DOMINANT FIRES: DIVISION XXI'S LETHAL EDGE

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BY
Major Gregory B. Schultz
Field Artillery

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

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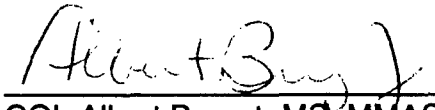

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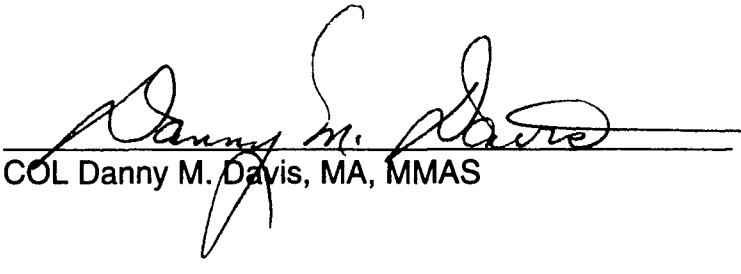

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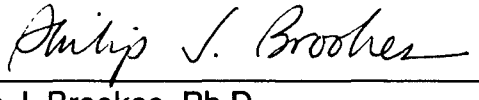

Director, Graduate Degree Program

Philip J. Brookes, Ph.D.

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ABSTRACT

DOMINANT FIRES: DIVISION XXI's LETHAL EDGE by MAJ Gregory B. Schultz, USA, 73 pages.

In preparation for the challenges of the 21st century, the United States Army has invested heavily in the development of Force XXI. Capitalizing on the power of information technologies, this developing force is being designed to achieve rapid and decisive results in combat largely through the ability to conduct simultaneous attacks throughout the depth of the battlespace. This capability is dependent primarily on the increasing potential of fires to dominate the battlefield. The purpose of this study is to determine if Division XXI, the primary tactical unit of Force XXI, can achieve fires dominance on the future mid- to high-intensity battlefield.

To answer this question, this monograph first considers the doctrinal and conceptual roles of fires, deep operations, the fires system, and the characteristics of fires. This monograph uses an historical review of fires in three major 20th century conflicts to validate and clarify three characteristics of dominant fires: fires responsiveness, lethality, and survivability. These three factors serve as the criteria for analysis of the potential of Division XXI fires.

A comparison of the major components of the Division XXI fires system compared to the Army of Excellence (AOE) division's fires system is made to determine the relative improvements in the fires system. With an understanding of the potential of the fires system, this paper considers the nature of future conventional threats and then analyzes the applied capabilities Division XXI fires responsiveness, lethality, and survivability on the future battlefield. This monograph concludes by considering the impact and implications of dominant fires in the future.

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I. INTRODUCTION

> Our forces must remain ready and modern to meet future, as well as present, threats or challenges. Integral to these efforts is the development of new systems and capabilities, incorporating state-of-the-art technology and new and more effective combat organizations.[1]
>
> A National Security Strategy of Engagement and Enlargement

Despite significant reductions in the size of the military force, the National Security Strategy policy of engagement and enlargement reflects America's commitment to maintaining its superpower status and leadership role in a new and much more complex world order. In support of this policy, the National Military Strategy recognizes that "being ready to fight and win the Nation's wars remains our foremost responsibility and the prime consideration governing all our military activities. This ability serves as the ultimate guarantor of our vital interests and is the fundamental reason that our Nation has raised and sustained its military forces."[2] Maintaining a military force that can ensure victory during time of war while meeting increased demands for operations other than war is a tremendous challenge confronting our future force.[3]

To meet the challenges of the near future, General Gordon R. Sullivan, while serving as the Army Chief of Staff, took the initiative to begin development of Force XXI, the Army of the early 21st century. Since 1994, Force XXI has begun to take a clearer form as needs have been analyzed, technology has been further developed, and force structures, equipment, tactics, techniques and procedures have been experimented with in simulations, battle labs, and in the field. The major tactical formation in this future force is Division XXI.[4]

The Training and Doctrine Command's Pamphlet 525-5, "Force XXI Operations," identifies five battle dynamics as the driving considerations for the design and capabilities of Division XXI: battle command, battlespace, depth and simultaneous attack, early entry, and

combat service support.[5] While many people associate information technology, as it relates to the battle dynamic of battle command, as the cornerstone of the Army's future force, it is not in itself the lethal edge that will ensure the success of Division XXI on the battlefield. Dominant fires, empowered by information technology, promises to be the lethal edge of Division XXI. It is primarily through fires that the force commander hopes to expand the depth of his battlespace while simultaneously attacking vital enemy formations and functions.[6]

The purpose of this paper is to answer the research question: Can Division XXI achieve fires dominance on the future mid- to high-intensity battlefield? The significance of this question becomes self-evident when considering that the cost of failing to achieve battlefield dominance leads to protracted and often inconclusive battles that are paid for in American lives and wasted combat power.[7]

Preparing to answer the research question, it should be emphasized that this monograph is limited in three significant ways. First, this paper deals with military forces only in conventional mid-to high-intensity wars. Second, whenever a researchers methodology is based on historical evidence, it is limited by his interpretation of the past. Finally, as is true of any research that deals with the future, assumptions have to be made based on the best available evidence, experimentation, and expert opinions.

Lacking a doctrinal definition, for the purpose of this monograph "dominant" fires is defined as the capability of fires to defeat selected enemy forces, formations, and functions throughout the depth of the battlefield, creating the conditions for exploitation by friendly maneuver forces. Dominant fires includes overwhelming the enemy's ability to employ fires effectively, the ability to defeat maneuver formations and critically limit the enemy's ability to react to friendly forces at critical times and places. Dominant fires are not necessarily decisive. To be decisive, fires would have to lead directly to the tactical decision; victory.

To determine the potential of Division XXI fires and its ability to achieve battlefield dominance, this monograph will first review the doctrine and concepts related to the role of fires, deep operations, the fires system, and characteristics of fires. Next, an historical review of fires during the First and Second World Wars, and the Persian Gulf War will serve to validate the factors that lead to fires dominance. These factors will serve as the criteria for analysis of the potential of Division XXI fires. Using the criteria for analysis, this paper will consider how the capabilities of the Division XXI fires system is superior to that of the current heavy army division, the Army of Excellence (AOE) division. Next, this monograph will consider the potential future threat, and examine the characteristics of dominant fires as they apply to Division XXI, in order to answer the research question. In conclusion, this monograph will examine the possible implications of dominant fires for the Army.

The applicability of dominant fires to Division XXI is limited when the full range of military missions and possible environments are considered. Army doctrine recognizes three different environments in which military forces operate: peacetime, conflict, and war.[8] Although it is likely that American forces will most frequently be involved in support and stability operations in peacetime or in conflict environments, the most basic and important role of the military is to fight and win the nations wars. Since the heavy armor and mechanized divisions are the primary Army units for fighting wars, the Army chose a heavy division as the experimental force (EXFOR) to test and develop Division XXI. For this reason, the scope of this monograph is limited to the heavy division and its use in conventional mid to high intensity wars.

II. FIRES DOCTRINE AND CONCEPTS

It is the potential of fires that may set the conditions and enable Division XXI to rapidly strike, stun, and then defeat larger enemy forces. For the United States Army, this represents a shift in the traditional role and priority of fires as they relate to maneuver forces, and a shifting emphasis away from the close fight and towards the full depth of the battlespace. To appreciate the potential significance of this shift away from maneuver dominance in the close fight to fires dominance and an emphasis on the full depth of the battlefield, an understanding of the basic role of fires and deep operations is necessary. The purpose of this chapter is to review the doctrinal role of fires and deep operations then describe the fires system and the characteristics of fires, which will serve as a framework for further analysis.

THE ROLE OF FIRES

Current doctrine notes that "maneuver and firepower are inseparable and complementary dynamics of combat."[9] However, the relationship of fires to maneuver in the United States Army has almost always been a subordinate one.

Fires in tactical operations perform one of three roles: close support, counterfire, and interdiction.[10] Traditionally, the primary effort of fires has been in the close support role; that is fire support for close operations. Close supporting fires is defined as "fires placed on enemy troops, weapons, or positions which, because of their proximity, present the most immediate and serious threat to the supported unit."[11] This involves the use of fires, directly subordinate to maneuver, to help create the conditions for success in the close fight. In fact, the first basic task of fire support is to support forces in contact.[12]

The Army defines fire support as:

> The collective and coordinated integration and synchronization of the fires and effects of armed aircraft, land-based and sea-based indirect fire systems, and electronic warfare systems that *directly support* combat forces

against ground targets to delay, disrupt, or destroy enemy forces, combat formations, and facilities in pursuit of operational and tactical objectives.[13]

The traditional concept and definition of fire support, like the term itself, denotes fires as a *supportive*, secondary, or subordinate effort to maneuver forces which are focused on gaining positional advantage over the enemy to employ direct-fires against him in the close battle. The subordination of fires to maneuver is linked to the traditional importance of the close fight, where maneuver forces are in contact with enemy forces, and the *supporting* nature of the deep fight, where fires usually play a more significant role.[14] Division level battle plans, like our doctrine, reflect the priority of maneuver forces and the close fight. As a result, the priority for fires is almost always the close support of maneuver forces. Although close fires may be used in the offense or defense, they are usually used for the ultimate purpose of maneuver force protection. For example, suppressing or neutralizing and enemy force prevents them from effectively engaging our maneuver forces when they attack to seize an objective. Since force protection is primarily a defensive measure, it is not unrealistic to say close fires are typically defensive in nature as well as subordinate to maneuver forces.

The second role of fires, counterfire, is essential for two reasons. First, counterfire prevents the enemy from threatening the depth of our battlespace with his cannon, rocket, and missile systems. Second, effective counterfire minimizes the enemy's ability to employ fires in support of his maneuver forces in the close fight. Counterfire, as the name implies, are "fire[s] intended to destroy or neutralize enemy weapons," usually directed at enemy mortar and artillery systems.[15] While effective counterfire enhances survivability, freedom of maneuver, and allows significantly greater flexibility and volume of fires, it also is primarily defensive in nature. Counterfire protects maneuver forces from enemy fires and protects the fires system to allow it to support maneuver forces.

As technology and experience has enhanced the capabilities of fires, the third role of fires, interdiction, has played an increasingly important role in combat. Interdiction involves "action[s] to divert, disrupt, delay, or destroy [the] enemy's surface military potential before it can be used effectively against friendly forces."[16] Commanders use interdiction fires as their primary means of conducting deep attacks. Interdiction offers the promise of using fires in a truly offensive manner, attacking and destroying vital enemy formations and functions independent of maneuver forces. For this reason, without disregarding the roles of close support and counterfire, this paper will focus on the interdiction role of fires in the deep attack.

Regardless of the role in which fires are applied, their effects on enemy forces, formations, functions, or facilities may be defined in terms of targeting objectives which include *limit, disrupt, delay, divert, destroy,* and *damage*. These terms originated from the fire support mission area analysis (FSMAA) and interdiction objectives defined by joint doctrine. They should not be confused with the effects for fires attack criteria; *harass, suppress, neutralize*, or *destroy*. These terms are used to describe the degree of damage or duration of effects on a specific target as required by the force commander.[17]

As technology increases the potential for fires to destroy targets throughout the depth of the battlefield, the ability to defeat the enemy primarily through fires greatly increases. This is a shift from the past, when the destructive capability of fires has usually been far more limited, and thus fires were used to suppress or neutralize the enemy in support of maneuver forces while they closed with and defeated the enemy.

Force XXI recognizes that the developing capabilities of fires and its role in deep and simultaneous attack "may drive a reassessment of the traditional relationship between fire and maneuver."[18] Thus, the term "fires" includes the traditional concept of fire support and expands it to include the use of indirect fire systems and armed aircraft to conduct attacks that are not

directly supportive or subordinate of maneuver forces and the close fight. Force XXI battle dynamics recognizes the importance of fighting deep and close simultaneously, and it is the improving ability of fires to attack deep that makes deep operations an increasingly vital part of decisive operations.

DEEP OPERATIONS

> The goal of deep operations is to shape and isolate the close operation by denying the enemy commander the ability to reinforce the close fight. They do this by disrupting his preparations for battle and his support structure; disrupting or destroying the coherence and tempo of his operations; and by denying him freedom of action. Deep operations degrade not only the enemy's combined arms force but the morale and cohesion of the enemy force. These effects allow the defeat in detail of the enemy forces in the close fight. In unique circumstances, the deep fight may be the decisive fight.[19]

In the past, deep operations were defined in terms of their relationship and impact on close operations. The relative importance of deep operations and their potential impact on both the close fight and the accomplishment of the division commander's overall objectives has increased over time as the ability to see deep and strike deep has improved. To accomplish deep operational objectives, the commander may employ both fires and maneuver.

In the past, when the deep attack included the use of maneuver forces in addition to fires, the chance of decisive results were increased considerably, however, the commander assumed significant risk by committing his maneuver forces deep.[20] Under most circumstances, division commanders can not afford the risk of using maneuver forces for deep operations. There are several reasons for this including the fact that maneuvering ground forces deep requires vital amounts of time, deep ground operations places both the maneuver force and its extended lines of communication at significant risk, and maneuver forces used deep are unavailable to support the security of the main force or to participate in close operations.[21] It is not surprising that division commanders primarily use fires to conduct their deep attacks.[22]

History has shown us that over time, technology, tactics, techniques, and procedures have improved to greatly increase the ability of fires to conduct deep attacks and accomplish the division's deep operation objectives. While doctrine has acknowledged that "the enemy is best defeated by fighting him close and deep simultaneously," the availability of fires assets and the capability of fires to support maneuver forces in close operations and successfully conduct deep attacks has been limited.[23] Division XXI fires may offer the ability to attack deep with such lethality and impact on the enemy that the relative importance and requirement for fire support of maneuver forces in the close fight may decrease.

