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REDLEG Update

The United States Army Field Artillery Branch's Newsletter

Getting After It

Doctrine Update

Link 16 and AFATDS

The Re-introduction of Predicted Fire and Standards of Precision to the Field Artillery

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Purpose: Founded in 2011, the *Redleg Update* provides past and present Field Artillery leaders with a monthly update of informational highlights to assist in their individual, collective and professional training efforts, as well as report on activities occurring throughout the Field Artillery community.

Official Distribution: The *Redleg Update* is distributed by the Commandant of the U.S. Army Field Artillery to key members of the Field Artillery chain of command across the U.S. Army. The current edition can be found @ http://sill-www.army.mil/USAFAS/index.html Past and current editions are also archived online @ http://sill-www.army.mil/USAFAS/redleg/page.html

Stephen G. Smith
Brigadier General, U.S. Army
Commandant,
United States Army Field Artillery School

Stephen G. Smith

RFIs, Notes, and Notices: To submit a Request for Information (RFI), please email the POC listed below.

Points of Contact:
We appreciate those who have provided announcements, notices, articles and lessons learned.

Additionally, if you have a story of interest or wish to initiate a discussion on any topic or issue facing the Field Artillery community, contact Ms. Sharon McBride, Field Artillery Public Affairs Officer, at (580) 558-0836 or sharon.g.mcbride4.civ@mail.mil

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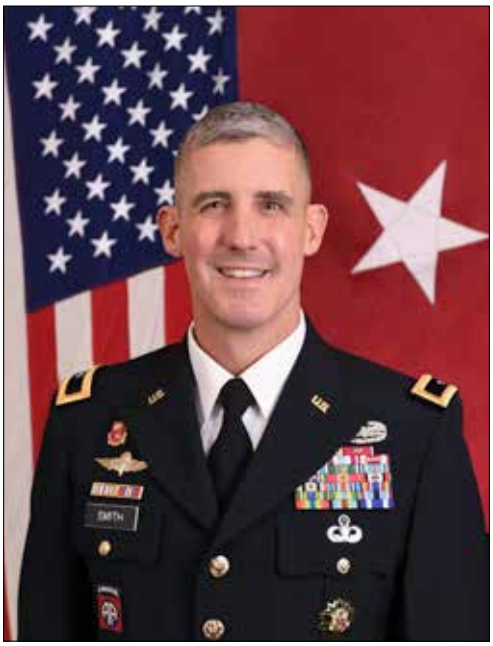
From the FA Commandant's desk

Getting After It

In this edition of the Redleg Update, you will see numerous articles from the field. These articles are a great addition to our publication, making it one of the largest we've had to date. All the articles within this edition make great points, and the ideas within are certainly worth discussing and exploring.

In particular, I want to point out the article that gives a detailed update on where we stand with our doctrine (Page 4). Early in my tenure, I outlined my initiatives and updating our doctrine was high on that list. Specifically, we identified that a re-write and re-publish of TC 3-09.8 Field Artillery Gunnery, FM 3-09 Field Artillery and ADP 3-09 Fires was imperative. These updates will help us shape Fires doctrine for large-scale ground combat and multi-domain operations.

We have also come to that time of the year, where we come together as a branch for the annual Fires Conference, to discuss the successes, challenges, and the future of the Fires enterprise. I realize that a lot of you, due to budget constraints, will not be able to attend in person, so please log



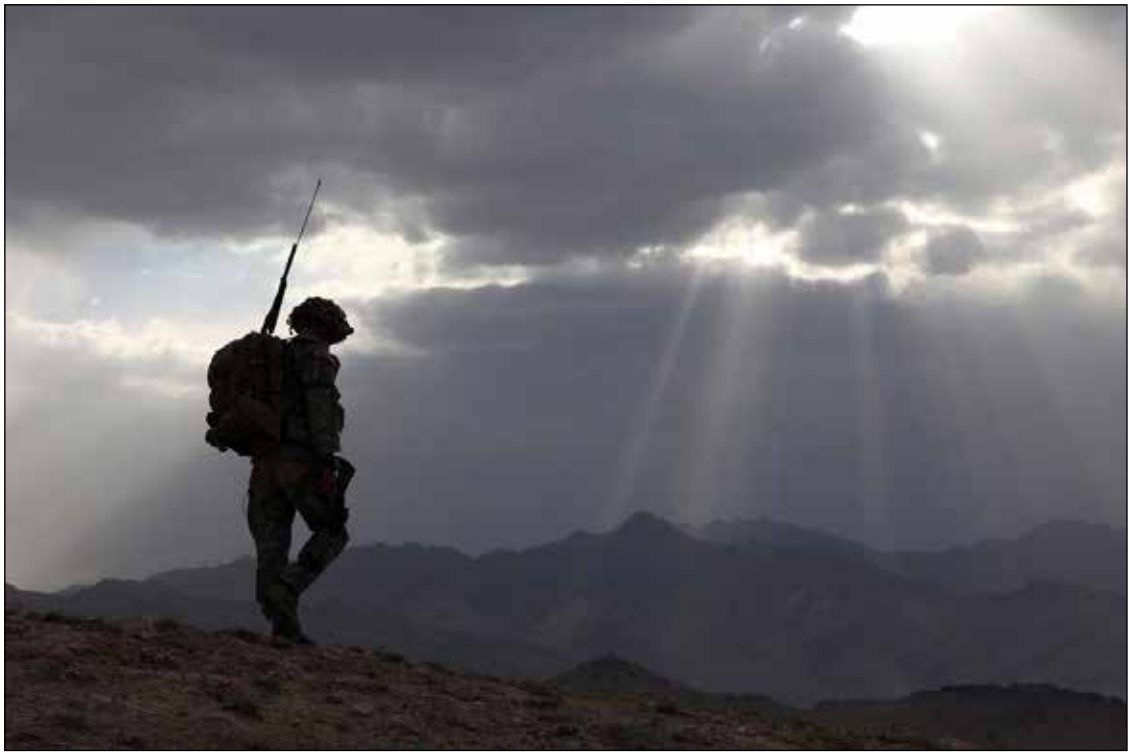
BG Stephen G. Smith

on to attend virtually by using Defense Collaboration Services (DCS). Directions for logging on and participation can be found online at https://sill-www.army.mil/fires-conference/.

Thank you for reading and keep those articles coming in. There's a lot of great training going on, as we prepare for LSGCO!

Keep up the Fire!
King of Battle!

DOCTRINE UPDATE



U.S. Army photo released

TC 3-09.8 Field Artillery Gunnery has been on milSuite since December 2018 and is going through a comment review board, as of this publication. Titled Fire Support and Field Artillery Certification and Qualification, the manual has updated content that reflects internal (FA) and external changes to training requirements as well as the framework that provides FA Commanders at all echelons with a comprehensive FA Training Strategy that is agile to future required changes. To access the updated TC 3-09.8 go to the following link: https://www.milsuite.mil/book/groups/tc-3-098-field-artillery-gunnery.

FM 3-09 is out for final staffing, with a suspense of 19 April 2019 for comments back to FA Doctrine Division. The draft FM and comment matrix template are available at https://www.milsuite.mil/book/groups/field-artillery-doctrine-revision-and-staffing. **FM 3-09 is titled Fire Support and Field Artillery Operations**, and represents the update to capstone FA doctrine to match FM 3-0's return to large-scale ground combat operations as the Army's focus.

ADP 3-09, Fires, is currently under revision, based on updated versions of **FM 3-09 and FM 3-01 Air and Missile Defense Operations.** Together with the two FMs, the ADP will shape Fires doctrine for large-scale ground combat and multi-domain operations. Stay tuned for staffing of the ADP this summer, with a final version delivered in time for the AUSA, conference in October 2019.

For any questions or comments for FA Doctrine Division, please email LTC Mike Stewart (michael.p.stewart3.mil@mail.mil), MAJ Mike Smith (michael.a.smith7.mil@mail.mil), Mr. Allen Shell (george.a.shell.civ@mail.mil), or Mr. Jim Cremeans (james.w.cremeans.civ@mail.mil).

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FA STRAC – A Story of Inadequate Support to Readiness

By CPT Tommy Cummins, 1st Cavalry Division Artillery Effects Officer

It is no secret that the ability to conduct a combined arms operation to the level we believe possible has been severely degraded over the past two decades. As is shown in CTC Trends, FY 17, "…failure to meet established doctrinal guidelines… cause errors resulting in firing incidents and/or fratricide… (especially) degraded operations require additional time and resources to achieve proficiency." Whether it is task saturation, the counter insurgency fight, or transitioning Field Artillery battalions as organic to BCTs and neglect of Fires, there is always a reason units can point to as an explanation for coming up short. While all these factors and more contribute to a Field Artillery unit's training challenges, they are the reality in which we live. We have failed, however, to adapt our training methodology to meet these demands. The new draft TC 3-09.8 reflects a very high training standard for Field Artillery units to achieve, however, the current ammunition allocation in DA 350-38 (FY19 STRAC, Chapter 3) limits those standards from being achieved.

