Optimizing US Army Field Artillery: A Future for the King of Battle

A Monograph

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Abstract

Optimizing Field Artillery: A Future for the King of Battle, by MAJ Linwood R. Nelson, US Army, 51 pages.

Field artillery is the US Army's primary fire support platform due to its all-weather responsiveness and multifunctional capabilities. The purpose of this monograph is to provide context for the examination of field artillery doctrine as it evolves from advances in technology. This analysis focuses on the role of field artillery and its evolution in providing support for maneuver forces. Historically, field artillery shaped the battlefield with its superior ability to mass fires and produce devastating effects on enemy forces. The introduction of precision guided munitions provided an additional field artillery capability with the objective of increasing lethality on the battlefield. Through an examination of chronological historical case studies, field artillery employment of massed fires evolved into a hybrid mix of mass and precision. Understanding how the new doctrine incorporated the employment of precision guided munitions encourages discourse on the optimal use of precision and massed fires. This monograph examines the increase in lethality and implications of precision fires. The recommendations from this study enhance the ground commander's ability to employ precision or massed field artillery capabilities in large scale combat operations. This understanding preserves institutional knowledge and informs plans for future unified land operations.

Contents

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Acronyms

ACC	Army Capstone Concept
ADP	Army Doctrine Publication
ADRP	Army Doctrine Reference Publication
AOC	Army Operating Concept
ATACMS	Army Tactical Missile System
ATP	Army Techniques Publication
BCT	Brigade Combat Team
CCF	Chinese Communist Forces
CENTCOM	United States Central Command
CEP	Circular Error Probable
DPRK	Democratic People's Republic of Korea
FA	Field Artillery
FADAC	Field Artillery Digital Automated Computer
FDC	Fire Direction Center
FM	Field Manual
GMLRS	Guided Multiple Launch Rocket System
GPS	Global Positioning System
HIMARS	High Mobility Artillery Rocket System
KTO	Kuwait Theater of Operations
MLRS	Multiple Launch Rocket System
PGK	Precision Guidance Kit
PGM	Precision Guided Munitions
SADARM	Search and Destroy Armor
TACFIRE	Tactical Fire Direction System

TRADOC	Training and Doctrine Command
UN	United Nations
UNSCR	United Nations Security Council Resolution
US	United States
WMD	Weapons of Mass Destruction

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Introduction

> For over 230 years, the artillery force has supported Army ground troops during the struggles to preserve and expand the fledging nation and then during the wars abroad to provide lasting security for both the country and the larger international community. Organized initially into companies supporting infantry battalions and brigades, artillerymen—the Army's Red legs—eventually manned battalions, regiments, groups, and brigades to support the growing number of combat divisions, corps, and armies with the battlefield fires necessary to ensure tactical victory.[1]
>
> —Jeffrey J. Clarke, quoted in Janice McKenney, *The Organization of the Field Artillery*

The 977th Field Artillery (FA) Battalion as part of VI Corps artillery performed admirably during World War Two. On January 22, 1944, during the battle of Anzio, the artillery unit showed its devastating power. In a single twenty-four-hour period, the 977th fired over 2,800 rounds into German enemy positions.[2] The battalion achieved a significant rate of fire, delivering over 135 tons of steel and high explosives with an impressive example of massing fires. In the aftermath of the battle, the 977th fired a total of 49,903 rounds at the enemy in 2,172 separate fire missions.[3]

The 977th continued to show its ability to mass fires. In the battle of Alsace on August 15th, 1944, the battalion fired extensively in support of US Army's VI Corps. The accuracy of its 155mm guns, and the skill of their gunners were tested to their limits as they decimated the 19th German Army. Their guns struck numerous tanks creating neat round holes in the thick armor.

In 492 days of combat, the 977th FA Battalion participated in several operations and campaigns, delivering devastating accurate fires upon German positions. The awesome power of the Long Tom pierced German tanks with its 95-pound projectile. It fired its Long Toms in

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[1] Janice E. McKenney, *The Organization of the Field Artillery: 1775-2003* (Washington, DC: Center of Military History, 2007), vii.

[2] James R. Lankford, "977th Field Artillery Battalion," Army Historical Foundation, January 28, 2015, accessed November 23, 2017, https://armyhistory.org/977th-field-artillery-battalion/.

[3] Lankford, "977th Field Artillery Battalion."

support of British, French, and American forces serving with the US Fifth and Seventh Armies, as well as the French First Army. The battalion conducted 5,934 fire missions delivering a total of 118,710 rounds at the enemy. The massive amount of ordnance wore out eighty-four gun tubes, enough to equip seven field artillery battalions.[4] Artillery units all over Europe supported maneuver elements during World War Two bringing destructive effects to German forces. The massed fires required significant numbers of artillery pieces and massive volumes of ammunition. General George S. Patton famously quoted the decisiveness of artillery by saying, "I do not have to tell you who won the war. You know the artillery did."[5]

Today, the United States Army faces a challenge in regards to the future role of division artillery. Divisions and Corps were the primary maneuver elements of the US Army until the Global War on Terrorism demanded particularization into brigade-level deployable formations. The Brigade Combat Team (BCT) consisted of modular maneuver, fires, intelligence, and logistics units capable of combined arms maneuver. The rationale behind the transformation was to enhance the US Army's ability to respond rapidly to various threats.[6]

Budget and force restructuring following major combat in the wars for final victory and limited wars in the 20th and 21st centuries, guided the US Army's decision to dissolve corps and division artillery. In 2014, the US Army reactivated a division artillery headquarters in each of the 10 active duty maneuver divisions, yet provided the organization with no physical fires assets.[7] In the limited wars currently ongoing, corps and divisions serve as headquarters while the subordinate brigades operate as maneuver elements. Doctrinally, corps/division artillery supports

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[4] Lankford, "977th Field Artillery Battalion."

[5] McKenney, *Organization of the Field Artillery*, 187.

[6] Boyd L. Dastrup, *US Army Field Artillery Center and Fort Sill Annual Command History: 1 January 2003 through 31 December 2003* (Fort Sill, OK: US Army Field Artillery Center, 2004), 62-63.

[7] US Army Forces Command, *US Army Forces Command Division Artillery (DIVARTY) Implementation Order*, April 9, 2014, Fort Bragg, NC, 2.

their respective maneuver echelons through reinforcing and general support missions as part of combined arms warfare.[8]

As the probability of conflict with a near-peer combat force reappears, the institutional problem created by the US Army's increased reliance on precision fires as a cost-saving measure presents itself. With prior reductions in artillery, the US Army faces a challenge of restoring higher-level artillery formations and their considerable cross-specialty requirements to support maneuver forces. Army Chief of Staff, General Mark Milley highlighted in his 2016 annual statement to the Association of the United States Army, that future warfare with a near-peer opponent will "be highly lethal, unlike anything our Army has experienced at least since World War Two."[9]

The need to increase artillery forces and the potential of ground combat seems to be increasing as near-peer adversaries such as Russia and North Korea view themselves in direct confrontation with the West. Future adversaries possess the potential to contest the air domain, which directly challenges the advantage in air superiority the US Air Force has used to provide support to ground forces since the Korean War. With the Army serving as the predominant land force component, artillery forces provide the ground commanders with a dominant, responsive capability to enable decisive maneuver.

Currently, readiness is the Army's highest priority as it affects the Army's ability to deploy troops quickly in combat situations. General Milley published specific readiness guidance with the prime objective of maximizing the readiness of the total force.[10] In his January 2016

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[8] US Department of the Army, Field Manual (FM) 3-09, Field Artillery Operations and Fire Support (Washington, DC: Government Printing Office, 2014), 1-33.

[9] Mark A. Milley, Thirty-ninth Chief of Staff of the Army (remarks presented at the Association of the United States Army Eisenhower Luncheon, October 4, 2016), 15, accessed September 16, 2017, http://wpswps.org/wp-content/uploads/2016/11/20161004_CSA_AUSA_Eisenhower_Transcripts.pdf.

[10] US Army Chief of Staff Memorandum, Army Readiness Guidance (January 2016): 2, accessed November 14, 2017, https://www.army.mil/e2/downloads/rv7/standto/docs/army_readiness_guidance.pdf.

memorandum, Milley noted that readiness was the army's number one priority and that there was "no other number one" priority.[11] The army attributes its low readiness levels primarily to end strength reductions and the lack of proficiency in core competencies.[12] Additionally, the US Army focused predominately on counterinsurgency operations since 2001, which led to the atrophy of collective training in combined arms maneuver.[13] The impact to any future downsizing jeopardizes the army's capability to accomplish its strategic mission.

Combat readiness of military organizations is a function of personnel, equipment, and training. To fight effectively, military forces are manned, equipped, and trained to operate under austere conditions. Efficient readiness is a balanced triad consisting of personnel, equipment, and training synchronized to support the organization. This three-tiered approach requires the right personnel operating the right equipment with the right training to win.[14] Fluctuations in Army force structure occur not only from the defense budget, but also from capabilities and requirements conferred to the army as part of the joint force. The Army's institutional senior leaders constantly shift funding priorities in readiness or modernization depending on the future threat.

Since World War Two, field artillery forces massed fires, giving ground commanders a responsive capability to shape the battlefield. Field artillery units organized and trained with a high degree of readiness. The introduction of precision fires generated the debate of whether precision fires could replace mass fires. The primary question this monograph attempts to answer is: how do precision fires in the current environment support maneuver?

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[11] US Army Chief of Staff Memorandum, Army Readiness Guidance, 9.

[12] United States Government Accountability Office (GAO) Report 16-841, "Military Readiness: DoD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan," (September 2016): 7, accessed November 12, 2017, https://www.gao.gov/assets/680/679556.pdf.

[13] GAO 16-841, "Military Readiness," 7.

[14] Richard J. Dunn, III., "Backgrounder: The Impact of a Declining Defense Budget on Combat Readiness," *The Heritage Foundation* no. 2828, (July 2013): 5-6, accessed September 23, 2017, http://thf_media.s3.amazonaws.com/2013/pdf/bg2828.pdf.