THE FIRES SYSTEM

To analyze and compare the development, capability, and impact of fires in battle, it helps to understand the fires system. The Army's doctrinal manual on operations, FM 100-5 describes fires in the following manner:

> The fires system provides a wide variety of striking power in combined arms operations to defeat enemy forces and support schemes of maneuver. It integrates nonlethal systems to complement firepower. The fires incorporate all manner of cannons, rockets, missiles, mortars, air-delivered weapons, naval surface fire support, and the nonlethal systems that facilitate their employment. Missile fires can provide simultaneous precision strikes of targets that are deep or hard to reach.[24]

Army doctrine recognizes three components that collectively make up the fires system: command, control, and coordination (C3); target acquisition and battlefield surveillance; and weapons and munitions.[25]

Command, control, and coordination involves the people, systems and procedures that plan and direct the use of fires to support the force commander. This responsibility falls on the Fire Support Coordinator (FSCOORD) who is the senior Field Artillery commander in the force and who works directly for the force commander. At the Division level, the FSCOORD is the Division Artillery Commander. He utilizes C3 to ensure fires "function with a unity of effort

and purpose" and are "responsive to the needs of the force commander."[26] C3 is supported by the Division Artillery and Aviation Brigade headquarters and Fire Support Elements (FSEs) at battalion through division level. The FSE includes representatives of all fires assets including army aviation, electronic warfare, and air defense artillery. Since the fires system supporting a division usually includes joint assets, the FSE includes air liaison officers and possibly a division air/naval gunfire section.[27] C3 represents the "brains" of the fires system.

Target acquisition and battlefield surveillance involves the use of available intelligence assets, sensors and trained personnel, to find, identify, and track targets throughout the depth of the battlespace. A large variety of target acquisition assets either belong to or may support the division. These include target acquisition radars, guardrail common sensors, Unmanned Aerial Vehicles (UAVs), Joint Surveillance Target Attack Radar Systems (J-STARS), Trailblazer and Quickfix radio intercept and direction finders, as well as a variety of human intelligence resources such as scouts, long-range surveillance units, and combat observation lasing teams (COLTs).[28] Target acquisition and battlefield surveillance serves as the "eyes" of the fires system.

The weapons and munitions of the fires system include mortars, cannons, rockets, missiles, fixed and rotary-winged aircraft, and naval surface fires. Fires also includes nonlethal means such as electronic warfare (EW), smoke, and illumination.

Field artillery, which includes cannons, rockets and missiles, continues to be the primary means of fires and deep attack for divisions. They are owned by, or dedicated to, the division commander and provide an all weather, day or night, responsive fires capability.

Fixed wing aircraft, provide a unique capability for interdiction fires and close support of division operations due to their range, speed, firepower, and precision. However, fixed wing aircraft are vulnerable to enemy air defenses, lack all weather capabilities, are usually not

immediately available, and only a limited number of sorties are allocated to each committed division.

Rotary wing aircraft, in the form of attack helicopters, are continuing to grow in importance as their capabilities are enhanced. They provide a lethal, dedicated, and relatively responsive fires capability to the division, and increasingly are capable of integrated target acquisition. However, like fixed wing aircraft, they are not all weather capable, they are limited in number and are vulnerable to enemy air defenses.

Naval surface fires usually are not available to support Army divisions. It is possible, however, that if divisions conduct operations near coastlines where naval forces are operating, they may be supported by naval surface fires, primarily in the form of a rapid firing 5 inch gun.

Regardless of the weapon system and its specific abilities to support accomplishment of the fires' mission, it is the munition that ultimately has the effects on target. One of the most significant factors in the potential shift towards dominant fires is the introduction and capabilities of precision munitions. Weapons and munitions represent the "muscle" of the fires system.

CHARACTERISTICS OF FIRES

When analyzing the fires system and its evolutionary development, or when comparing the capabilities of fires, three characteristics of fires may be used. These three characteristics include responsiveness, lethality, and survivability. These characteristics gain meaning, and therefore must be defined, in terms of the relationship between friendly and enemy capabilities.

Responsiveness equates to the speed and efficiency of the targeting system versus the mobility of the target and the tempo of operations. Lethality is the product of the range, accuracy, and effects of fires in relation to the location and vulnerability of the target.

Survivability involves the relative vulnerability of the fires system and the potential for enemy attack to interrupt friendly fires. To gain a better sense of each characteristic and to understand its relationship to enemy forces and capabilities, a more detailed review is in order.

Responsiveness is effected by all three elements of the fires system, but can normally be measured in terms of the amount of time between target detection and target engagement. This includes the time required of the sensor or observer, the request and processing of information for fires, the computation of firing data, time for processing and initiating actions on the weapon system, and time of flight or attack on the target. The more mobile or fleeting the target, the greater the need for responsiveness. Additionally, the greater the tempo of operations, the greater the need for C3 responsiveness. As the responsiveness of the fires system increases, more targets can be fired, mobile targets are more likely to be engaged effectively, and fires are flexible enough to exploit quickly developing opportunities and defeat newly identified threats.

The greatest influence on the responsiveness of the fires system is the targeting process. The targeting process involves all three parts of the fires system, not just target acquisition (the ability to detect, identify, and report the location of enemy forces, functions, or facilities that fires may be employed against.) Contemporary doctrine expands targeting to include the full process of decide, detect, deliver, and assess. The greatest challenges of targeting are accurately finding deep targets and quickly processing the target information for engagement. Deep targets that are stationary and likely to remain in place are easier to locate and engage accurately, if they can be detected. Deep targets that are moving are easier to detect, but much more difficult to engage accurately. Thus, the responsiveness of the fires system and deep targeting are critical in determining the likely success of deep fires against moving targets and stationary targets that move frequently. Even if the fires are very responsive, they have no chance of being dominant if

they lack the range, accuracy, or effects required by the commander. Range, accuracy, and target effects are the basis for fires lethality.

Range, is simply the distance at which a target can be engaged from the firing system, weapon's platform, or in relation to the forward line of troops (FLOT), line of departure, or friendly perimeter. The range of the division commander's fire systems tends to determine the limits of his battlespace. The greater the range of his weapon systems the larger the area he can influence and the greater his ability to mass the effects of fires on targets of interest. Additionally, increased range, when matched with capable targeting assets, increases the amount of time and number of opportunities available to interdict forces approaching the close battle area.

Given the ability to range desired targets, effects are dependent on the combined result of accuracy, and munition lethality. As accuracy increases, the number of rounds required to achieve target effects decreases. Likewise, the greater the lethality of the munition fired, the greater the chance of having desired target effects. Fires munitions are generally designed for area targets (to harass, suppress, or neutralize), or for point targets (to destroy).

The lethality of fires is measured against the enemy's ability to protect himself. Protection normally takes one of two forms, hardening or dispersal. Adding armor to vehicles or digging in infantry are examples of hardening. Dispersal of troops, formations, and systems has continually increased in response to the lethality of fires. Dispersal creates fewer targets in a given area, thereby decreasing the targets signature and the potential effects of massed fires. The greater the target area, or the more hardened and protected the target, the greater the requirement for large quantities of massed fires in order to have significant effects. While massing fires increases lethality, it detracts from responsiveness since coordination and integration of more C3 elements and firing units is required.

The final characteristic for analyzing fires is survivability. This usually refers to the survivability of the weapon system, but may also include the observer/sensor, and C3 elements. The enemy will attempt to interrupt friendly fires in one of four ways: first, enemy fires (counterbattery threat to artillery and air defense artillery to fixed and rotary wing based fires); second, enemy maneuver forces; third, air attack; and finally, electronic attack. Survivability is enhanced by cover and concealment; hardened positions; armor protection; dispersion, movement; system redundancy; and minimizing electronic signatures. Of course, ground and air defense forces and other fires assets may augment the security and survivability of the fires system. Historical analysis will demonstrate that fires responsiveness, lethality, and survivability are effective criteria for evaluating the significance of fires on past battlefields, and the potential of fire in the future.

III. HISTORICAL REVIEW

A brief historical review of the development and nature of fires on the battlefield can help identify the conditions and factors that may lead to fires dominance. The fires system and the three characteristics of fires (responsiveness, lethality, and survivability) will serve as the analytical framework for reviewing the evolution of fires on the battlefield. Three significant periods of development in the capability and application of fires include the First and Second World Wars and the recent Persian Gulf War (Operation Desert Storm).

WORLD WAR I

> In the titanic opening struggles of 1914, which statesman and generals had expected would be settled by press of numbers, as battles had been decided for three thousand years, massed infantry had been slaughtered in droves by the shrapnel of quick-firing artillery.[29]
>
> Soldiers: A History of Men in Battle

During the First World War, firepower was truly dominant and it came in two forms. The machinegun gave the infantry a tremendous source of rapid direct-fire, and when combined with obstacles like barbed-wire, it created a deadly threat to advancing massed infantry. As deadly and significant a role as the machinegun played in World War I, the greatest source of firepower and the greatest killer on the battlefield was the artillery.

Cannon artillery, and to a lesser degree heavy mortars, provided the only practical source of fires and deep attack to the force commander. Leading up to 1914, advances in survey instruments, mapping topography, weapons refinement, gunnery techniques and the field telephone led to the ability to conduct indirect fire with considerable accuracy. At the same time, the development of new artillery and mortar munitions using trinitrotoluene (TNT) and improved fuzes made shells far more lethal than ever before.[30]

Advances in weapons technology and the industrial potential of nation-states led to the continued rapid development and use of artillery on a tremendous scale during the period of 1914 to 1918. During this same period, belligerents on both sides were developing and refining the tactics, techniques, and procedures for using fires.

The devastating capability of fires led many in the First World War to conclude that fires not only could be dominant, but decisive; thus the maxim, "artillery conquers, infantry occupies."[31] In fact, fires were never decisive despite their dominance in the close fight.

The dominance of fires so overwhelmed maneuver forces that by the fall of 1914 the infantry on the Western Front was forced into trench warfare and a stalemate that, with few exceptions, would last the rest of the war.[32] Fires dominance was the natural result of the extreme lethality of fires to the exposed infantryman and the responsiveness of fires compared to the slow moving foot mobile infantryman. The vast quantity of artillery and mortars throughout

the depth of the battlefield ensured fires survivability was sufficient to maintain its ability to mass and kill exposed enemy forces.

Despite the devastating firepower brought to bear, soldiers that were protected by deep, well developed trenches with reinforced overhead protection were relatively safe from the fires. As the military historian John Keegan noted, "While the infantry remained under cover, the effect of much of this fire was wasted; but when they rose to advance in attack, it might destroy a battalion of a thousand men in a few minutes."[33] This situation demonstrated one of the clear characteristics of dominant fires in relation to maneuver forces. Freedom of maneuver is lost or severely restricted in an environment where fires are dominant.

The dominance of fires led warring nations to mass produce cannons and mortars of greater caliber and range in an effort to achieve decisive fires. From late 1914 through 1916, fires were employed for the purpose of destruction. To gain the destructive effects desired, huge quantities of artillery and heavy mortars were massed against enemy positions and offensives began with bombardments that lasted several days.[34] The best example of the attempt at decisive fires was Verdun, which John Keegan described as "the first artillery offensive in history."[35] Massing 1700 guns and over two and a half million shells, the Germans overwhelmed the French, and were on the verge of victory when the French commander, managed to quickly mass all available heavy French artillery to fight the German guns in a massive counter-battery fight. After an intense and lengthy artillery battle, the French succeeded in defeating the German offensive at the cost of 600,000 casualties; most by artillery fires.[36]

Though on a grander scale, Verdun, like other battles of World War I, demonstrated the importance of counterfire to neutralize of destroy the enemy's capability to employ fires. The greater the importance of the fires system to the success of tactical operations, the greater the necessity of early and decisive counterfire.[37] The inability of either side to conclusively win the

counterfire fight was one of several reasons why decisive fires was not achieved at Verdun or on other battlefields.

Four other factors contributed to the lack of decisive fires. First, the lethality of fires was insufficient to efficiently destroy dug-in infantry. Second, the element of surprise was forfeited by the attacking forces which allowed the defenders time to reinforce the front under attack with additional artillery and infantry. Third, fires lacked the deep attack ability to effectively target and engage forces moving into the area. Finally, command and control of fires was insufficient to responsively support maneuver forces that initially attacked and exploited the effects of the preparatory fires.[38]

Failing to achieve victory through attempts at the decisive use of fires, a renewed emphasis on the use of dominant fires with greater effort given to deep attack was developed by the German Colonel Georg Bruchmuller. He developed a technique which emphasized close and deep "neutralization" fires by short and very intense preparatory bombardments, instead of the earlier tactic of "destruction." Bruchmuller knew that in addition to lethal effects, massed and intensive fires on enemy forces had a psychological effect that resulted in such shock that the surviving enemy was stunned to the point of giving little or no resistance if maneuver forces advanced quickly to exploit the effects of fires.[39] He also recognized fires are most dominant, and create conditions for decisive maneuver, when close fires are combined with centralized control of massed and coordinated counterfires and deep fires.[40] For this reason, Bruchmuller organized long-range artillery groups, fernkampfartillerie (FEKA), for the specific purpose of conducting deep attacks against enemy "command centers, lines of communications, ammunition dumps, flank targets, and reserve assemble areas."[41] To assist in targeting for deep attack, each FEKA group was given its own aerial observer and balloon sections. "These FEKA groups were among the first units to appear on the emerging modern battlefield with a specific deep

mission."[42] With improvements in the ability to acquire targets deep, and a growing acknowledgment of the value of deep attack, by 1918 the deep fight became the primary focus of fires.[43]

The Germans used neutralization fires with great success on the Eastern Front at the decisive battle of Riga. The resulting defeat of the Russians allowed Bruchmuller and a great quantity of artillery to be shifted to the Western Front, where the technique was used again with great success against the British Fifth Army on the Somme. Within three days German maneuver forces had advanced through the depth of the British defenses and into their rear area. Only logistical failure by the Germans prevented a decisive victory. On four more occasions Bruchmuller's tactic for using fires was employed, each time with success.[44] Bruchmuller's improved tactics, combined with technological advances, allowed fires to become more dominant in depth which helped the German's gain freedom of maneuver which previously had been lost.