As a community, the Fires enterprise has acknowledged the essential skills that have been lost, and is appropriately updating our certification and qualification criteria; however, without the resources to accomplish those tasks, the new standards will never be a feasible training objective. The current STRAC not only does not support the range of missions for a cannon battery, but completely neglects Fire Support specific training (where they are the primary audience). In order to meet or exceed the standards, live fire training must be a top priority with resources allocated as such. A key step in combatting this loss of training readiness is to separate responsibility of Artillery STRAC- leaving the BCTs in control of the CALFEX ammunition and the DIVARTYs in control of Artillery Table ammunition. At the brigade level, a DIVARTY can then advocate specifically for the Artillery training and have the assets to accomplish that training.

The draft TC 3-09.8, Chapter 10, specifies 14 fire missions (see Table 3) batteries and battalions must certify semi-annually (Tables XV & XVIII). Of those 14 missions, 10 have a Fire for Effect phase. Using as an example the FY 19 STRAC for a 155mm (SP) battalion in an Armored Brigade Combat Team, there are 75 total "training HE" (DA 51) rounds allocated to accomplish 10 fire missions, and an additional eight rounds to support the eight illumination, four IR illumination, and four smoke rounds (the only additional ammunition authorized is four white phosphorous rounds). With the required adjust fire rounds, this leaves a battery able to either shoot six missions with a battery two rounds, or accomplish all of them with a battery one round. Ideally, enough ammunition would be allocated for a battery three rounds representing a battalion mass destruction of 54 rounds. Not only are these numbers insufficient for tough realistic training, but it leaves zero allocation for retraining or fire supporters. As you will see in the below table, the delta in authorized and recommended rounds is not as short as one would anticipate, as Table XV is authorized twice a year. However, when you combine all the tables that must be completed and add Fire Support training, total rounds short comes out to 1,778 HE rounds, 332 SMK rounds, and 160 ILLUM rounds per battalion. Additionally, this recommendation allocates Tables XV & XVIII as an annual event, aligning it with the gated training strategy, and adds an additional Table VI, as that is the most frequently needed Artillery Table due to crew turnover and requirements tied to sustained readiness. A by table recommended STRAC is also included at the end of the article.

As is evident, the current STRAC is insufficient, but it is an equalizing metric based on real resources and money available. The problem is, when you always run with the slowest ability group, no one ever moves up. In that vein, when did the Army stop rewarding the winners? If a unit is able to properly forecast and use more rounds supporting their own certifications, CALFEX, EXEVAL, and Fire Support lanes, why not reward the unit with the ability to do so? In

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STRAC ... Continued from Page 5

order to support these events, however, we must make an honest assessment of the number of rounds required to become proficient, anticipate re-training and qualification and still maintain the ability to provide fires in support of maneuver units. Those numbers will never be the same for every battalion, not only in the Army, but even within the same division. Some training events can be run in tandem, such as shooting Table VI missions during a CALFEX, while other battalions will have crews break after training events are completed and require additional qualifications.

In order to support the varying unit requirements and ability to train, we should adjust the ammunition allocation methodology. An immediate course of action that could begin to remedy this is the "split STRAC" method. By aligning one STRAC against only Artillery Tables, under the purview of the DIVARTY, and one STRAC specifically for maneuver support, under the purview of the BCT, Artillery Tables would be planned and resourced by the individuals who understand them best. This course of action would additionally force DIVARTY, BCT, and FA BN staffs to synchronize early identifying training pitfalls and if required cross load ammunition to better support the timing of each training event.

Even without an increased STRAC, commanders can compensate for resource shortfalls with a handshake deal for another unit's STRAC. Units, however, will be unlikely to share ammunition until the end of the fiscal year when they are certain they have met their own training objectives, and very likely would not support the training timelines. Thus, if all FA Table STRAC was under the direct supervision of the DIVARTY, sharing of ammunition between Artillery BNs could be streamlined and managed to better support each BN. With the understanding of the METL tasks from the BCT commanders, DIVARTY could shape the Artillery Tables to meet that intent, while consolidating and reporting what missions were unable to be trained due to ammunition availability. This would tailor every Artillery Table by BN to meet the intent of the supported commands and keep commanders better informed of the status and efficacy of Artillery training.

Additionally, while the STRAC must increase to ensure the firing units are properly trained, we must also take into account our Fire Supporters. According to the draft TC 3-09.8, Chapter 5, Fire Supporters are always a secondary training audience. They will complete their qualification by "catching a round" live either during an Artillery or Mortar certification or during Platoon LFX/ Company CALFEX. The draft TC 3-09.8 does take an excellent approach to what tasks and abilities every member of the Fire Support Team should have, but if they are never the primary training audience, missions are scripted and the ability to adjust fires are significantly restricted to support the maneuver or gunline training. In order to achieve accurate target location and size, Fire Support Teams must be able to train the way they fight, picking a target in a wide area - not the center grid of a safety box. In the "split STRAC," DIVARTYs would be able to forecast the ammunition available to ensure this is conducted. Currently, the trend across the 1st Cavalry Division Artillery battalions is that Fire Supporters qualify almost exclusively with mortars due to FA ammunition restrictions. If this continues, the required live fire missions in the new draft TC 3-09.8 will almost certainly fall by the wayside.

To combat the loss of Fire Support training, two distinct events must occur. First, additional ammunition, especially real "HE" (D571/D544) rounds rather than "Training HE" (DA 51), must be authorized either in the STRAC or to resource over STRAC. Real "HE" is especially important for the observers to accurately acquire and adjust fires. Ammunition must be available to train the gunline, support the maneuver, and give the Fire Supporters annual training where they are the sole focus. Second, time must be allocated at the division level for annual Fire Support collective training, planned by the Division Artillery and incorporating all aspects of the Fire Support system.

Beginning at the company level, we must allow a Fire Support Table VI to be conducted at least once with Field Artillery assets and working by echelon to the brigade fight. After being qualified on Fire Support Table VI (see Table 5 for recommended STRAC), company level Fire Support officers should execute an externally evaluated lane to include creating and

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STRAC ... Continued from Page 5

briefing a Fires plan, air assets resourced forcing the integration of enablers, and Field Artillery and mortar assets to test and stress the company teams ability to echelon fires. This could be achieved with minimal impact to supporting units by simply extending a BDE EXEVAL by 96 hours, running day and night lanes for every FiST in the BDE. Following the company lanes, Battalion Fire Support Elements are equally lacking the resident knowledge and skills to perform the basic tasks of managing FSCMs for maneuver units, receiving and disseminating timely fires information, and effectively controlling the FiSTs assigned to the battalion. As such, an additional BN FSE focused lane should stress their ability to plan, coordinate and execute fires simultaneously to all assigned teams. It should be noted that the company and battalion level lanes are of minimal STRAC impact as the goal is not observe as many rounds as possible, but test a units tactics, ability to plan, and execute dynamic targeting and fires (this STRAC is accounted for in Table 6).

Finally, nested with the gated training strategy the BDE Fires Cell should be heavily incorporated in the BDE EXEVAL. Normally, any BDE exercise begins with sending out scouts and waiting to hear the report-- it should begin with a major shaping operation planned and executed by the BDE Fires Cell, utilizing scouts (and FiSTs) as an observation platform to report BDA or confirm BDA from intelligence and ISR elements. This will require the BDE Fires Cell to request and plan assets not organic to their brigade, create real observation plans, and carefully control the FSCMs from the top down. This can be done with no additional STRAC allocation to our current recommendation, as the Artillery Table XVIII can be run in conjunction and the BCTs will have their allocated CALFEX Artillery ammunition to offer.