This study examines the evolution of massed fires to precision fires across artillery formations and illuminates how the transformation affects the combat capability of the US Army in an era of budget uncertainty. This monograph hypothesizes that precision munitions gives artillery forces the ability to destroy fixed targets without the massive expenditure of ammunition. Precision fires supports maneuver by providing destructive effects. On the other hand, field artillery forces mass fires to suppress enemy forces. As a result, field artillery units incur higher training, ammunition, and equipment costs when they deliver precision fires as opposed to massed fires.

With the renewed emphasis on combined arms decisive maneuver, an artillery force with the proper capabilities provides US Army ground forces with a position of relative advantage in the operational environment. This study makes the primary assumption that the US Army will conduct maneuver warfare in large scale combat operations in the future, using conventional forces supported by artillery. Because of this, an additional assumption is that the Gulf War is the most appropriate example for the analysis of optimizing artillery assets in a rapidly changing operational environment.

The monograph uses a chronological methodology to evaluate two conditional periods that highlight the evolution of US Army artillery and presented here as four case studies in format. First, illustrative operations from World War Two through the end of the Cold War period highlight the concept of massed fires as a normative application of artillery forces. Second, following the end of the Cold War, Operations Desert Storm and Iraqi Freedom demonstrate hybrid cases involving a transitional period that saw the application of both precision and massed fires against a conventional opponent.

The study analyzes four case studies qualitatively against three doctrinal criteria for field artillery effects with the missions to destroy, defeat, or disrupt enemy forces. All three effects

describe how artillery forces accomplish their mission by supporting maneuver.[15] The first criterion assesses destruction, the condition that renders an adversary combat ineffective by targeting and damaging its systems where it cannot perform any function.[16] The second criterion assesses defeat, the condition that occurs when an enemy force temporarily or permanently loses the physical means or the will to fight.[17] The final criterion evaluates disruption, the condition that intends to upset an enemy's formation or tempo."[18]

The purpose of this study is to demonstrate through historical research the transient and evolutionary nature of Army artillery from massing fires in World War Two to a hybrid capability of mass and precision in the current Global War on Terrorism. It analyzes the evolution of mass to precision, and reaches conclusions and recommendations for the transformation to current artillery manning, equipping, and training operations for combat.

Primary source documents utilized during this monograph included the US Army Capstone Concept, Army Operating Concept, and the Army Functional Concept for Fires. Analyzing these documents provided insightful information on the capabilities and effects field artillery forces provide to the ground commander. Additionally, the Field Artillery Journal included numerous articles on field artillery operations during Operation Desert Storm and Operation Iraqi Freedom. The scholarly articles provided detailed information of how maneuver commanders employed field artillery forces during each of the conflicts.

Additional primary source documents utilized during this monograph included command reports and division histories. The 84th Infantry Division After Action Report published by the US

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[15] US Department of the Army, Army Doctrine Reference Publication (ADRP) 3-09, Fires (Washington, DC: Government Printing Office, 2012), 1-4.

[16] US Department of the Army, Field Manual (FM) 3-09, Field Artillery Operations and Fire Support (Washington, DC: Government Printing Office, 2014), 1-2.

[17] US Army, FM 3-09 (2014), 1-2.

[18] Ibid., 1-3.

Army during Operation Clipper provided specific analysis of artillery employment during the conflict. The General Board Report, United States Forces, European Theater, Field Artillery Operations, provided key insights from senior officers during World War Two. This primary source document describes field artillery operations throughout the European Theater.[19]

Specific historical and current US Army and field artillery references used here inform the transitional nature of the change in artillery doctrine across time, such as Field Manual (FM) 100-5, Operations, and Field Service Regulations-Operations. Both doctrinal manuals detailed the roles of field artillery units in US Army operations. The 1944 edition of FM 100-5, Field Service Regulations-Operations, confirmed the role of field artillery as a supporting arm that is critical to the combined arms fight.[20] The 1986 edition of FM 100-5, Operations, outlined artillery's role as supporting other arms by fire.[21] The 2001 edition of FM 3-0, Operations, highlighted field artillery forces as a key enabler on the battlefield.[22]

Important field artillery references included doctrinal manuals such as Army Doctrinal Reference Publication (ADRP) 3-09, Fires and FM 3-09, Field Artillery Operations and Fire Support. Both manuals covered the contextual employment and characteristics of field artillery fires both in mass and precision. Each of these documents provided additional perspectives on the capabilities, employment, and impact of artillery operations. Two major secondary sources that portray the history and organization of field artillery forces are Dr. Boyd Dastrup's *King of Battle: A Branch History of the US Army's Field Artillery* and Janice E. McKenney's *The Organizational*

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[19] The General Board, United States Forces, European Theater, *Report on Study of Field Artillery Operations,* June 1945, 1.

[20] US Department of the Army, Field Manual (FM) 100-5, Field Service Regulations-Operations (Washington, DC: Government Printing Office, 1944), 11.

[21] US Department of the Army, Field Manual (FM) 100-5, Operations (Washington, DC: Government Printing Office, 1986), 4.

[22] US Department of the Army, Field Manual (FM) 3-0, Operations (Washington, DC: Government Printing Office, 2001), 4.

History of Field Artillery 1775-2003.[23] Dastrup's *King of Battle* provided a comprehensive review of field artillery history, while McKenney's *Organizational History* was an excellent source for examining field artillery organizations.

In addition to these sources, this paper reviews several military works such as the *Infantry School Quarterly* and *Field Artillery* magazines.[24] The *Infantry School Quarterly* examined Operation Ripper in detail and documented the contributions artillery forces provided during the operation.[25] The 1991 and 2003 *Field Artillery* magazines included detailed interviews from ground commanders discussing field artillery operations and how field artillery forces enabled success.[26] These works in concert provide contextual background into the transition from massed fires to precision fires for field artillery forces throughout the modern era.

This study is organized into four sections following the introduction. The introduction describes the fires capability requirements outlined in US Army capstone concepts. It assesses the effectiveness of surface-to-surface indirect fire systems and provides an overview of massed as well as precision fires. Section one examines illustrative operations from World War Two through the end of the Korean War period that highlight the concept of massed fires as a normative application of artillery forces. Operation Clipper during the Second World War, Operation Ripper during the Korean War, and the Cold War buildup, especially its final doctrinal manifestation in AirLand Battle provide the touchpoints for massed fires study. The second section highlights

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[23] Boyd L. Dastrup, *King of Battle: A Branch History of the US Army's Field Artillery* (Fort Monroe, 1992), xi; and, Janice E. McKenney, *The Organization of the Field Artillery: 1775-2003* (Washington, DC: Center of Military History, 2007), ix.

[24] John W. Baumgartner and Arthur P. Price, eds., "Operation Ripper," *Infantry School Quarterly*, October 1951, 5; Colin K. Dunn, ed., *Field Artillery: A Professional Bulletin for Redlegs*, October 1991, 1; Patrecia S. Hollis, ed., *Field Artillery: A Professional Bulletin for Redlegs*, September-October 2003, 1.

[25] Baumgartner, "Operation Ripper," 5.

[26] Dunn, *Field Artillery*, 2; Hollis, *Field Artillery*, 5, 10.

Operation Desert Storm and Operation Iraqi Freedom to demonstrate two hybrid cases involving a transitional period that saw the application of both precision and massed fires against a conventional opponent. Section three highlights three implications as artillery forces complete the transition to hybrid fires capabilities in the current operational environment. The fourth and final section describes a conclusion and recommendations concerning the implications of employing precision fires during large scale combat operations, and proposes several recommendations for further analysis. The key outcome of the study highlights how artillery forces acquired a precision capability to increase its lethality when supporting maneuver forces on the battlefield.

The US Army Capstone Concept (ACC) describes the future operational environment, those broad capabilities required by future army forces to accomplish its enduring missions, and role of the army in the joint force.[27] In addition to the ACC, the Army Operating Concept (AOC) also provides a conceptual framework that describes how army forces operate to accomplish campaign objectives. Not only does the AOC outline campaign objectives, but it also underpins the additional capabilities required for future army, joint, and multinational forces to accomplish missions in support of policy goals and objectives.[28] US Army field artillery forces use both conceptual documents to derive their fires capability requirements to support both the ACC and AOC.

The ACC outlines two capabilities for the Fires warfighting function. The first requirement is the "capability to access and authorize the employment of joint, multinational fires to support operations over wide areas in complex terrain to enable commanders to gain, maintain,

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[27] US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 535-3-0, *The US Army Capstone Concept* (Fort Eustis: Department of the Army, 2012), 3.

[28] TRADOC Pamphlet 535-3-0, *The US Army Capstone Concept*, 24; US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-3-1, *The US Army Operating Concept: Win in a Complex World 2020-2040* (Fort Eustis: Department of the Army, 2014), 25.

and exploit positions of advantage in support of unified action."[29] The second requirement highlights how field artillery forces use "offensive and defensive fires capabilities to deter, disrupt, degrade, or destroy threat capabilities, pre-empt enemy actions, and protect friendly forces and other critical assets abroad and in the homeland in support of unified action."[30]

To meet the fires capability requirements outlined in the ACC and the AOC, field artillery forces use the Training and Doctrine Command (TRADOC) *Army Operating Concept* and *Functional Concept for Fires 2020-2040*; which state that field artillery forces be operationally adaptive, and enable joint combined arms operations from land across all domains. Operationally adaptive fires provide the army with versatile capabilities to respond and defeat a wide range of threats utilizing offensive and defensive fires for combined arms, joint, and multinational operations. Additionally, the *Functional Concept for Fires 2020-2040* describes the future requirements for field artillery forces in four tenants: precision, responsiveness, effectiveness, and multi-functionality.[31]

Being precise means operating with accuracy and achieving the desired effects on the desired targets. Precision gives commanders greater flexibility when applying fires in all situations.[32] Precision fires involves applying accuracy standards to planning and targeting, target location, platform capabilities, munitions, computational procedures, judgment, and execution.[33] There are three considerations when employing precision fires. These requirements are accurate target location, precision-guided munitions, and weapon platforms.

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[29] TRADOC Pamphlet 535-3-0, *The US Army Capstone Concept*, 30.

[30] Ibid.

[31] US Army Training and Doctrine Command (TRADOC), TRADOC Pam 525-3-4, *Functional Concept for Fires 2020-2040* (Fort Monroe: Department of the Army, 2017), 8; TRADOC Pamphlet 525-3-1, *The US Army Operating Concept*, 18.