World War I witnessed the birth of modern artillery, and with it, many of the tactics and techniques that allowed fires to dominate the battlefield. In addition to Bruchmuller's "neutralization" tactics, other lessons learned during the war included maneuver's dependence on firepower, the mobility required of artillery, the potential for deep attack to significantly influence the close fight, and the absolute necessity of effective counterfire, target acquisition, and command and control of fires.[45]

Fires Responsiveness vs. Target Mobility

Fires were much more responsive than the slow moving foot mobile infantry of the First World War. On the front lines, where targets were easily identified by ground observers, the infantry simply was unable to move fast enough to avoid the lethal effects of fires. Fires were

not as responsive deep due the challenge of deep target acquisition, and the inability to quickly send targeting data. As a result, fires were often ineffective in deep attack against moving targets. With improvements in aerial observation, technological advances in the fires system, and improved tactics, fires became increasingly effective in the deep fight against stationary targets, but the ability to see deep was still limited to only a few kilometers.

Fires Lethality vs. Target Survivability

Fires lethality far exceeded the survivability of the infantry and other targets throughout the depth of the battlefield. To enhance survivability and greatly limit the lethality of fires, the infantry was forced to dig-in and give up its freedom of maneuver. Fires, when massed sufficiently could have effects on dug-in infantry, however, destructive effects were very hard to get and required tremendous amounts of massed artillery. Deeper on the battlefield, fires lethality was limited when the enemy was dispersed, dug-in, moving, or out of range. When deep targets were in range and stationary long enough for the targeting system to accurately locate them and adjust fire, massed fires had great effects.

Fires Survivability vs. Enemy Attack

Due to the dominant role of fires, counterfire, or counter-battery fire, was a significant aspect of the First World War. Fires effectiveness was reduced due to tremendous resources being applied to counter-battery fights; however, fires survivability usually exceeded the enemy's ability to attack. Fires survivability primarily resulted from a fires system that was so robust that fires maintained their effectiveness despite heavy counterfire. Survivability was further enhanced by the problems associated with deep attack, specifically identifying targets quickly and getting accurate fires on the enemy artillery batteries before they moved. To enhance fires survivability, and limit the enemy's deep attack capability, air-to-air combat developed as aircraft

would attempt to shoot down enemy spotter planes, thus degrading the ability of the enemy to identify targets.

Summary of Fires in World War I

Fires in World War I were dominant but not decisive. Fires were more responsive than the mobility of the troops on the line. The lethality of fires greatly exceeded the survivability of infantry, except when dug-in and under cover, and when dug in, freedom of maneuver was lost and the morale neutralizing effects of fires could be exploited by attacking forces. Finally, the huge quantities of artillery that were fielded resulted in fires that were sufficiently robust to survive the counterfire fight. Fires failed to be decisive because their lethality was not great enough to defeat dug-in infantry, and technology limited the ability to acquire and responsively engage deep targets and defeat the enemy's artillery.

Throughout the First World War, slow but continuous progress was made in the ability to attack deep. By the Second World War, the potential for fighting deep grew with increased use of radios, aircraft, and other advances in the capability of fires.

WORLD WAR II

The potential for fires dominance in World War II varied greatly between the European and Pacific theaters. In Europe and North Africa, the conflict is often remembered as a fast paced war of mobility and firepower. The war in the Pacific was the slow infantryman's war of attrition, in which the heavy jungles and mountains greatly favored the defender with both cover and concealment.

In the Second World War, tactical commanders were no longer dependent on artillery alone for deep attack. In Europe, the aircraft added a tremendous fires capability for the ground commander, and it was the Germans, once again, that were in the forefront in the development

and exploitation of fires as the Second World War began. The Germans developed and used dive bombers as "flying artillery" which supported the fast moving armor formations by blasting holes in enemy defensive lines which were immediately exploited by armored maneuver forces. The added C3I capability provided by the smaller, mobile radio allowed commanders, tank forces, artillery, and aircraft to communicate and coordinate actions quickly and continuously.[46] Although the Germans were the first to identify and develop the potential of aircraft to provide close and interdicting fires for the maneuver commander, the Americans quickly learned and further refined that capability.

The mobile nature of the war in Europe and the increased depth of the tactical battlefield required that the U.S. field large quantities of self-propelled artillery with greater range, responsiveness, and lethality.[47] American success at employing fires was largely due to its ability to mass fires responsively and quickly exploit the psychological and lethal effects of the fires with maneuver forces.

> The American style of blitzkrieg began by concentrating the fires from guns scattered throughout the front on a narrow point of attack to demoralize the enemy and punch a hole in his defenses for the infantry and armor to exploit. Mobile guns kept up with the exploitation force and ensured that continuous firepower was available to destroy pockets of resistance that might slow the advance.[48]

Although the U.S. was slow to resolve problems in coordinating and employing aircraft to compliment the effects of artillery fire in the tactical fight, by the invasion at Normandy in 1944, the Americans finally were getting it right.

> Comments of friend and foe alike proved the wisdom of the American style of blitzkrieg. German field commanders were not much impressed with the quality and effectiveness of American armored forces, but they uniformly expressed a grudging respect for American artillery and tactical airpower during the last eight months of the war.[49]

The dominant role of fires in Europe during the second World War led General Patton to say, "I don't have to tell you who won the war...you know...the artillery did."[50] Similar

sentiments were expressed by General William E. Depuy who described his job as an infantry commander as "moving the artillery's forward observers across France and Germany," because he was convinced that artillery and aircraft "provided the firepower that was the margin of superiority in overall combat that Americans enjoyed."[51]

Although fires played a significant role in close and deep operations for the divisions in Europe during World War II, they were not always dominant. The depth of the battlefield often challenged the targeting system, and when the speed of maneuver forces could be exploited, their mobility often exceeded the responsiveness of the fires system. When natural and manmade obstacles slowed or stopped the enemy's armored forces, fires could be massed with devastating effect. That was the case in the Ardennes during the Battle of the Bulge, when German armored formations attempting a breakthrough at Monshau were broken and defeated by the massed effects of twelve artillery battalions.[52]

In the Pacific, naval and air fires played a more significant role than artillery due to the very dense and restricted nature of the terrain.[53] Targeting for deep attack was difficult at best in the Pacific, where the Japanese were masters at using the dense jungles, hills and mountains for cover and concealment.[54] Throughout most of the War in the Pacific, the Japanese used well prepared defenses which maximized the use of deeply dug in positions to protect themselves from the much greater firepower of the Americans. As a result of the problems finding and effectively engaging targets deep, fires in this theater were limited for the most part to close support of the infantry.[55] In this role, fires enjoyed limited effectiveness in the offense against the protection the Japanese gained from hardened, dug-in positions. In the defense, however, when fires were responsive, they proved extremely lethal and effective at defeating Japanese attacks due to the vulnerability of enemy forces as they massed in the open.[56]

Fires Responsiveness vs. Target Mobility

The responsiveness of fires had improved significantly since the First World War, largely due to the increased use of radios to communicate between ground and aerial observers and the firing units. Fires responsiveness far exceeded the mobility of infantry units, but only occasionally exceeded the mobility of mechanized units. The increased mobility of armored and motorized forces challenged the responsiveness of fires because of the difficulty of engaging moving formations. The effectiveness of fires against the more mobile targets was greatest when terrain and natural or manmade obstacles served to slow or canalize the enemy. In more open terrain fires were frequently not responsive enough to catch their targets. Fires responsiveness also made it increasingly necessary to make artillery self-propelled so that it could keep up with friendly maneuver forces, especially during rapid offensive operations.[57]

While deep targeting remained a challenge, dedicated observer planes flying for artillery units greatly improved the effectiveness of fires in the deep attack and counterfire roles.[58] Fixed wing aircraft, which became the fire system of choice for deep interdiction was immediately responsive when on station and engaging targets of opportunity. Aircraft were considerably less responsive when not dedicated and pre-planned to support ground forces in contact.

Fires Lethality vs. Target Survivability

Fires continued to be very lethal and effective against enemy targets. Tanks, which had the greatest armor protection and gained potential protection from its mobility, were still vulnerable to the direct fires and bombs of aircraft as well as the increased lethality of larger caliber artillery.[59] The armor protection of tanks did minimize their vulnerability to the shrapnel of area fires when they were not massed and accurate. But, as clearly demonstrated by the Americans during the Battle of El Geuttar and the Battle of the Bulge, and by the Russians

throughout the Eastern Front after 1941, massed and responsive artillery fires could destroy enemy armor and infantry formations creating the opportunity for decisive maneuver.[60] The majority of forces involved in conflict attempted to enhance their survivability through dispersion and the use of cover and concealment. Even when the enemy survived the lethal effects of fires, the psychological effects and morale dislocation that Bruchmuller and others exploited during the First World War still proved to contribute to victory.[61] The Americans in particular proved increasingly effective at massing fires on suitable targets when and where they were identified, defeating maneuver with fires and developing greater ability and effectiveness in deep attack.[62]

Fires Survivability vs. Enemy Attack

Like the First World War, counterfire continued to be the greatest threat to artillery. For the most part, the Americans enjoyed fires survivability throughout World War II due to air superiority and better artillery mobility. Additionally, they had greater success in the counterbattery fight because of better deep targeting and more effective C3 to quickly mass artillery to gain destructive or neutralizing effects on enemy artillery.

The survivability of air delivered fires was enhanced by greatly limiting the ability of the enemy to attack spotter planes and attack planes from the air or the ground. American air superiority minimized the air threat, and the vulnerability of aircraft to enemy air defense artillery was limited by the use of the artillery in Suppression of Enemy Air Defenses (SEAD).

Summary of Fires in World War II

During the Second World War fires were often dominant. Significant improvements in the fires system's responsiveness was offset somewhat by the increased mobility of motorized forces. On most terrain, most of the time, the fires responsiveness exceeded the mobility of

German units, especially when the weather and aircraft availability provided division commanders with air support for interdiction. The lethality of U.S. fires due to the complementary nature of air and artillery fires, the increased firepower of artillery, and the increased ability to mass the effects of fires, exceeded the German's ability to protect their formations and systems. Generally, fires survivability exceeded the attack capabilities of the Germans due to the greater mobility of self-propelled artillery, air superiority, and greater success with counterfire. In Europe, fires were used primarily to attack the enemy and create conditions for decisive exploitation by maneuver forces. Just the opposite was true in the Pacific.

In the Pacific fires did not gain dominance due to limitations on responsiveness resulting from difficulties targeting, moving, and positioning in the dense jungles and mountainous terrain. The lethality of fires, even with the heavy bombs dropped by dive bombers, often proved ineffective against the heavily dug-in Japanese forces. While survivability of the fires system exceeded the enemy's ability to attack it, excelling in only one of the three characteristics of fires is insufficient for fires dominance

PERSIAN GULF WAR

> "...our division artillery, augmented by the fires of an additional MLRS battalion, fired more than 400 rockets deep into Iraq in less than 90 seconds. We were after Iraqi artillery, command and control targets of the front-line divisions and his air defenses. We found out later the raids had been very effective, and the forces immediately across the border from us, several infantry divisions, had been fixed in place and effectively blinded to the repositioning of the VII and XVIII Corps."
>
> BG Tommy R. Franks, 1st Cavalry Division

The American experience in the Persian Gulf War was defined by dominant fires and decisive maneuver. The Iraqis fell victim to dominant fires, which blinded them, defeated their fires system, degraded their ability to command, control, and maneuver. Then they were

defeated by maneuver forces which sustained a tempo of operations they could not match, and was led by an armor force superior to them in mobility, firepower, and protection.