Table 1

Recommended STRAC based off TC 3-09.8 AT VI

Table 3-14. Howitzer Table VI: Section Qualification (Live-Fire)

Method of Fire Control	155mm Fire Mission	Table	Ammo	Recommended Round	Recommended Mission Size per Section	Recommended Mission Type per Section	Recommended Frequency per year	FOC	Degraded	Manual
	Direct Fire	VI	*HE, 4 rds	DM 51	3	IE	3	x		
WR	Low Angle, AF	VI	*HE, 5 rds	DM 51	3	1 ADJ, 2 IE	3		x	
DNL/CDNL	Low Angle (Multiple Sheaf), FFE	VI	*HE, 3 rds	DM 51	3	IE	3	x		
WR	High Angle, AF	VI	*HE, 5 rds	DM 51	3	1 ADJ, 2 IE	3	x		
AMC	High Angle, FFE	VI	*HE, 2 rds	DM 51	3	IE	3			x
ON CALL	Priority Target, FFE	VI	*HE, 2 rds	DM 51	3	IE	3	x		
WR	Towed-Out of Traverse, FFE SP-Emergency, FFE	VI	*HE, 1 rd	DM 51	2	IE	3	x		
COUNTDOWN	Time on Target, FFE	VI	*HE, 1 rd	DM 51	3	IE	3	x		
Total Rounds Recommended per Section					23					
Total Rounds Recommended per BTRY					138					
Total Rounds Recommended to Certify BN x 1					414					
Total Rounds Recommended to Certify BN x 3					1242					
Current STRAC Authorization per Section					23					
Current STRAC Authorization to Certify BN x 1					414					
Current STRAC Authorization to Certify BN x 2					828					

* Total number of rounds did not change per section, frequency of crews breaking requires additional authorization

As a Fires community, we continue to teach the immense capabilities that the King of Battle should have, but we are unable to resource the training to achieve those standards. On the gunline and in the FDC, the basic skills of troubleshooting, maintaining communications, and achieving time standards repeatedly slow our ability to provide fires and integrate in combined arms operations. In the Fire Support community, the skills and knowledge that are gained through live training are being relegated to a secondary training audience. New ammunition allocations and training timelines are critical to put the King back on his throne. By giving the senior fires organization in a division the ability to control and balance Field Artillery specific training, including resources, the community as a whole can better synchronize its efforts to begin training to standard. We all recognize the skills that have been degraded over the past several years, the question is: will we adapt as a community and create the ability to succeed?

Editor's Note: Additional reference tables are on following pages

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Table 2

Recommended STRAC based off TC 3-09.8 AT XII

Table 10-3. Cannon Platoon A T XII Fire Missions (executed live)

Method of Control	Mission Type	Recommended Round	Recommended Mission Size per Platoon	Recommended Mission Type per Platoon	Recommended Frequency per year	FOC	Degraded Comms	Manual
WR	Low Angle, AF	DA 51	7	1 ADJ/PLT 3 IE	3			
DNL/CDNL	Low Angle (Multiple Sheaf), FFE	DA 51	9	PLT 3 IE	2			
WR	High Angle, AF	DA 51	7	1 ADJ/PLT 3 IE	3			
AMC	High Angle, FFE	DA 51	9	PLT 3 IE	2			
WR	Sweep and Zone (Large Irregular Shaped Target), FFE	DA 51	27	PLT 3 IE	3			
WR	Immediate SMK Suppression, FFE	DA 76	9	PLT 3 IE	3			
AMC	Illumination, AF/FFE	DA 65	4	By Piece By Round	3			
COUNTDOWN	Schedule of Fires, FFE (x3 missions)	DA 51	36	PLT 3 IE, PLT 2 IE, PLT 3 IE	3			
Total Recommended HE Rounds per PLT			63					
Total Recommended HE Rounds per BTRY			166					
Total HE Rounds to Certify BN x 1			498					
Total HE Rounds to Certify BN x 2			996					
Total Recommended SMK Rounds per PLT			9					
Total Recommended SMK Rounds per BTRY			18					
Total SMK Rounds to Certify BN x 1			54					
Total SMK Rounds to Certify BN x 2			108					
Total Recommended Illum Rounds per PLT			9					
Total Recommended Illum Rounds per BTRY			18					
Total Illum Rounds to Certify BN x 1			54					
Total Illum Rounds to Certify BN x 2			108					
Current HE STRAC Authorization per PLT			50					
Current HE STRAC Authorization per BTRY			100					
Current HE STRAC Authorization per BN x 2			378					
Current SMK STRAC Authorization per PLT			0					
Current SMK STRAC Authorization per BTRY			0					
Current SMK STRAC Authorization per BN x 2			0					
Current Illum STRAC Authorization per PLT			0					
Current Illum STRAC Authorization per BTRY			0					
Current Illum STRAC Authorization per BN x 2			0					

Table 3

Recommended STRAC based off TC 3-09.8 AT XV

Table 11-3. Cannon Battery A T XV Fire Missions (executed Live)

Method of Control	Mission Type	Recommended Round	Recommended Mission Size per BTRY	Recommended Mission Type per BTRY	Recommended Frequency per year	FOC	Degraded Comms	Manual
WR	Low Angle, AF	DA 51	14	2 in ADJ/ BTRY 2 IE	1			
DNL	Low Angle (Multiple Sheaf), FFE	DA 51	18	BTRY 3 IE	1			
WR	High Angle, AF	DA 51	14	2 in ADJ/ BTRY 2 IE	1			
AMC	High Angle, FFE	DA 51	18	BTRY 3 IE	1			
DNL	Priority Target, FFE	DA 51	12	BTRY 2 IE	1			
AMC	Out of Sector, Safety Violation	NA	0	NA	1			
AMC	Towed – Out of Traverse, FFE; SP – Emergency, FFE	DA 51	12	BTRY 2 IE	1			
AMC	Precision Registration Quick and Time, AF	DA 71	26	Both FDCs conduct 1x time	1			
AMC	PGK, FFE (155mm only)	DA 71	6	By piece by round	1			
DNL / AMC	* Excalibur, FFE (155mm only)	NA	0	0	1			
BRAMC / BPBRAMC	Quick Smoke, AF	DA 71/DA 28	1 HE/12 SMK	1 in ADJ/ BTRY 2 IE	1			
AMC	Coordinated Illumination, AF/FFE	DA 71/DA 65	12 HE/8 Illum	PLT Illum ADJ/ BTRY 2 IE	1			
DNL / AMC	Schedule of Fires, FFE (x3 Missions)	DA 51	48	BTRY 3 IE, BTRY 2 IE, BTRY 3 IE	1			
TOT	Battery FFE (mass from separate PLT locations)	DA 71	18	BTRY 3 IE	1			
Total Recommended HE Rounds per BTRY			199					
Total HE Rounds to Certify BN x 1			597					
Total Recommended SMK Rounds per BTRY			12					
Total SMK Rounds to Certify BN x 1			36					
Total Recommended Illum Rounds per BTRY			8					
Total Illum Rounds to Certify BN x 1			24					
Current HE STRAC Authorization per BTRY*			166					
Current HE STRAC Authorization per BN			498					
*Current STRAC is 83 rounds per AT XV, but is authorized twice a year which units generally don't conduct								
Current SMK STRAC Authorization per BTRY			4					
Current SMK STRAC Authorization per BN x 3			24					
Current Illum STRAC Authorization per BTRY			12					
Current Illum STRAC Authorization per BN x 2			24					

Table 4

Recommended STRAC based off TC 3-09.8 AT XVIII

Table 12-3. Cannon Battalion A T XVIII Fire Missions (executed Live)

Method of Control	Mission Type	Recommended Round	Recommended Mission Size per BN	Recommended Mission Type per BN	Recommended Frequency per year	FOC	Degraded Comms	Manual
WR	Low Angle, AF	DS71/DS44	42	6 in ADJ/ BN 2 FFE	1	Select Fire Missions should be conducted FOC, Degraded, or Manual at the certifying commander's discretion.		
DNL	Low Angle (Multiple Sheaf), FFE	DS71/DS44	54	BN 3 IE	1			
WR	High Angle, AF	DS71/DS44	42	6 in ADJ/ BN 2 IE	1			
AMC	High Angle, FFE	DS71/DS44	54	BN 3 IE	1			
DNL	Priority Target, FFE	DS71/DS44	36	BN 2 IE	1			
AMC	Out of Sector, Safety Violation	NA	0	NA	1			
AMC	Towed – Out of Traverse, FFE; SP – Emergency, FFE	DS71/DS44	36	BN 2 IE	1			
AMC	Precision Registration Quick and Time, AF	This mission doesn't make sense at the BN level						
AMC	PGK, FFE (155mm only)	DS71/DS44	18	By piece by round	1			
DNL / AMC	* Excalibur, FFE (155mm only)	NA	0	0	1			
BRAMC / BPBRAMC	Quick Smoke, AF	DS28/DS50	6 HE/ 36 SMK	6 in ADJ/ BN 2 IE	1			
AMC	Coordinated Illumination, AF/FFE	DS71/DS05	36 HE/ 8 Illum	BTRY Illum ADJ, BN 2 IE	1			
DNL / AMC	Schedule of Fires, FFE (x3 Missions)	DS71/DS44	144	BN 3 IE, BN 2 IE, BN 3 IE	1			
TOT	Battalion FFE	DS71/DS44	54	BN 3 IE	1			
Total Recommended HE Rounds per BN			522					
Total Recommended SMK Rounds per BN			36					
Total Recommended Illum Rounds per BN			8					
Current HE STRAC Authorization per BN			200*					
Current STRAC is only 100 HE rounds per Table XVIII but authorized 2x times per year.								
Current SMK STRAC Authorization per BN			8 (WP)					
Current Illum STRAC Authorization per BN			48					