[32] TRADOC Pamphlet 525-3-4, *The US Army Functional Concept for Fires*, 8.

[33] Ibid., 8.

One critical requirement for employing precision munitions is accurate target location. Precision munitions require a small circular error probable (CEP). A CEP is the radius of a circle centered on a target encompassing an area where fifty percent of the rounds will impact. The CEP determines the accuracy of a specific munition and the delivery accuracy of a weapon system.[34]

A smaller CEP implies greater accuracy, while a larger CEP corresponds to less accuracy. The US Army *Functional Concept for Fires* defines precision capabilities having a CEP of less than ten meters, near-precision fires with a CEP less than fifty meters, and area effects with a CEP greater than fifty meters.[35] Trained observers using advanced technology and software provide refined target coordinates to fulfill this requirement. Understanding the CEP is important to achieving the accuracy and desired effects on a target.

To support near-precision effects, a Precision Guidance Kit (PGK) exists to increase the accuracy of the existing stock of munitions in the US Army inventory for large-caliber munitions. The PGK is a near-precision fuze that attaches to conventional munitions. The PGK uses Global Positioning System (GPS) technology to correct the trajectory of projectiles inflight, while achieving a CEP of fifty meters regardless of range.[36] The PGK seeks coordinates compared to a PGM that course corrects to the target. Only the M109A6 and M777A2 howitzers fire 155mm high explosive projectiles compatible with PGKs. On the other hand, the M119A3 howitzer does not support PGKs.

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[34] William Nelson, "Use of Circular Error Probability in Target Detection" (Hanscom Air Force Base, MA: Electronic Systems Division, US Air Force, 1988), 1.

[35] TRADOC Pamphlet 525-3-4, *The US Army Functional Concept for Fires*, 12.

[36] Cal A. Thomas and Jonathan S. Delong, "Regaining our Luster: How Fort Sill Institutional Training is Improving to Meet Requirement for the 21st Century Field Artillery NCO," *Redleg Update: The US Army Field Artillery Branch's Newsletter* (August 2014), 6.

Two other requirements when employing precision fires include the ammunition and systems available. There are three precision-guided munitions available for field artillery forces.[37] The Army Tactical Missile System (ATACMS) and the Guided-MLRS (GMLRS) rockets represent the first two precision munitions. The third munition is the M982 Excalibur projectile. Excalibur is a Global Positioning System GPS-aided 155mm projectile. These three precision munitions support field artillery operations at the operational and tactical levels. The Multiple Launch Rocket System (MLRS) and High Mobility Artillery Rocket System (HIMARS) fire the ATACMS and GMLRS rockets. Both systems give the army the capability to conduct deep precision strikes. Of the three US Army cannon systems, the M109A6 self-propelled howitzer and the M777A2 towed howitzer have the capability to fire the Excalibur projectile.[38]

Being responsive encompasses reacting quickly to battlefield stimuli and having the ability to create desired effects on the target by moving quickly.[39] Effectiveness involves fires units having the capacity, range, and lethality to enable friendly maneuver.[40] The fourth tenet is multi-functionality, which involves artillery forces having the capability to support any mission across the range of military operations with limited assets.[41] Under these four tenets, field artillery forces employ their gunnery fire support team.

The gunnery fire support team consists of three integrated components, the observer, the fire direction center, and the firing unit. The observer serves as the "eyes and ears" of all indirect

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[37] US Department of the Army, Army Techniques Publications (ATP) 3-09.32, JFIRE: Multi-service Tactics, Techniques, and Procedures for Joint Application of Firepower (Washington, DC: Government Printing Office, 2016), 34-35.

[38] US Army ATP 3-09.32 (2016), 34-35.

[39] TRADOC Pamphlet 525-3-4, *The US Army Functional Concept for Fires,* 8.

[40] Ibid., 9.

[41] Ibid.

fire systems. They detect and locate suitable indirect fire targets within the zone of observation.[42] Examples of observers are soldiers, radar systems, or any source suitable for detecting/locating targets. The fire direction center (FDC) serves as the control system. Known as the "brains" of the gunnery team, the FDC receives the call the fire from an observer and converts the data into a firing solution for the howitzers.[43] Firing units serve as the "muscle" of the gunnery team and receive data from the FDC to fire the projectile.[44] The gunnery team produces effects on the target depending on the relationship to maneuver forces.

Field artillery forces deliver effects for the maneuver commander based on four types of support relationships. These four support relationships are direct, reinforcing, general, or general support reinforcing. Direct support requires a force to support another specific force by answering the supported force's request for assistance.[45] An example is a field artillery unit concerned with the fire support needs of a maneuver unit. Reinforcing requires a force to support another supporting unit. An example is a field artillery unit supporting another field artillery unit. Only similar units receive a reinforcing mission.[46]

The third type of support is general. General support provides support to the entire supported force as a whole without any subdivision. A field artillery unit assigned as general support has all fires under the control of the supported commander.[47] General support reinforcing, is a support relationship assigned to a unit to support the force as a whole and to reinforce another

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[42] US Department of the Army, Training Circular (TC) 3-09.81, Field Artillery Manual Cannon Gunnery (Washington, DC: Government Printing Office, 2016, 1-1.

[43] US Army TC 3-09.81 (2016), 1-2.

[44] Ibid.

[45] US Army, FM 3-09, Field Artillery Operations (2014), 1-33.

[46] Ibid.

[47] Ibid.

like-type unit.[48] These support relationships task-organize field artillery units for particular missions and enable commanders to employ specific capabilities to achieve desired results.[49]

The second fires capability requirement describes the fires by type and effects. The *US Army Functional Concept for Fires* distinguishes two types of fires by their purpose: offensive and defensive. Offensive fires preempt enemy actions and defensive fires protect friendly forces, population centers, and critical infrastructure. Offensive fires include preparation fires, close support fires, interdiction, electronic attack, early warning engagement, and counterfires. Defensive fires include counterfire and final protective fires. The US Army requires the field artillery to provide offensive and defensive fires that address the wide range of threats in future operational environments.[50]

The fires capability requirement outlined in the ACC requires offensive and defensive fires to "deter, disrupt, degrade, or destroy threat capabilities."[51] This requirement is important to the field artillery force because of ammunition consumption. Field artillery units require a significant amount of rounds to destroy a target. The field artillery translates these tasks into quantitative computed effects of destroy, neutralize, and suppress. Destroy, neutralize, and suppress correlate to 30 percent, 10 percent, and three percent, respectively.[52] While the ACC describes these capabilities as requirements for fires, field artillery forces facilitate maneuver by destroying, degrading, or neutralizing selected enemy forces.[53]

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[48] US Army, FM 3-09 (2014), 1-33.

[49] Ibid., 1-32.

[50] TRADOC Pam 525-3-4, *The US Army Functional Concept for Fires*, 11; US Army, ADRP 3-09, (2012), 1-6.

[51] TRADOC PAM 535-3-0, *The US Army Capstone Concept*, 30.

[52] US Army, FM 3-09 (2014), 1-3.

[53] US Department of the Army, Field Manual (FM) 3-0, Operations (Washington, DC: Government Printing Office, 2017), 2-46.

Field artillery assigns missions to its units of destroying, defeating, or disrupting enemy forces to support maneuver commanders.[54] Destroy, defeat, and disrupt are effects achievable through the employment of offensive and defensive fires. Meeting the fires capability requirements described above enables field artillery forces to accomplish their mission when supporting maneuver forces. These capabilities provide field artillery forces with the ability to mass in time and space.[55]

Section 1: Massing Fires on Multiple Battlefields

Throughout modern military history, commanders saw mass as a key to decisive victory. Mass, a principle of war, noted by prominent military theorist Carl von Clausewitz is a factor in achieving victory. In his book, *On War*, Clausewitz argued that "superiority in numbers is the most common element in victory."[56] Massing artillery fires means simultaneously engaging the same target with multiple elements. An example of massing fires is two systems firing one volley, as opposed to one system firing two volleys. Although both instances fire two projectiles, the element of surprise occurs only on the initial volley. Multiple volleys allow the enemy to react and seek protective cover. Therefore, field artillery forces strive for maximum effect on targets, through massing fires.

The US Army defines massing fires as the combining of fire from two or more weapons at a single point or target.[57] Massing fires consists of three conditions. The first condition is command and control of artillery units. The second condition involves multiple artillery units engaging a target. The last condition is accurate procedures to ensure the rounds impact the

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[54] US Army, FM 3-0 (2017), 1-1.

[55] TRADOC PAM 525-3-4, *The US Army Functional Concept for Fires*, 12.

[56] Carl von Clausewitz, *On War*, ed. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 194.

[57] US Army, FM 3-09 (2014), 2-2.

desired target. Commanders concentrate artillery to provide greater firepower and maximize effects on engaging targets.[58]

With the attacks on Pearl Harbor ushering the United States into World War Two, artillery forces expanded to support ground forces. In 1937, the US Army possessed 100 firing batteries. Five years later, 568 batteries existed.[59] In the early 1940s, field artillery saw its primary mission in supporting maneuver as counterbattery fire. Field artillery supported their maneuver brethren with artillery barrages. The number of artillery pieces, centralized fire control, and stockpiles of ammunition enabled artillery to mass fires.[60]

Operation Clipper occurred during World War Two from 16-30 November, 1944. It was an allied offensive by the British XXX Corps as part of Ninth US Army to reduce the Geilenkirchen salient from the Siegfried line to the Roer river. The operation illustrated how field artillery forces massed fires and shifted artillery from corps to corps to provide effective support for ground forces. Artillery forces supported the US Ninth Army advance by reducing enemy strongpoints, covering the initial maneuver assaults, and disrupting enemy counterattacks through massing fires at the appropriate moment.[61]

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[58] US Army, FM 3-09 (2014), 2-2.

[59] Boyd L. Dastrup, *King of Battle: A Branch History of the US Army's Field Artillery* (Fort Monroe, 1992), 208.

[60] Dastrup, *King of Battle*, 223.

[61] The General Board, *Field Artillery Operations*, 97.