The tremendous targeting and counterfire capabilities of American artillery using the Firefinder Radar System combined with cannon and MLRS units completely overwhelmed the Iraqi artillery, and won continuous fire superiority for the U.S. divisions.[63] As noted in one article reviewing the effects of fires during the war, "fast, accurate and responsive, our Firefinder target-locating radars, linked by voice or digitally to MLRS and cannon units, delivered rapid and devastating results...once engaged with counterfire, no enemy artillery fired again."[64] The reactive counterfire fight represented the true potential of fires responsiveness. The Firefinder radars, the fires C3 computers, and the MLRS's on board computers were designed for a digital sensor-to-shooter link that allowed the almost instantaneous detection and precise targeting of enemy artillery, and the transmission of targeting data to rocket launchers which could fire on the enemy artillery positions even before the enemy's initial volley reached its target.[65]

The speed and efficiency of the targeting system, which defines fires responsiveness, was better during Operation Desert Storm than ever before in history, and yet it had some shortcomings. Responsiveness suffered primarily from the inability to quickly process intelligence data into targets, C3 shortcomings in coordinating and clearing deep fires, and artillery and sensor mobility limitations during rapid and lengthy movements.[66]

Despite some shortcomings, fires responsiveness exceeded the enemy's mobility while the lethality of fires far exceeded their survivability. Fires in this war were typified by the accurate, rapid, mass firing of cannon and MLRS systems at planned targets, often in conjunction with Apache attack helicopters exploiting the effects of indirect fires and adding to the lethality of the deep attack.[67] These "artillery raids" often involved two to four battalions of MLRS and three to five battalions of cannons firing with devastating psychological and lethal

effect; destroying or silencing Iraqi artillery, air defenses, and C3.[68] These deep attacks by fire proved very effective for the 1st Cavalry Division and the 1st Infantry Division before crossing the boarders into Iraq, and later the 1st Armored Division enjoyed equal success in fighting with fires, and creating the conditions for decisive maneuver.[69]

The introduction of the joint surveillance and target attack radar system (JSTARS) demonstrated a unique and promising ability to gain real-time targetable intelligence on moving and stationary targets deep on the battlefield. During the Gulf War, JSTARS successfully identified and supported deep attacks by both fixed wing aircraft and the Army Tactical Missile System (ATACMS), but failed to support deep attacks with AH-64 Apache's.[70] JSTARS shortcomings were largely the result of the fires system lacking sufficient ground station modules (GSM) to receive and process real-time intelligence and targeting data from the aircraft's radar system, and procedures for exploiting the targeting potential of the sensor.[71]

Another experimental targeting system used during the Persian Gulf War, which demonstrated exceptional promise, was the unmanned aerial vehicle (UAV). The UAVs that were used in the war were effective at providing near-real time precision targeting, reconnaissance, and battle damage assessment information, however, only a few systems were available and the C3 infrastructure within the division's did not support their full exploitation.[72]

Fixed wing air support for tactical ground operations was relatively limited during the Gulf War, but still contributed to fires dominance. Notably, if the war would not have allowed the opportunity to conduct a sequential application of air attack of strategic and operational targets, followed by the ground attack, air support for division level commanders would have likely been even lower.[73] The growing capability of division and corps commanders to fight the tactical deep battle with army systems, combined with the Air Forces' focus on air superiority, strategic and operational targets it is likely to lead to even less fixed wing support of Army

division level close and deep attacks. This sentiment was expressed by the US Air Force Chief of Staff, General Ronald R. Fogleman, in a recent interview, when he noted CAS should only be needed when " something has gone terribly wrong with the battle plans."[74]

Fires Responsiveness vs. Target Mobility

Fires responsiveness exceeded the mobility of the Iraqi forces, which were forced to seek prepared defensive positions. While the American's targeting process was far more responsive and accurate than the Iraqis, it was still challenged to quickly and effectively identify and engage deep targets and moving or relatively mobile targets.[75] The most notable exception, and the greatest example of responsive fires, was the reactive counterfire fight. The targeting experiences in Desert Storm reaffirm the need to develop more sensors capable of identifying targets throughout the depth of the battlefield, and the need for C3 systems that can quickly process, coordinate, and clear fires.

Fires Lethality vs. Target Survivability

In terms of terminal effects of munitions, fires had tremendous lethality against most target types during Operation Desert Storm. The munitions delivered in mass by cannon, rocket and missile systems proved extremely lethal against all but the hardest targets, such as tanks and bunkers. The A-10, and the Apache using Hellfire missiles proved lethal enough to destroy any armor target on the battlefield. The greatest limitations in fires lethality was the inability of the most responsive and low risk fires asset, artillery systems, to efficiently destroy enemy tanks. A lesser shortcoming to fires lethality was the limitation in the range of the artillery systems supporting the division commanders.[76] Increased range, if supported by responsive and accurate targeting would have allowed more Iraqi systems to have been destroyed in depth, further enhancing the security of maneuver forces and the potential for more rapid movement.

Like previous wars, the psychological effect of fires on the enemy proved to be a significant factor on the battlefield. The moral dislocation that resulted from massed, accurate, and lethal fires greatly contributed to the disintegration of the enemy's will to fight. As Brigadier General Robert Scales noted in the official history of the Gulf War, "a dispirited soldier's reaction to disciplined troops wielding superior firepower has always been the same....he either cowers before the firepower or runs away. The Iraqis were no exception."[77]

Fires Survivability vs. Enemy Attack

The combination of air superiority, electronic security, and overwhelming fire superiority (both against enemy air defense artillery systems and their indirect fire systems) greatly enhanced the survivability of the fires system. The Iraqi's failure to invest in advanced technologies and procedures for counterfire targeting and fires responsiveness prevented them from threatening the American's fires system and contributed to their overwhelming loss in the counterfire fight. As a result of fires survivability, more continuous and responsive fires were available for deep attacks.

Summary of Fires in the Persian Gulf War

With fires responsiveness exceeding Iraqi mobility and tempo, and with excellent lethality and fires survivability, the American's were able to exploit the conditions of fires dominance. As noted by Brigadier General Creighton Abrams, the commanding general of VII Corps Artillery during the Persian Gulf War, "How do you defeat a battle-toughened, well-equipped Iraqi force on his own turf in 90 hours? The answer is simple: better fires--with maneuver exploiting the effects of fires and fires exploiting the effects of an enemy reacting to maneuver."[78]

The American experience in the Persian Gulf War not only achieved fires dominance, but demonstrated the likelihood of fires and deep attack playing even more decisive roles in future wars. The potential for fires was evident in the tremendous accuracy and responsiveness of the Firefinder shooter-to-sensor links, the target acquisition capabilities of JSTARS and UAVs, and the lethality of systems like the Apache Attack Helicopter and ATACMS. These capabilities demonstrate the continuing trend in the growing importance of deep attack and fires that began at the turn of the century.

HISTORICAL CONCLUSIONS

Since World War I the relative ability of the U.S. Army to gain fires dominance has varied, however, certain trends are evident. Fires responsiveness has increased rapidly over time; first with the large scale use of the radio in World War II, and then the increased use of digital sensor-to-shooter links by the Gulf War. The increased responsiveness of fires by the Second World War was offset somewhat by the increased mobility of mechanized units and their dispersion tactics in open terrain. By the Gulf War, fires responsiveness had increased significantly while the mobility of tanks and trucks had grown much less. A second attribute of responsiveness which increased only moderately between the two World Wars but significantly by the 1990's is the ability to see deep. The trend over the past century clearly demonstrates a much more rapid advance in fires responsiveness than in target mobility, and technology is likely to further increase the difference between the two.

The lethality of fires has grown moderately over time. Fires lethality greatly exceeded the lack of protection available to the infantry of the First World War, forcing them to forfeit their freedom of maneuver and seek greater survivability by digging-in. In the Second World War, foot mobile infantry were as vulnerable as ever to fires; however, armored vehicles in

mechanized units were far less vulnerable to fires due to their increased protection and maneuver tactics. The development and use of close air support and larger caliber, self-propelled artillery combined with the tactic of massing fires kept the enemy vulnerable to fires lethality, although the overmatch was not nearly as significant. By the Persian Gulf War, fires lethality had increased due to better range, munitions, rates of fire, targeting and weapons' accuracy. These advances in fires lethality were generally matched with improvements in the armored protection of tanks and mechanized vehicles, but softer targets like artillery, C3, and logistic elements were as vulnerable to fires as the exposed infantry was in the First World War. The historic trend in the gradual, parallel development in fires lethality and enemy armored survivability began a substantial shift during the Gulf War with the introduction and limited use of precision munitions which demonstrated the growing potential for fires lethality to far exceed the protective efforts of enemy forces.

Historically, fires survivability is dependent on both active and passive defensive measures. When adversaries share similar fires capabilities, like during the First World War, counterfire efforts may be continuous and inconclusive. The World War II and the Persian Gulf War demonstrated the importance of air superiority, fires system mobility and dispersion, effective communications and counterfire to ensure fires system survivability. These historically effective means of enhancing the survivability of the fires system will grow in importance as fires become more dominant on the battlefield and the enemy expends greater effort to attack the fires system.

FACTORS OF DOMINANT FIRES

History has indicated that all three characteristics of fires examined in this monograph are important. The responsiveness, lethality, and survivability of the fires system must be

developed and maintained at the highest levels possible. How strong each characteristic is at any given point in time is dependent on the equipment, technologies, tactics, techniques, and procedures used by the adversaries. An army that is strong in one or two of the characteristics may have effective fire support for their maneuver forces, and even enjoy fire superiority, but they will not have fires dominance; such was the case with fires in the Pacific during World War II. When the friendly fires system excels in responsiveness, lethality, and survivability compared to enemy forces, the conditions are right for fires dominance.

To determine if Division XXI fires has the potential for battlefield dominance, the three characteristics of fires must exceed the mobility, survivability, and attack capability of any potential enemy. An examination of the new capabilities of various component systems of Division XXI's fires system should illustrate how fires may become more responsive, lethal, and survivable.

IV. AOE vs DIVISION XXI FIRES--A COMPARATIVE ANALYSIS

The Training and Doctrine Command conducted a Force XXI Division Design Analysis that considered several potential organizational designs for Division XXI. Using a combination of qualitative and quantitative methods for analysis, and analyzing the alternative divisional designs against several significantly varying scenarios, the study concluded that the Division XXI design should be a modified version of the AOE division design.[79] Although Division XXI, as it is currently developing, may represent significant improvements in terms of combat capabilities, in most ways it will very similar to the AOE divisions that fought in Operation Desert Storm. Recognizing the similarities between the current and future divisions, this chapter will focus only on the significant differences between components of Division XXI fires and the

AOE division fires and their contribution to greater fires responsiveness, lethality, and survivability. This comparison will be formatted using the three elements of the fires system.

COMMAND, CONTROL, AND COORDINATION (C3)

Force XXI is being developed conceptually around the power of information and the ability of advanced information technologies to greatly enhance the efficiency and effectiveness with which commanders can employ their units in combat to achieve decisive results. The use of digitization and computer systems to speed the C3 process is not new. In the AOE divisions and separate FA Brigades, field artillery units have had the tactical fire direction system (TACFIRE), or more recently the initial fires support automation system (IFSAS), to digitize and increase the efficient and effective use of fires. TACFIRE and IFSAS, however, were basically "stovepipe" systems; that is they worked in relative isolation from other battlefield operating systems. Division XXI is built around the Army Tactical Command and Control System (ATCCS), a component of Force XXI's Army Battle Command System (ABCS), which integrates the processing of information up, down, and across the battlefield operating systems.[80] The goal of ATCCS is to provide commanders and staff with a relative common picture (RCP) of the battlefield which will significantly reduce the fog of war and enhance the ability to effectively plan, coordinate, control, and direct combat operations.[81]

The three components of the ATCCS that most directly relate to fires include the maneuver control system-Phoenix (MCS/P), the all source analysis system (ASAS), and the advanced field artillery tactical data system (AFATDS). MCS/Phoenix facilitates command, control, planning and integration of maneuver elements and serves as the integrator of the components of ATCCS and provides the near real-time "picture" of the battlefield. ASAS receives, processes, and distributes strategic, operational, and tactical intelligence information.

ASAS manages the variety of integrated intelligence collection resources and sensors available to support Division XXI, and provides the staff and commanders with a relatively clear picture of the enemy throughout the battlespace. Based on the intelligence collection plan, when high payoff targets are detected, the targeting information will be sent automatically to AFATDS as nominated targets for engagement by fires.

The centerpiece of ATCCS for fires is the AFATDS. AFATDS has already proven to significantly enhance the responsiveness of fires even when it operates without the full ATCCS system in place.[82] It does the by "provid[ing] integrated, automated support for planning, coordinating and controlling fire support assets and for executing counterfire, interdiction and suppression of enemy targets for close and deep operations...this system increases the responsiveness, efficiency and effectiveness of the fire support system; it focuses fires for the digitized force."[83]

AFATDS will interface with all Army and joint C2 systems and may linked directly to sensors or have targeting information sent via ASAS or MCS/Phoenix. Using specific targeting and attack guidance, combined with real-time situational awareness of fires assets including CSS related information, AFATDS will enhance the survivability and responsiveness of fires while increasing its lethality by focusing fires at the right place and time, using the right fires assets to meet the commander's intent.[84]

TARGET ACQUISITION AND BATTLEFIELD SURVEILLANCE

The difficulty of accurate and timely deep targeting, and its effects on the responsiveness of fires, has historically been the most common shortcoming in the capability of fires. ASAS, as part of Division XXI's ATCCS system, gives the fires system a new ability to process and fuse the intelligence being gathered throughout the full depth of the battlespace to create one relative

common picture of the enemy. To do this in near real-time, ASAS is dependent on the much improved capabilities of numerous sensors that will be available to support Division XXI.

The AOE divisions that fought in Desert Storm enjoyed, even if only on a limited and experimental basis, some of the capabilities for target acquisition and battlefield surveillance that will be prevalent in support of Division XXI. These targeting and intelligence sensors include new dedicated intelligence assets like unmanned aerial vehicles (UAVs) and the joint surveillance target attack radar system (JSTARS). It also involves improvements on existing systems like the Firefinder target acquisition radars, Advanced Quickfix, and Guardrail. Finally, Division XXI will benefit from new capabilities and weapon platforms that double as targeting systems such as the Apache Longbow attack helicopter and the Comanche scout and light attack helicopter. The sensors of the Division XXI are characterized by increased range, accuracy, and responsiveness, and the ability to communicate digitally through the ATCCS system or directly with dedicated firing assets for an instantaneous direct sensor-to-shooter link.