STRAC ... Continued from Page 7

Table 5

Recommended STRAC based off TC 3-09.8 Fire Support Table VI							
Table 6-7. Fire Support Table VI: Fire Support Team Fire Missions							
Mission	*Recommended Round*	*Recommended Mission Size per FIST*	*Recommended Mission Type per FIST*	*Recommended Frequency per year**	*Fully Capable*	*Degraded Comms*	*Denied GPS*
Immediate Suppression	D571	6	PLT 2 IE	1	X		
Irregularly Shaped Target	D571	6	PLT 2 IE	1			X
Quick Smoke	D571	1 HE/6 SMK	1 in ADJ/ PLT 2 IE	1	X		
Coordinated Illumination	D571	6 HE/4 Illum	4 in ADJ/ PLT 2 IE	1	X		
Precision Registration	D571	13	N/A	1			X
Engage a Moving Target/array	D571	16	4 in ADJ/ PLT 2 x 2 mission IE	1	X		
Adjust Final Protective Fires	D544 (Comp B HE)**	6	At 800m from OP drop 200, followed by creeping fires	1	X		
Priority Target	D571	6	PLT 2 IE	1	X		
Simultaneous missions	D571	12	PLT 2 IEx 2 missions	1		X	
Time on target	D571	6	PLT 2 IE	1		X	
Total Recommended HE Rounds per FIST		77	*Fire Support Table VI requires semi-annual certification, recommend the other certification is accomplished with Mortars or during CALFEX to conserve FA STRAC **D544 COMP B HE is required to accomplish fires Danger Close due to smaller danger areas associated with the round.				
Total Recommended SMK Rounds per FIST		6					
Total Recommended Illum Rounds per FIST		4					
Total Recommended HE Rounds per ABCT		1001					
Total Recommended SMK Rounds per ABCT		78					
Total Recommended Illum Rounds per ABCT		52					
Current STRAC Allocation for Fire Support Table VI		0					

Table 6

Recommended STRAC Fire Support Collective Training				
Mission	*Recommended Round*	*Recommended Mission Size per FIST*	*Recommended Mission Type per FIST*	*Recommended Frequency per year**
Irregularly Shaped Target	D571	6	PLT 2 IE	1
Quick Smoke	D571	1 HE/6 SMK	1 in ADJ/ PLT 2 IE	1
Priority Target	D571	6	PLT 2 IE	1
Total Recommended HE Rounds- CO FS Training		169	*3 additional missions are recommended to be conducted by Mortars for both CO and BN level lanes *CO and BN lanes would accomplish the same missions or missions that support METL requirements	
Total Recommended SMK Rounds- CO FS Training		78		
Total Recommended HE Rounds- BN FSE Training		169		
Total Recommended SMK Rounds- BN FSE Training		78		
Total Recommended HE Rounds- Collective Training		338		
Total Recommended SMK Rounds- Collective Training		156		
Current STRAC Allocation FS Collective Training		0		

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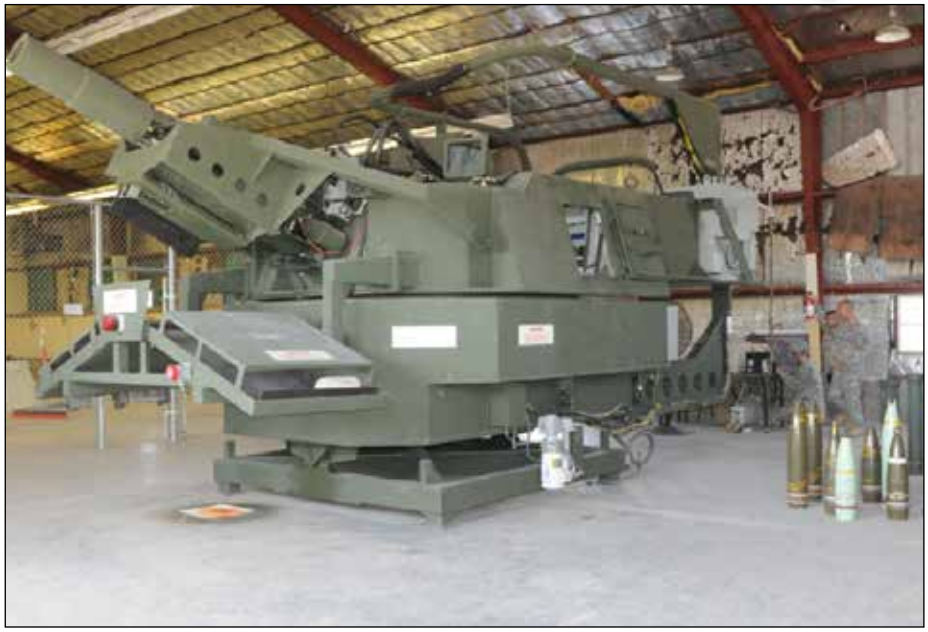
[i] Center for Army Lessons Learned, Bulletin NO. 18-14, CTC Trends FY2017, https://usacac.army.mil/sites/default/files/publications/17644.pdf, March 2018.

[ii] Fire Center of Excellence, TC 3-09.8, Fire Support and Field Artillery Certification and Qualification, https://www.milsuite.mil/book/groups/tc-3-098-field-artillery-gunnery, 2018.

[iii] Headquarters Department of the Army, Standards in Weapons Training DA Pam 350-38, https://www.atsc.army.mil/tcmlive/strac/MenuFY19.html, September 2018.

An FSCAT for the 21st Century

4-27 Field Artillery, 2nd Brigade
1st Armored Division



U.S. Army photo released

The Fire Support Combined Arms Tactical Trainer, or FSCAT, first fielded in 1997 was designed as a low-cost simulator to train M109A6 Paladin crews. The system replicates all the primary systems associated with conducted standard fire missions in the Paladin. The Paladin Commander's station is complete with Paladin Fire Control System (PDFCS), gunners position, and number one position. Unlike dry-fire training in the unit motorpool, the FSCAT allows for the loading and firing of a simulated round. The system permits Paladin crews to train Artillery Tables I – V and with DIVARTY commander approval, can also be used to substitute for Table VI crew live-fire certification. When properly trained and utilized, the FSCAT is an invaluable tool for an M109A6 battalion to maintain readiness and proficiency. With the Army recently making the decision to field more Armored Brigade Combat Teams, the Field Artillery community finds itself with a large number of NCOs who have never worked on Paladins. The FSCAT bridges the knowledge gap by allowing familiarization and multiple repetitions in simulation, prior to certification. In addition, it is an excellent resource for leader certification, allowing platoon leaders to experience all the crew positions for the gun. Where the FSCAT falls short is that it only trains howitzer crews and has limited Fire Direction Center participation. In order for an FA battalion to train at the platoon level, units are required to go to the field. M109A6 and A7 battalions require an immersive virtual system, to allow platoons to train tasks in Tables VIII through XII, including maneuver, occupations, and emergency missions. Such a capability would enable Paladin platoons to gain extensive experience in a low-cost environment.

An Armored Brigade Combat Team's life revolves around its two primary killing systems, the M1A2 Abrams main battle tank, and the M2A3 Bradley Fighting Vehicle. The crew gunnery requirements for these platforms are time consuming and the Army has fielded a number of simulators to enable these crews to train; prior to live fire. In order to train at the collective level of platoon or higher, the Army developed the Close Combat Tactical Trainer (CCTT). The CCTT is "designed to provide Infantry, Armor, Mechanized Infantry, Cavalry, and Armored Reconnaissance crews, units, and staff with a virtual, collective training capability that will increase and sustain readiness. Soldiers train using full-crew simulators, mock-up command posts and live battalion command posts to accomplish their combined arms training tasks. Units can conduct multiple platoon-level training events, or company and team collective training up to battalion task force level. CCTT allows for up to 32 simultaneous, independent exercises." This allows platoon through company to fight in virtual environment; where they man an interior replicate of their platform and maneuver in an immersive 360-degree digital simulation.