Figure 1. Operation Clipper. Theodore Draper, *The 84th Infantry Division in the Battle of Germany: November 1944-May 1945* (New York: Viking Press, 1946), 14.

Field artillery forces supported maneuver with a sequenced four-phase approach.[62] In the first phase all artillery fired on targets to disrupt enemy communications. In the second phase, corps artillery targeted enemy defensive positions close to the front lines. During the third phase, all artillery massed fires on enemy defensive positions close to the front lines. In the last phase, corps artillery shifted to the enemy's rear areas while division artillery continued close support. Field artillery forces used this four-phased approach to disrupt, destroy, and defeat German forces. The 84th Infantry Division received indirect fire support from the 84th division artillery, enabling them to seize the towns of Lindern, Leiffarth, and Wurm during Operation Clipper.

The 84th Infantry Division's plan of attack included seizing key terrain along the Siegfried Line. The problem was a triangle of four villages, Wurm, Beeck, Leiffarth, and

[62] The General Board, *Field Artillery Operations*, 105.

Lindern.[63] An enemy strongpoint inside the triangle, northeast of Beeck, was a piece of high ground that the 84th wanted to secure. This key terrain represented one of the most formidable segments of the Siegfried Line.[64] The main enemy resistance included pillboxes, tanks, artillery, and infantry from four German divisions. These forces consisted of the 183d Volksgrenadier, 9th Panzer, 15th Panzer, and the 10th SS Panzer divisions.[65] Field order number seven designated the 335th Infantry Regiment as the main effort and directed them to first, seize the high ground northeast of Beeck. Afterwards, the 335th Infantry seized Lindern, and continued the attack against Wurm.[66]

Supporting the 84th Infantry Division in their attack was the 84th Division Artillery, which consisted of the 325th, 326th, and 327th Field Artillery Battalions. To support the division artillery, the XIII corps artillery reinforced the 84th with the 909th Field Artillery Battalion.[67] The four battalions gave the 84th division artillery tremendous firepower and the ability to mass fires. The number of field artillery units enabled the division artillery to shift support from one unit to the other without a loss of efficiency.[68]

Field artillery forces disrupted the German's ability to defend their strongpoints by massing artillery fires and disrupting counterattacks. As the 335th Infantry Regiment attempted to seize Lindern, the infantry came under heavy German artillery fire. The 84th division artillery fired on the German strongpoints reducing the volume of enemy fire and allowing the 335th to

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[63] After Action Report (AAR), Headquarters, 84th Infantry Division, December 1944, 11.

[64] AAR, 84th Infantry Division, 8.

[65] Ibid., 13.

[66] Ibid., 11.

[67] Ibid., 13.

[68] Ibid.

advance.[69] The Germans attempted to counterattack on the Lindern-Linnich road with seventy-five infantrymen. The 335th disrupted the German counterattack by calling in artillery fire from the 84th division artillery.

On the seizure of Leiffarth, artillery forces disrupted the German defenses with artillery barrages and preparatory fires to support maneuver units. The 334th Infantry Regiment planned an extensive artillery barrage before advancing on the town of Leiffarth. On December 2, 1944, the division artillery combined with the corps artillery delivered a five-minute artillery barrage on the German forces. The barrage stunned the German defenders and forced them to remain in their foxholes.[70] Once the barrage ended, 1st Battalion, 334th Infantry advanced to the town of Lieffarth only to find the town unoccupied by German defenders. The defeated Germans retreated and enabled the 334th to seize the town in thirty minutes.[71]

On December 14, the 2d Battalion, 694th Volksgrenadier regiment and the 1st Battalion, 343rd Volksgrenadier regiment attempted to counterattack under German artillery fire. Prior to the advance, the Germans established a minefield to prevent the 84th from seizing Wurm.[72] The two German battalions encountered artillery fire from the 84th division artillery five hours after they started their attack. The artillery fire isolated the German forces. They either met the destruction of artillery fire from their front or their minefield if they retreated. Massed artillery fire destroyed both battalions consisting of two hundred troops within one hour.[73]

The 84th Infantry Division considered Operation Clipper a success. In thirteen days, every unit achieved their objectives. The 334th Infantry seized Prummern, the 333rd occupied

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[69] Theodore Draper, *The 84th Infantry Division in the Battle of Germany: November 1944-May 1945* (New York: Viking Press, 1946), 58.

[70] Draper, *The 84th Infantry Division*, 70-71.

[71] Ibid.

[72] Ibid., 77.

[73] Ibid., 77-78.

Geilenkirchen, and the 335th took Lindern.[74] The division artillery allowed the infantry regiments to achieve their objectives. Artillery fire destroyed the 183rd Volksgrenadier Division. The flexibility of numerous artillery units to centralize fires enabled multiple artillery battalions the ability to mass fires and influence the battlefield.[75]

After World War Two, massing fires in support of maneuver forces remained artillery doctrine. Attempting to incorporate the lessons learned from the war, artillery leaders advocated increasing the number of field guns to provide increased firepower for massing rather than shifting artillery units.[76] In light of a shrinking military budget and restricted procurement funding, the US army reduced its forces. With the Soviet Union as the next likely adversary in war, the US Army reorganized its means for increased firepower, mobility, and air power to overcome its manpower limitations.[77]

With the surrender of the Japanese at the end of World War Two, allied powers divided the Korean peninsula. Soviet troops occupied North Korea, giving military equipment to the Northern Peoples Republic of Korea (NPRK) forces. In the South, the United States supported the South Koreans with military training and equipment despite readiness issues.[78] US infantry and artillery units operated below their authorized peacetime strength. Under political pressure, President Truman cut the military budget, which further reduced a capable United Nations (UN) military response.[79]

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[74] AAR, 84th Infantry Division, 13.

[75] The General Board, *Field Artillery Operations*, 95.

[76] Dastrup, *King of Battle*, 241.

[77] Charles E. Kirkpatrick, *An Unknown Future And A Doubtful Present: Writing The Victory Plan of 1941* (Center of Military History: Washington DC, 1990), 90-92.

[78] Ridgway, *The Korean War*, 6-10.

[79] Ibid., 13, 23.

Prior to the North Korean attack, the United States reduced its forces unilaterally in South Korea. Compared to UN forces on the Korean peninsula, the NPRK possessed a distinct numerical advantage in artillery and armor assets.[80] With advantages in equipment and a prepared force, the NPRK launched an offensive south of the 38th parallel on June 25, 1950.[81] In response, UN forces conducted a counteroffensive, advancing to the Manchurian border.[82]

On November 3, 1950, the Chinese Communist Forces (CCF) intervened in the Korean conflict. The CCF reinforced North Korean troops and launched attacks against UN forces. The CCF attacked the Eighth US Army in late December, driving UN forces back 12 miles from Kaesong to the Pukhan river.[83] In January 1951, the Eighth Army launched a counteroffensive after having falling back to a line along the 37th parallel. By February 20th, the successful drive reached the Han River, south of Seoul.[84]

Operation Ripper began on March 7, 1951 and ended March 31, 1951. With specific guidance from Eighth Army commander, General Matthew Ridgway, UN forces sought to "inflict maximum casualties on the enemy, while destroying enemy personnel and equipment."[85] The plan involved attacking through successive phase lines to seize the town of Ch'unch'on while destroying enemy forces, supplies, and equipment south of phase line IDAHO. The town was an important supply centers and controlled key road junctions.[86] Crucial to the success of Operation Ripper was massing artillery fire. During this operation, UN forces encountered difficult terrain

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[80] Ridgway, *The Korean War*, 17.

[81] US Military Academy, *Confrontation in Asia: The Korean War* (Department of History: West Point, NY, 1981), 1.

[82] US Military Academy, *Operations in Korea* (Department of Military Art and Engineering: West Point, NY, 1953), 20.

[83] Ibid., 21-29.

[84] Baumgartner, "Operation Ripper," 5.

[85] Ridgway, *The Korean War*, 113.

[86] US Military Academy, *Confrontation in Asia*, 54.

making attacks against enemy defenses slow and treacherous. Mountains, deep valleys, rivers, and rice paddies made UN operations problematic.[87] The attack covered the entire Eighth Army front. Eighth Army consisted of three US corps: I, IX, and X Corps.

Field artillery units on the Korean peninsula massed fires despite an ammunition shortage. The proximate cause of the ammunition shortage was the rise in normal rates of fire caused by the shortage of artillery pieces.[88] The reduced number of artillery battalions per mile of front meant that each gun had to fire more rounds to achieve the desired effectiveness.

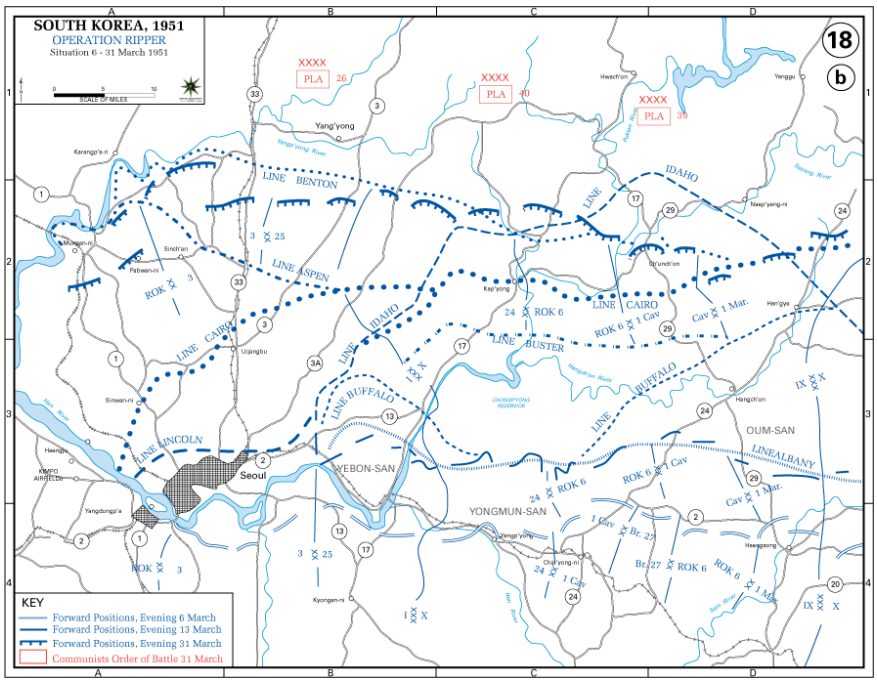

Figure 2. "South Korea, 1951. Operation Ripper." Department of History, US Military Academy, West Point, accessed 13 April 2018, https://www.westpoint.edu/history/SiteAssets/SitePages/Korean%20War/Korea18b.gif.

