive counterbattery fires.

The battery of M198s complemented the 18 M119 howitzers from 2-319 FA already on the ground. The M119s that could quickly cover 6,400 mils and the M198s that have increased range and munition variety proved to be a good mix to protect the lodgment. An additional Q-36 radar from the 82d Airborne Division increased the detection capabilities of the force.

Tied with the Q-36 radars, the 155-mm cannons proved to be a force multiplier as soon as they were in position on the airfield. The M198s fired more than 200 rounds against high-payoff targets (HPTs) that included enemy indirect fire assets.

Subsequently, the Field Artillery fired in support of 1-14 Cav. As a result, the brigade commander shaped the battlespace for the follow-on mission executed by 1-14 Cav using indirect fires.

Command Relationship with the Forced-Entry Artillery Battalion. In some cases, early entry artillery organizations may find themselves serving as the force FA headquarters. For example, units that follow the 75th Ranger Regiment executing forced-entry operations often provide greater indirect fire support assets and additional range and capabilities, such as radars, to augment the force already on the ground. Key to success is quickly incorporating all assets into a structure that can provide the right effects at the right time and place.

In contrast, during Millennium Challenge 2002, 1-37 FA served in a reinforcing role to the 2-319 FA because the airborne battalion was on the ground first and had the required level of command and control to accept additional fire support assets to protect the lodgment. 2-319 FA was the counterfire headquarters, and 1-37 FA was reinforcing during this build up of forces.

1-37 FA learned several lessons serving as a reinforcing battalion.

Direct Coordination Between Commanders. Face-to-face contact between commanders of each DS artillery battalion proved extremely valuable. Each commander and portions of their staffs attended each other's fire support rehearsals to further nest the missions that were essential to the force at key moments in time. However, face-to-face contact cannot always be counted on in many potential battlefield or geographic situations.

Close Support Battery. A battery commander in the SBCT must be able to flow into the theater early and autonomously provide close support to one of the brigade's maneuver battalions in the event there is no force FA headquarters on the ground. A close support battery establishes communications with and responds to calls-for-fire from a maneuver battalion as its first priority. The

1. **Purpose.** Used when a firing battery is assigned to provide close support fires autonomously to a maneuver unit (normally a battalion).
2. **Scope.** The SBCT will encounter many situations where this relationship may be established. Examples are as follows:
   a. Early entry operations where the FA battalion tactical operations center (TOC) may or may not be available and a battery is scheduled early in the brigade's flow.
   b. When a battalion from the Stryker brigade combat team (SBCT) is given a mission outside of the span of control of the brigade and requires dedicated fire support.
   c. A maneuver unit is given a mission that is so important that a close support relationship is set up to provide more responsive fires to that specific unit.
3. **General.** The close support battery also may have additional assets with it.
4. **Prior to Departing or Conducting Link-Up with Supported Unit:**
   a. Battery commander fully understands the support relationship and seven inherent responsibilities (priority of fires, zone of fires, requirement to furnish fire support team or fire support element, requirement to furnish liaison officer, establishment of communications, who positions the battery and who plans the battery's fires).
   b. Link up information. Determine–
      - Guides at flight landing strip or port of entry.
      - Passage-of-lines information (passage points, recognition signs, routes, release points).
      - Known enemy and obstacle information.
   c. Determine attachments and detachments to the firing battery.
   d. Determine the time line for follow-on forces and command and control (include triggers for command support relationships to change).
   e. Battery commander assumes the role of battery S3 and effects coordinator (ECOORD), develops battery FA support plan (FASP) and provides input to supported unit's military decision-making process (MDMP), if possible.
   f. Determine if battery is to be included in brigade-level essential fires and effects tasks (EFETs) and (or) assigned essential FA tasks (EFATs).
   g. Conduct rehearsals and pre-combat checks (PCCs), when possible.
5. **Firing Battery Information to Provide the Supported Unit:**
   a. Ammunition carried load (155-mm and small arms), mission requirements and munitions capabilities.
   b. Equipment mission-capable status (howitzers, vehicles, generators, etc.).
   c. Personnel status (numbers, key shortages and special needs).
   d. Combat service support (CSS) status, requirements and unique support the battery can provide; provide unit-level logistics system-ground (ULLS-G) disk to supported unit.
   e. Attachments, such as radar, survey, meteorological (Met), retransmission, etc.
   f. Communication status and number of FM nets, advanced FA tactical system (AFATDS), enhanced position location reporting system (EPLRS) and Force XXI battle command brigade and below ($FBCB^2$) systems.
6. **Information to Coordinate/Receive from Supported Unit:**
   a. Mission of maneuver unit; battery commander is involved in the supported unit's MDMP.
   b. Mission for the firing battery, if not provided by 1-37 FA prior to departure; get a copy of Annex D of the operations order (OPORD).
   c. Commander's intent for fires.
   d. Position area for artillery elements (howitzers, radar, etc.).
   e. Current overlay (friendly and enemy).
   f. Mortars– location, azimuth-of-fire, tube strength and ammunition load.
   g. Locations for CSS assets and nodes, such as ammunition transfer points (ATPs), ammunition exchange points (AXPs), brigade support area (BSA), battalion aid station (BAS), maintenance collection points, the CSS plan, etc.
   h. Observer plan, scheme of fires and fire support products, such as fire support coordinating measures (FSCM), targets, etc.
   i. Participation in brigade EFETs and (or) assigned EFATs; battery commander must deconflict these with the supported unit commander.
   j. Communications plan– frequencies, call signs, retransmissions, etc.
   k. Met and survey support, if not available.
   l. Standing operating procedures (SOP) requirements (i.e., reports and reporting times).
   m. Force protection requirements– mounted/dismounted ground threat, air threat and indirect fire threat.
7. **Tactical Issues to Resolve:**
   a. Counterfire operations; recommend senior fire support element (FSE) on ground take responsibility for counterfire.
   b. Massing artillery and mortars, if needed or possible; work out issues with communications, survey and Met.
   c. Liaison in the maneuver TOC, as needed.
   d. Battery commander position on the battlefield during the fight to maintain situational awareness and pass information to the supported unit as well as the FA battalion and SBCT TOCs, as applicable.
   e. Preparations to tie into the 1-37 FA jump-TOC or the fires and effects coordination cell (FECC) when it arrives in the area of operations.