While maneuver units can train collectively in a networked, virtual environment, the Paladin battalion can only train one crew at a time on what is a simple simulator. What Army installations with ABCTs

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require is a new, upgraded version of the FSCAT to train Paladin platoons in a low-cost environment. Each CCTT should be equipped with a platoon set of three FSCATs and a platoon operations center (POC). The upgraded FSCAT would not only replicate fire mission processing, but would provide a full virtual environment. A driver's station should be added, as well as 360-degree wrap-around screens identical to a Bradley or Abrams in the CCTT. This would allow the entire Paladin platoon to maneuver in a virtual environment and execute their occupation drills. The Paladin section chief could also employ his .50 caliber machine gun in self-defense and the simulation would allow direct fire engagements by the Paladin crew. The platoon operations center would operate from a M1068 mock up, sending digital commands through the Army Field Artillery Tactical Data System (AFATDS), or by voice. The CCTT in a degraded environment already replicates a M2A3 Bradley Fire Support Vehicle (BFIST), which could then call for fire directly to the POC.

A CCTT equipped with a Paladin platoon set would have enormous benefits to train artillery Tables VII through XI, with multiple repetitions and no impact on operational readiness of the Paladin fleet. Platoon leaders would be able to issue orders, conduct rehearsals, and execute operations moving between Position Area for Artillery (PAAs). This simulator would also allow for training on special munitions, such as Excalibur or the Family of Scatterable Mines (FASCAM). Units could employ the entire chain of sensor-to-shooter in one simulation, execute several iterations, and all while in the comfort of a climate controlled building. As platoons prepare for their Table XII live fire certification, such a simulator would better prepare units for first time GOs and increase unit readiness.

The FSCAT is an invaluable tool for M109A6 battalions to train crews; prior to live fire certification. With platoons being the centerpiece of a M109A6 Paladin battalion, a more immersive, low-cost virtual trainer is essential for building readiness and expertise. Using the current CCTT and adding a platoon set of upgraded FSCAT trainers would greatly enhance a unit's ability to train platoons to proficiency in a digital environment; prior to going to the field. The result would be better trained crews and reduced training and maintenance costs on the home station fleet of equipment.

Editor's Note: LTC David Smith, MAJ Justin Cuff, MAJ Joshua Jacquez, CPT Tomas Falkenberg, CPT Jason Nobles, SFC Adam Smith, SFC Brian Reynolds and SFC Scott Parham all contributed to this article.

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Words Have Meaning – HIRAIN and LHP

By MAJ Anthony J. Allen, Brigade XO and 1LT Zachary P. Howard, 18th Field Artillery Brigade

Our doctrinal foundation continues to be diluted with acronyms and undefined terms. Overused and ill-defined terms lead to confusion and miscommunication due to multiple meanings and interpretations. The M142 High Mobility Artillery Rocket System (HIMARS) community currently faces the issue of non-doctrinal terminology filtering into common 17operational terms. The community consistently provides precision fires to conventional Ground Force Commanders (GFC) and Special Operations Forces (SOF) executing missions that are described utilizing non-doctrinal terminology. Two terms widely used in the CENTCOM AOR and that have gained traction in the Joint Community are Light HIMARS Package (LHP) and HIMARs Rapid Infiltration (HIRAIN).

HIMARS deliver precision rocket and missile fires through an expeditionary platform equipped with Hot Panel Software. This software provides HIMARS the ability to load an aircraft, travel to a distance location while maintaining GPS signal, and unload the aircraft in a firing capable status (ATP 3-09.60). The Fires Center of Excellence in concert with the HIMARS Project Managers published two HIMARS Hot Panel Guides. These guides are associated with software versions 7.10 and 8 and provide checklists for the use of the Hot Panel Software. Beyond these documents, there is very little doctrine as a foundation for conducting this type of operation.

Currently, in the CENTCOM AOR the term HIRAIN describes a multitude of HIMARS related operations. For example, a raid, a live-fire exercise, fire base operations, shipping GMLRS, and the movement of a HIMARS from one country to another are described as HIRAIN operations. The use and meaning of the acronym depends on the source using it (see references a-c).

Prior to the introduction of the term HIRAIN into our operational lexicon, the operation terminology used was "Hot Panel Raid." This term evolved from the software giving HIMARS its expeditionary roll off firing capability. Based on flight duration, the hot panel capability can be broken down into two categories: Hot Panel Raid (HPR) and Moving Base Alignment (MBA) operations. HPR is used when the HIMARS panel remains on for the duration of a flight 90 minutes or less. If the flight duration exceeds 90 minutes, the HIMARS panel must be shutdown to maintain battery power and crews execute MBA.

We make the case to use HPR and MBA terminology rather than HIRAIN acronym; however, HIRAIN is so widely used that it is unlikely it will be removed. Consequently, it may be worth retaining the HIRAIN acronym and doctrinally defining the term. In doing so we have the opportunity to tie its meaning back to a doctrinal foundation.

Proposal: HIRAIN – HIMARS Raid via Aerial Insertion vs. HIMARS Rapid Infiltration

HIRAIN at its core is an artillery raid, specifically using an aircraft. By stating it is a HIMARS Raid it is clarifying the platform which is conducting the operation and the type of operation being conducted. A raid is an operation that temporarily seizes an area in order to secure information, confuse an adversary, capture personnel or equipment, or to destroy a capability culminating in a planned withdrawal (JP 3-0). A raid is conducted either cross FLOT or behind the FLOT and is not limited to the enemy's rear area. Denoting the mode of travel by stating Aerial differentiates this operation from a ground movement. Insertion annotates the first part of a raid. Conversely, within HIMARS Rapid Infiltration the terms selected provide very little doctrinal explanation or clarification. The term Rapid provides little guidance and is open to interpretation and perspective. Additionally, Infiltration is the covert movement of all or part of the attacking force through enemy lines to an objective in the enemy's rear area (FM 3-09.21).

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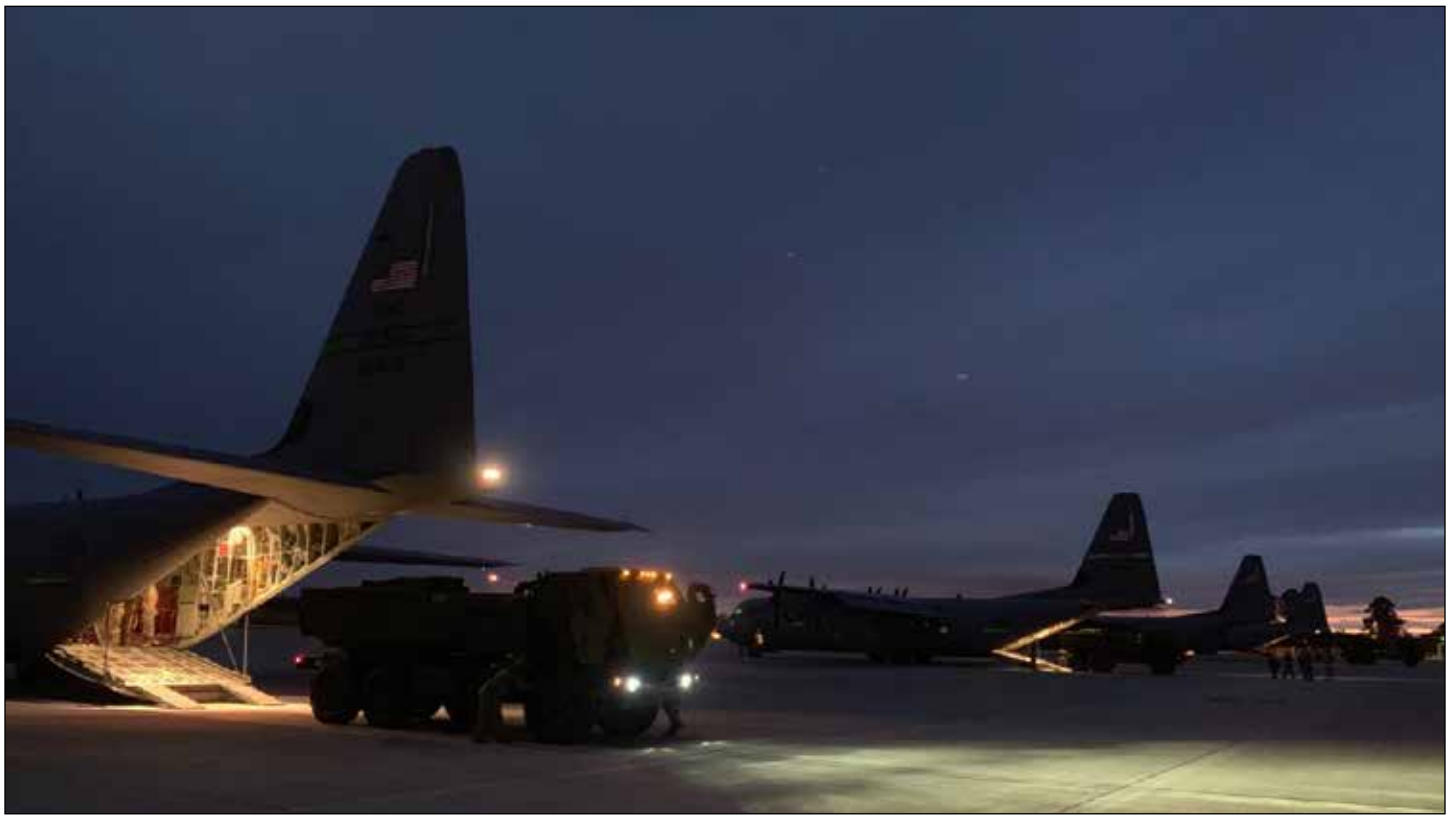