On March 7th, UN forces conducted the largest artillery bombardment during the Korean War. Opposing the UN forces were elements of the DPRK's Tenth Division and the Chinese Communist Force's 38th Army. The heavy massing of fire preceded the assault across the Han

[87] US Military Academy, *Operations in Korea*, 33.

[88] McKenney, *Organization of the Field Artillery*, 202.

River. Ten battalions of artillery concentrated their fire on the landing areas of the US Army's 35th, 27th, and 24th Infantry regiments. Prior to crossing the Han, the 25th Division Artillery, commanded by Brigadier General George B. Barth, fired 5,000 rounds in a twenty-minute preparation.[89]

Field artillery forces expended massive amounts of ammunition during the Han river crossing. In preparation for the river crossing, the 25th Division ammunition officer approved 652 transportation trucks to carry 1,628 tons of ammunition, while the artillery battalions carried excess loads of ammunition. This condition allowed field artillery forces to fire close to 19,000 rounds of artillery in a twenty-four period.[90]

Just as the twenty-minute artillery preparation ceased, the second battalion of the 24th infantry regiment assaulted the north bank. As the enemy recovered from the bombardment, Echo and Fox companies received sporadic mortar and small arms fire.[91] On March 8, the enemy counterattacked causing Echo and Fox companies to withdraw 1500 yards. Seven hours later, elements of the CCF ceased their attack due to massed US artillery fire.[92]

The Han River crossing highlighted field artillery forces successfully massing fires to disrupt enemy forces. The high rate of fire accounted for the limited number of artillery units.[93] Select artillery units fired five times the ammunition expenditure rate of artillery employment during World War Two. Despite the small number of artillery pieces, the narrow division front

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[89] Baumgartner, "Operation Ripper," 16.

[90] Ibid., 14, 16.

[91] Ibid., 26.

[92] Ibid.

[93] Stanford Research Institute, *Operational Data for Selected Field Artillery Units During World War II and The Korean War* (Stanford, CA: Stanford Research Institute, 1954), 1.

allowed artillery to mass fires and support maneuver forces.[94] By defeating elements of the CCF, US Eighth Army forces arrived on the 38th parallel by the end of March. UN forces considered Operation Ripper a success as allied forces seized all geographical objectives. Lieutenant General Frank W. Milburn, Commanding General of the US Army First Corps commented on the effective artillery fire in stating "the twenty-minute preparation employing every supporting weapon and the close follow-up behind it were fundamental in securing this success."[95] Milburn further stated that "detailed planning by all levels of command called for aggressive employment of Infantry and maximum use of all supporting elements."[96]

Section 2: Hybrid Fires in the Contemporary Operational Environment

With the signing of the Korean Armistice in 1953, the United States refocused on the Soviet Union. The advent of nuclear weapons led to the belief that a nuclear capability would compensate for inferior field artillery weapons, which resulted in a decrease in the number of weapon systems. A US military policy known as the "New Look" emerged in 1953. The policy called for an increased reliance on nuclear airpower rather than ground forces armed with conventional weapons.[97]

In 1954, General Matthew B. Ridgway, Army Chief of Staff directed that US forces prepare to fight outnumbered and increase its mobility and firepower.[98] Initiatives included increased responsiveness of fires, weapon system range, and lethality. As a result, the field

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[94] Command Report, Headquarters Second Infantry Division 1March-31Mar 1951; Clark C. Monroe, *The Second United States Infantry Division in Korea: 1950-1951* (Nashville: Battery Press, 1992), 115.

[95] Baumgartner, "Operation Ripper," 31.

[96] Ibid.

[97] McKenney, *Organization of the Field Artillery,* 207.

[98] Dastrup, *King of Battle*, 267.

artillery developed a nuclear role in its missile program as an effort to optimize support for maneuver forces. Weapon systems and computers improved the field artillery's responsiveness, while revamping the field artillery's force structure facilitated exploiting the new technological advances.[99]

The push to restructure the US Army to fight on the nuclear battlefield led to the development of new weapons in the mid-1950s. The field artillery introduced the Honest John rocket in 1954 and the Corporal rocket in 1955.[100] The Honest John was a free flight rocket capable of delivering a single nuclear warhead. The Corporal had dual capability of being a nuclear rocket or a conventional general support rocket designed to operate outside of cannon artillery range. In addition to rockets, the field artillery made improvements to its fire direction systems.

In 1959, the field artillery introduced the field artillery digital automatic computer (FADAC). FADAC increased accuracy, decreased response time between calls for fire, and allowed gun crews to engage more targets with less ammunition.[101] In an effort to reduce the time between calls for fire and the first round on target, the US Army Field Artillery Branch replaced FADAC with the Tactical Fire Direction System (TACFIRE). This system gave artillery forces the capability to link other computers from different artillery units. The increased command and control with the ability of tracking the status of guns and ammunition enabled artillery forces to decrease response time for calls for fire, and accurately mass fires onto different targets.[102]

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[99] John J. McGrath, *Fire for Effect: Field Artillery and Close Air Support in the US Army*, (Fort Leavenworth, KS: Combat Studies Institute Press, 2008), 133-135.

[100] McKenney, *Organization of the Field Artillery*, 207.

[101] Dastrup, *King of Battle*, 287.

[102] Ibid., 290.

In the 1960s, field artillery forces improved their cannon and rocket capabilities. With help from helicopters, artillery forces extended their operational reach as helicopters moved and supplied cannon artillery. Even though dispersed along extended fronts, artillery forces operated in an effective manner.[103] In 1962, field artillery forces introduced the Pershing and Lance batteries. Both rockets provided general support for ground maneuver forces outside of cannon artillery range.[104]

After the Vietnam War, the United States reduced defense spending. Subsequently, field artillery forces underwent several organizational changes due to US Army force restructuring during this period. In 1973, US Army corps formations replaced field armies as the main fighting unit in land operations. As part of the change, the US Army eliminated artillery groups and decentralized field artillery assets downward to support corps and division headquarters.[105]

For field artillery forces, technological advances in weaponry and platforms improved its lethality in the late 1970s. This period marked the transition from mass fires to the introduction of precision munitions. In support of Active Defense, the field artillery focused on research and development instead of fielding new equipment. Technological advances and force restructuring influenced the Army and the field artillery to abandon their historical reliance upon defeating the enemy with numerical superiority and seek to fight the Soviets resourcefully.[106] Rather than quantitative changes in field guns, field artillery forces introduced qualitative changes.

To counterbalance the Soviet Union's large numbers of tanks and armored personnel carriers, the US Army contemplated two courses of action. Either increase the number of field pieces or develop artillery munitions that were deadlier than existing high-explosive

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[103] McKenney, *Organization of the Field Artillery*, 276.

[104] Ibid., 230-234.

[105] Ibid., 306.

[106] Dastrup, *King of Battle*, 300.

fragmentation munitions. As part of the modernization effort, the US Army saw advances in technology and organizational changes as effective options to defeat a numerically-superior Soviet Union.

Among several new missile delivery systems, MLRS represented the most dramatic development. Fielded in the 1980s, the MLRS weapon system met the requirement as a deep strike, area fire weapon, capable of shaping deep operations and providing responsive counterfire.[107] The system gave the US Army a long-range indirect fire weapon system that saturated the battlefield with bomblets in less than one minute. The 12 rockets targeted a one-kilometer by one-kilometer grid area, giving corps artillery commanders massive amounts of firepower for counterbattery fire and suppression of enemy air defenses.[108]

The AirLand Battle concept evolved as the overarching doctrinal approach to counter the potential Soviet threat in Western Europe. The basic tenets of AirLand Battle were initiative, depth, agility, and synchronization. The premise of the doctrine was to retain the initiative by attacking the enemy with a powerful blow from an unexpected direction, with a force succeeding to prevent the enemy's recovery. The intent was to attack the enemy in depth and prevent the enemy from taking effective counteractions.[109] To meet this intent, the doctrine recommended deep strikes to create confusion and disorientation among enemy forces. The purpose was to create gaps in the enemy's order of battle and exploit the success with a rapid offensive maneuver using mechanized forces supported by fires.

To increase lethality on the battlefield, the US Army decided to invest in precision munitions as the field artillery's one great handicap was inaccuracy. Precision munitions gave the field artillery pinpoint accuracy, reduced ammunition expenditures, and decreased the

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[107] McKenney, *Organization of the Field Artillery*, 291.

[108] McGrath, *Fire for Effect*, 135.

[109] US Army 100-5, (1986), 14.

number of rounds required to neutralize enemy armor.[110] Approved in 1979 and fielded in 1984, the Copperhead was a high explosive, anti-tank, 155mm laser-guided projectile. The round contained a nose section with a guidance package and laser seeker with a warhead comprised of an anti-tank, shaped charge.[111] Designed to engage point targets, the Copperhead required an observer to paint the target, so the laser homing device could engage the appropriate target.

After the fall of the Soviet Union, the US military shifted its strategic focus from a Soviet threat, to increasing responsiveness to various contingencies around the globe. Another concern for the US military, especially the US Army, was force structure. The platforms designed for a Soviet threat dominated the inventory, so modernization efforts adapted to the new operational environment. As the Cold War ended, President George H. W. Bush's administration, with advice from senior advisors, decided to change the posture of the military from a threat-based force focused on the Soviet Union, to a capabilities-based force. This strategic change resulted in reducing military forces with a goal of becoming lighter and more expeditionary.

Precision munitions existed as elements of the Cold War AirLand Battle construct. The end of the Cold War depicted a hybrid artillery force armed with providing massed or precision fires. While the US Army planned to employ both capabilities in Europe to offset Soviet numerical superiority, the demise of the Soviet Union negated that chance. The US Army's opportunity to employ the experimental precision munitions occurred when Iraq invaded Kuwait in the early 1990s.