JSTARS, which proved itself in the Gulf War, is a tremendous intelligence and targeting resource. The JSTARS is a targeting system that uses the advanced synthetic aperture radar and has a moving target indicator capability that allows it to detect, locate, track, and classify moving and stationary targets to a range of 300 kilometers.[85] In Division XXI, the JSTARS will be digitally linked to Ground Station Modules (GSMs) which are linked to the ATCCS system or directly to the fire control elements for MLRS/ATACMS units.

UAVs also have proven themselves as an outstanding intelligence and targeting resource. In Division XXI, UAVs will be available at the division and brigade level. Using multiple sensors and capable of targeting for deep attack to ranges in excess of 200 kilometers, the UAVs will provide a continuous intelligence feed to ASAS to help maintain the near-real

time relative common picture of the battlefield, and may work in conjunction with other sensor and attack assets to confirm or track targets and determine battle damage assessment (BDA).[86]

The Firefinder radars that proved so successful in Desert Storm, and proved the responsiveness of digital sensor-to-shooter links, will be improved in Force XXI. Although the Q36 and Q37 radars are both being modified to be more responsive, mobile, accurate, and reliable, the greatest improvement will be in the detection range of the Q37, which will expand from the current maximum of 50KM to 300KM.[87]

Advanced Quickfix and Guardrail serve as integrated targeting systems that detect, locate, and report communications and electronic intelligence through direction finding. Quickfix provides near real-time targeting data to a range of 50 kilometers. The Guardrail common sensor, with its direction finding system, Chaals, targets near real-time to a range of 250 kilometers from aircraft to data link.[88]

The Apache Longbow and the Comanche will be capable of multiple target detection, classification, and prioritization within seconds of scanning the target area. Equipped with the second generation forward-looking infrared (FLIR) sensor, it has 40% greater range and greater than 100% greater target identification capabilities compared to the first generation FLIR used on current Apache and OH-58D helicopters.[89] With the addition of the Longbow fire control radar, these systems have further enhanced detection capabilities which penetrates battlefield obscurants and the effects of adverse weather.[90] Targets detected by Comanche or Apache Longbow sensors may be engaged by the attack aircraft or passed off for indirect fire engagement.

These high-tech sensors combined with the continued use of human intelligence sources, will provide Division XXI with a redundant, highly accurate, real or near-real time targeting capability that extends throughout the depth of the battlespace. This capability will allow high

payoff targets located 150 KM or deeper on the battlefield to be detected and engaged in as few as two minutes. The enemy will be unable to maneuver battalions, emplace artillery, establish logistical sites, or operate command posts without our intelligence and targeting systems detecting, classifying, and processing targetable data on them almost instantly. Clearly, the targeting capabilities of Division XXI fires system far exceeds the capabilities and responsiveness of the AOE division.

WEAPONS AND MUNITIONS

The increased ability to see and target the enemy throughout the depth of the battlefield needs to be matched by the increased lethality of weapons and munitions to effectively and efficiently conduct deep attack and enjoy fires dominance. To accomplish this, Force XXI divisions will benefit from two new weapons systems; the Crusader, advanced field artillery system, and the Comanche, reconnaissance and attack helicopter. Another attack helicopter, the Apache, is being significantly upgraded to the Longbow version. The other key lethal fires asset that belongs to the division, the multiple launch rocket system (MLRS), is also undergoing significant improvements.

The Crusader represents a quantum leap as a self propelled artillery cannon system. Scheduled to replace the M109A6 Paladin, which itself is far superior to the older M109 howitzers that fought in Desert Storm, the Crusader is a smart, robotic, artillery system specifically designed to maximize the potential of the digitized battlefield. In terms of speed, fire mission responsiveness, range, rate of fire, and survivability the Crusader exceeds the performance of the Paladin by 30% to 150%.[91] Crusader's unique multiple round simultaneous impact capability allowing each howitzer to fire four to eight rounds that will impact at the same

time on a single target gives Division XXI's artillery the ability to mass the equivalent fires of 12 to 24 battalions of artillery on critical targets.[92]

The Cost and Operational Effectiveness Analysis conducted by the Army's Training and Doctrine Command's Analysis Center compared the overall performance differences between a Paladin equipped division and one equipped with Crusader using a variety of different scenarios. The findings were overwhelming. For a variety of reasons, especially its responsiveness and range, Crusader allowed the enemy to be attacked with great lethality much earlier and deeper on the battlefield. As a result, "the system reduces the number of direct-fire engagements by up to 40 percent, allowing friendly forces unprecedented freedom of maneuver in close operations, resulting in a more lethal and survivable force...a force [which] kills up to 75 percent more enemy systems than an M109A6-equipped force, while suffering up to 40 percent fewer losses."[93]

As already mentioned, the Comanche has a tremendous intelligence and targeting capability, but it is also a very lethal weapon system. In addition to its ability to ability to identify and transmit targeting data with 15 meter accuracy within three seconds, it is also able to engage six targets simultaneously using the extremely lethal Hellfire missile.[94] The Comanche is also armed with 2.75 inch rockets, air-to-air stinger missiles, and a 20-mm turreted gun. Specially designed for deep operations, the Comanche has a variety of integrated systems to enhance its survivability. These systems include ballistic and electronic hardening; electromagnetic, acoustic, and thermal stealth; radar, chemical, and laser detection; and a self-SEAD capability.[95]

Whereas Comanche is a tremendous reconnaissance and targeting asset that has a lethal attack capability, the Apache Longbow is designed primarily for its attack capabilities and adds to its lethality by being able to identify, process, and pass targeting information to other fires

assets. The Apache Longbow is a tremendous leap ahead in the capabilities of the Apache AH-64A attack helicopter common to the AOE division. After a year of operational testing the Apache Longbow was found consistently to be seven times more survivable and four times more lethal than the Apache AH-64A.[96] Apache Longbow is capable of identifying, targeting, prioritizing, transmitting, and engaging numerous targets simultaneously with a true fire-and-forget capability due to its advanced Fire Control Radar (FCR).[97] As demonstrated during operational testing and TRADOC Cost and Operational Analysis, the Apache Longbow, especially when combined with the Comanche, will offer the Division XXI commander with a deep attack capability that is significantly more responsive, lethal, and survivable.[98]

Another proven weapons system that is being upgraded for Division XXI is the MLRS. The M270A1 MLRS will be far more responsive to fire missions. Due to its improved fire control systems (IFCS) and improved launcher mechanical systems (ILMS), it will be able to fire any of the full range of MLRS and Army Tactical Missile System (ATACMS) missiles in less than 20 seconds of receiving a fire mission, more than four times faster than the MLRS supporting the AOE division.[99] These same improvements will enhance command and control, accuracy, and survivability of the system.[100]

While the improved MLRS and the new Crusader significantly contribute to the fires capabilities of Division XXI, their impact on the future battlefield are greatly increased by new munitions that extend the range of their effects and greatly enhance lethality. The standard dual purpose improved conventional munition (DPICM) is being modified with an extended range capability (ER-DPICM) than will achieve a 47 KM range with Crusader, more than double the range of DPICM with the Paladin.[101] The standard MLRS rocket is being modified in a new extended range version with a 45 KM range and an extended range guided version that will improve accuracy, requiring one-sixth the number of rounds to be fired for desired effects, and

achieving a 60 KM range.[102] A final example of munitions available to the AOE Division that is being modified for the purpose of extending range is the ATACMS. The ATACMS used so successfully in Desert Storm, the Block I version, had a range of 165 KM. Block IA extends the ATACMS range to 300 KM and the Block IB pushes the range to 500 KM.[103] All three versions of the Block I use anti-personnel, anti-material bomblets to saturate soft, stationary area targets, such as C3, ADA, missile, and logistical sites.

As significant as additional range is to the capabilities of Force XXI artillery munitions, the greatest advancements and improved lethality will be in precision munitions. Although the AOE division does have a precision artillery munition, the laser guided Copperhead, it is severely limited in its range and dependence on a separate laser designator. It is not a truly brilliant precision munition. In contrast, the search and destroy armor (SADARM) is a 155mm submunition that uses millimeter wave radar and infrared sensors, with proven countermeasure resistance, to locate targets and attack the target with point accuracy and great lethality. Each 155mm projectile will carry two SADARM submunitions, both of which will identify targets and destroy them using an explosively formed penetrator. SADARM will be at least five times as lethal as current DPICM munitions.[104] During live-fire testing, "SADARM fulfilled all performance expectations against targets employing offensive and defensive countermeasures in conditions of fog, rain and wind...demonstrating its all-weather ability to kill armored vehicles in depth."[105] A product improved version of SADARM is already under development that will improve the sensors and give each submunition a larger detection footprint, doubling its lethality.[106]

The precision munition being developed for artillery rockets and missiles is the brilliant anti-armor munition called BAT. Thirteen BAT submunitions will be carried by a new version of ATACMS, the Block II, which will have a range of 140 KMs. The BAT uses acoustic and

infrared sensors to autonomously seek and destroy moving armored targets. The division or corps commander will primarily use Block II to destroy moving tank and mechanized battalions; a task that would require only six to eight missiles.[107]

A more advanced version of BAT, the BAT P3I (pre-planned product improvement), will have a more lethal warhead and will use three sensors to substantially increase the targeting footprint of the submunition, increase its performance in bad weather, further enhance its ability to defeat enemy countermeasures, and enable it to attack and destroy armored or soft targets, hot or cold, stationary or moving.[108] The BAT P3I will replace the BAT submunition in ATACMS Block II missiles made after its fielding (currently scheduled for 2004).[109] Additionally, six BAT P3I submunitions will be used in an extended range ATACMS Block IIA that will reach 300 KM.[110]

Division XXI and the Factors of Dominant Fires

This chapter has described the characteristics of component elements that contribute to the Division XXI fires system compared to the AOE division. The digital framework which links C3, the target acquisition sensors, and the weapon systems will allow the controlled and focused use of sensor-to-shooter links that may make fires responsiveness almost instantaneous against selected high-payoff targets. Responsiveness will be further enhanced by the computers and robotics that will enable Crusader, MLRS launchers, and attack helicopters to respond to targets much more quickly than ever possible before.

The lethality of Division XXI is most evident in precision munitions; however, several other factors also increase fires lethality. Increased range and accuracy will enable enemy forces to be engaged at greater distances and with better effects. The increased rate of fire and MRSI capability of Crusader will increase lethality by creating the effects of massed fires while using

far fewer systems. Finally, the complimentary effects of artillery and aviation working together will increase lethality and survivability.

Division XXI's ability to create a relative common picture reflecting exceptional situational awareness, combined with the enhanced fires C3, and weapon systems capabilities, will greatly increase fires survivability. It will support greater dispersion, more rapid movement, and avoidance of threat areas. With continued air superiority and an even greater overmatch in counterfire capabilities, fires survivability far exceeds that of the AOE division.

While the various components of Division XXI's fires system contribute to increased responsiveness, lethality, and survivability, it is the synergistic effect of the C3 , target acquisition, and weapon systems working together as a system of systems that truly maximizes the opportunity for fires dominance and the future ability to conduct deep and simultaneous attack .

V. FIRES AND DEEP ATTACK IN DIVISION XXI

> The relationship between fire and maneuver may undergo a transformation as as armies with high technology place increasing emphasis on simultaneous strikes throughout the battlespace.[111]

To determine the potential for future fires dominance, some consideration of the future threat must be made. Additionally, consideration of how Division XXI fires might be employed and how enemy forces might respond should be considered. The purpose of this chapter is to address these issues. After first considering the nature of the future battlefield, Division XXI fires will be analyzed using the factors of dominant fires; responsiveness, lethality, and survivability. This chapter will conclude by considering some of the implications of dominant fires.

THE FUTURE THREAT

Any attempt to define the "next war" is likely to be wrong. As noted in the National Security Strategy, "We will never know with certainty how an enemy might fight or precisely what demands might be placed on our own forces in the future."[112] While we may not know with certainty what future mid- to high-intensity conflicts may be like, some characteristics of future battle can be anticipated. Future conflicts will likely be defined by greater dispersion of forces, higher tempo of operations, greater range and lethality of weapons systems, and greater dependence on advanced technologies for C3 and intelligence.[113]

Some theorists and futurists believe we will no longer have large force on force battles so common to European conflicts, and most recently fought in the war with Iraq. So, why develop a force that is designed to fight and defeat a modern mechanized or armor based enemy? Because such an enemy is potentially the most lethal (short of weapons of mass destruction), and a significant and growing number of nations around the world are capable of mid-to high-intensity conflict and are continuing to invest heavily in conventional forces based on tanks, mechanized infantry vehicles, artillery, and attack aviation.[114] Additionally, high tech equipment, tactical ballistic missiles and other advanced weapons are available to almost any nation-state. This threat was recognized by the Army's Training and Doctrine Command, which noted the nature of the future threat environment:

> While global political conditions from a U.S. vantage have improved dramatically, the expanding international arms market and the proliferation of high technology weapons are disturbing factors in an increasingly unstable world...the United States could face a number of opponents armed with sophisticated weaponry. Potential enemies could possess sizable modern armored combat forces, long range artillery, and tactical air support. They could have state-of-the-art command and control systems as well as reconnaissance, intelligence, surveillance, and target acquisition (RISTA) capabilities.[115]

How will Division XXI, as part of a joint force, fight and defeat "a sizable modern armored combat" army which may likely include some state-of-the-art capabilities? Like the Persian Gulf War, joint forces will use strategic and operational fires to isolate the tactical battlefield and simultaneously attack to win air superiority and electromagnetic spectrum supremacy. At the tactical level, Division XXI will also support these efforts with fires directed against enemy air defenses and electronic warfare systems. These initial efforts are part of the Army's basic concept for operations; seize the initiative, maintain momentum, and exploit success.[116] Division XXI's operations will be characterized by bold and aggressive offensive operations, striking simultaneously throughout the depth of the battlefield, and sustaining a high operations tempo, to win a quick and decisive victory.