U.S. Army photo released

Another term in use currently across the force that needs attention is the Light HIMARS Package or LHP. There is no doctrinal basis for this term and it is extremely misleading concerning size and capabilities of various sizes of artillery fighting elements. Assumptions for what a LHP consists of span the gambit from a single launcher to an entire platoon. At times, those assumptions are directly linked to an aircraft configuration and not the mission or desired effects to meet the maneuver commander's intent.

"The LHP is designed for rapid deployment in order to provide a combatant commander a range of indirect fire options across an area of responsibility. The standard package for a C-17 aircraft has four vehicles: two launchers, a fire direction center (FDC) vehicle, and a command HMMWV with a generator trailer."(https://sill-www.army.mil/firesbulletin/archives/2018/nov-dec/articles/8-6_Nov-Dec_web_Deveraux.pdf).

The "standard" C-17 configuration presented in this excerpt from the Fires Bulletin was specifically organized to meet the Multi-domain Task Force Commander's objectives during RIMPAC 18. The "standard LHP" may not have been the same had the Task Force Commander's intent or the mission had been different. Currently, in the CENTCOM AOR the LHP term is being used to describe decentralized elements operating from firebase locations. These elements are task organized to perform a directed mission and not tied to any aircraft platform.

Proposal: Define LHP and use doctrinal unit terminology when referring to HIMARS elements.

Definition: Light HIMARS Package (LHP) – A modular, tailorable, and scalable HIMARS element that is executing a specified mission to provide fires capabilities, and enables the CFLCC and joint force commander. LHP alone does not denote the size, capabilities, or command and support relationship of the element.

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Element	# of Launchers	Includes FDC Capability	Includes Sustainment Capability
BTRY	8	Yes	Yes
BTRY (-)	5-6	Yes	Yes
PLT	4	Yes	Yes
PLT (-)	2-3	Yes	Possibly
Section(+)	1	Possibly	Possibly
Section	1	No	No

Table 1. HIMARS element sizes with denoted capabilities.

Given the information provided throughout the article, which of the following mission statements convey more information and provides greater understanding?

Alpha Battery conducts a LHP HIRAIN NLT 190200ZMAR19 at Firing Point 1 vicinity Redleg Airfield IOT provide strike fires ISO TF GOLD's seizure of OBJ BEAR.

Or

Alpha Battery conducts a PLT(-) HIMARS Raid via Aerial Insertion (HIRAIN) NLT 190200ZMAR19 at Firing Point 1 vicinity Redleg Airfield IOT provide strike fires ISO TF GOLD's seizure of OBJ BEAR.

References:

a. HI-RAIN – HIMARS Rapid Infiltration (https://www.army.mil/article/119731/artillery_air_crews_execute_hi_rain_joint_exercise)

b. HIRAIN - HIMARS Rapid Infiltration (https://www.eielson.af.mil/News/Photos.aspx?igphoto=2001915653)

c. HIRAIN - HIMAR Rapid Insertion (http://fortblissbugle.com/2017/08/30/hirain-training-5th-armored-bde-coordinates-rocket-mobility-training/)

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Link 16 and AFATDS Interoperability Addressing the Critical Gap in the Sensor to Shooter Chain

By LTC Aaron Sadusky (CDR 3-321 FAR), CPT James Ford (A/S3) and CPT Arthur Wilas (FCO)

An emerging trend demanding the Joint Force and Fires community's attention is the development of sensor-to-shooter capabilities to allow successful delivery of long-range precision to support multi-domain fires operations. 18th FA Brigade and 3-321 Field Artillery Regiment support the USAF's Weapons School Integration (WSINT) Course twice a year. This support provides the opportunity to test HIMARS rapid deployment capabilities through a Joint LFX and replicate Combined Air Operations Center (CAOC) integration of a BN or BDE Fires Cell in support of the Air Force's Joint Force Entry Exercises. During the WSINT 18B rotation in DEC 2018, one of the critical lessons learned focused on interoperability challenges between Link 16 and AFATDS. In this article, we will briefly highlight Link 16 Integration and discuss the interoperability challenges 3-321 FAR experienced to foster discussion and potential Joint solutions that allow for more effective sensor-to-shooter capabilities.

Linking Link-16 to AFATDS

Link-16 information flow is a complex process that requires greater understanding prior to achieving successful integration with AFATDS. Link-16 data is first generated by USAF elements (fighter aircraft, C2 nodes) and transmitted between stations. A separate data system, the Joint Range Extension (JRE), collects Link-16 data and redistributes it across other computer networks. One such network is the Air Defense System Integrator (ADSI), used in air-defense applications. Currently, AFATDS can interface with the ADSI to read some Link-16 messages.

Link 16 and AFATDS interoperability challenges

Link-16 communication occurs through the sending and receiving of different standardized messages between Link-16 users. Messages receive an identifier (J-code) based on the type of information they carry. For example, most aircraft periodically send a J2.0 message containing their position, altitude, ammo status, and other information. Command and control elements can then track friendly elements on their C2 platforms to provide a common operating picture. Currently, AFATDS is limited on what Link-16 J-Code messages it can receive. More critically to our ability to deliver fires, AFATDS currently only understands one type of land-based target J-message (J3.5) from C2 aircraft, the only AF platforms that emit J3.5 messages. This is a system limitation and a major hurdle in the sensor-to-shooter goal from attack aircraft. In addition, AFATDS is extremely limited on the types of J-messages it can send. Essentially, the AFATDS can only transmit a J2.0 position message for its own location. While this provides friendly USAF elements situational awareness of a FDC's location, it does not allow, nor maximize, two-way communication over Link-16.

AFATDS should be able to send image and free text J-messages, but during WSINT 18B, these messages were unsuccessful and caused system operation issues on the AFATDS. These limitations require a second communication channel to identify and prosecute targets using the method described in Figure 1.

Despite the current limitations, the team trained on Link-16 during WSINT 18B to reduce mission processing times. During the exercise, the 3-321 FAR cell in the CAOC usually received targeting requests or calls for fire from a USAF C2 element via mIRC. Soldiers then manually entered the data into AFATDS, processed, and sent MTO data back to the C2 element via mIRC. However, using Link-16 through dedicated efforts by the Fires Cell, a C2 aircraft only needed to pass the unique number ID of a specific J3.5 track, which contained target location data. The AFATDS operator then selected that specific J3.5 message and initiated a fire mission. MTO data to the C2 element was sent via mIRC. While not yet ideal, it provided a glimpse into what further Link-16/AFATDS integra-

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tion could provide.

A second challenge emerged during WSINT 18 when the Fires Cell processed practice fire missions to verify target data with Link-16. The target location in a J3.5 track in AFATDS did not exactly match the target location when sent via mIRC from an AF C2 element. The differences in target location was often greater than 50m, enough to eliminate the advantage of precision munitions. The Fires Cell was unable to trace the source of the location error, but that may have occurred due to translation issues as the J3.5 message passes between JRE, ADSI, and the AFATDS.