Iraq's invasion of Kuwait on August 2, 1990 represented the first major international crisis since the Cold War.[112] Iraqi President Saddam Hussein's act of aggression brought

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[110] Dastrup, *King of Battle,* 292.

[111] McKenney, *Organization of the Field Artillery,* 286.

[112] Michael A. Reynolds, "The Wars' Entangled Roots," in Beth Bailey and Richard H. Immerman, ed., *Understanding the US Wars in Iraq and Afghanistan* (New York: New York University Press, 2015), 33.

international condemnation. When President Bush offered US assistance to Saudi Arabia, the Saudis accepted.[113] After the United Nations Security Council passed the resolution, UNSCR 678, authorizing the use of force to expel Iraq from Kuwait, President Bush stated four US national policy objectives to the US Congress.[114] These four objectives were the "immediate withdrawal of Iraqi forces from Kuwait, restoration of Kuwait's legitimate government, stability in the Persian Gulf region, and safety of American citizens abroad."[115]

General Norman Schwarzkopf, the commander of US Central Command (CENTCOM) oversaw the military response. He developed a plan consisting of three phases. Phase one was the strategic air campaign, designed to gain air supremacy in the theater of operations, and force an early resolution to the crisis. Phase two was a preparation for the ground campaign, while phase three was the actual ground offensive, if needed.[116]

The Third US Army, commanded by Lieutenant General John Yeosock, served as the field army headquarters.[117] Two US Army corps along with their artillery served under Third Army. Attached to Third Army was XVIII Airborne Corps, commanded by Lieutenant General Gary Luck, and VII Corps commanded by Lieutenant General Frederick Franks. The XVIII Airborne Corps Artillery commander was Brigadier General Fred N. Halley while Brigadier General Creighton W. Abrams, Jr. commanded the VII Corps Artillery.[118]

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[113] Reynolds, "The Wars' Entangled Roots," 33.

[114] David Fisher, *Morality and War: Can War Be Just in the Twenty-First Century?* (Oxford: Oxford University Press, 2011), 194.

[115] Department of Defense (DoD), *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, DC: Department of Defense, 1992), 19.

[116] Ibid., 74.

[117] Richard M. Swain, *"Lucky War:" Third Army in Desert Storm* (Fort Leavenworth, KS: US Army Command and General Staff College Press, 1994), 27-28.

[118] Charles Lane Toomey, *XVIII Airborne Corps in Desert Storm: From Planning to Victory* (Central Point, OR: Hellgate Press, 2004), 190; and Stephen A. Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Department of the Army, 2002), 12.

The US-led coalition faced a formidable near peer opponent with Soviet-style military equipment. Iraqi forces consisted of thirty-six divisions with 450,000 troops, 4,000 tanks, and 3,000 artillery pieces. The Iraqis had 600 Scud missiles capable of delivering conventional, chemical, or biological warheads. The Iraqis possessed a respectable air force with 1,000 aircraft and numerous integrated air defense systems.[119] Iraqi forces demonstrated a significant numerical superiority in infantry, tanks, and artillery.

US field artillery forces during Operation Desert Storm represented the largest artillery force since World War Two. Seven field artillery brigades and seven division artillery organizations totaled 43 cannon, rocket, and missile battalions.[120] Desert Storm was the first post-Cold War conflict that validated the capability for US Army artillery forces to use massed fires and precision fires within the construct of AirLand Battle doctrine. The effects of massing conventional munitions led to the successful defeat of Iraqi positions before maneuver ground forces continued the attack.

Operation Desert Storm demonstrated the application of AirLand Battle against a near-peer adversary with numerical superiority while defending from prepared defensive positions. The US-led coalition faced a numerical inferiority of approximately four to three in tanks and five to three in artillery.[121] Therefore CENTCOM's plan was an extensive air campaign prior to the commencement of group operations as a measure to reduce Iraqi forces. CENTCOM sought to destroy fifty percent of the Iraqi artillery, armor, and mechanized systems in the Kuwait Theater

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[119] Allen R. Millett, Peter Maslowski, and William B. Feis, *For the Common Defense: A Military History of the United States from 1607 to 2012*, 3d ed. (New York: Free Press, 2012), 597-599.

[120] Fred F. Marty, "On the Move: FA On Target in the Storm," *Field Artillery*, October 1991, 1.

[121] Norman Friedman, *Desert Victory: The War for Kuwait* (Annapolis, MD: US Naval Institute Press, 1991), 217.

of Operations (KTO). CENTCOM planned on destroying at least ninety percent of the artillery capable of ranging the breach areas prior to the US ground offensive.[122]

Operation Desert Storm demonstrated how field artillery forces used massed fires and precision fires to support the operation. Through the employment of MLRS, the coalition artillery intended to attrite the Iraqi artillery and destroyed their enemy observation posts prior to the US ground offensive. As a result, battle damage assessment reports indicated that artillery destroyed fifty-three percent of the Iraqi artillery and forty-two percent of the Iraqi armor.[123]

Artillery forces massed fires to support maneuver ground forces during 1st Infantry Division's breaching operation and Second Armored Calvary Regiment's offensive. The 1st Infantry Division's breaching operations on the first day of the ground offensive provides an example of massing fires that occurred during Operation Desert Storm. BG Creighton Abrams allocated three field artillery brigades and ten MLRS batteries to support the breach area, which was twenty by forty kilometers in size. Over three hundred fifty howitzers covered the attack firing over 11,000 artillery rounds and 414 MLRS rockets.[124]

As the Second Armored Cavalry Regiment (2ACR) began their offensive, they depended on artillery support to reduce the superior numbers of Iraqi forces. Intelligence reports indicated that the Iraqi Republican Guard possessed numerous T-72 tanks.[125] To mitigate the threat, an artillery brigade supported 2ACR as the main effort for the offensive by conducting a thirty-minute barrage of preparation fires to "suppress or destroy Iraqi observation posts located in

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[122] Robert H. Scales, *Certain Victory: The US Army in the Gulf War* (Fort Leavenworth, KS: US Army Command and General Staff College Press, 1994), 178.

[123] Richard M. Swain, *"Lucky War": Third Army in Desert Storm* (Fort Leavenworth, KS: US Army Command and General Staff Press, 1994), 204.

[124] Scales, *Certain Victory*, 226.

[125] Ibid., 223.

several bunkers and observation towers."[126] This thirty-minute artillery barrage defeated the Iraqi forces. Three division artilleries coordinated artillery on Iraqi artillery, headquarters, and sustainment nodes to prevent any enemy forces of disrupting the offensive. The Third Army battle damage estimate reported that field artillery destroyed one hundred Iraqi artillery pieces.[127]

Throughout the entire operation, the artillery barrage involved more than 350 US artillery pieces. Three field artillery brigades supported breaching operations, firing more than 6,000 rounds and 414 rockets. This massed fire neutralized Iraqi tanks, armored vehicles, and artillery pieces.[128] When the regiment received enemy contact, artillery forces suppressed the enemy by responsive artillery support.[129] General Robert Scales commented on the massing effects of artillery in his book, *Certain Victory*. He stated:

> DPICM or bomblet artillery munitions, in turn, have almost tripled the kill radius for artillery. This quantum jump in precision and lethality meant that for the first time in history the artillery kill radius was greater than its radius of error. In other words, if American artillery shot at an Iraqi position, it died.[130]

In addition to lethal massed fires during Operation Desert Storm, US Army field artillery forces ushered in the precision munitions age as they supported maneuver forces with precision fires. Two primary precision munitions that artillery forces employed were the ATACMS and the Copperhead projectile.[131] The ATACMS was a large, semi-ballistic, inertially guided rocket capable of ranging targets beyond one hundred kilometers. In addition to ATACMS, field

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[126] 210th Field Artillery Brigade, *Summary of Significant Events: Operation Desert Storm* (New York: Department of the Army, March 1991), 2.

[127] Scales, *Certain Victory*, 226.

[128] Colin K. Dunn ed., "Field Artillery Desert Facts," *Field Artillery*, October 1991, 2.

[129] 210th Field Artillery Brigade, *Summary of Significant Events*, 3.

[130] Scales, *Certain Victory*, 203-204.

[131] Ibid., 194.

artillery forces fired the Copperhead round during Desert Storm, to complement the precision strike capabilities. Throughout Operation Desert Storm, US artillery fired more than thirty ATACMS at high value targets and more than 90 Copperhead projectiles.[132] Both munitions passed their "test by fire," achieving desired effects on targets. Increased lethality and artillery precision strikes contributed to the significant loss of Iraqi artillery and armor during Operation Desert Storm. The Copperhead projectile proved its utility in combat. On February 7, the US 1st Cavalry Division fired a single laser-guided Copperhead round from a M109 howitzer that destroyed a forty-foot observation tower capable of observing thirty kilometers into the US sector.[133] Neither conventional artillery nor fixed wing assets could engage the towers due to their small stature.

Following AirLand Battle doctrine, and employing a hybrid mix of massing/precision fires enabled the artillery to prove its relevance as a supporting arm to maneuver forces. Artillery met the requirement to mass fires with MLRS. The employment of ATACMS and Copperhead munitions shuffled experimental precision capabilities into the US Army's artillery arsenal. US Army artillery forces now possessed the capability to provide deep massed fires with MLRS and precision fires with Copperhead and ATACMS missiles.

Field artillery forces demonstrated the effectiveness and lethality of precision munitions in Operation Desert Storm. The low volume of precision fires appeared as a test bed rather than general use or doctrinal understanding. Their limited, but effective use, validated a reduction in artillery platforms and ammunition requirements. Despite technological advances, field artillery forces employed PGMs. In the mid to late 1990s, humanitarian and peace operations rather than

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[132] Friedman, *Desert Victory*, 348; Dunn, "Desert Facts," 2.

[133] Scales, *Certain Victory*, 203.

combat dominated military interventions.[134] The Global War on Terror brought several new developments and implications.

The September 11, 2001 terrorist attacks in the United States altered US Army doctrine. The US Army eliminated the AirLand Battle concept, and implemented a military strategy of force projection under Full Spectrum Operations (FSO). Across the range of military operations, the US Army projected military power, enabled by technological superiority and global responsiveness.[135] Enhanced by superior technological communications and maneuverability, the Brigade Combat Team (BCT) became the main fighting force of the US Army.