Figure 2: Close Support Battery Checklist

battery plots fires on targets planned by the task force fire support officer (FSO). The battery commander must fully understand the commander's intent and scheme of maneuver and should attend all maneuver rehearsals.

The ECOORD recommends to the brigade commander whether or not to establish a close support battery. 1-37 FA developed a close support battery checklist, including a list of situations in which the brigade commander might establish a close support battery. (See Figure 2 on Page 42.) Additionally, the task force FSO must be prepared to help the battery commander in the close supporting role; 1-37 FA produced a checklist for issues the task force FSO must address (Figure 3).

Trained Personnel for the Liaison Officer (LNO) Role. A Battery, 1-37 FA did not have an LNO to send to 2-319 FA. The lack of an LNO put additional stress on the 2-319 FA staff to understand the battalion's 155-mm consumption rates and limitations. It also put pressure on the M198 battery commander to understand his role and the value of his expertise to 2-319 FA.

Clearly, a DS battalion must train members of its staff to assume the LNO role, if called upon.

Preparations to Receive a Reinforcing Unit. Like the 2-319 FA, 1-37 FA must be prepared to quickly accept a reinforcing FA battalion and have systems and procedures in place that any unit reinforcing the battalion can use easily—especially those units that may not have the same weapon or digital systems as in the SBCT. Much of this can be achieved during the planning process as long as the staff anticipates these missions vice having to react to them.

Field Artillery is the longest-range weapon system that is organic to the SBCT. The decision to send a battery and Q-36 radar in early proved to be critical to the defense of the lodgment and set the conditions for the SBCT's follow-on combat operations.

Conclusion. The brigade O&O makes it clear the SBCT must be ready to conduct early entry operations that involve securing the lodgment and conducting follow-on operations. The M198 is the longest range weapon organic to the brigade. The decision to send a battery of M198s and a Q-36 early proved to be critical to the defense of the lodgment and to setting the conditions for follow-on operations.

The lessons from this exercise also showed that 1-37 FA, as a DS FA battalion, was not fully prepared to reinforce another DS FA headquarters. It did not have the experience, equipment and manning for this mission. This exercise also forced the battalion to assess its capability to receive a reinforcing unit.

Most of the challenges were handled by reactive measures vice proactive planning in anticipation of such missions. Early entry forces need to address these possibilities early in the planning cycle to develop the unique answers that will work for their specific organization to overcome any equipment, procedural and manning shortcomings to successfully perform these roles.

Additionally, the counterfire mission in this first exercise was shared between both battalions—not just delegated to the reinforcing battalion. The decision to share counterfire was based on the capabilities that each battalion had on the ground.

The SBCT is testing its early entry capabilities and principles for employing combat power during a brigade rotation at the NTC in April, the first time the entire brigade has trained together in the field. The SBCT will be certified at the Joint Readiness Training Center, Fort Polk, Louisiana, in May, making it deployable for operations worldwide.