Defeating a large modern combat force and winning a decisive victory is dependent on dominant fires and the successful conduct of deep attack. Consideration of the applied capabilities of Division XXI fires responsiveness, lethality, and survivability may indicate the ability of fires to conduct deep and simultaneous attacks and achieve battlefield dominance.

FIRES RESPONSIVENESS

The speed of digital sensor-to-shooter links ensures a tremendous overmatch in the responsiveness of fires compared to the limited speed and mobility of enemy ground based systems, contributes significantly to the dominance of fires on the future battlefield. The responsiveness of fires directly supports the division commander's ability to seize the initiative and ensure an operation's tempo that the enemy cannot match. The tremendous increases in real-time precision deep targeting, digitally linked to an integrated C3 system, enables the commander to focus fires on multiple target sets throughout the battlespace and quickly shift the focus of fires as new opportunities and threats arise. This capability accomplishes the objective

of deep and simultaneous attack, "to overload the enemy's ability to cope by presenting an overwhelming number of actions throughout the depth of the battlefield."[117] Unable to effectively react to attacks against his forces and functions, the enemy forfeits whatever initiative he may have held.

Having seized the initiative, responsive fires helps the commander maintain the momentum by constantly attacking the enemy and creating ever-changing demands on him which he can't react to fast enough. The result is an operations tempo that prevents the enemy from ever recovering.[118]

Responsive fires also contributes to force protection. The range and accuracy of targeting sensors, combined with weapons range and lethality, allows the identifying and selective destruction of enemy forces long before they are in a position to threaten friendly units. The enemy can't run fast enough to hide, much less mount a coordinated attack.

FIRES LETHALITY

As noted in chapter four, the lethality of future fires is greatly enhanced by significant increases in range, accuracy, and rates of fire. While these improvements would likely ensure the continued overmatch of fires lethality to the ability of the enemy to protect their systems and forces, it is the tremendous potential of precision munitions that promises to make the greatest improvements in fires lethality. Precision munitions will change the purpose for which fires have traditionally been employed. Since the First World War, the inaccuracy of fires have made them inefficient for the destruction of point targets, so fires have primarily been used to suppress or neutralize enemy forces. Precision munitions will make destruction of targets the primary effect of fires.

The potential lethality of fires on the future battlefield has been demonstrated in a variety of models and simulations. The Force XXI Division Design Analysis using a variety of design alternatives and varying scenarios consistently found that fires from attack helicopters and MLRS systems accounted for over 70 percent of all enemy systems killed.[119] The analysis also confirmed that deep attack, particularly with ATACMS Block II/IIA, "enabled the division to mass the munitions' effects instead of massing forces," and found fires could not only be dominant, but decisive.[120]

The lethality of future fires offers an asymmetrical advantage over potential enemies in both the aspects of asymmetry: dissimilarity and overmatch.[121] Dissimilarity involves using one type of weapon system to fight against a different type of weapon system. With the exception of counterfire missions, when artillery targets enemy artillery systems, fires are naturally used asymmetrically. The objective of an asymmetrical attack is to decrease one's own vulnerability while effectively attacking an enemy system that is not designed or capable of countering the attack. Effective asymmetrical attacks may not only have great lethal effects on enemy targets, but due to the natural sense of helplessness and vulnerability felt by those under attack, it leads to tremendous shock and morale dislocation which significantly contributes to their defeat. The military historian and theorist Christopher Bellamy noted, "If artillery has been the greatest killer in twentieth-century warfare, its effect in crushing morale, numbing thought, and paralyzing movement is incomparably greater."[122]

Overmatch, the second aspect of asymmetry, involves "generating and applying power similar to that of the enemy's at a level and in a manner he cannot match."[123] Division XXI fires gains an asymmetrical advantage due to its overwhelming superiority over the fires capabilities of potential enemies and its ability to support an operational tempo that the enemy can't counter. Fires overmatch was evident in the decisive counterfire victory the Americans won over the

Iraqi's in the Persian Gulf War. With greater responsiveness, range, rates of fire, the SADARM precision munition, and enhanced ability for proactive counterfire, Division XXI fires greatly enhances the fires overmatch already enjoyed by the AOE division. The responsiveness and lethality of fires that leads to overmatch directly contributes to fires survivability and the increased protection of friendly forces throughout the depth of the battlespace.

FIRES SURVIVABILITY

Fires survivability for Division XXI is likely to far exceed the proven survivability of fires in the past, although due to the tremendous threat future fires poses for enemy forces, it is likely they will place a very high priority on their counterfire effort.[124] For this reason, the defense of the fires system grows even more important.

Future enemy forces will likely attempt to destroy or degrade the American fires systems, through a combination of four types of attack: artillery, air, electronic, and ground forces. Historically, artillery has been the greatest of these four threats. Fires overmatch, as already discussed, will very likely eliminate the enemy's effective fires capability, and with it his ability to use cannons, rockets, or missiles to attack any of the three parts of the fires system. In addition, improved situational awareness, C3, and individual weapon systems capabilities, will further enhance survivability through greater dispersion, more rapid movement, and avoidance of threat areas. Several other factors will also contribute to fires survivability.

At the beginning of any conflict, the Air Force takes the lead in the joint effort to quickly win air superiority, if not supremacy, to reduce or eliminate the threat of enemy air attack. This effort directly contributes to the survivability of all ground forces as well as Division XXI's indirect fires and attack aviation assets. The survivability of rotary and fixed-wing aircraft is further enhanced by the use of artillery for the suppression of enemy air defenses (SEAD).

SEAD is not a new mission for fires, however, its importance and the ability of fires to effect enemy air defenses is growing. Clearly, as deep and simultaneous attacks become the standard means of defeating the enemy, the importance of attack aviation assets like the Comanche and Apache Longbow increases. Defending these assets, and fixed wing aircraft that support the close fight and deep interdiction, is the purpose of SEAD.

In the past, SEAD has been fired just prior to cross FLOT operations by rotary and fixed wing aircraft. Due to problems locating enemy ADA assets accurately, targeting them quickly, and engaging them with sufficiently massed indirect fires, the objective of SEAD, as the name implies, was to *suppress* the enemy's air defenses. With the introduction of SADARM, combined with greater situational awareness, faster dissemination of targeting intelligence, and shortened or automated sensor-to-shooter links, the potential will exist to significantly enhance the force commander's ability to negate enemy air defenses. The current procedure of planned, programmed fires may be replaced with a standard fires responsibility for the Immediate Destruction of Enemy Air Defenses (IDEAD) throughout the depth of the battlespace. Once destroyed, the commander will never need to worry about identifying, tracking, or suppressing the air defense system again. This enhanced capability for SEAD, or IDEAD, will contribute to the survivability of Division XXI's air based fire systems.

As already mentioned, army and joint forces place high priority on gaining supremacy of the electromagnetic spectrum which is necessary for fires survivability from electronic attack. As emphasized in TRADOC Pam 525-5, "protection of friendly information systems from myriad threats, while denying the enemy the use of his systems, will be absolutely critical...the ability to manipulate, isolate, or negate portions of the electromagnetic spectrum will be a key element of future military operations."[125] A wide variety of joint and army resources will be committed to spectrum supremacy and information operations, which is "the ability to acquire,

use, protect, manage, and deny enemy use of data and information."[126] Fires will be one of the primary means the force commander will use to protect our use of the electromagnetic spectrum while denying it to the enemy. Reflecting this importance, the highest priority for fires in the future may be to destroy, or at least neutralize the enemy's capability to jam or interfere with the electromagnetic spectrum that U.S. communications and sensors depend upon. Related to this effort may be the selective attack by fires of enemy command posts.

The remaining threat to the fires system, ground attack, is likely to be a major effort of enemy forces. Since the enemy will be almost unable to maneuver armored units without detection and likely destruction, ground threats to firing units and aviation forces are likely to be from dismounts, bypassed enemy forces, special forces, or other infiltrating forces. This may justify increased use of maneuver forces, especially infantry, to provide security for the division's artillery and aviation units. Fortunately, as deep attack decreases the frequency and intensity of close engagements, forces may more readily be available for security purposes.

The survivability of Division XXI's fires system will likely far exceed the ability of an enemy force to effectively attack it. The mutually supporting and protective capabilities of the fires, maneuver, and information systems in Division XXI, combined with the efforts of other Army and joint forces, will help ensure the survival of the fires system.

FIRES AND DEEP ATTACK

The ability to see the enemy deep on the battlefield with great accuracy and responsively strike deep with great lethality, justifies the shift in the focus and priority of fires from the close fight to the deep. It is this capability for dominant fires that will most enable the Division XXI commander to seize the initiative, maintain the momentum, and create the conditions for maneuver to decisively exploit the success of fires.

Dominant fires and situational awareness will create tremendous opportunities for decisive maneuver. This will be done in several ways. First, deep and simultaneous attacks will seek to destroy the enemy's fires and electronic warfare systems to enhance the protection of friendly forces and the electromagnetic spectrum. Second, fires will destroy or significantly degrade selected enemy C3I systems which will prevent them from quickly realizing when and where maneuver forces are focused and will greatly reduce their ability to respond by massing or synchronizing their combat power. Individual enemy units will be left to act on their own initiative with little information about U.S. actions or the actions of their higher, lower and adjacent units. Third, enemy combat formations maneuvering in an area that threatens the main effort will be destroyed by indirect or attack aviation precision fires. Fourth, the enemy will be faced with a lethal dilemma. They can attempt to maneuver in response to U.S. forces, thus exposing themselves to destruction by fires, or they can seek hardened positions or terrain that minimizes their vulnerability to fires, and in so doing enhance the U.S. ability to maneuver freely around these positions and mass combat power at the decisive point. It is even possible that once deep precision fires have paralyzed the enemy's C3 system, destroyed their fires capability, and defeated other selected target sets, that an enemy so overwhelmed would lack the discipline and morale to continue to operate as a cohesive combat team; the clear evidence of decisive fires.[127]

Just as the infantry of World War I had to give up any ability to maneuver and seek the protection of trenches in an attempt to survive lethal and responsive fires, the enemy forces that confront the U.S. in the future must make the same decision. Regardless of the decision, American infantry and armor forces will have the freedom to maneuver decisively, quickly exploiting the conditions of dominant fires and achieving the tactical victory.

VI. CONCLUSION

> We'll use long-range fires as the spearhead of the attack to the extent that the ground maneuver forces may only need to mop up after the fires. That's a totally different concept of operations. This concept aims at achieving decisive results while minimizing the usual high casualties of the direct fire battle.[128]
>
> General Glenn K. Otis

The potential for fires to dominate the battlefield is dependent on the fires system being highly responsive, lethal, and survivable. The fires system supporting Division XXI, empowered by information technologies and armed with brilliant munitions, will excel in all three factors required for dominant fires. Can Division XXI fires achieve battlefield dominance on the conventional mid- to high-intensity battlefield? Based on the factors which historically have been conditional for the dominance of fires, and the capabilities of Division XXI's fires system compared to the AOE division, it appears evident that the tremendous capabilities of Division XXI fires will not only be dominant, but potentially even decisive.

The United States Army needs to recognize the possible implications of dominant fires in the future. The first of these became evident during the Persian Gulf War, when ground force commanders faced continuous problems with the Air Force when trying to clear and coordinate timely deep attacks with indirect fires and attack aviation assets. As Army division and corps commanders significantly increase their use of fires for deep attacks, the roles, responsibilities, and relationships between the Army and other services regarding the tactical and operational deep fight must be reexamined.

A second implication of the potential for dominant fires is the need for maneuver commanders and their fire support coordinators to change the way they think about fires and their relationship to maneuver. This paradigm shift is needed because of the historical emphasis

on fire support for maneuver forces in the close battle. The future will likely find the priority for fires is the decisive deep fight, and close fire support will become relatively less important. This paradigm shift includes the realization that maneuver forces may more frequently be used for security missions and exploitation of fires rather than a decisive close fight.

An eventual implication of dominant fires is the proliferation of brilliant weapons technologies, combined with off the shelf technologies to enhance C3I, which may greatly increases the vulnerability of U.S. forces. In the future, as some countries likely gain access to some form of brilliant munitions to greatly increase the lethality of their artillery systems, the importance of maintaining fires dominance, and specifically an overmatch in counterfire capabilities, will grow.

Clearly the Army must continue to study the implications of dominant fires in terms of doctrine and tactics, organizational structure, training, and the research and development of future systems. As in the past, efforts must continue to further develop the responsiveness, lethality, and survivability of fires.

Future efforts at increasing responsiveness may include developing the target acquisition system to quickly and accurately identify low profile targets such as dug-in, hardened positions, and vehicles and systems designed with stealth technology to make them more invisible to existing sensors. Recognizing that precision munitions are far to lethal for even the most advanced armor systems, it is likely that many countries will work to design a variety of countermeasures and may greatly increase the use of hardened defensive positions in depth. Future efforts at improving fires lethality should include the continued development of advanced sensors that defeat active and passive countermeasures. Additionally, fires in support of the division should develop the capability of defeating dug-in hardened targets.

At the same time, additional research is needed on the potential developing threats to the fires system. Of particular importance is the continuing need to protect the electromagnetic spectrum. As potent and capable as the individual systems in Division XXI will be, its greatest potential is the result of the synergistic effect of its seamless system-of-systems which is empowered by information dominance. Since the electromagnetic spectrum is the medium used to link the many systems in Division XXI, it may potentially by the Army's future Achilles' Heel.[129]

While fires have contributed to the lethality of forces in battle for hundreds of years, it is really just during the past century that armies have had the ability to use fires deep on the battlefield, beyond the forces in contact. Since World War I, as technology has improved the fires system, the use of fires in the deep fight has grown in potential and in importance. With an increased ability to target and strike the enemy deep, the role of the deep fight has slowly evolved from an increasing ability to contribute to the close fight to being the primary fight.