US Defense Secretary, Donald Rumsfeld envisioned an expeditionary, lighter, technological force capable of responding to numerous threats around the world. In 2002, Secretary Rumsfeld, canceled the Crusader system, citing that the system was Cold War-era weaponry where precision was not a factor.[136] His decision to cancel the program emphasized the diminishing role of massing fires and the renewed focus on precision capabilities.

Restructuring of field artillery units soon followed as the US Army transformed into modular brigades. Modularity impacted the field artillery forces in two ways. First, the transformation eliminated corps and division artillery headquarters. Second, it reduced the US Army's total active field artillery battalions from ninety-six to fifty.[137]

Operation Desert Storm achieved the limited political objectives of removing Iraqi forces from Kuwait, but kept Saddam Hussein's regime in power. Reports indicated that he possessed

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[134] McKenney, *Organization of the Field Artillery*, 319.

[135] John L. Romjue, "From Active Defense to AirLand Battle: The Development of Army Doctrine, 1973-1982," (Monograph, US Army Training and Doctrine Command, 1984), 42.

[136] Donald Rumsfeld, "Rumsfeld Defends Termination of Crusader Artillery System, May 16, 2002," http://www.defense-aerospace.com/articles-view/release/3/10071/rumsfeld-defends-crusader-termination-%28may-21%29.html. Accessed April 13, 2018.

[137] McKenney, *Organization of the Field Artillery*, 317.

weapons of mass destruction despite a series of sanctions and diplomatic pressures. President George W. Bush and his administration decided that the threat to US national security was too high and required the removal of Saddam.[138] The administration believed that Saddam possessed the ability to provide weapons to terrorist organizations such as Al Qaeda. Intelligence reports further confirmed this belief when terrorist Abu Musab Zarqawi appeared in Northeast Iraq.[139] Two months after 9/11, President Bush directed Defense Secretary Rumsfeld to review the battle plans for Iraq. Secretary Rumsfeld tasked General Tommy Franks, commander of CENTCOM, to update the plans.[140]

The overall objective of the campaign plan was removal of Saddam and his Baath Party regime. Secondary objectives included neutralizing any suspected Weapons of Massed Destruction (WMDs), preventing sabotage of Iraqi oil fields, and destroying Iraqi military forces.[141] General Franks wanted to apply a light footprint in Iraq. He told the national security team, "if we have multiple, highly skilled Special Operations Forces identifying targets for precision-guided munitions, we will need fewer conventional ground forces."[142]

Franks intended to achieve his objectives in four phases. Phase one was an air preparation. The second phase consisted of shaping the battlespace. Phase three was the decisive operation. The final phase was post-hostility operations.[143] With a solid campaign plan, President Bush issued a final ultimatum on March 17, demanding that Saddam and his sons leave Iraq

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[138] George W. Bush, *Decision Points* (New York: Crown Publishers, 2010), 229.

[139] Ibid., 236.

[140] Ibid., 234.

[141] Williamson Murray and Robert H. Scales, Jr., *The Iraq War: A Military History* (Cambridge, MA: Harvard University Press, 2003), 89-90.

[142] Bush, *Decision Points*, 234.

[143] Tommy Franks and Malcolm McConnell, *American Soldier* (New York: Harper Collins, 2004), 332.

within forty-eight hours.[144] On March 19, 2003, President Bush, in front of the National Security Council turned to Secretary Rumsfeld and said, "I hereby give the order to execute Operation Iraqi Freedom."[145]

V Corps commander, Lieutenant General W. Scott Wallace stated his commander's intent for artillery "was to kill as many bad guys as we could as often as we could so they were not effective when we got in direct fire contact."[146] Given the Iraqi Army's numerical artillery advantage, Wallace's primary concern was their ability to mass fires or employ chemical weapons against US ground forces. He later stated "we targeted the enemy's artillery to preclude him from massing fires."[147]

The V Corps artillery commander, Colonel Theodore Janosko planned to mass corps artillery assets for the initial attack. On March 20, 2003, 214th FA brigade fired thirteen ATACMS Unitary missiles at Iraqi corps, division, and artillery command posts from Al Basrah to Al Amarah 210 kilometers away.[148] Following this attack, the 41st fires brigade reinforced the 101st Airborne Division while the 214th supported the 3d Infantry Division.[149]

The launches by the 214th FA brigade were the first thirteen unitary missiles fired in combat. Over the next five hours, the 214th fired forty-seven Block 1 ATACMS missiles to suppress Iraqi air defenses, and counterbattery assets. The fires from V Corps disrupted the Iraqi 11th Infantry Division's ability to command and control its forces or mass fires above the battery

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[144] Bush, *Decision Points*, 253.

[145] Ibid., 223.

[146] Patrecia S. Hollis, "Trained, Adaptable, Flexible Forces=Victory in Iraq," *Field Artillery*, September-October 2003, 6.

[147] Ibid.

[148] Theodore J. Janosko and Robert G. Cheatham, Jr., "The Sound of Thunder," *Field Artillery*, September-October 2003, 35.

[149] Ibid.

level. Artillery fires destroyed the Iraqi forces as the following day the division "had ceased to exist as a coherent fighting force."[150]

Field artillery forces improved their ability to support maneuver forces using cannon launched precision fires. The Sense-and-Destroy Armor (SADARM) munition promised to achieve first round accuracy. The use of SADARM disrupted the Iraqi 11th Infantry Division's operations and led to 3d Infantry Division accomplishing its mission of attacking in zone to defeat the 11th and destroy the Medina division.[151] 1st Battalion, 10th FA were the first to fire SADARM in combat.[152] While 3d Brigade, 3d Infantry Division was in An Nasariyah, forward observers located two Iraqi tanks and destroyed them with SADARM.[153]

Another example on the use of SADARM was during 3d Infantry Division's preparation to move through the Karbala gap. The enemy attempted to locate 3d Infantry Division ground forces using reconnaissance forces, infantry fighting vehicles, and trucks. Field artillery forces employed SADARM to destroy the Iraq reconnaissance elements before they massed fires on friendly elements.[154] The 3d Infantry Assistant Division Commander (Maneuver) mentioned in an interview that "in terms of precision guided munitions, we employed SADARM in Iraq, and it was incredible."[155]

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[150] Janosko, "The Sound of Thunder," 35.

[151] Patrecia S. Hollis, ed., "3d ID in OIF: Fires for the Distributed Battlefield," *Field Artillery*, September-October 2003, 10.

[152] Robert W. Rooker, "Historical Recounting of Marne Thunder in OIF," *Field Artillery*, September-October 2003, 18.

[153] Ibid.

[154] Ibid.

[155] Hollis, "3d ID in OIF," 11.

The army deployed to Operation Iraqi Freedom with a proportion of artillery to maneuver forces lower than that of any major campaign since World War One.[156] During Operation Iraqi Freedom, the field artillery provided the same lethality with one-third of the artillery units employed in the Gulf War. In Operation Desert Storm, a committed division expected to receive one or more two reinforcing brigades of artillery. In Operation Iraqi Freedom, the 101st Airborne Division (Air Assault) and the 3rd Infantry Division (Mechanized) went into battle with only their organic division artilleries.

The outcome validated that smaller artillery formations were just as effective as large artillery formations without the significant footprint.[157] Throughout Operation Iraqi Freedom, commanders relied on the field artillery to provide counterfire in order to destroy Iraqi cannon and rocket systems. These counterfire operations set the conditions for the main attack towards Baghdad. The Iraqi artillery outranged and outnumbered US artillery systems while the Iraqi artillery harassing fires had little effect on slowing down the tempo of US ground forces.[158] Corps and division artillery provided interdiction fires, counterfire, and general support artillery while organic field artillery assets provided close fires to maneuver forces. Field artillery units provided long range timely and accurate fires with the sole purpose of creating favorable conditions for the supported ground forces.

The success of initial combat actions during Operation Iraqi Freedom (OIF) validated the concept of modularity. US Army Central Command (CENTCOM) fielded only a third of the ground forces needed for Operation Desert Storm. In Operation Iraqi Freedom, the US Army employed conventional ground forces with cold war era designed formations to decisively

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[156] William G. Pitts, "Overview: Field Artillery In Operation Iraqi Freedom," *Field Artillery*, September-October 2003, 2.

[157] McGrath, *Fire for Effect*, 155.

[158] Hollis, "Victory in Iraq," 6.

overwhelm Iraqi forces.[159] Not only did employing PGMs with lighter forces validate the theoretical construct of technology over manpower, but it confirmed how precision made up for mass. In other words, field artillery forces improved their precision capabilities, but reduced force structure.

Section 3: Implications of Hybrid Artillery Capabilities

The current Army Chief of Staff emphasizes readiness as his number one priority. The hybrid of massing/precision fires maximizes the field artillery capabilities to support maneuver forces in large scale combat operations against a near-peer opponent. In a conflict with North Korea, the Democratic People's Republic of Korea have a numerical advantage in troops and artillery systems. Ground forces totaled around 1 million troops, 8,000 artillery pieces, and 2,000 tanks.[160] A US-led coalition would employ precision fires to offset the North Korean numerical advantage. Along the seventy-five-mile front, US artillery forces would destroy North Korean long-range artillery systems using GMLRS and ATACMS Unitary first, since they can range Seoul. To support the close fight and minimize collateral damage, US field artillery forces would fire Excalibur from cannon tubes and GMLRS from rocket systems.

The capability to strike long-range targets with precision and minimal collateral damage have excessive costs for field artillery units. As field artillery forces employ precision fires, they incur higher ammunition, training, and equipment costs. The cost of ammunition procurement, training observers with precision guided munitions, and operating the weapon system call into question the economic viability of using precision fires in large scale combat operations.

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[159] Andrew F. Krepinevich, "Operation Iraqi Freedom: A First-Blush Assessment," *Center for Strategic and Budgetary Assessments* (Washington, DC: 2003), 16-20, accessed December 15, 2017, https://csbaonline.org/uploads/documents/2003.09.16-Operation-Iraqi-Freedom-Assessment.pdf.