Recommendation

Further exploration of AFATDS/Link-16 interoperability needs to focus on three specific tasks. First, the AFATDS PM should help identify and then resolve the source of the J3.5 track location errors. The ability to quickly and reliably receive accurate fire missions via Link-16 from an aircraft other than C2 platforms, in a useable transmission is a significant upgrade from current capabilities. Second, we need better training to understand the connection between the ADSI and AFATDS in order to identify and discriminate AFATDS limitations from system network limitations. Understanding the AFATDS/ADSI relationship will help BN and BDE Fires cells to more effectively support the USAF in expeditionary settings where successful Link-16 integration will rely on our LNOs. The key to both of these tasks is the integration of ADAM/BAE technical experts who understand the ADSI. Finally, the AFATDS PM should develop solutions for the current AFATDS software concerns over target location and Link-16 messaging limitations.

In conclusion, we are unaware of other Army units or services successfully conducting a digital fire mission from sensor-to-shooter solely via Link 16 to AFATDS. The United States Marine Corps (USMC) successfully executed a digital sensor to shooter mission, but used non-standard equipment. The USMC also achieved a sensor to shooter fire using organic equipment, but the process involved a voice radio transmission to send fire mission data. Improving this capability will build lethality and shorten response times for the delivery of Fires; a goal our Fires community should embrace and strive for.

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Be Responsible on Social Media

If a Soldier uses a social networking site where he or she is or may be identified or associated with the U.S. Army, they must remember how they appear to represent their organization and the United States of America. UCMJ and other guidelines and regulations still apply.

STEEL ON TARGET:
The Re-introduction of Predicted Fire and Standards of Precision to the Field Artillery

By LTC Mike Stewart and MAJ Mike Smith

"While the U.S. Army must be manned, equipped, and trained to operate across the range of military operations, large-scale ground combat against a peer threat represents the most significant readiness requirement."
– FM 3-0, December 2017

The Army has recently substantially changed its doctrinal and developmental focus to large-scale ground combat operations after decades of training for and conducting protracted contingency and counterinsurgency operations from the Balkans to Iraq and Afghanistan. Changes in the operational environment - particularly in the capabilities and political will of adversaries like Russia and China - force adaptations to how the U.S. Army supports the joint force. For the field artillery, potential responses to this shift can be found in our past, and can be described within the framework of the five requirements for accurate predicted fire. While some solutions must be new innovations, older methods and techniques are increasingly relevant today. In many ways, the Army of 2019 may need to be closer to the Army of 1989 than that of 2009.

The Contemporary Operational Environment

First, we must define our operational environment; specifically, what has changed? Our contemporary operating environment (late 1990s-Present) became defined by near-continuous contingency and counterinsurgency operations. From Bosnia and Kosovo through to today's ongoing fights in Iraq and Afghanistan, the American way of war adapted to FOB-based, deliberate application of vast technological superiority against a threat with very limited capabilities compared to our own. Our adversaries had little means to contest our ability to enter into a theater, establish air supremacy, and sustain combat operations indefinitely. We came to expect air supremacy and the establishment of bases as conditions we required for ground combat.

Against peer threats as we face today, those critical assumptions are no longer valid. Continued establishment of FOBs and fixed-sites will present high-value targets easily struck by adversaries who can challenge our dominance. Our technological advantage isn't as great against peer threats; in fact technological dependence presents vulnerabilities we must address. Air and maritime supremacy can be challenged or nullified entirely by recent adversary adaptations. Our actions and movements are constantly monitored and contested by peer threats globally, from home station into any theater. That competition is manifest in all domains – land, air, maritime, space, and cyberspace – and by multiple adversaries with varying agenda. Our adversaries' particular advancements in space and cyberspace mean that if we are not prepared to fight without our technological edge, we risk failure at great scale.

Revisiting concepts from more challenged and less technologically saturated times is valuable in assessing how we should operate in a degraded, denied, or disrupted environment against a peer threat. Concepts like predicted fire and standards of precision are relevant now as they were in generations past, and the five requirements for accurate predicted fire provide a framework we can use to analyze and assess our capabilities and training for the full range of environments, from fully operational capable through varying

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degrees of degradation.

The Importance of Predicted Fire

In 2014, U.S. Army field artillery doctrine (FM 3-09) stripped the term "predicted" from the five requirements for accurate predicted fire. The reason was described in a February 2014 Redleg Update article:

> ***Predicted Fire is a Misnomer.*** **After review of the elements of the Five Requirements, the working group relooked the title. The title, formerly known as the Five Requirements for Accurate Predicted Fire, became a misnomer. In the past this title held true as the method of predicting the impact points of ballistic munitions. However, with the inclusion of precision and near precision munitions into the firing unit's inventory, there are instances where we are in fact not predicting the true trajectory of the projectile. This requires a shift in ideology and culture to fully appreciate each of the elements of the Five Requirements in achieving accuracy or precision standards for all munitions.**

Eliminating "predicted" fire from our lexicon based on this logic, and emphasizing instead a reliance on GPS-guided munitions eroded the very premise and method of how we provide fire support. *Predicted* fire has a real and relevant meaning today, as it did when the term originated in World War I. By accounting for all of the variables described in the five requirements, we *predict* where our rounds will impact to create the desired effects. Reliance on technological widgetry and satellite guidance to get rounds to a target detracts from the more important mastery of ballistic principles, and the *standards of precision* required to deliver consistent results.

During World War I, German and British gunners first defined "predicted fire" or "silent registration" by establishing and accounting for the all of the variables that influenced a projectile from the breech of the tube to the target. Through much of the Great War, guns registered on their targets – that is, enemy positions – sometimes spending weeks or months preparing for an attack. This kind of preparation came at the expense of surprise and contributed to prolonged, costly maneuver through no-man's land with little advantage to the attacker. Additionally, firing artillery within view of the enemy's lines (and his artillery) put guns at great risk of counterbattery fire. To achieve surprise with an attack and to preserve artillery pieces from counterbattery fire, gunners began measuring data and applying predictive techniques instead. That is, they began firing their guns on ranges well to the rear of the fight, where they could "ascertain their piece's muzzle velocity by conducting calibration of the gun or howitzer tube"[1] without compromising their targets. Using this data to predict where rounds would impact, gunners could target enemy positions with greater accuracy, achieve greater surprise, and fire from greater standoff ranges away from immediate counterbattery fire.

Similarly, today we must apply detailed understanding of the ballistic principles of the five requirements to deliver accurate rounds consistently on target. We are still predicting where the rounds will impact, even if we use a guided munition. When we achieve effects with fewer rounds, we are more lethal and less vulnerable to counterfire.

Stripping the word "predicted" from the description of these five requirements in 2014 had the unintended consequence of focusing our efforts on developing and delivering GPS-guided munitions, and decreasing our emphasis on fundamentally understanding the ballistic conditions that must be met to hit a target with or without satellite assistance.

We also developed the false impression that wars can be won using only precision-guided munitions with little collateral damage and no civilian casualties. That presumption is false in a large-scale ground combat operation. Precision-guided munitions will be

1 Bradbeer, Thomas G., "Gunners at Cambrai, 1917: How the Royal Artillery Set the Conditions for the Successful Armored Assault," p. 33. Lethal and Non-Lethal Fires: Historical Case Studies of Converging Cross-Domain Fires in Large-Scale Ground Combat Operations, pp 21- 44 44. Army University Press, Fort Leavenworth, Kansas, 2018.

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insufficient alone against a peer threat and winning will require application of all resources, including area fire munitions, by values-based leaders who apply force in accordance with the law of war.

In the 2019 draft FM 3-09, we re-emphasize understanding those ballistic conditions and their importance by returning the word "predicted" to the five requirements. This seemingly small correction, combined with more emphasis in our professional military education on ballistics, manual gunnery, and degraded operations, must refocus our branch to deliver fires under all conditions, with or without satellite-guided munitions.

Standards of Precision

As we increasingly used the word precision to refer to a type of munition, we diluted the meaning of the word. "Precision" has come to be associated with a measurement of target location error or circular error probable, which is a substantial and unhelpful change to the field artillery. We seem to have replaced the concept of accuracy with precision, and lack of understanding combined with sloppy language has made the two terms synonymous. In the context of a technical profession such as ours, accuracy and precision are not synonyms, and precision is an all-important concept.

Precision was never a description of a type of munition or a specific number of meters of target location error. Rather, standards of precision described the necessary consistency of action that delivered predictable results. This technical use of the term precision must be re-introduced into the language of artillerymen. Standards of precision assure the delivery of rounds to a target beyond visual range from the firing system. Accuracy is the description of how close rounds impact to a target, and we achieve consistent accuracy by executing every action from the observer to the fire direction center to the gun or launcher with precision. As we achieve accuracy by meeting standards of precision, we must integrate guided munitions (not "precision" munitions) into a broader menu of weaponeering options to create effects on our adversaries.

