Howitzer technology

Changing the culture of field artillery

By Lt. Col. Daniel Blackmon, Maj. Bryan Fanning and Sgt. 1st Class Christopher Kimble

The young lieutenant stared anxiously at the field grade officer standing inside the fire direction center. "Is it safe to shoot, sir?" asked the lieutenant. "You tell me," replied the major.

This line of questioning and answering took place at firing points across the Pohakuloa Training Area on the "Big Island" of Hawaii in August 2016. Over the course of two weeks, 2nd Battalion, 11th Field Artillery Regiment prepared for, and finished, a Table XVIII battalion qualification. The battalion and its batteries struggled to employ howitzers fitted with new computers and software. Frustrated due to Soldiers' lack of faith in their training and equipment, the battalion commander removed all safety Ts from the fire direction centers and howitzers and directed that only field-grade officers supervising the fire direction centers hold the safety T; a significant break from field artillery doctrine. This emphasized that the battalion's troops were indeed trained and ready and had cutting-edge equipment to safely accomplish the mission.

The challenges experienced by the *On Time Battalion's* Table XVIII qualification stemmed from inexperience with new equipment, coupled with training under current doctrine. Soldiers of 2-11th FAR received updated software packages for the digital fire control system on their howitzers in April 2016. Prior to the new software, howitzer platoons updated their location from the center of the firing unit and computed muzzle velocity variations only after training. The new software allowed for continuous updates to each howitzer's individual location and instant calculations to the variations in muzzle velocity.

With technology changing the way Soldiers complete tasks, field artillery doctrine needs to also change. Particularly, computing post-occupation safety in the fire direction centers should be eliminated; the dispersal of towed artillery systems (if permitted) in the operational environment should be encouraged; and the ability of the commander to maintain maximum feasible centralized control should be emphasized.

Upgrades to the M777A2 and M119A3's digital fire control systems eliminate the need to conduct post-occupation safety during training. The long-taught Training Circular (TC) 3-09.81 (formerly known as Field Manual 6-40) requires the fire direction officer to conduct manual safety before occupying a firing point identified by a six or eight digit grid on a range card.[1] After the unit arrives to the firing point, the fire direction officer (FDO) updates the safety with a more accurate center location. FDOs transmit safety to the howitzers through a safety T with fixed left, right, minimum and maximum limits, based off the center grid to the firing unit. Similarly, TC 3-09.8 tests Soldiers in the fire direction center (FDC) on their ability to compute safety using the handheld fire direction computer, the Centaurs[2]. These two doctrinal requirements present a dilemma.

As mentioned, the modern software allows continuous updates to the howitzer's location with each howitzer producing its own individual technical firing solution for fire missions.[3] The fixed safety computational requirements do not and

1 US Army, Training Circular No. 3-09.81: Field Artillery Manual Cannon Gunnery (Washington, DC: Government Printing Office, 2016), 15-6.

2 Ibid., 6-9.

3 US Army, Army Training Publication 3-09.23: The Field Artillery Cannon Battalion (Washington, DC: Government Printing Office, 2015), 5.5.

cannot account for the subsequent movements of howitzers after arriving to a firing point, much less the precise location and ballistic information provided to the FDC by each howitzer. This becomes more problematic as individual howitzers move around the firing point or position area. If a howitzer moves far enough from the center grid of the firing point, the technical firing solution will likely appear unsafe to fire based off safety computations from the previous position. To meet the doctrinal training requirements, the FDO has to recalculate safety each time the center of the firing position changes. Even more frustrating for the FDC, is a howitzer battery firing into a small impact area. The smaller impact area means narrower limits in the safety T. When the FDC attempts to verify correct safety computations with the howitzer crews through a dry-fire mission, the howitzers positioned farthest from the azimuth of fire will likely present unsafe firing data, again, because of the precise computations provided by each howitzer. The frustration experienced by the FDC does not compare to possibilities in lost training time.

Crews can struggle, as shown during 2-11th FAR's Table XVIII qualification, to meet doctrinal requirements that do not pair with the current technology of the force thereby losing critical training time. Rather than continue computing post occupation safety, updated doctrine should reflect the need to use the modern systems to their full advantages and distribute digital safety Ts. The FDC sends digital geometries from their Advanced Field Artillery Tactical Data System to each howitzer section. As a secondary check, the FDC receives an alert message from the howitzer's computer if the geometries did not download properly. The FDC and howitzer sections conduct dry-fire verification based on the applied geometries as a tertiary check. This method returns training time and allows firing units to focus on movement tables, a skill greatly atrophied over the last 15 years. Two challenges arrive with this recommendation. First, although unwitnessed in 2-11th FAR's firing of thousands of rounds, errors in any one of the howitzer sections' computers could lead to unsafe shooting. Secondly, the greatest challenge lies in local range and training regulations requiring physical safety Ts on each gun and in the FDC. While the modern technology has proven to be safe, old requirements die hard.

Next, current field artillery doctrine falls short when acknowledging the modern software capabilities allowing towed howitzer sections greater dispersion. The doctrine encourages traditional formations and positioning howitzers in a smaller area.[4] Field artillery doctrine does acknowledge decentralized movement techniques based off modern howitzer capabilities, but seems to discourage these techniques by listing many disadvantages.[5] Dispersion and decentralized movements are not new to the M109 self-propelled howitzer community. The Paladin's superior mobility and existing digital computer capabilities should lend itself to adaptions in doctrine that are applicable to the towed M777 and M119 systems.