What is clear and undeniable is the fact that the United States military is in the midst of major changes. While its size and overseas presence has decreased significantly, the prime responsibility of the Army remains to fight and win this country's wars. The hopes and expectations of the American people dictate that when the Army must fight, it must do so decisively, seeking a quick and overwhelming victory. To achieve such a victory on the future battlefield, the Army's leaders must learn how to capitalize on the full potential of Division XXI and its lethal edge, dominant fires.

ENDNOTES

[1] *A National Security Strategy of Engagement and Enlargement*, U.S. Government Printing Office, Washington DC, February 1996, 14.

[2] *National Military Strategy of the United States of America*, U.S. Government Printing Office, Washington DC, 1995, ii.

[3] Ibid., 2. The Army Chief of Staff, General Dennis J. Reimer reported that American military forces have been deployed 27 times since 1990 and 60 percent of the forces involved were from the Army. In FY 97, 31,000 soldiers were deployed on average in 91 different countries for operations and training missions. This does not include soldiers permanently assigned overseas in Europe and Korea. GEN Dennis J. Reimer. "Preparing Now to Meet 21st-Century Challenges." *Army*, Volume 47, No. 10, October 1997, 21.

[4] U.S. Army. *TRADOC PAM 525-5. Force XXI Operations*. Fort Monroe, VA: Department of the Army, 1994, 4-5.

[5] Ibid., 3-3 and 3-15.

[6] Ibid., 3-10 and 4-7. This source notes "the domination of extended battlespace will require agile and robust deep and simultaneous attack capabilities." Crediting the potential of improved targeting capabilities due to advanced sensors and information technology combined with advances in fires, especially deep-precision strike weapons and brilliant munitions, the document notes the potential need for "reassessment of the traditional relationship between fire and maneuver." The pamphlet notes that advances in sensors, information technologies, and fires systems "will greatly expand the battle space of future maneuver formations," and "will allow combat forces to apply overwhelming firepower within their battlespace."

[7] Oscar, Kenneth J. "Fielding a Versatile Army Today to Meet Tomorrow's Challenges." *Army*, Volume 47, No. 10, October 1997, 32.

[8] U.S. Army. *Field Manual 100-5, Operations*. Department of the Army, Washington DC, June 1993, 2-1.

[9] Ibid., 2-10.

[10] U.S. Army. *Field Manual 6-20-30, Fire Support at Corps and Division*. Washington, DC: U.S. Government Printing Office, 1988, 1-3.

[11] *Joint Pub 1-02, DOD Terminology*, 23 March 1994 (Updated through April 1997), 100 as found on *Joint Electronic Library*, CD-ROM, May 1997.

[12] U.S. Army. *Field Manual 6-20, Fire Support in the AirLand Battle*. Washington, DC: U.S. Government Printing Office, 17 May 1988, 1-3. The four basic tasks of fire support are: support forces in contact; support the force commander's battle plan; synchronize fire support; and sustain fire support.

[13] U.S. Army. *Field Manual 101-5-1 Operational Terms and Graphics.* Department of the Army, Washington DC, 30 September 1997, 1-66.

[14] *FM 100-5,* 6-14. Deep operations "facilitate overall mission success," helping set the conditions for close operations to "gain decisive and lasting battlefield effects." U.S. Army. *Field Manual 71-100, Division Operations.* Department of the Army, Washington, DC, 28 August 1996, 2-11 to 2-15.

[15] *Joint Pub 1-02,* 137.

[16] Ibid., 274.

[17] U.S. Army. *Field Manual 6-20-10, The Targeting Process.* Department of the Army, Washington DC, 8 May 1996, 1-1 to 1-2.

[18] *TRADOC PAM 525-5,* 3-10.

[19] U.S. Army. *Field Manual 100-40 (Revised Initial Draft), Tactics.* Ft. Leavenworth, KS: Corps and Division Doctrine Directorate, Command and General Staff College, 2-5.

[20] U.S. Army. *Field Manual 71-100, Division Operations.* Department of the Army, Washington, DC, 28 August 1996, 2-12.

[21] Ibid., 2-13. When considering the risks associated with employing maneuver forces deep, the doctrinal manual notes, "the division commander must carefully consider the time and resources required for the deep maneuver force to strike and return or link up with the main body. Misjudging either can result in loss of the deep force or failure of the force to accomplish its mission."

[22] *FM 100-40 (Revised Initial Draft),* 5-3.

[23] *FM 100-5,* 6-14.

[24] *FM 100-5 (Final Draft),* 6-3.

[25] *FM 6-20,* 1-2.

[26] Ibid., 1-2.

[27] Ibid., 2-3.

[28] *FM 6-20-10,* B-4 to B-7.

[29] Keegan, John and Richard Holmes. *Soldiers: A History of Men in Battle.* (London: Hamish Hamilton Ltd., 1985), .97.

[30] Scales, Robert H., Jr. *Firepower in Limited War.* (Novato, CA: Presidio Press, 1995), 7.

[31] Gudmundsson, Bruce I. *On Artillery*. (Westport, CT: Praeger Publishers, 1993), 43-63. This source explains well the early tactics of both the Germans and the French in their attempt to employ artillery and heavy mortars for decisive effects. J.B.A. Bailey, *Field Artillery and Firepower*, (New York: The Military Press, 1989), describes the British belief in decisive fires which would "crush all resistance, and that it would be necessary for the infantry only to march forward and take possession." (p. 134). The belief in decisive fires emphasized a tactic of "destructive fires" that used lengthy and intense preparatory fires (or bombardments) based on detailed fire plans.

[32] Bailey, J.B.A. *Field Artillery and Firepower*. (New York: The Military Press, 1989), 129.

[33] Keegan, John. *The History of Warfare*. (New York: Alfred A. Knopf, Inc., 1993), 362.

[34] Bailey, 132 and 135; Gudmundsson, 52. The British applied the artillery tactic of "destruction" first at Festubert in May 1915 where the preparatory bombardment last 48 hours; later on the Somme it lasted 7 days. This compared to 35 minutes at the battle of Neuve Chapelle. The preparatory fires at Artois in May 1915 lasted six days; Champagne lasted three days; and Artois in September 1915 lasted five days.

[35] Keegan & Holmes, *Men in Battle,* 113.

[36] Ibid., 113-114.

[37] Bailey, 51-55.

[38] Ibid., 51 and 132.

[39] David T. Zabecki, *Steel Wind: Colonel Georg Bruchmuller and the Birth of Modern Artillery*. (Westport, CT: Praeger Publishers, 1994), 34.

[40] Bailey, 143-144; Zabicki, 37-42. Although intelligence and targeting for the deep fight remained a problem, Bruchmuller emphasized deep attack against enemy command posts, communications nodes, and observation platforms as part of preparatory fires. To most efficiently meet the competing demands of close fires, counterfires, and deep fires, Bruchmuller had his artillery organized functionally into four groups: close support artillery controlled at division level, counter-battery artillery controlled at corps level, deep battle artillery controlled at corps level, and special destruction fires for hardened targets, bridges, etc. that were controlled at army level.

[41] Zabecki, 41-42.

[42] Ibid., 42.

[43] Bailey, 134 and 151.

[44] Keegan & Holmes, *Men in Battle,* 115.

[45] Bailey, 127-128.

[46] John Keegan. *The History of Warfare*. (New York: Alfred A. Knopf, Inc., 1993), 369-370.

[47] Boyd L. Dastrup, *King of Battle: A Branch History of the U.S. Army's Field Artillery*. (Fort Monroe, VA: TRADOC Branch History Series, 1992), 205-206.

[48] Scales, *Firepower in Limited War*, 10.

[49] Ibid., 10. General Scales cited documents from the Foreign Military Studies Branch which conducted numerous interviews with various German officers of the II Parachute Corps who fought against US forces from 6 June till 24 July 1944, and officers of the 3d Falschirmjaeger Division who fought the US in France June through August 1944.

[50] General George S. Patton in Bad Tolz, Germany, May 1945 as quoted in, *Right of the Line, A History of the American Field Artillery*. Fort Sill, OK: U.S. Army Field Artillery School, December 1977, 15.

[51] Herbert, Paul H. *Deciding What Has To Be Done: General William E. Depuy and the 1976 Edition of FM 100-5, Operations*, Combat Studies Institute, Leavenworth Paper Number 16. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1988, 16.

[52] *Right of the Line, A History of the American Field Artillery*. Fort Sill, OK: U.S. Army Field Artillery School, December 1977, 15.

[53] Bailey, 233.

[54] Ibid., 228.

[55] Ibid., 227-233.

[56] Ibid., 233.

[57] Boyd L. Dastrup, *King of Battle: A Branch History of the U.S. Army's Field Artillery*. (Fort Monroe, VA: TRADOC Branch History Series, 1992), 205-206; Gudmundsson, 139. The lack of mobility by German artillery was cited as one of the contributing factors to their defeat in the Ardennes in 1944-1945. The German ability to mass fires was disrupted when "German artillery was generally unable to follow in the wake of the victorious tanks." Without a threat from German fires (the artillery was left behind and the weather and American air superiority prevented the Germans from using aircraft) American artillery was not required in the counterfire role, allowing all artillery assets to be massed for interdiction fires deep, and supporting fires in the close fight.

[58] Dastrup, 212.

[59] Bailey, 206-207. Drawing from his analysis of tactical operations in North Africa,1940-42, and North West Europe, 1944-45, Bailey notes that "the dominance of armoured mobility proved short-lived" and "that in mobile operations the gun could master the tank." He further noted,

"Just as artillery had shown its ability to counter mobility, so it seemed the best means of regaining mobility once the Allies went to the offensive." The Soviets came to the same conclusion regarding the dominance of fires on the battlefield and the role of maneuver forces to exploit the effects of fires. Chris Bellamy, *Red God of War: Soviet Artillery and Rocket Forces.* (New York: Brassey's Defence Publishers, 1986), 55-74.

[60] Dastrup, 210-225; Bailey, 226-227. During the Battle of El Guettar, massed artillery was primarily responsible for the destruction of nearly 30 German tanks as they prepared to overrun friendly infantry (p. 210). During the Battle of the Bulge, 208 battalions of artillery were concentrated by the U.S. Third and First Armies to mass fires on advancing German units. "Hit by staggering firepower from tube and rocket artillery, the German offensive in Ardennes finally collapsed." (p. 225). The Soviets adopted and successfully employed the tactic of massing artillery fires to destroy defenders at the point intended for penetration, and than throughout the depth of their battlespace to support a decisive breakthrough. Their employment of fires emphasized both the close and deep fight. There use of dominant fires recognized that survival of artillery was essential and thus, counterfire was considered as important as close fires.

[61] Dastrup, 223.

[62] Bailey, 205-207.

[63] BG Creighton W. Abrams. "Field Artillery Desert Facts." *Field Artillery.* October 1991, 2-3.

[64] Abrams, 2.

[65] Scales, *Firepower in Limited War*, 242.

[66] MAJ Mark S. Jensen, USA. "MLRS in Operation Desert Storm." *Field Artillery.* August 1991, 34; and CPT Richard A. Lacquement, Joseph V. Pacileo, and Paul A. F. Gallo. "Targeting During Desert Storm." *Field Artillery.* February 1992, 36-38.

[67] BG Robert H. Scales, Jr. *Certain Victory: The U.S. Army in the Gulf War.* (Washington: Brassey's, 1994), 200-206.

[68] Abrams, 2; and BG Tommy R. Franks, USA. "Deception, Firepower, and Movement." *Field Artillery.* June 1991, 31-32; and Scales, *Certain Victory: The U.S. Army in the Gulf War*, 226. BG Scales describes artillery fires massed against 13 Iraqi artillery positions discovered by a UAV, all of which were destroyed. He also reports on the Iraqi 48th Infantry Division's Artillery group, which after the air campaign had lost only 17 of its 100 guns. Following a 30 minute artillery prep by MLRS units, every Iraqi gun was destroyed.

[69] Franks, 31-32. BG Franks relates his experiences as the Assistant Division Commander for Maneuver with the 1st Cavalry Division during Operation Desert Storm, referring to numerous "artillery raids" conducted by the division against Iraqi artillery, C2 elements, and enemy air defenses, he noted, "the raids had been very effective, and the forces immediately across the border from us (several infantry divisions) had been fixed in place and effectively blinded. Abrams, p.2, relates the effects of massed fires, involving over 6,000 cannon rounds and 414

MLRS rockets fired in support of 1st Infantry Division's breaching operations resulting in no enemy counterfire, no resistance and no American casualties during the breach. Richard M. Swain. *"Lucky War" Third Army in Desert Storm.* (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1994), 247. Swain reports on the 1st Armored Division's use of air and artillery fires to "continue the attack," as maneuver forces prepared for a deliberate attack, fires attacked the enemy throughout the night enabling the division "to overrun its objective in the morning."