- **Integrate the battery commander into all orders processes.** Depending on the situation, the battery commander may take the role of task force effects coordinator (ECOORD) and battery S3.
- **Ensure the task force EFETs are a priority for the battery.** The task force FSO coordinates with the deputy effects coordinator (DECOORD) to ensure the close support battery is not required to execute brigade EFETs.
- **Coordinate for battery positioning.** Consider distance, terrain and travel time.
- **Coordinate for logistical support.** Based on logistical considerations, certain classes of supply may be provided by the maneuver task force. For example, Class III and VIII must come from the task force while the flow of other classes of supplies, such as Class V, continue to be the responsibility of the brigade support battalion (BSB).
- **Coordinate for force protection.** This is based on enemy capabilities, terrain and distance.
- **Integrate the battery into all rehearsals.** Conduct task force technical/tactical rehearsals.

Figure 3: Task Force Fire Support Officer (FSO) Checklist. These are considerations for supporting the close support battery.

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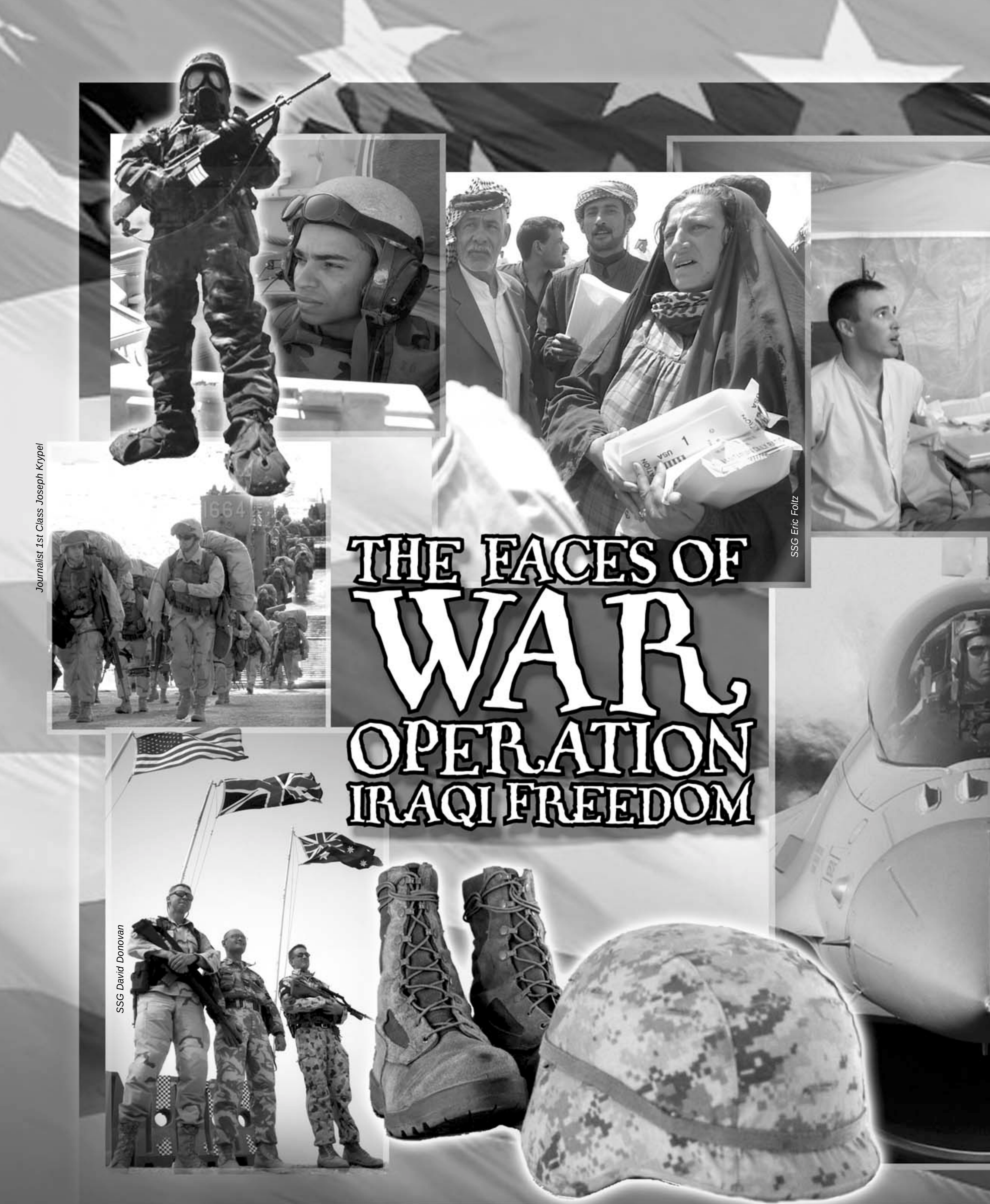

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