Degraded Operations and the Five Requirements for Accurate Predicted Fire

Applying technological solutions to the five requirements for accurate predicted fire has allowed the field artillery to increase the responsiveness and accuracy of our fires. However, our adversaries have noted our increasing reliance on these technological solutions and challenge us in the space and cyber domains, to include the electromagnetic spectrum, to disrupt, deny, or degrade our ability to use our technology to responsively and accurately create effects. Examining how we have met the five requirements in the past, before these technological solutions existed, can inform how we must be prepared to fight today in a contested environment.

	Full Operational Capability	Degraded Methods	Potential Effects of Degradation
Accurate Target Location and Size	Laser designator / Rangefinder GPS/INS PFED/PFI Mensuration Tools	Map Compass Binos	Reduction from CAT I-IV TLE to CAT V/VI TLE[1] Decreased first round accuracy
Accurate Firing Unit Location	GPS/INS Survey	Aiming Circle (Direction, distance, vertical angle from known point) Map & Compass Hasty Survey Techniques Registration Observer adjusts fire	Increased occupation times Increased counterfire threat Decreased first round accuracy
Accurate Weapons and Munitions Information	Calibration Chronograph	Predictive Muzzle Velocity Technique Registration Observer adjusts fire Concurrent MET technique	Increased counterfire threat Decreased first round accuracy
Accurate Meteorological Information	GBS/Profiler Computer distributed	Registration Observer adjusts fire	Increased counterfire threat Decreased first round accuracy
Accurate Computational Procedures	AFATDS Centaur AFCS	Manual fire direction	Potential increased fire mission processing time[2]

1- Training of observers on degraded methods can improve TLE back to CAT III/IV.
2- Training of FDC personnel on manual methods can mitigate increased processing time.

Figure 1. The Five Requirements for Accurate Predicted Fire in Fully Operational and Degraded Operations

The first requirement, accurate target location and size, is ideally met through a positioning navigation and timing (PNT) device, such as a GPS, giving accurate observer location, laser rangefinders giving accurate distance and direction to the target, and fire support computers that combine this data into an ac-

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curate target location and transmit that target location and description to a higher headquarters for engagement. This target location may be further refined through the use of mensuration tools. Enemy capabilities may deny an observer the use of their PNT device through jamming or spoofing. They may also deny the use of fire support computers through either cyberattack or by attacking digital communications. Finally, laser rangefinders may be disrupted through the use of obscuring smoke or interruptions to the supplies needed to keep the device in working order. In these situations, there are several techniques the observer may use to generate an accurate target location. First, mounted observers will have an inertial navigation system (INS) in their vehicle which can provide an accurate vehicle location as long as it is routinely updated, removing the need to rely on a GPS. Mounted and dismounted observers must also retain the ability to self-locate using a map and compass through techniques such as terrain association and resection. They must also be able to use a map, compass, and binoculars to determine a target location that will allow for first-round fire-for-effect. Field artillery personnel in both fire support and fire direction must understand that transitioning to these degraded methods will increase the target location error and decrease first-round accuracy and they should adjust target shape, size, and sheaf as well as the fire order to increase the likelihood of creating the required effects. Training observers on the use of these degraded methods can also help decrease target location error.

The second requirement, accurate firing unit location, has also become more reliant on PNT devices that can provide an exact location from the howitzer or rocket launcher to the fire direction center. As with the observer's PNT devices, the use of these devices to obtain an accurate firing unit location can be denied, disrupted, or degraded by the enemy. In this situation, firing units will ideally default to obtaining their location through the use of survey and INSs. If a surveyed location is near enough, the firing unit may also determine their location through the use of an aiming circle to determine direction, distance, and vertical angle from the known point. However, survey equipment is increasingly GPS-reliant and the removal of survey personnel from field artillery units will decrease the prevalence of surveyed locations on the battlefield. In the absence of both GPS and survey support, the firing unit has several techniques available to determine their location. These include the use of a map and compass, hasty survey techniques outlined in ATP 3-09.50, or registration. In a worst-case scenario, the firing unit can attempt to create effects on the target by having the observer adjust fire. Denial of GPS and INS capabilities can increase occupation times and decrease first-round accuracy, potentially requiring longer fire missions and more rounds in effect to create the required effect on the target. This, in turn, can increase the vulnerability of the firing unit to counterfire by forcing them to fire from the same location for a longer period of time.

The third requirement, accurate weapons and munitions information, is more difficult for the enemy to effect than the first two requirements. However, calibration isn't always possible due to the tactical situation and devices such as the chronograph that assist with determining muzzle velocity can't always be relied on. Therefore, firing units must be prepared to use alternate methods to meet the third requirement. These include the predictive muzzle velocity and concurrent MET techniques, both discussed in TC 3-09.81, registration, and the observer adjusting fire. As with the solutions for the second requirement, these solutions may decrease first-round accuracy and increase the threat from enemy counterfire.

The fourth requirement, accurate meteorological information, is entirely met through the use of computer modelling and distributing the required information through networked computers. The enemy can deny the firing unit this information by attacking this network or the communication devices used to link the computers together. There is no method for a firing unit to determine MET on their own, but they can use techniques like registration or the observer adjusting fire to continue providing fire in an environment where they are unable to receive meteorological information. Again, these solutions may decrease first-round accuracy and increase the threat from enemy counterfire.

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The fifth, and final, requirement is accurate computational procedures, ideally completed using some combination of AFATDS, Centaur, and the fire control system onboard the firing platform. Use of these computing tools may be interrupted by cyberattack or by attacking the communications networks that link them together. To ensure the ability of the firing unit to always deliver accurate and responsive fires, fire direction personnel must regularly train on manual fire direction. The training of the fire direction center on manual fire direction procedures will be inversely related to any increase in fire mission processing times when use of digital systems is denied.

In addition to the five requirements for accurate predicted fire, the ability to communicate quickly and clearly from the sensor up through fire support channels and then down through the fire direction center to the shooter is a constant requirement for the delivery of responsive fires. Assets like the Joint Network Node (JNN) and Command Post Node (CPN) have helped extend reliable, beyond line-of-sight upper tactical internet access to the brigade and battalion with future technological developments promising to push it lower.

As with our other technological innovations, while we must be masters of these systems, we must not be reliant on them as the enemy and the environment get a vote. A field artillery Soldier who can't communicate higher or lower is unable to do their job and therefore useless for providing fires to the force. To ensure constant, reliable communications to all levels, field artillery units must have a PACE (Primary, Alternate, Contingency, Emergency) plan for communications. As much as possible, this PACE plan should allow the transmission of digital fire missions using the digital fire support network. When the PACE plan uses assets outside of the digital fire support network, such as Blue Force Tracker, internet chat programs, or voice communications, there must be a clear plan for how fire missions passed using that asset will be formatted and at what level they will transition to the digital fire support network. Artillery units must be trained and equipped to transition within their PACE plan to non-satellite based networks such as HF or FM to move information from sensor to shooter.

In conclusion, as we train and organize for large-scale ground combat operations, the field artillery must relearn many lessons from our past to ensure we can continuously provide fire support to the Army and the joint force in an increasingly complex and challenging operating environment. Concepts like predicted fire, standards of precision, and operating without dominance in all domains are neither new nor outdated. The actions of peer threats must drive us to innovations that meet the five requirements for accurate predicted fire under all conditions, and ensure our branch can survive and be lethal.

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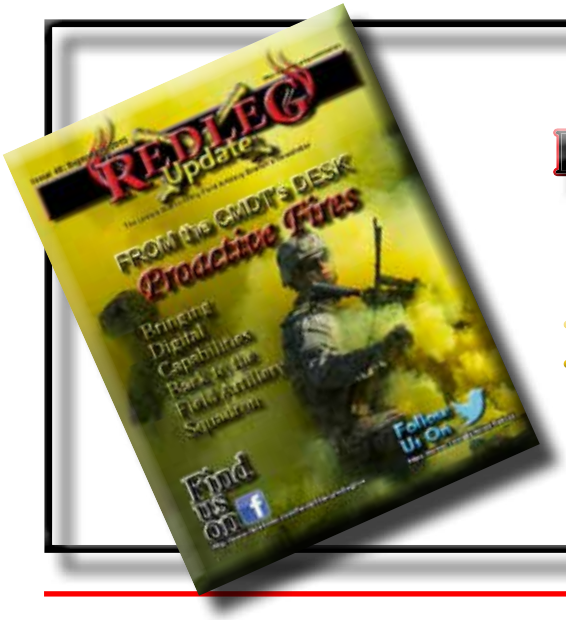

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