[70] COL Martin S. Kleiner, USA. "Joint STARS Goes to War." *Field Artillery.* February 1992, 28-29. Colonel Kleiner notes examples of JSTARS supporting numereous deep attacks including its detection of Iraqi efforts to reinforce and resupply attacking units during the Battle of Kafji. JSTARS passed the deep target off to attack aircraft which interdicted the enemy forces, destroying 70 percent of the vehicles. JSTARS also proved valuable in validating and refining ATACMS targets with real-time data. Kleiner goes on to note, "JSTARS information supported decision making and targeting at all echelons. At least one brigade commander of the 24th Infantry Division used JSTARS reports to target his artillery and adjust his maneuver. JSTARS ability to detect movement across the Euphrates River and support the interdiction of bridges and river crossings proved invaluable in keeping Iraqi forces bottled up in the Basra basket."

[71] Ibid., p. 28

[72] LTC L. Scott Lingamfelter, USA. "In the Wake of a Storm: Improving the FA After Operation Desert Storm." *Field Artillery.* August 1991, 29; and Scales, *Certain Victory,* 169 and 204.

[73] Richard M. Swain. *"Lucky War" Third Army in Desert Storm.* (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1994), 188-189.

[74] General Ronald R. Fogleman. "Making the Most of Air Power." *FA Journal.* Volume 1, No. 4. September-October 1996, 5.

[75] Scales, *Certain Victory,* 201-204; Lacquement, Pacileo, & Gallo, 38. The authors note that while the Iraqi artillery outranged most US artillery, and they had far more artillery as well, they simply had failed to invest in upgrading their systems to include digital fire-control computers, precise weather-measuring devices, target-acquisition radars, laser range finders, and GPS based systems to enhance precision in target location and firing unit locations.

[76] Franks, 33; and MAJ Mark S. Jensen, USA. "MLRS in Operation Desert Storm." *Field Artillery.* August 1991, 34.

[77] Scales, *Certain Victory,* 232.

[78] Abrams, 2.

[79] *Force XXI Division Design Analysis: Phase I, Final Report.* Technical Report TRAC-TR-0396, Fort Leavenworth, KS: TRADOC Analysis Center, March 1996, pp. ES1-ES6. This study examined four possible designs for Division XXI using the performance criteria specified

in TRADOC Pam 525-71, *Force XXI Division Operations Concept*, as the basis for analysis. Each design alternative was considered using scenarios that included close and open terrain. The scenarios included a construct of the European area, North East Asia (NEA), and South West Asia (SWA). The analysis included two time period variations; FY 2001 and FY 2010. The scenarios involved mid-to-high intensity combat operations against enemy forces with low to high technological capabilities.

[80] *TRADOC Pam 525-5,* 3-4. The ABCS includes the Army Global Command and Control System (AGCCS), the Army Tactical Command and Control System (ATCCS), and the Force XXI Battle Command-Brigade and Below (FBCB2) Systems. The ATCCS is Division XXI's integrated C3I system. Its components include the maneuver control system/Pheonix (MCS/P), advanced field artillery tactical data systems (AFATDS), all-source analysis system (ASAS), forward area air defense command and control intelligence (FAADC2I) system, combat terrain information system (CTIS), and the combat service support control system (CSSCS). U.S. Army. *Field Manual 71-100-5, EXFOR Division Operations Tactics, Techniques, and Procedures (Version 3).* Department of the Army, Washington DC, June 1997, pp 1-4 to 1-7, 2-7.

[81] *Field Manual 71-100-5, (Version 3),* 2-7.

[82] Colonel Raymond T. Odierno and Major Thomas L. Swingle, "AFATDS: Digitizing Fighting with Fires." *FA Journal.* Volume 1, No. 4, September-October 1996, 14.

[83] MG Randall L. Rigby, "Mapping the Future: FA State of the Branch 1996." *FA Journal.* Volume 1, No. 5, November-December 1996, 4-5.

[84] CPT Henry M. Hester, Jr., "Digitization in Task Force XXI." *FA Journal.* Volume 1, No. 4, September-October 1996, 42.

[85] *FM 6-20-10,* B-3 to B-5.

[86] Ibid., B-4 to B-6.

[87] LTC Robert M. Hill, USA, "Future Watch: Target Acquisition and Precision Attack Systems." *Field Artillery.* January-February 1996, 19. As reported in *Special Text 6-20-30, Fire Support for Division XXI, Tactics, Techniques, and Procedures (Initial Draft).* (U.S. Army Field Artillery School, Fort Sill, OK: November 1996, A-6.) the Advanced Firefinder will be integrated into the digital targeting system which includes the UAV, JSTARS, Theater Missile Defense (TMD) and Theater High Altitude Area Defense (THAAD) as well as AFATDS. "Enhancements will allow the system to detect, locate, and classify hostile enemy fire sources at ranges up to 300 kilometers, to include ballistic missile launchers."

[88] *FM 6-20-10,* B-4 to B-6.

[89] MAJ Eric S. Johnson, USA, "RAH-66 Comanche- Eyes and Ears for the 21st Century." *FA Journal.* Volume 1, No. 2, May-June 1996, 29-30.

[90] Ibid., p. 30.

[91] MAJ Steven Lopez, USA, and MAJ Fred Coppola, USA, "Crusader: Force XXI's Top Gun." *Military Review.* Volume LXXV, No. 6, November-December 1995, 63-66; *Special Text 6-20-30, Fire Support for Division XXI, Tactics, Techniques, and Procedures (Initial Draft).* U.S. Army Field Artillery School, Fort Sill, OK: November 1996, A-7,8. The Crusader and its companion resupply vehicle will be capable of automatic docking and the automated simultaneous transfer of fuel, and 130 rounds of ammunition and propellant in 12 minutes. The Crusader itself will be capable of a maximum rate of fire of 10 to 12 rounds per minute (Paladin is 4 rds/min) and a sustained rate of fire of 3 to 4 rounds per minute (Paladin is 1 rd/min). Due to its automated fire control and ammunition handling system, Crusader will have a multiple round simultaneous impact capability allowing one Crusader to deliver 4 to 8 rounds on a target at once. Crusaders maximum range of 40 KM (50 KM assisted) far exceeds Paladins maximum range of 30 KM. Additionally, Crusader's speed and responsiveness gives it a shoot and scoot capability that enables it to fire a mission within 30 seconds of receipt and than within 90 seconds to have moved 750 meters away to avoid any counterfire. "Crusader's command, control, communications, computers and intelligence (C4I) architecture will give its crew an unparalleled level of situational awareness...the system continually monitors and displays friendly and enemy locations, maneuver graphics, fire support coordination measures and the location of battlefield hazards." (p. 66). Crusader's C4I system includes prognostics and diagnostics, and automated decision aids to help the crew manage efficiently and effectively the massive amount of information constantly being processed in the digitized environment. (p. 65-66). "Increased survivability is achieved by an integrated defense system that includes stealth design, active defense against incoming threats, new lighter-weight armor protection, comparmentation to include a specially protected three man crew compartment, 72 hour NBC collective protection, and a very high mobility for shoot-and-scoot to avoid enemy counterfire." (p. A-8).

[92] MG Randall L. Rigby, "Mapping the Future: FA State of the Branch 1996." *FA Journal.* Volume 1, No. 5, November-December 1996, 5.

[93] Lopez & Coppola, 64. The COEA analysis scenarios included offensive and defensive operations with varying amount of advanced notice in both South West Asia and North East Asia. A separate study conducted by the TRADOC System Manager for Cannons came to similar conclusions regarding the impact of the greater range of Crusader over Paladin. That study found Crusader engaged 47% more artillery targets, 15% more maneuver targets, and 144% more C3 than the Paladin. (Based on a slide presentation presented by COL Bristol W. Williams, Jr., "Crusader Solid Propellant Operational Analysis." Undated, slide 5.)

[94] Johnson, 28.

[95] Ibid., 30.

[96] LTC Harold K. Neilson, "Longbow: More Lethal With Less Fratricide." *Army Aviation.* Volume 45, No. 5, May 31, 1996, 26. The operational tests included 15 side-by-side force-on-force trials comparing the Apache Longbow (AH-64D) to the Apache (AH-64A), and discovered the force-exchange-ratio of 28:1, based on Longbow's seven times greater survivability and four times greater lethality.

[97] *FM 71-100-5,* 1-4; and Neilson, 30. In a total of 30 seconds, the Longbow can precisely detect 100 stationary or moving targets; classify them; prioritize the 16 most dangerous; transmit the digital targeting information to other aircraft, indirect fire systems, ASAS and AFATDS; and initiate a coordinated precision attack.

[98] CPT David A. Dykes, "Does Longbow Apache Really Make A Difference?" *Army Aviation.* Volumbe 45, No. 2, February 29, 1996, 30-37; Neilson, 30. In this article, CPT Dykes reports on the results of TRADOC's COEA to determine the operational effectiveness of Apache Longbow given several different scenarios and force structures. The optimal force structure involved the combine use of Apache Longbow with Commanche, as planned for Division XXI.

[99] *FM 71-100-5, (Version 3),* 1-5; and *ST 6-20-30,(Initial Draft),* A-7; and MG Leo J. Baxter, "Honing the Edge: State of the Field Artillery 1997." *FA Journal,* Volume II, No. 5, November-December 1997, p. 4. MLRS mechanical and fire control system improvements "reduce launcher elevation and slew times from more than 90 seconds to just 16 seconds for maximum range rocket missions. Reload times for this system will decrease by 33 percent. Finally, the weapon's survivability also improves with this upgrade by reducing its exposure by 75 percent."

[100] *ST 6-20-30, (Initial Draft),* A-7.

[101] Ibid., A-8 to A-10.

[102] Ibid., A-9 to A-10.

[103] John K. Yager and Jeffrey L. Froysland, "Improving the Effects of Fires with Precision Munitions." *FA Journal.* Volume II, No. 2, March-April 1997, 7.

[104] *ST 6-20-30, (Initial Draft),* A-8.

[105] MG Leo . Baxter, "Honing the Edge: State of the Field Artillery 1997." *FA Journal.* Volume II, No. 6, November-December 1997, 4.

[106] *ST 6-20-30,(Initial Draft),* A-8.

[107] Ibid, A-9.

[108] Yager & Froysland, 7.

[109] MAJ Jay Hilliard, "ATACMS Block II: Killing Armored Targets Deep." *Field Artillery.* January-February 1996, 22.

[110] Yager & Froysland, 7.

[111] *TRADOC PAM 525-5,* 2-9.

[112] *A National Security Strategy of Engagement and Enlargement,* 14.

[113] GEN Gordon R. Sullivan and LTC James M. Dubik, *Land Warfare in the 21st Century*, Carlisle Barracks, Pennsylvania: Strategic Studies Institute, February 1993, 12-25. General Sullivan noted that our future forces in conflict will be characterized by a greater dispersion of forces, lethality of weapon systems, volume and precision of fires, use of integrated technology to gain greater battlefield intelligence, mass and effects by smaller more mobile units, and increasing abilities to conceal one's own signature on the battlefield while detecting the enemy. The futurists, Alvin and Heidi Toffler, in their book *War and Anti-War: Survival at the Dawn of the 21st Century*, (New York: Little, Brown and Co., 1993), note that off the shelf technologies will be purchased and applied by armies around the world to increase their lethality and their abilities to command, control, communicate, and gain intelligence on the battlefield (p. 106).

[114] GEN Dennis J. Reimer, "Challenge and Change: A Legacy for the Future." *Military Review*, Volume LXXVII, No. 4, July-August 1997, 109. General Reimer notes that "at least 56 countries already are capable of engaging in mid-intensity conflict, each having military forces that include at least 700 tanks or armored personnel carriers, 100 combat aircraft, 500 artillery pieces, and more than 100,000 soldiers." He also notes that as many as 30 countries could possess some form of weapons of mass destruction by the turn of the century, and that the proliferation of precision-guided munitions and other high-technology weapons will add to the conventional lethality of the military forces of these developing countries.

[115] U.S. Army. *TRADOC PAM 525-200-5, Depth and Simultaneous Attack.* Fort Monroe, VA: Department of the Army, 1 June 1994, 2.

[116] U.S. Army. *Field Manual 100-5, Operations (Final Draft).* Department of the Army, Washington DC, 5 August 1997, 3-1.

[117] *TRADOC PAM 525-5*, 3-11.

[118] *FM 100-5,(Final Draft),* 3-2.

[119] *Force XXI Division Design Analysis: Phase I; Final Report.* Technical Report TRAC-TR-0396, TRADOC Analysis Center, Fort Leavenworth, Kansas: March 1996, p. 44.

[120] Ibid., 43. The TRADOC analysis found that under a FY2010 scenario using all tested force designs, deep fires were decisive and the source of over 80% of the enemy systems destroyed. In each scenario at least 40% of enemy formations (MRR and above) were destroyed. It found that the minimum divisional assets included a battalion (18 systems) of MLRS and a battalion of attack helicopters. It also found that divisional fires must be augmented by two FA Brigades from Corps and an Attack Helicopter Brigade from Corps to ensure the division could proved all needed deep, close, and counterfires to dominate the battlefield (this validates the current force allocation guidelines). (p. D-20 to D-28).

[121] *FM 100-5, (Final Draft),* 3-5.

[122] Christopher Bellamy, *The Evolution of Modern Land Warfare: Theory and Practice.* (New York: Routledge, 1990), 47.

[123] *FM 100-5, (Final Draft),* 3-6.

[124] Bailey, 51.

[125] *TRADOC PAM 525-5*, 2-7 & 3-7.

[126] *FM 100-5, (Final Draft)*, 2-9.

[127] Price T. Bingham. "On Machine Guns and Precision Engagement." *Joint Forces Quarterly*, Summer 1997, 89.

[128] GEN (ret.) Glenn K. Otis. "Ascendancy of Fires: The Evolution of the Combined Arms Team." *Field Artillery*. June 1995, 18.

[129] *TRADOC PAM 525-5*, 3-6 & 3-7.

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