The lack of digital systems on the M119A2 forced batteries to shoot like, or similar data for all guns in a position area to achieve specific effects. The alternative was lengthy radio transmissions of passing individual technical firing data from the FDC to each gun. Howitzers fired similar data using terrain gun positioning corrections (TGPCs). TGPCs allowed howitzers in close proximity to fire a converged sheaf or achieve specific effects.[6] And like manual safety, the FDC must compute TGPCs after its firing unit occupies a new location.[7] These requirements forced howitzers to operate in close-knit formations. With the upgrades to the M119A3 and M777A2, gun positioning is essentially limited to the communications capabilities of a firing unit. As long as a howitzer section is able to maintain digital communication with the FDC, the Soldiers are able to compute firing data based on individual location. Viewed as a whole, the platoon or battery provides the commander with converged sheafs and required effects. The dispersion of modern howitzers also increases survivability.

The Russo-Ukrainian War has shown that dispersal of forces is necessary to avoid mass artillery barrages. Consequently, the U.S. Army Chief of Staff, Gen. Mark A. Milley stressed units must move constantly because if "you can be seen, you will be hit, and you will be hit fast."[8] Cannon battery doctrine highlights enemy indirect fire as the greatest threat to the field artillery and recommends dispersion.[9] The doctrine also lists armored forces, air attack and dismounted attacks as other threats to field artillery.[10] Towed artillery systems stand little chance against an armored or dismounted force given their lack of mobility and organic direct fire assets.

During 2-11th FAR's Joint Readiness Training Center rotation, small enemy elements destroyed numerous howitzers. These formations were typically hardened and concealed, but in a close perimeter. The dispersion of units may result

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4 US Army, Army Training Publication 3-09.50: The Field Artillery Cannon Battery (Washington, DC: Government Printing Office, 2016), 3-7.

5 Ibid., 2-3.

6 TC 3-09.81, 12-16.

7 Ibid.

8 C. Todd Lopez, "Milley: Army on cusp of profound, fundamental change," USArmy.mil, October 6, 2016, https://www.army.mil/article/176231/milley_army_on_cusp_of_profound_fundamental_change.

9 ATP 3-09.50, 5-8.

10 Ibid.

in the loss of individual sections rather than platoons. The risk with dispersion is that platoon or battery direct-fire weapon systems are less effective outside of a close perimeter, leaving sections to defend themselves. The battery commander must weigh the threat to their force and choose appropriate defensive techniques.

Lastly, field artillery doctrine should emphasize the modern howitzer's capability to enable the commander to retain maximum feasible centralized control. Artillery battalion doctrine distinguishes between maximum and decentralized control. Doctrine defines maximum control as the battalion FDC fighting its batteries while decentralized control stresses platoon-based operations.[11] With the upgraded software, particularly in the M119A3, battalion commanders can now maintain maximum control of firing platoons. The automation at the howitzers caused the FDC to assume a broader role of performing tactical fire control and managing movement, with technical fire control as a secondary task.[12] Thus, the battalion FDC possesses the capability of sending tactical firing data directly to a platoon of howitzers.

Artillery doctrine correctly states that fewer firing units available characterize maximum centralized control.[13] With one artillery battalion supporting a brigade combat team and artillery brigades serving each U.S. Army corps, targets and requirements will likely outpace available assets. Maximum centralized control of a battalion's howitzers, therefore, becomes necessary in most instances. The battery-centric model of centralized control is necessary when a maneuver commander must mass its firepower at a particular decisive point or high value target. The platoon-centric model of centralized control arises when a maneuver unit identifies numerous critical artillery tasks, such as counterfire, suppression of enemy air defense, and emplacing minefields. The modern digital systems allow the FA battalion commander to now mass the effects of their battalion at any time. The greatest challenge with maintaining maximum control of platoons includes managing the movement of platoons and ensuring they are in positions to mass effects at critical times in battle. The requirement to maintain dispersion and avoid remaining stationary for too long compounds this challenge. The benefits, given a permissive operating environment, outweigh the risk.

Soldiers from 2nd Battalion, 11th Field Artillery Regiment, 2nd Brigade Combat Team, 25th Infantry Division, prepare an M777 howitzer for defense during a battle-period exercise during a field training exercise at the National Training Center, Fort Irwin, Calif. (Spc. Jacolby Young/NTC Operations Group)

The Soldiers of 2-11th FAR demonstrated the unique capabilities of upgraded computers and software on the M119A3 and M777A2 during a demanding training cycle in 2016, culminating in a JRTC rotation in February 2017. The modern systems call for the elimination of computing post-occupation safety during training, encouraging the dispersal of towed artillery systems and emphasizing the ability of the commander to maintain maximum feasible centralized control. The adoption of these recommendations serves to enhance home station training, though roadblocks exist with agencies managing ranges and training areas.

Soldier safety is always, and should be, the entry argument for these discussions. Education on systems and their capabilities, as the Soldiers of 2-11th FAR saw during their train-up, becomes critical. After our peers and supporting agencies understand the capabilities of the new systems, the training opportunities are endless. Ultimately, better training leads to a more lethal field artillery force capable of enabling maneuver forces to close with and kill the enemy.

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11 ATP 3-09.23, 5-3.

12 ATP 3-09.50, 2-4.

13 ATP 3-09.23, 5-3.