[160] Franz-Stefan Gady, "What Would the Second Korean War Look Like?" *The Diplomat* (April 2017), accessed March 1, 2018, https://thediplomat.com/2017/04/what-would-the-second-korean-war-look-like/.

Numerous reports indicate that precision guided munitions increase cost savings and reduce artillery logistical requirements. The relative cost of precision guided munitions is substantial. A GMLRS rocket cost $133,000 while an Excalibur round has a price tag of $68,000.[161] To attain near-precision effects, the US Army retrofitted high explosive 155mm shells with $3,000 PGK fuze kits.[162] The high price of precision munitions present challenges for commanders during combat and peacetime training.

The reality is that training determines readiness. Resource dollars drive training. When artillery rounds become costly, it is difficult to acquire sufficient quantities to enable unit training. The challenge for field artillery forces is routine peacetime training with precision guided munitions. Without the access to sufficient quantities of ammunition, training suffers and reduces the proficiency necessary for combat readiness.

Although forward observers carry advanced equipment, their fire support competencies diminished due to nonstandard missions. Substituting technology for manpower came at the expense of a less well-trained force, especially for the forward observers within the field artillery gunnery team. Trained observers incur less costs than new innovations in equipment and technology. Relying on technical solutions to military problems is problematic in large scale combat operations.

In 2009, a critical point that illustrated the US Army Field Artillery's shortcomings was the publication of a widely circulated white paper entitled "The King and I: The Impending Crisis

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[161] Sydney J. Freedberg Jr., "Excalibur Goes to Sea: Raytheon Smart Artillery Shoots Back." 12 January 2016, accessed February 10, 2018, https://breakingdefense.com/2016/01/excalibur-goes-to-sea-raytheon-smart-artillery-shoots-back/.

[162] Scott R. Gourley, "XM1156 Precision Guidance Kit Heads to Afghanistan," Defense Media Network, April 26, 2013, accessed February 11, 2018, https://www.defensemedianetwork.com/stories/xm1156-155mm-precision-guidance-kit-heads-to-afghanistan/; Matt Hilburn, "Precision: GPS kits for artillery rounds would reduce collateral damage," *Seapower* (June 2007): 18-19, accessed January 3, 2018, http://www.seapower-digital.com/seapower/200706?search_term=hilburn&doc_id=-1&search_term=hilburn&pg=21#pg21.

in Field Artillery's Ability to Provide Fire Support to Maneuver Commanders." The premise of the paper highlighted the deficiencies of artillery forward observers in their core competency skills. The authors of the white paper, Colonels Sean MacFarland, Michael Shields, and Jeffrey Snow all served as maneuver brigade commanders in combat and witnessed the ramifications of fire supporters conducting counterinsurgency operations (COIN). They stated that

> No branch of the Army has suffered a greater identity crisis than Field Artillery, as a result of transformation, COIN-centric operations and nonstandard manpower demands of OIF/OEF. The once-mighty "King of Battle" has been described by one of its own officers as a "dead branch walking." Now the Army is beginning to see real consequences in our ability to integrate fires with maneuver—an important capability for both COIN and High Intensity Conflict (HIC).[163]

The costs associated with the four delivery systems capable of delivering precision guided munitions do not vary significantly. The M777 155mm howitzer costs $1,500,000 while the upgraded M109A7 155mm howitzer has a price tag of $14,500,000.[164] The M109A7 comes as a set with the ammunition carrier and howitzer together. The M270 MLRS and M142 HIMARS have production costs of $20,000,000 and $18,500,000 respectively.[165] US Army Apache attack helicopters have a substantially higher cost and flight hours compared to artillery systems. Apaches have a price tag of $14,000,000 with a flight hour cost of $3,851.[166] The unit cost difference favor artillery systems as a capability for deep operations.

Currently, the division artillery lacks any organic physical delivery systems to shape the deep fight for the division commander. Army divisions benefit by having an organic MLRS or

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[163] Sean MacFarland, Michael Shields, and Jeffrey Snow, "The King and I: The Impeding Crisis in Field Artillery's Ability to Provide Fire Support to Maneuver Commander" (White Paper, Memorandum to Chief of Staff of the Army, 2007), 1.

[164] Nations: Dawn of an Era, "Military Equipment," accessed March 1, 2018, http://nationsdawnofanera.weebly.com/artillery-systems.html.

[165] Ibid.

[166] Google, "Rotary Aircraft," accessed January 18, 2018, https://www.globalsecurity.org/military/systems/aircraft/rotary.htm.

HIMARS battalion. A rocket battalion in each division provides greater flexibility for the division commander and reduces the strain on the field artillery battalions supporting each brigade combat team. Having a rocket battalion in each division alleviates the reliance on corps assets.

The MLRS/HIMARS provides the ability to shape the operational environment. The rockets possess the range and capability to deliver precision fires. The MLRS/HIMARS platforms are organic to the field artillery brigades. Each brigade aligns with an active Army corps. These FA brigades can deploy as battalion or battery formations depending on the mission. The capability to deliver cannon-launched precision munitions resides with the field artillery battalions within the Armored, Stryker, and Infantry Brigade Combat Teams.

There is a cost to support this recommendation. The ultimate bill-payers are the subordinate cannon field artillery battalions in each division. By reducing the number of cannons in each field artillery battalion from six guns to four, each division would create enough personnel to support a rocket battalion. A force design update allows each active component US Army division the capability to deliver long range precision fires.

All divisions with an armored brigade combat team should receive a MLRS battalion. On the other hand, divisions with subordinate stryker brigade combat teams or infantry brigade combat teams should receive a HIMARS battalion. This force structure allows each division artillery to serve as the force field artillery headquarters. Corps artillery focuses on the deep fight without providing assets to the subordinate divisions during large scale combat operations. Another key implication involves the maneuver commander's understanding of employing the hybrid capabilities of mass and precision. Precision enables ground commanders to destroy fixed targets with an organic indirect fire weapon system.

Despite the fluctuations in defense spending and force structure, the field artillery retains its role in supporting maneuver forces through counterfire and shaping operations. Since the Gulf War, maneuver commanders requested indirect fire support predominately from the US Air

Force, rather than the field artillery. Maneuver commanders employed fixed wing aircraft for deep strike operations instead of organic field artillery systems to destroy, neutralize or suppress the enemy. When employing fixed wing aircraft for operations, maneuver commanders have to consider two limitations: air support platforms are not organic to ground forces and weather could limit close air support of ground operations.

Conclusion

Historical case studies validated the need of massed and precision fires in the field artillery arsenal. Operations Clipper and Ripper demonstrated the field artillery's ability to mass fires with great effects to support maneuver forces. Operation Desert Storm saw the introduction and capability of precision fires against a near-peer opponent. Field artillery forces saw precision fires as a way to increase its lethality on the battlefield. Precision fires supported coalition maneuver forces in expelling the Iraqi Army from Kuwait. Capitalizing on advantages in technology, the combat phase of Operation Iraqi Freedom validated the necessity of mass and precision fires on the battlefield.

The capability to mass fires depends on the number of artillery pieces relative to the maneuver fronts. During World War II, the US Army possessed a plethora of artillery pieces with a sufficient supply of wartime ammunition. Divisional fronts covered nine kilometers with enough artillery pieces to cover the entire front. Whereas during the Korean War, divisional fronts increased extending out to 15 kilometers.[167] The shortage of ammunition and artillery pieces affected the number of rounds fired. Artillery howitzers fired more rounds to provide the same effect of many artillery pieces.

[167] Michael Forsyth, "Precision Launch Rocket System: A Proposal for the Future of the Field Artillery," *Military Review* (March 2003): 82.

During Operation Desert Storm, field artillery forces supported maneuver forces with the largest field artillery force since World War Two.[168] The divisional front expanded to 30 kilometers, but artillery had sufficient pieces to support the seven divisions.[169] Overall, V corps artillery fired 18,500 rounds, 857 MLRS rockets, and 414 ATACMS missiles through the end of large scale combat operations.

Artillery forces reduced in size after the US Army transformed into a lighter force. Operation Iraqi Freedom had a significantly low ratio of artillery to maneuver forces. Precision munitions compensated for the lack of artillery units, even though the divisional fronts remained the same size as in Desert Storm. The logic of reducing logistical requirements for ground forces, while achieving the same desired effects shuttled precision fires to the forefront. Although, precision garnered significant attention, it was a miniscule percent of fires.

In regards to ground support, the artillery retains its traditional, responsive area fire capability while air assets employ point fire weapons. The force continues to improve its ability to synchronize and mass fires shaping the conditions for future operations. Field artillery adds depth to the battlefield and operates in all-weather conditions. This capability allows commanders to shift combat power with the ability to mass fires onto key targets. The largest disadvantage to artillery weapons is the heavy logistical footprint.[170] It remains an area weapon system where volumes of fire account for limited artillery pieces.

Technology along with fiscal realities influence the development and fielding of new combat formations. Future changes will challenge the US Army to balance its current capabilities while investing time, money, and resources into the Army of the future. These changes enable the US military to respond to new and different threats while maintaining its strength and position in

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[168] Fred F. Marty, "On the Move: FA On Target in the Storm," *Field Artillery* (October 1991): 1.

[169] Forsyth, "Precision Launch Rocket System," 82.

[170] McGrath, *Fire for Effect*, 162.

the world. The field artillery adapted to the operational environment as the US Army underwent these changes. Field artillery forces continue to cope with change as precision and lethality evolve depending on the threat and operational environment. Two important characteristics of change are flexibility and adaptability. While the operational environment changes, the field artillery remains flexible in its role of supporting maneuver forces with precise massed fires.

The US Army transforms its forces to optimize technological capabilities on the battlefield. Doctrine and future capabilities drive force structure. Fire support doctrine evolved from traditional massed fires to precision fires with the introduction of emerging technologies. The mission of destroying forces required artillery to mass pieces and fire massive quantities of ammunition. Precision allows field artillery the capability to destroy enemy forces with reductions in ammunition and weapons. Maneuver commanders should understand the hybrid nature of field artillery capabilities. Field artillery doctrine needs to codify that precision gives the ground commander a responsive, organic capability to destroy point targets. Precision does not replace massed fires, but gives the commander options to attain a position of relative advantage.

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